Low-power configurable multiple function gate Rev. 2 — 16 September 2015 P

Product 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_{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.

Features and benefits 2.

- Wide supply voltage range from 0.7 V to 2.75 V
- Low input capacitance; C₁ = 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 μA (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

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3. Ordering information

Table 1. Ordering information

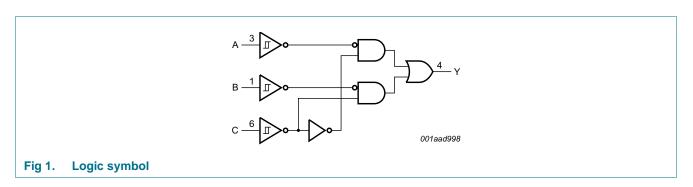
Type number	Package	Package						
	Temperature range	Name	Description	Version				
74AXP1G97GM	–40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 \times 1.45 \times 0.5 mm	SOT886				
74AXP1G97GN	–40 °C to +85 °C	XSON6	extremely thin small outline package; 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				
74AXP1G97GX	–40 °C to +85 °C	X2SON6	plastic thermal extremely thin small outline package; no leads; 6 terminals; body 1 \times 0.8 \times 0.35 mm	SOT1255				

4. Marking

Table 2. Marking						
Type number	Marking code ^[1]					
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.

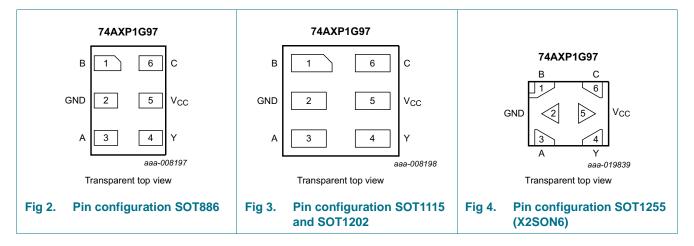
5. Functional diagram



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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				
Y	4	data output				
V _{CC}	5	supply voltage				
С	6	data input				

7. Functional description

Table 4.Function table^[1]

Input	Output		
C	В	Α	Y
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

[1] H = HIGH voltage level;

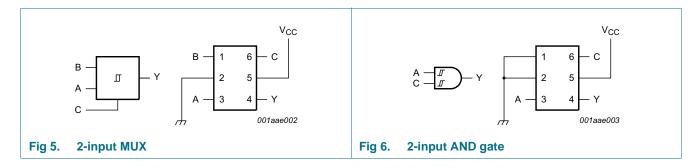
L = LOW voltage level.

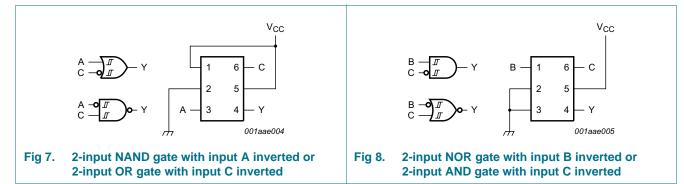
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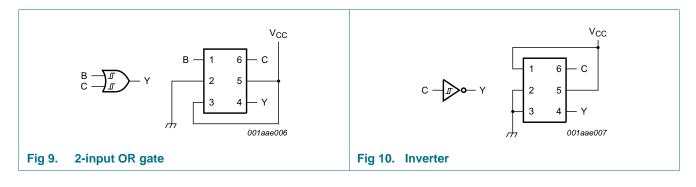
7.1 Logic configurations

Table 5.Function selection table

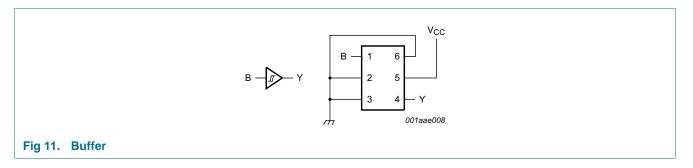
Logic function	Figure
2-input MUX	see <u>Figure 5</u>
2-input AND	see <u>Figure 6</u>
2-input OR with one input inverted	see Figure 7
2-input NAND with one input inverted	see Figure 7
2-input AND with one input inverted	see Figure 8
2-input NOR with one input inverted	see Figure 8
2-input OR	see Figure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







