## **74AXP1G58**

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

Preliminary data sheet

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

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<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				
74AXP1G58GM	–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				
74AXP1G58GN	–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				
74AXP1G58GS	–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				

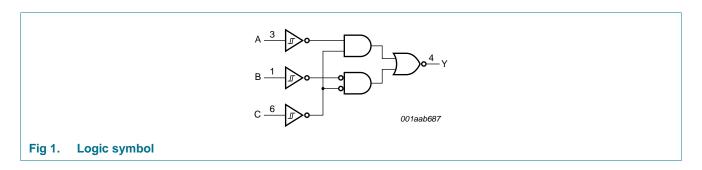
### 4. Marking

#### Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74AXP1G58GM	RK
74AXP1G58GN	RK
74AXP1G58GS	RK

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

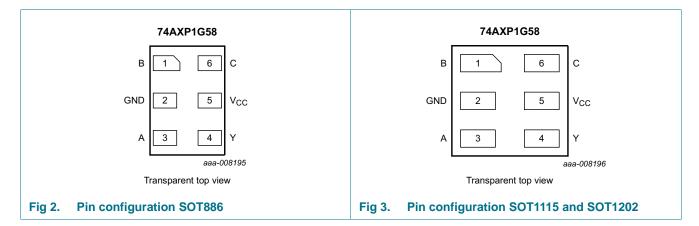
### 5. Functional diagram



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	Н
L	Н	L	L
L	Н	Н	Н
Н	L	L	Н
Н	L	Н	Н
Н	Н	L	L
Н	Н	Н	L

<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 NAND	see Figure 4
2-input NAND with both inputs inverted	see Figure 7
2-input AND with inverted input	see Figure 5 and Figure 6
2-input NOR with inverted input	see Figure 5 and Figure 6
2-input OR	see Figure 7
2-input OR with both inputs inverted	see Figure 4
2-input XOR	see Figure 8
Buffer	see Figure 9
Inverter	see Figure 10

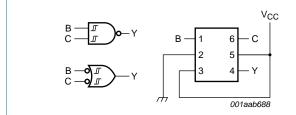


Fig 4. 2-input NAND gate or 2-input OR with both inputs inverted

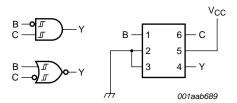


Fig 5. 2-input AND gate with inverted B input or 2-input NOR gate with inverted C input

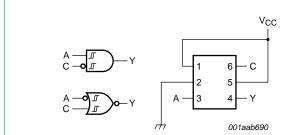


Fig 6. 2-input AND gate with inverted C input or 2-input NOR gate with inverted A input

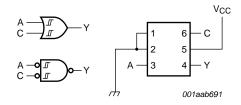
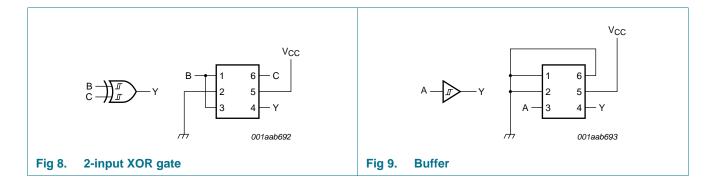
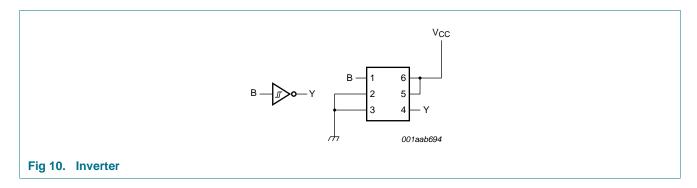


Fig 7. 2-input OR gate or 2-input NAND gate with both inputs inverted



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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 <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
VI	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
Vo	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 <sub>GND</sub>	ground current		-50	-	mA
T <sub>stg</sub>	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
$V_I$	input voltage		0	2.75	V
Vo	output voltage	Active mode	0	$V_{CC}$	V
		Power-down mode; V <sub>CC</sub> = 0 V	0	2.75	V
$T_{amb}$	ambient temperature		-40	+85	°C

