# **74AXP1G58**

# **Low-power configurable multiple function gate**Rev. 3 — 16 September 2015 P

**Product 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
- Low input capacitance; C<sub>I</sub> = 0.5 pF (typical)
- Low output capacitance; C<sub>O</sub> = 1.0 pF (typical)
- Low dynamic power consumption;  $C_{PD} = 2.7 \text{ pF}$  at  $V_{CC} = 1.2 \text{ V}$  (typical)
- Low static power consumption; I<sub>CC</sub> = 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<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				
74AXP1G58GX	–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				

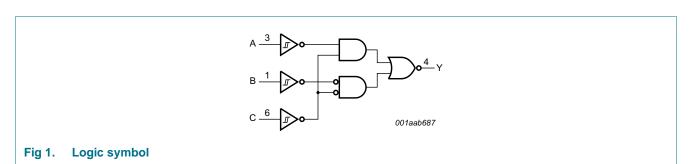
# 4. Marking

#### Table 2. Marking codes

Type number	Marking code[1]
74AXP1G58GM	RK
74AXP1G58GN	RK
74AXP1G58GS	RK
74AXP1G58GX	RK

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

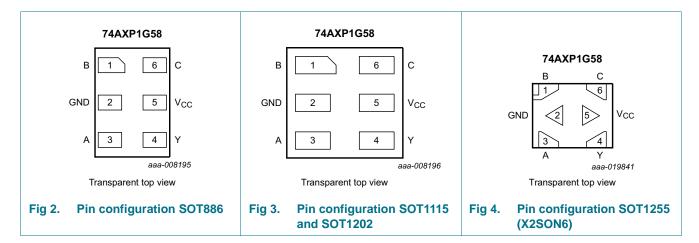
# 5. Functional diagram



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	Input		
С	В	A	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

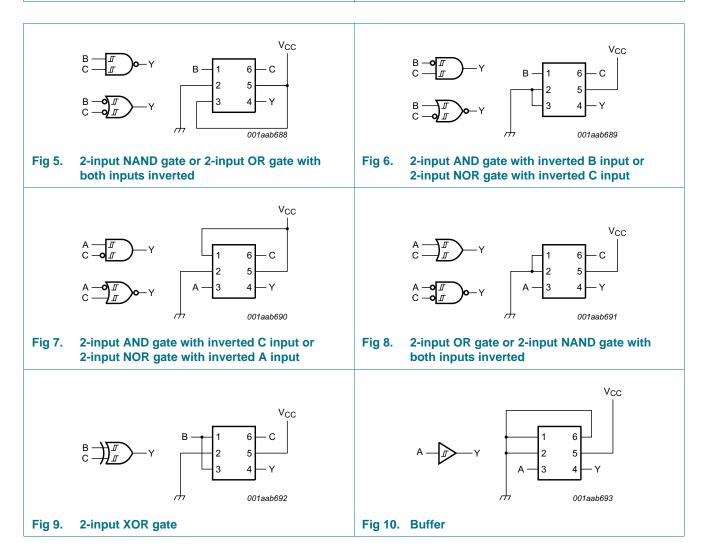
[1] H = HIGH voltage level; L = LOW voltage level.

## Low-power configurable multiple function gate

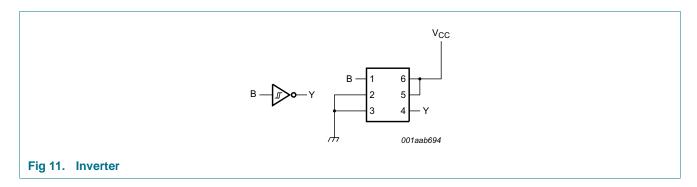
## 7.1 Logic configurations

Table 5. Function selection table

Logic function	Figure
2-input NAND	see Figure 5
2-input NAND with both inputs inverted	see Figure 8
2-input AND with inverted input	see Figure 6 and Figure 7
2-input NOR with inverted input	see Figure 6 and Figure 7
2-input OR	see Figure 8
2-input OR with both inputs inverted	see Figure 5
2-input XOR	see Figure 9
Buffer	see Figure 10
Inverter	see Figure 11