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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 ₁ < 0 V	-50	-	mA
VI	input voltage	[1]	-0.5	3.3	V
I _{OK}	output clamping current	V _O < 0 V	-50	-	mA
Vo	output voltage	[1]	-0.5	3.3	V
lo	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	$T_{amb} = -40 \ ^{\circ}C \ to \ +85 \ ^{\circ}C$	-	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	Мах	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; $V_{CC} = 0 V$	0	2.75	V
T _{amb}	ambient temperature		-40	+85	°C

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10. Static characteristics

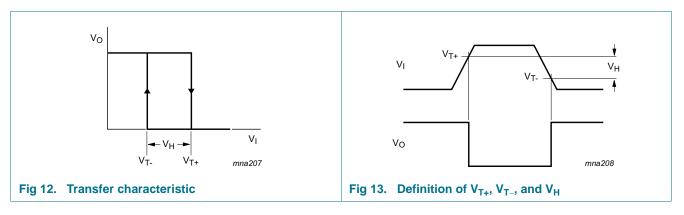
Table 8. Static characteristics

At recommended operating conditions, unless otherwise specified; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		T _{amb} = −40 °C to +85 °C				
				Min	Тур 25 °С	Max 25 °C	Max 85 °C	
V _{T+}	positive-going	see Figure 12 and Figure 13						
	threshold voltage	$V_{CC} = 0.75 \text{ V} \text{ to } 0.85 \text{ V}$		$0.3V_{CC}$	-	0.8V _{CC}	0.8V _{CC}	V
		V _{CC} = 1.1 V to 1.95 V		$0.4V_{CC}$	-	0.7V _{CC}	0.7V _{CC}	V
		V_{CC} = 2.3 V to 2.7 V		0.9	-	1.7	1.7	V
V _{T-}	negative-going	see Figure 12 and Figure 13						
	threshold voltage	$V_{CC} = 0.75 \text{ V} \text{ to } 0.85 \text{ V}$		$0.2V_{CC}$	-	0.7V _{CC}	0.7V _{CC}	V
		V _{CC} = 1.1 V to 1.95 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	see Figure 12 and Figure 13						
	voltage	$V_{CC} = 0.75 \text{ V} \text{ to } 0.85 \text{ V}$		0.06V _{CC}	-	$0.5V_{CC}$	$0.5V_{CC}$	V
		V _{CC} = 1.1 V to 1.95 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
011	HIGH-level	I_{O} = -20 μ A; V_{CC} = 0.7 V		-	0.69	-	-	V
	output voltage	$I_{O} = -100 \ \mu\text{A}; \ V_{CC} = 0.75 \ \text{V}$		0.65	-	-	-	V
		$I_0 = -2 \text{ mA}; V_{CC} = 1.1 \text{ V}$		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	$I_0 = 20 \ \mu A; \ V_{CC} = 0.7 \ V$		-	0.01	-	-	V
	output voltage	$I_{O} = 100 \ \mu\text{A}; \ V_{CC} = 0.75 \ \text{V}$		-	-	0.1	0.1	V
		I _O = 2 mA; V _{CC} = 1.1 V		-	-	0.275	0.275	V
		I _O = 3 mA; V _{CC} = 1.4 V		-	-	0.35	0.35	V
		I _O = 4.5 mA; V _{CC} = 1.65 V		-	-	0.45	0.45	V
		I _O = 8 mA; V _{CC} = 2.3 V		-	-	0.7	0.7	V
I	input leakage current	V _I = 0 V to 2.75 V; V _{CC} = 0 V to 2.75 V	<u>[1]</u>	-	0.001	±0.1	±0.5	μA
I _{OFF}	power-off leakage current	V_{I} or $V_{O} = 0$ V to 2.75 V; $V_{CC} = 0$ V	[1]	-	0.01	±0.1	±0.5	μA
ΔI_{OFF}	additional power-off leakage current	$V_1 \text{ or } V_0 = 0 \text{ V or } 2.75 \text{ V};$ $V_{CC} = 0 \text{ V to } 0.1 \text{ V}$	[1]	-	0.02	±0.1	±0.5	μA
I _{CC}	supply current	$V_I = 0 V \text{ or } V_{CC}; I_O = 0 A$	[1]	-	0.01	0.3	0.6	μA
Δl _{CC}	additional supply current			-	2	100	150	μA