#### Low-power configurable multiple function gate

### 10. Static characteristics

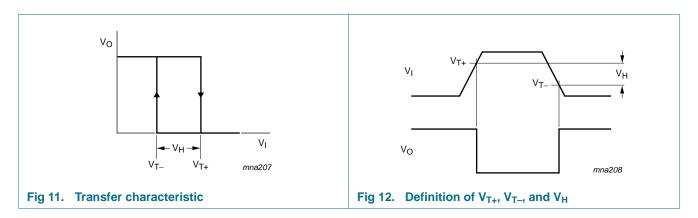
Table 8. Static characteristics

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

Symbol	Parameter	Conditions		T <sub>amb</sub> = -40 °C to +125 °C				
				Viin	Typ 25 °C	Max 25 °C	Max 85 °C	
$V_{T+}$	positive-going	see Figure 11 and Figure 12					'	
	threshold voltage	$V_{CC} = 0.75 \text{ V to } 0.85 \text{ V}$	0.3	5V <sub>CC</sub>	-	$0.75V_{CC}$	0.75V <sub>CC</sub>	V
	voltage	$V_{CC} = 1.1 \text{ V to } 1.95 \text{ V}$	0.4	4V <sub>CC</sub>	-	$0.7V_{CC}$	$0.7V_{CC}$	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	$V_{CC} = 0.75 \text{ V to } 0.85 \text{ V}$	0.2	5V <sub>CC</sub>	-	$0.65V_{CC}$	0.65V <sub>CC</sub>	V
	voltage	V <sub>CC</sub> = 1.1 V to 1.95 V	0.0	3V <sub>CC</sub>	-	$0.6V_{CC}$	$0.6V_{CC}$	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.7	-	1.5	1.5	V
V <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>	-	$0.5V_{CC}$	$0.5V_{CC}$	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
V <sub>ОН</sub>	HIGH-level	$I_{O} = -20 \mu A$	Vcc	-0.05				V
	output voltage	$I_O = -100 \mu A; V_{CC} = 0.75 V$	V <sub>C</sub>	<sub>C</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
V <sub>OL</sub>	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	$V_I = 0 V \text{ to } 2.75 V;$ $V_{CC} = 0 V \text{ to } 2.75 V$	[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	μΑ
VI <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
СС	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
Δl <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

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

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### 11. Dynamic characteristics

#### Table 9. Dynamic characteristics

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

10.1 Waveform transfer characteristics

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C		°C	T <sub>amb</sub> = -4	0 °C to +85 °C	Unit	
				Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation	A, B and C to Y; see Figure 13	[2][3]		•	•		1	
	delay	$V_{CC} = 0.75 \text{ V to } 0.85 \text{ V}$		4.0	12.0	55	3.4	145	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V		2.5	4.5	7.5	2.1	8.0	ns
		$V_{CC} = 1.4 \text{ V to } 1.6 \text{ V}$		2.1	3.4	5.7	1.7	6.0	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.7	2.9	4.7	1.4	5.1	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		1.4	2.3	3.6	1.2	3.9	ns
t <sub>t</sub>	transition time	$V_{CC} = 2.7 \text{ V}$ ; see Figure 13	[4]	1.0	-	-	-	-	ns
Cı	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	Symbol Parameter Conditions				T <sub>amb</sub> = 25 °C		$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +85  ^{\circ}\text{C}$		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]								
	$V_{CC} = 0.75 \text{ V to } 0.85 \text{ V}$		-	3.1	-	-	-	pF		
			V <sub>CC</sub> = 1.1 V to 1.3 V		-	3.1	-	-	-	pF
		V <sub>CC</sub> = 1.4 V to 1.6 V		-	3.2	-	-	-	pF	
		V <sub>CC</sub> = 1.65 V to 1.95 V		-	3.4	-	-	-	pF	
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		-	3.8	-	-	-	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 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

