74AXP1G14

Low-power Schmitt trigger inverter

Rev. 3 — 29 September 2021

Product data sheet

1. General description

The 74AXP1G14 is a single inverter with Schmitt trigger input. It transforms slowly changing input signals into sharply defined, jitter-free output signals.

This device ensures very low static and dynamic power consumption across the entire V_{CC} range from 0.7 V to 2.75 V. It 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

- 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} = 2.4 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							
	Temperature range	Name	Description	Version				
74AXP1G14GM	-40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886				
74AXP1G14GN	-40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115				
74AXP1G14GS	-40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202				
74AXP1G14GX	-40 °C to +85 °C	X2SON5	plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.32 mm	SOT1226-3				

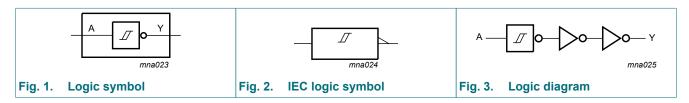
4. Marking

Table 2. Marking

Type number	Marking code [1]
74AXP1G14GM	rF
74AXP1G14GN	rF
74AXP1G14GS	rF
74AXP1G14GX	rF

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

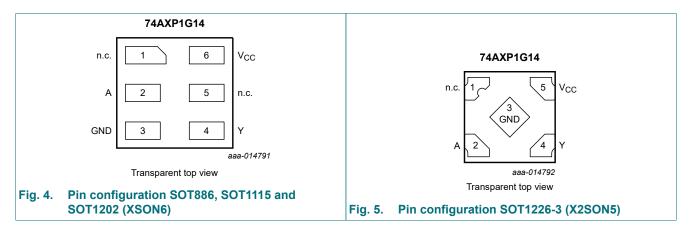
5. Functional diagram



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6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

Symbol	Pin		Description
	X2SON5	XSON6	
n.c.	1	1	not connected
A	2	2	data input
GND	3	3	ground (0 V)
Υ	4	4	data output
n.c.	-	5	not connected
V _{CC}	5	6	supply voltage

7. Functional description

Table 4. Function table

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

Input	Output
A	Υ
L	Н
Н	L

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8. Limiting values

Table 5. 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
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
Io	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 °C to +85 °C [2]	-	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 6. 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 V	0	2.75	V
T _{amb}	ambient temperature		-40	+85	°C

^[2] For SOT886 (XSON6) package: Ptot derates linearly with 3.3 mW/K above 74 °C.

For SOT1115 (XSON6) package: Ptot derates linearly with 3.2 mW/K above 71 °C.

For SOT1202 (XSON6) package: Ptot derates linearly with 3.3 mW/K above 74 °C.

For SOT1226-3 (X2SON5) package: Ptot derates linearly with 3.0 mW/K above 67 °C.