[1] Typical values are measured at V_{CC} = 1.2 V.

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10.1 Waveform transfer characteristics

11. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit, see <u>Figure 20</u>.

Symbol	Parameter	Conditions		mb = 25 °	°C	T_{amb} = -40 °C to +85 °C		Unit
			Min	Typ <mark>[1]</mark>	Max	Min	Max	
t _{pd}	propagation	A, B and C to Y; see Figure 14 [2][3]						
	delay	$V_{CC} = 0.75 \text{ V} \text{ to } 0.85 \text{ V}$	3	14	45	3	148	ns
		V _{CC} = 1.1 V to 1.3 V	2.3	5.0	8.1	2.1	8.5	ns
		V _{CC} = 1.4 V to 1.6 V	1.9	3.7	5.4	1.7	5.8	ns
		V _{CC} = 1.65 V to 1.95 V	1.6	3.1	4.3	1.4	4.7	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.3	2.4	3.3	1.1	3.5	ns
t _t	transition time	V _{CC} = 2.7 V; see <u>Figure 14</u> [4]	-	-	-	1.0	-	ns
CI	input capacitance	$V_{I} = 0 V \text{ or } V_{CC};$ $V_{CC} = 0 V \text{ to } 2.75 V$	-	0.5	-	-	-	pF
Co	output capacitance	$V_{O} = 0 V; V_{CC} = 0 V$	-	1.0	-	-	-	pF

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Symbol Parameter		Conditions		mb = 25 °	C	T _{amb} = −40 °C to +85 °C		Unit
			Min	Typ <mark>[1]</mark>	Max	Min	Max	
C _{PD} power dissipation capacitance	$f_i = 1 \text{ MHz}; V_I = 0 \text{ V to } V_{CC}$ [5]							
	$V_{CC} = 0.75 \text{ V} \text{ to } 0.85 \text{ V}$	-	2.5	-	-	-	pF	
		V _{CC} = 1.1 V to 1.3 V	-	2.6	-	-	-	pF
		V _{CC} = 1.4 V to 1.6 V	-	2.7	-	-	-	pF
		V _{CC} = 1.65 V to 1.95 V	-	2.8	-	-	-	pF
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	-	3.2	-	-	-	pF

Table 9. Dynamic characteristics ... continued

Voltages are referenced to GND (around = 0 V); for test circuit, see Figure 20.

[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 μ W).

 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + C_L \times V_{CC}^2 \times f_o$ 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

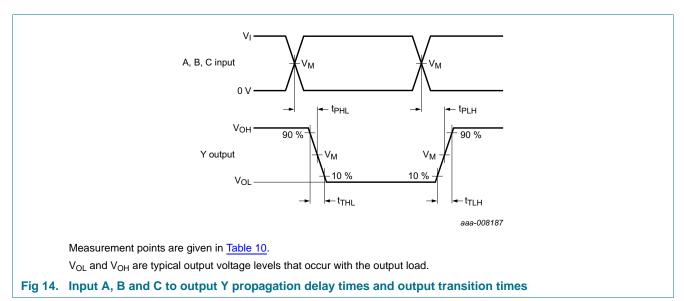


Table 10. Measurement points

Supply voltage	Output	Input				
V _{CC}	V _M	V _M	VI	t _r = t _f		
0.75 V to 2.7 V	0.5V _{CC}	0.5V _{CC}	V _{CC}	≤ 3.0 ns		