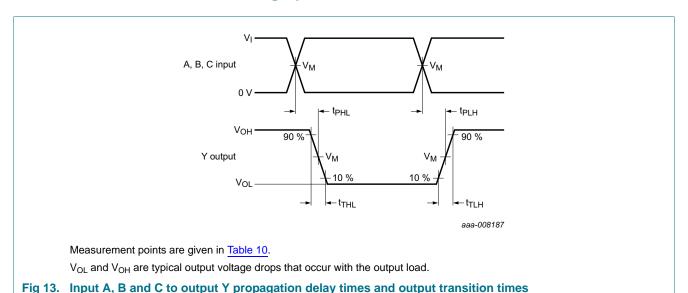


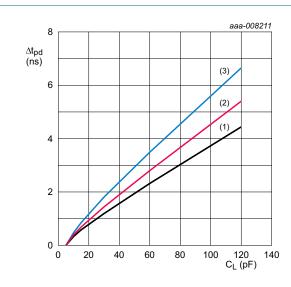
Table 10. Measurement points

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

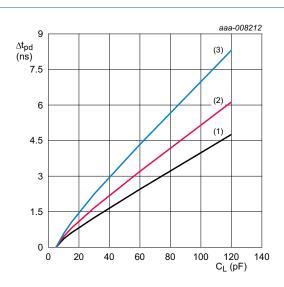


 $T_{amb}$  = -40 °C to +85 °C unless otherwise specified.

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

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

Fig 14. Additional propagation delay versus load capacitance



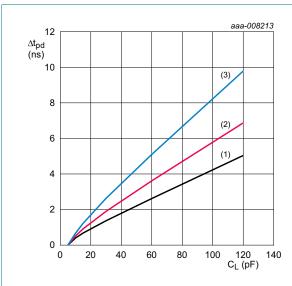
 $T_{amb} = -40$  °C to +85 °C unless otherwise specified.

(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 V

Fig 15. Additional propagation delay versus load capacitance



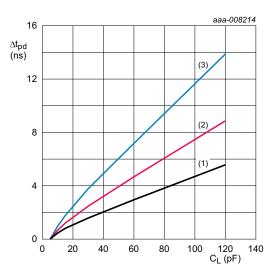
 $T_{amb} = -40 \, ^{\circ}\text{C}$  to +85  $^{\circ}\text{C}$  unless otherwise specified.

(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.

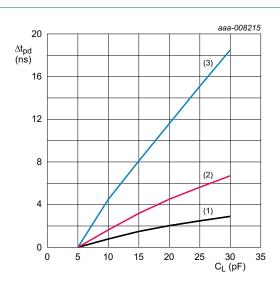
(1) Minimum:  $V_{CC} = 1.1 \text{ V to } 1.3 \text{ V}$ 

(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

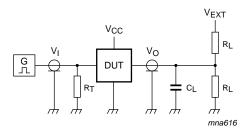
#### Low-power configurable multiple function gate



 $T_{amb}$  = -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:  $V_{CC} = 0.75 \,^{\circ}\text{V}$  to  $0.85 \,^{\circ}\text{V}$ 

Fig 18. Additional propagation delay 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  $Z_0$  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

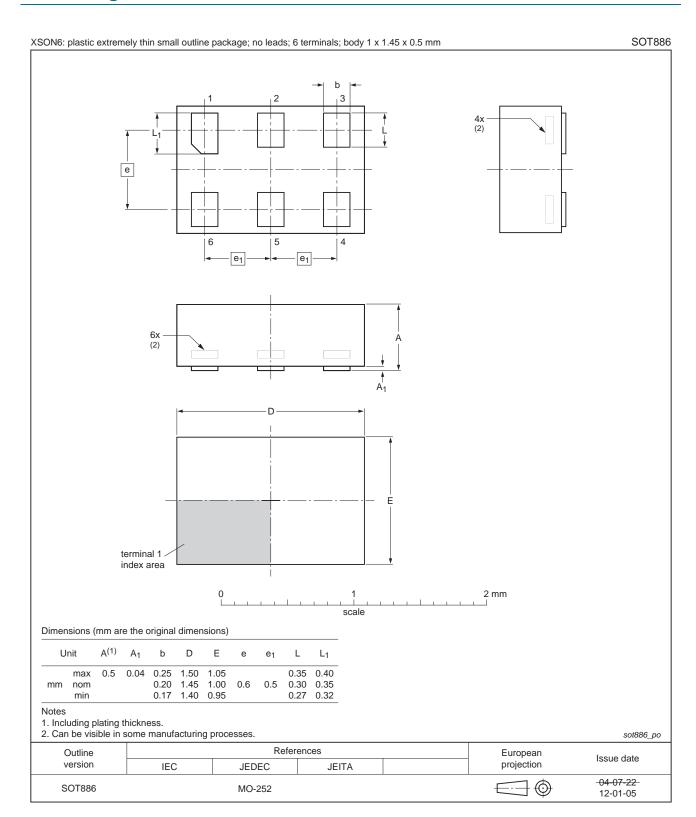


Fig 20. Package outline SOT886 (XSON6)