## 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 <sub>CC</sub>	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	[1]	-0.5	+3.3	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-50	-	mA
Vo	output voltage	[1]	-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 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	Max	Unit
V <sub>CC</sub>	supply voltage		0.7	2.75	V
VI	input voltage		0	2.75	V
Vo	output voltage	active mode	0	V <sub>CC</sub>	V
		power-down mode; V <sub>CC</sub> = 0 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

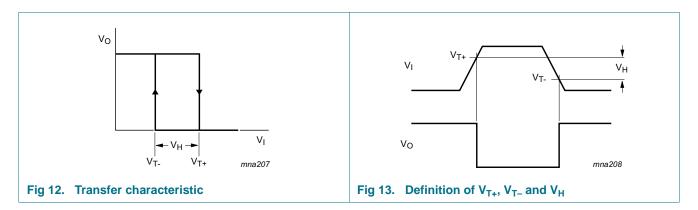
At recommended operating conditions, unless otherwise specified; voltages are referenced to GND (ground = 0 V).

				$T_{amb} = -40$ °C to +85 °C			
٠,,			Min	Typ 25 °C	Max 25 °C	Max 85 °C	
	positive-going	see Figure 12 and Figure 13					
	threshold voltage	V <sub>CC</sub> = 0.75 V to 0.85 V	0.3V <sub>CC</sub>	-	0.8V <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>	0.7V <sub>CC</sub>	V
		V <sub>CC</sub> = 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 <sub>CC</sub> = 0.75 V to 0.85 V	0.2V <sub>CC</sub>	-	0.7V <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>	0.6V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.7	-	1.5	1.5	V
V <sub>H</sub>	hysteresis	see Figure 12 and Figure 13					
	voltage	V <sub>CC</sub> = 0.75 V to 0.85 V	0.06V <sub>CC</sub>	-	0.5V <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>	0.4V <sub>CC</sub>	V
	V <sub>CC</sub> = 2.3 V to 2.7 V	0.2	-	1.0	1.0	V	
V <sub>OH</sub>	/ <sub>OH</sub> HIGH-level output voltage	$I_O = -20 \mu A; V_{CC} = 0.7 V$	-	0.69	-	-	V
		$I_O = -100 \mu A; V_{CC} = 0.75 V$	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 <sub>OL</sub>	LOW-level	$I_O = 20 \mu A; V_{CC} = 0.7 V$	-	0.01	-	-	V
	output voltage	$I_O = 100 \mu A; V_{CC} = 0.75 V$	-	-	0.1	0.1	V
		I <sub>O</sub> = 2 mA; V <sub>CC</sub> = 1.1 V	-	-	0.275	0.275	V
		$I_O = 3 \text{ mA}; V_{CC} = 1.4 \text{ V}$	-	-	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
l <sub>l</sub>	input leakage current	$V_1 = 0 \text{ V to } 2.75 \text{ V};$ $V_{CC} = 0 \text{ V to } 2.75 \text{ V}$	-	0.001	±0.1	±0.5	μΑ
l <sub>OFF</sub>	power-off leakage current	$V_{I}$ or $V_{O} = 0$ V to 2.75 V; $V_{CC} = 0$ V	-	0.01	±0.1	±0.5	μΑ
$\Delta I_{ m OFF}$	additional power-off leakage current	$V_1 \text{ or } V_O = 0 \text{ V or } 2.75 \text{ V};$ $V_{CC} = 0 \text{ V to } 0.1 \text{ V}$	-	0.02	±0.1	±0.5	μА
I <sub>CC</sub>	supply current	$V_I = 0 \text{ V or } V_{CC}; I_O = 0 \text{ A}$	<u>1]</u> _	0.01	0.3	0.6	μΑ
Δl <sub>CC</sub>	additional supply current	$V_I = V_{CC} - 0.5 \text{ V}; I_O = 0 \text{ A};$ $V_{CC} = 2.5 \text{ V}$	-	2	100	150	μΑ

<sup>[1]</sup> 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 Figure 20.