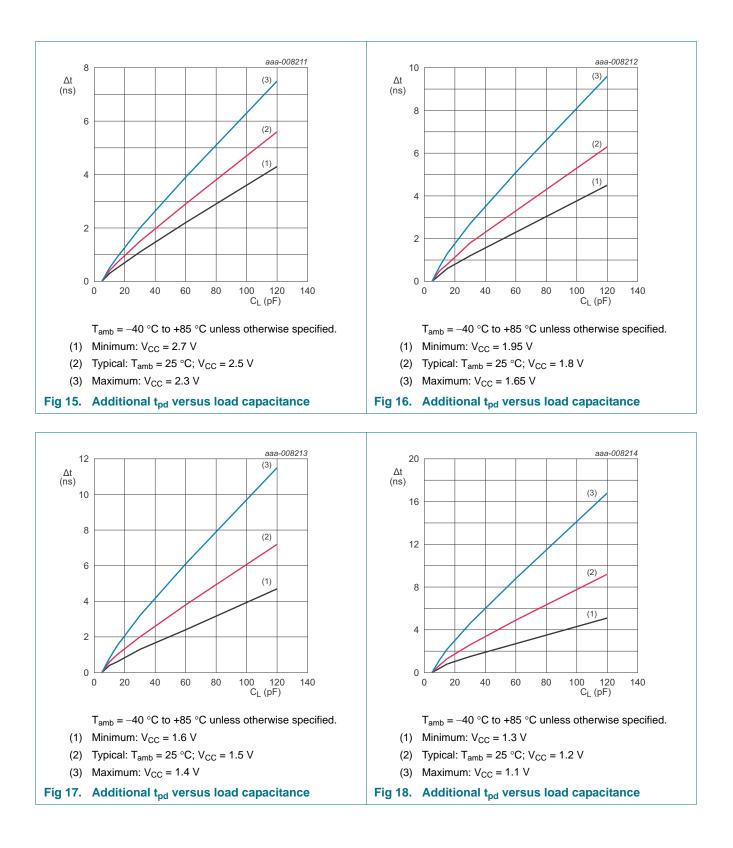
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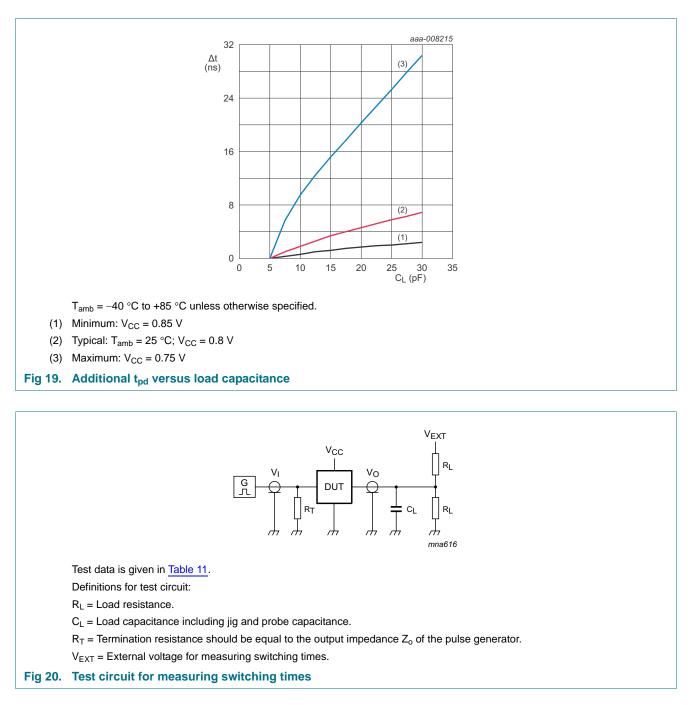