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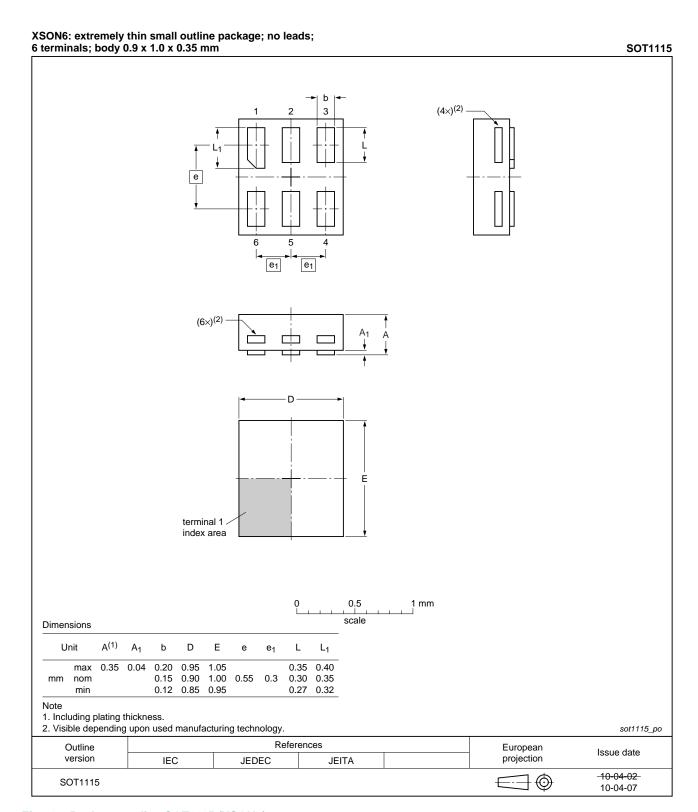


Fig 21. Package outline SOT1115 (XSON6)

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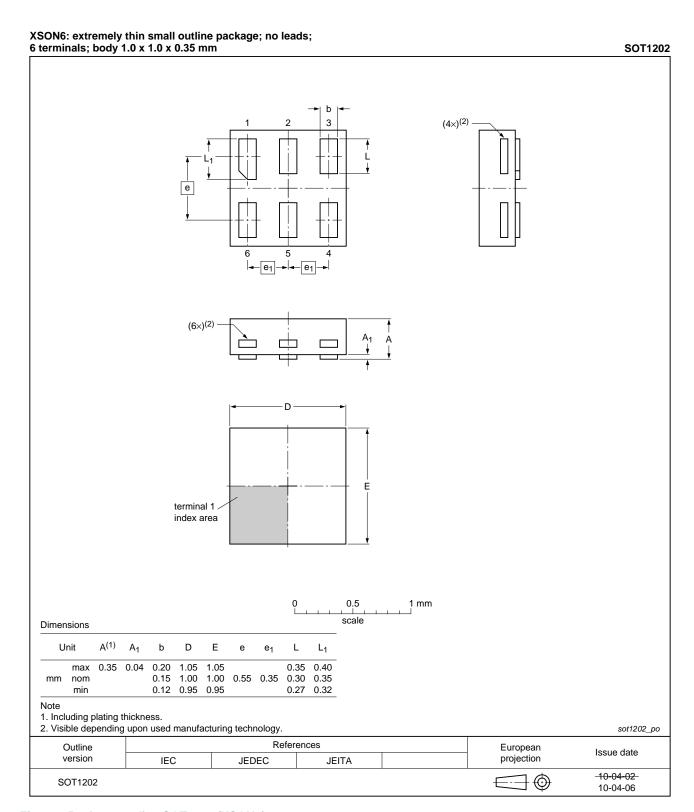


Fig 22. Package outline SOT1202 (XSON6)

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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
74AXP1G58 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"
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#### Low-power configurable multiple function gate

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