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10. Static characteristics

Table 7. Static characteristics

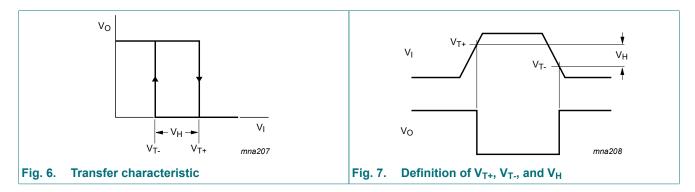
At recommended operating conditions, unless otherwise specified; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		T _{amb} = 25 °C			T_{amb} = -40 °C to +85 °C		Unit
				Min	Тур	Max	Min	Max	1
V _{T+}	positive-going	see Fig. 6 and Fig. 7							
	threshold voltage	V _{CC} = 0.75 V to 0.85 V		0.3V _{CC}	-	0.8V _{CC}	0.3V _{CC}	0.8V _{CC}	V
		V _{CC} = 1.1 V to 1.95 V		0.4V _{CC}	-	0.7V _{CC}	0.4V _{CC}	0.7V _{CC}	٧
		V _{CC} = 2.3 V to 2.7 V		0.9	-	1.7	0.9	1.7	٧
V _{T-}	negative-going	see Fig. 6 and Fig. 7							
	threshold voltage	V _{CC} = 0.75 V to 0.85 V		0.2V _{CC}	-	0.7V _{CC}	0.2V _{CC}	0.7V _{CC}	٧
		V _{CC} = 1.1 V to 1.95 V		0.3V _{CC}	-	0.6V _{CC}	0.3V _{CC}	0.6V _{CC}	٧
		V _{CC} = 2.3 V to 2.7 V		0.7	-	1.5	0.7	1.5	٧
V _H	hysteresis	see Fig. 6 and Fig. 7							
	voltage	V _{CC} = 0.75 V to 0.85 V		0.06V _{CC}	-	0.5V _{CC}	0.06V _{CC}	0.5V _{CC}	٧
		V _{CC} = 1.1 V to 1.95 V		0.1V _{CC}	-	0.4V _{CC}	0.1V _{CC}	0.4V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V		0.2	-	1.0	0.2	1.0	٧
V _{OH}	HIGH-level	I _O = -20 μA; V _{CC} = 0.7 V		-	0.69	-	-	-	V
	output voltage	I _O = -100 μA; V _{CC} = 0.75 V		0.65	-	-	0.65	-	٧
		I _O = -2 mA; V _{CC} = 1.1 V		0.825	-	-	0.825	-	V
		$I_O = -3 \text{ mA}; V_{CC} = 1.4 \text{ V}$		1.05	-	-	1.05	-	٧
		I _O = -4.5 mA; V _{CC} = 1.65 V		1.2	-	-	1.2	-	V
		$I_O = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$		1.7	-	-	1.7	-	٧
V_{OL}		$I_O = 20 \mu A; V_{CC} = 0.7 V$		-	0.01	-	-	-	V
	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 mA; V_{CC} = 2.3 V		-	-	0.7	-	0.7	V
l _l	input leakage current	V _I = 0 V to 2.75 V; V _{CC} = 0 V to 2.75 V	[1]	-	0.001	±0.1	-	±0.5	μA
l _{OFF}	power-off leakage current	$V_1 \text{ or } V_0 = 0 \text{ V to } 2.75 \text{ V};$ $V_{CC} = 0 \text{ V}$	[1]	-	0.01	±0.1	-	±0.5	μΑ
Δl _{OFF}	additional power-off leakage current	V_1 or $V_0 = 0$ V or 2.75 V; $V_{CC} = 0$ V to 0.1 V	[1]	-	0.02	±0.1	-	±0.5	μΑ
lcc	supply current	$V_I = 0 \text{ V or } V_{CC}; I_O = 0 \text{ A}$	[1]	-	0.01	0.3	-	0.6	μΑ
ΔI _{CC}	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

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

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10.1. Transfer characteristic waveforms



11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit, see Fig. 14.

Symbol	Parameter	Conditions		_{amb} = 25	°C	T _{amb} = -40 °C to +85 °C		Unit
				Typ[1]	Max	Min	Max	1
t _{pd}	propagation	A to Y; see <u>Fig. 8</u> [2][3]					
C	delay	V _{CC} = 0.75 V to 0.85 V	3	12	35	2	114	ns
		V _{CC} = 1.1 V to 1.3 V	2.0	4.6	7.2	1.8	7.5	ns
		V _{CC} = 1.4 V to 1.6 V	1.6	3.5	5.0	1.4	5.3	ns
		V _{CC} = 1.65 V to 1.95 V	1.4	2.9	4.1	1.2	4.5	ns
		V _{CC} = 2.3 V to 2.7 V	1.2	2.3	3.2	1.0	3.5	ns
t _t	transition time	V _{CC} = 2.7 V; see <u>Fig. 8</u> [4] -	-	-	1.0	-	ns
C _I	input capacitance	V _I = 0 V or V _{CC} ; V _{CC} = 0 V to 2.75 V	-	0.5	-	-	-	pF
Co	output capacitance	$V_{O} = 0 \text{ V}; V_{CC} = 0 \text{ V}$	-	1.0	-	-	-	pF
C _{PD}	1.	$f_i = 1 \text{ MHz}; V_I = 0 \text{ V to } V_{CC}$ [5]					
	capacitance	V _{CC} = 0.75 V to 0.85 V	-	2.3	-	-	-	pF
		V _{CC} = 1.1 V to 1.3 V		2.4	-	-	-	pF
		V _{CC} = 1.4 V to 1.6 V		2.5	-	-	-	pF
		V _{CC} = 1.65 V to 1.95 V		2.6	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	3.0	-	-	-	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 Fig. 9 to Fig. 13.
- [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.