Table 11. Test data

Supply voltage	Load		V _{EXT}			
V _{cc}	CL	RL	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	$2 \times V_{CC}$	

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12. Package outline

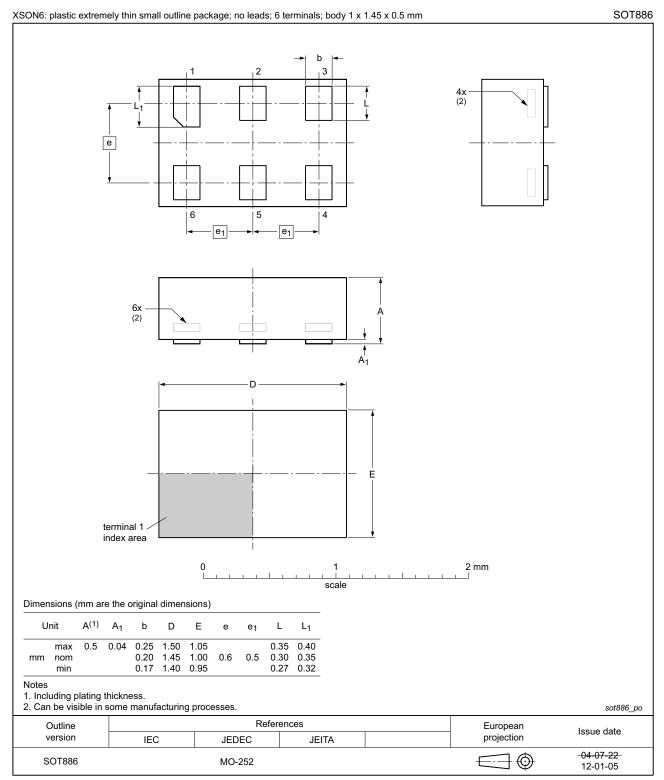
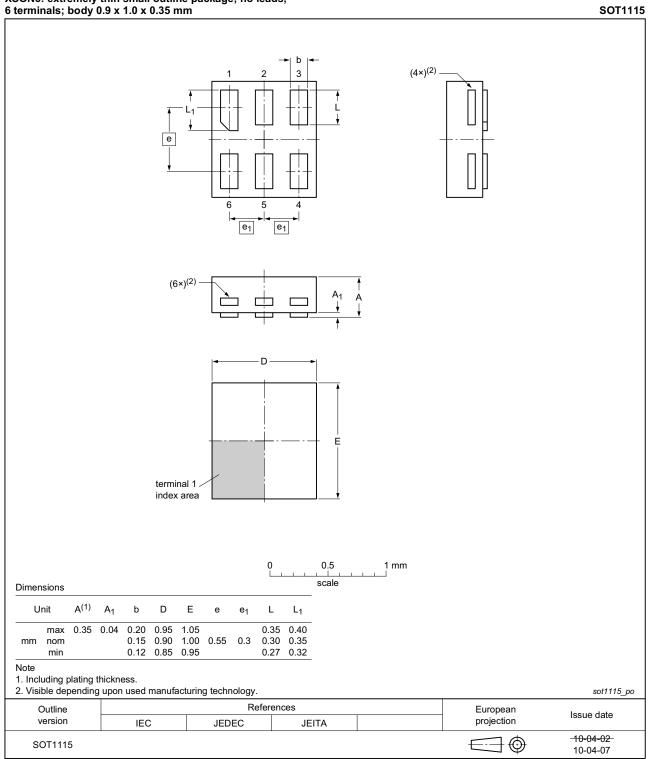


Fig 21. Package outline SOT886 (XSON6)