Symbol	Parameter	Conditions	Ta	<sub>mb</sub> = 25	°C	$T_{amb} = -40^{\circ}$	°C to +85 °C	Unit
			Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A, B and C to Y; see Figure 14 [2][3]						
		V <sub>CC</sub> = 0.75 V to 0.85 V	3.0	14	46	1	152	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	2.3	5.0	8.3	2.1	8.7	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	1.9	3.7	5.6	1.7	6.0	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.6	3.1	4.7	1.4	5.1	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.3	2.4	3.5	1.1	3.9	ns
t <sub>t</sub>	transition time	V <sub>CC</sub> = 2.7 V; see <u>Figure 14</u> [4]	-	-	-	1.0	-	ns
Cı	input capacitance	$V_I = 0 \text{ V or } V_{CC}$ ; $V_{CC} = 0 \text{ V to } 2.75 \text{ V}$	-	0.5	-	-	-	pF
Co	output capacitance	V <sub>O</sub> = 0 V; V <sub>CC</sub> = 0 V	-	1.0	-	-	-	pF
C <sub>PD</sub>	power dissipation	$f_i = 1 \text{ MHz}; V_i = 0 \text{ V to } V_{CC}$						
	capacitance	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	-	2.9	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	3.3	-	-	-	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 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  $\mu W$ ).

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

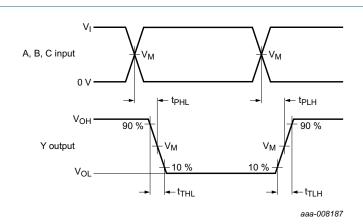
N = number of inputs switching.

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#### Low-power configurable multiple function gate

## 11.1 Waveforms and graphs



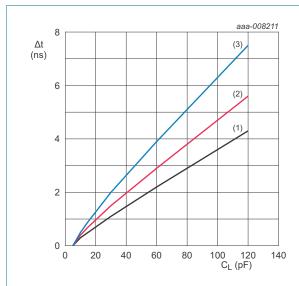
Measurement points are given in Table 10.

 $V_{\mbox{\scriptsize OL}}$  and  $V_{\mbox{\scriptsize OH}}$  are typical output voltage levels that occur with the output load.

Fig 14. Input A, B and C to output Y propagation delay times and output transition times

Table 10. Measurement points

Supply voltage	Output	Input		
V <sub>CC</sub>	V <sub>M</sub>	V <sub>M</sub>	VI	$t_r = t_f$
0.75 V to 2.7 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	V <sub>CC</sub>	≤ 3.0 ns



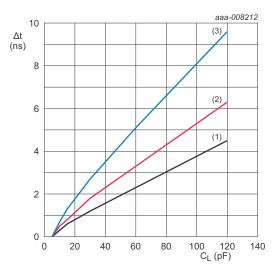
 $T_{amb}$  = -40 °C to +85 °C unless otherwise specified.

(1) Minimum:  $V_{CC} = 2.7 \text{ V}$ 

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

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

Fig 15. Additional t<sub>pd</sub> versus load capacitance



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

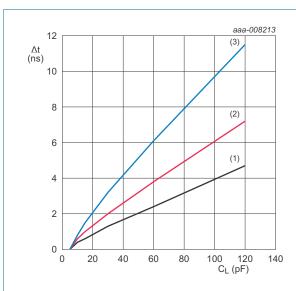
(1) Minimum:  $V_{CC} = 1.95 \text{ V}$ 

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

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

Fig 16. Additional t<sub>pd</sub> versus load capacitance

#### Low-power configurable multiple function gate



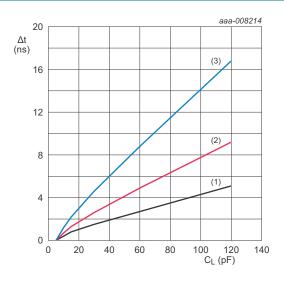
 $T_{amb}$  = -40 °C to +85 °C unless otherwise specified.

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

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

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

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



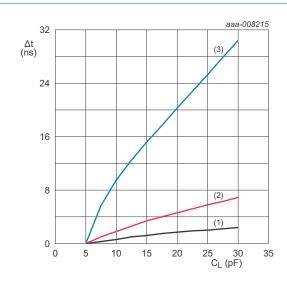
 $T_{amb} = -40$  °C to +85 °C unless otherwise specified.

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

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

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

Fig 18. Additional tpd versus load capacitance



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

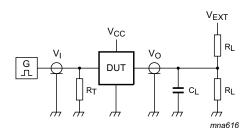
(1) Minimum:  $V_{CC} = 0.85 \text{ V}$ 

(2) Typical:  $T_{amb} = 25 \,^{\circ}C$ ;  $V_{CC} = 0.8 \,^{\circ}V$ 

(3) Maximum:  $V_{CC} = 0.75 \text{ V}$ 

Fig 19. Additional t<sub>pd</sub> versus load capacitance

## Low-power configurable multiple function gate



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.