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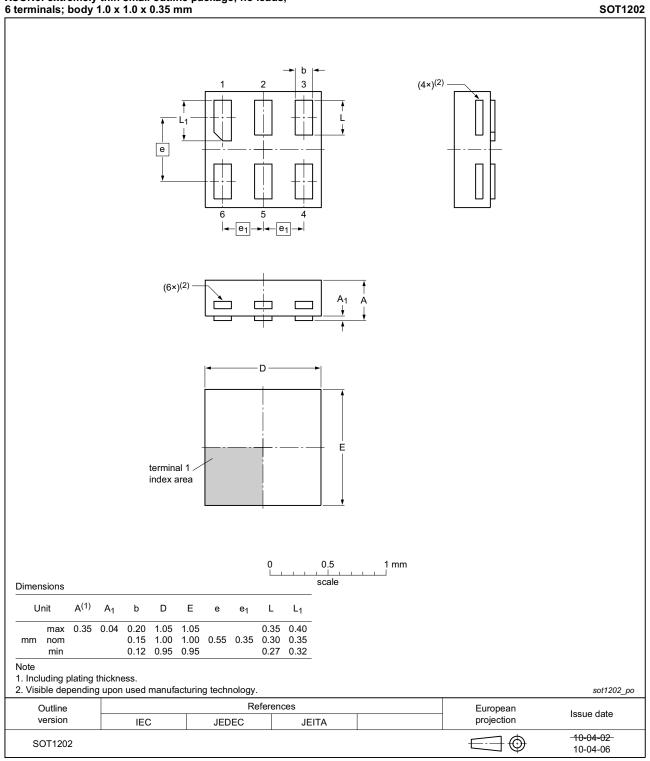


XSON6: extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm

Fig 22. Package outline SOT1115 (XSON6)

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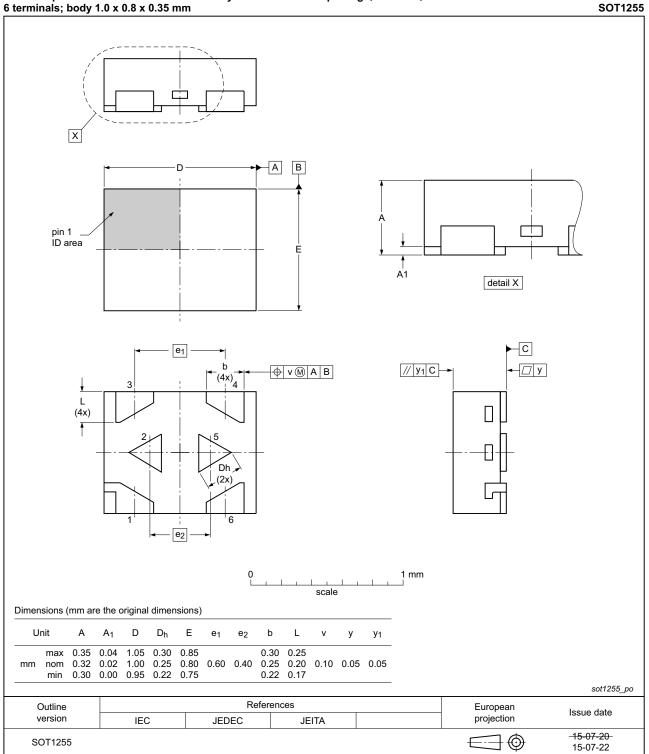


XSON6: extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm

Fig 23. Package outline SOT1202 (XSON6)

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

Fig 24. Package outline SOT1255 (X2SON6)

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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.3	20150916	Product data sheet	-	74AXP1G97 v.2
Modifications:	Added type number 74AXP1G97GX (SOT1255/X2SON6).			
74AXP1G97 v.2	20140903	Product data sheet	-	74AXP1G97 v.1
Modifications:	Specification status changed to product data sheet.			
74AXP1G97 v.1	20130625	Preliminary data sheet	-	-

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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.
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[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".

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