 $V_{\text{EXT}}$  = External voltage for measuring switching times.

Fig 20. Test circuit for measuring switching times

#### Table 11. Test data

Supply voltage	Load		V <sub>EXT</sub>			
V <sub>CC</sub>	CL	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>PLZ</sub>			
0.75 V to 2.7 V	5 pF	10 kΩ	0 V	0 V	2V <sub>CC</sub>	

#### Low-power configurable multiple function gate

# 12. Package outline

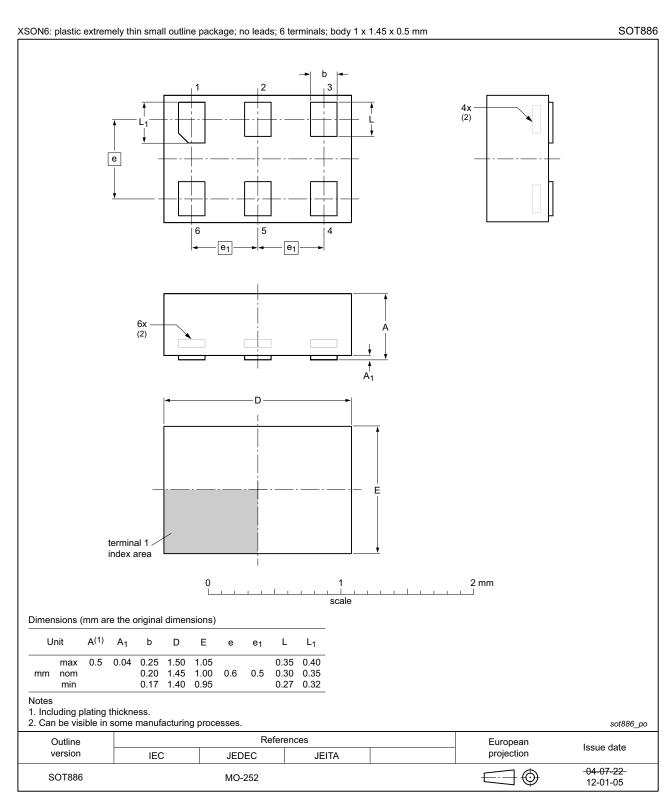


Fig 21. Package outline SOT886 (XSON6)

#### Low-power configurable multiple function gate

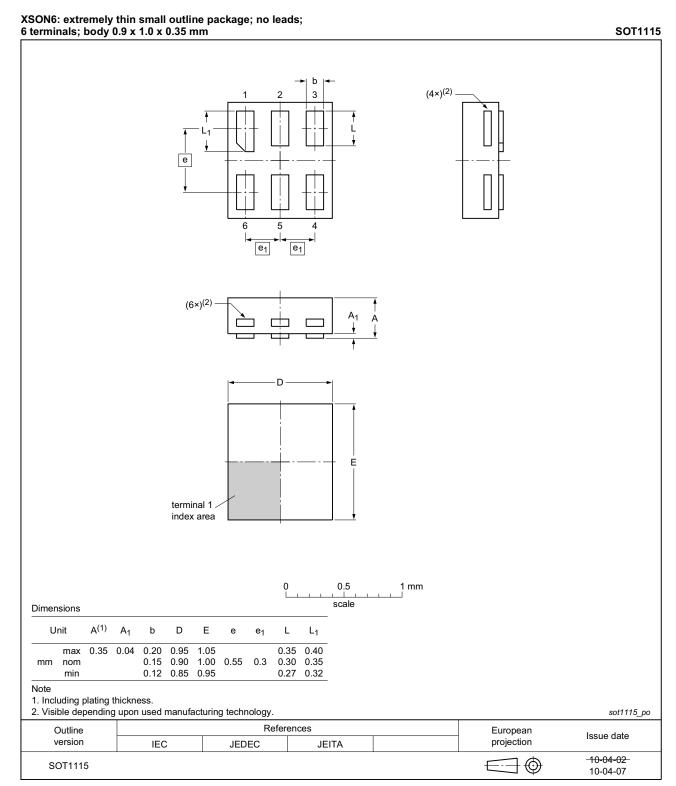


Fig 22. Package outline SOT1115 (XSON6)

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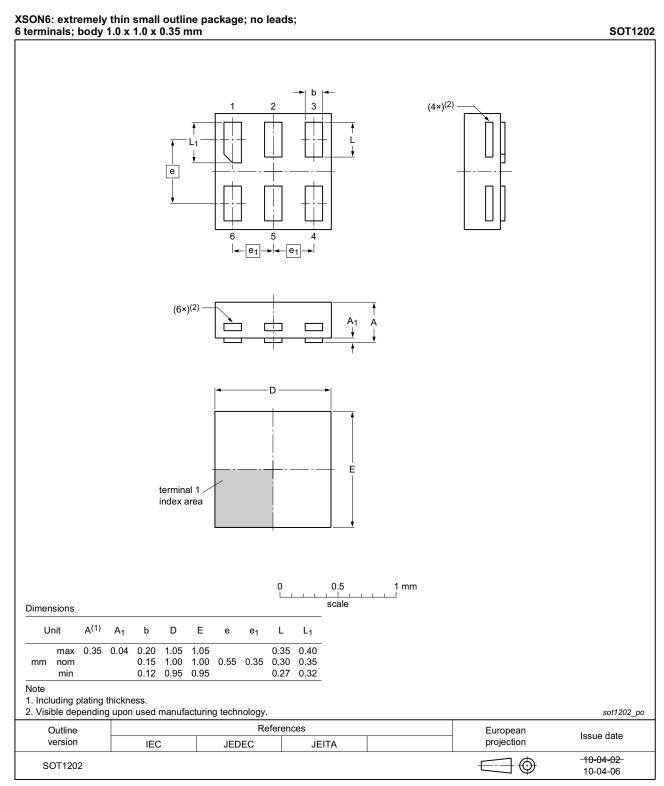


Fig 23. Package outline SOT1202 (XSON6)

**74AXP1G58** 

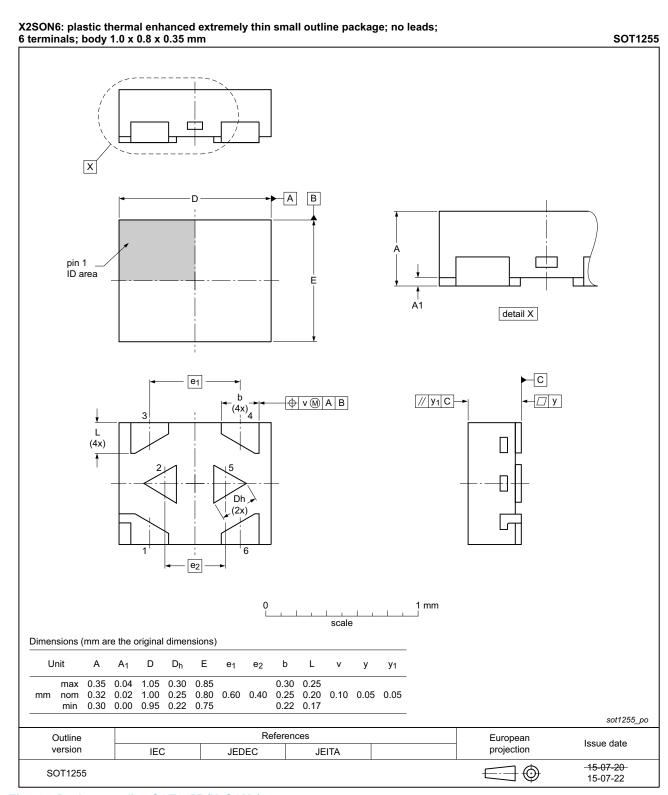


Fig 24. Package outline SOT1255 (X2SON6)

# Low-power configurable multiple function gate

# 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
74AXP1G58 v.3	20150916	Product data sheet	-	74AXP1G58 v.2
Modifications:	Added type number 74AXP1G58GX (SOT1255/X2SON6).			
74AXP1G58 v.2	20140724	Product data sheet	-	74AXP1G58 v.1
Modifications:	Data sheet status changed to product data sheet.			
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"
- [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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