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11.1. Waveforms and test circuit

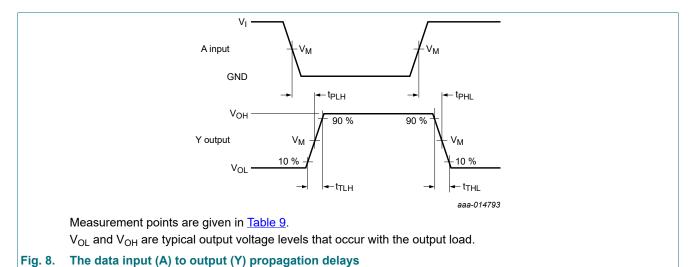
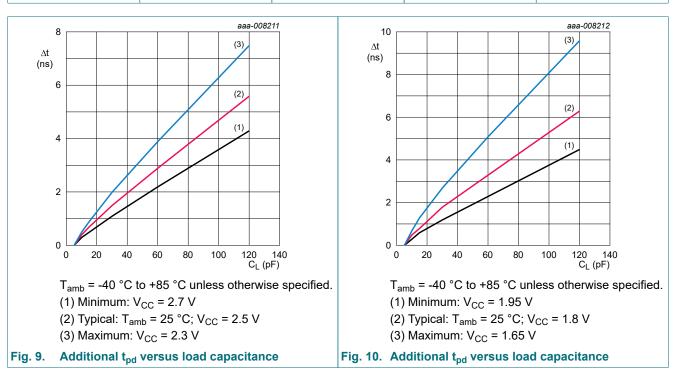
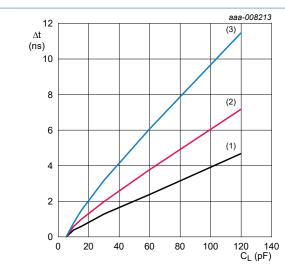


Table 9. Measurement points

Supply voltage	Input	Output		
V _{CC}	V _M	VI	$t_r = t_f$	V _M
0.75 V to 2.7 V	0.5V _{CC}	V _{CC}	≤ 3.0 ns	0.5V _{CC}



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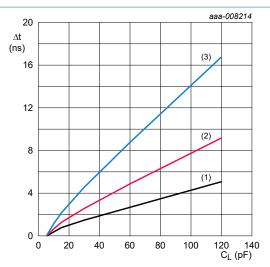
 T_{amb} = -40 °C to +85 °C unless otherwise specified.

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

(2) Typical: T_{amb} = 25 °C; V_{CC} = 1.5 V

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

Fig. 11. Additional t_{pd} versus load capacitance



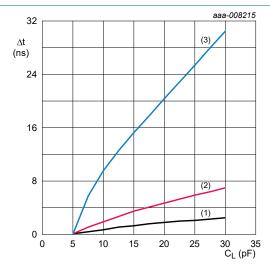
 T_{amb} = -40 °C to +85 °C unless otherwise specified.

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

(2) Typical: T_{amb} = 25 °C; V_{CC} = 1.2 V

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

Fig. 12. Additional t_{pd} versus load capacitance



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

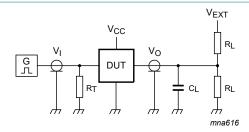
(1) Minimum: $V_{CC} = 0.85 \text{ V}$

(2) Typical: T_{amb} = 25 °C; V_{CC} = 0.8 V

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

Fig. 13. Additional t_{pd} versus load capacitance

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Test data is given in <u>Table 10</u>.

Definitions for test circuit:

 R_L = Load resistance.

 $\ensuremath{C_L}$ = 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. 14. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Load		V _{EXT}			
V _{CC}	CL	R _L	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 × V _{CC}	

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12. Package outline

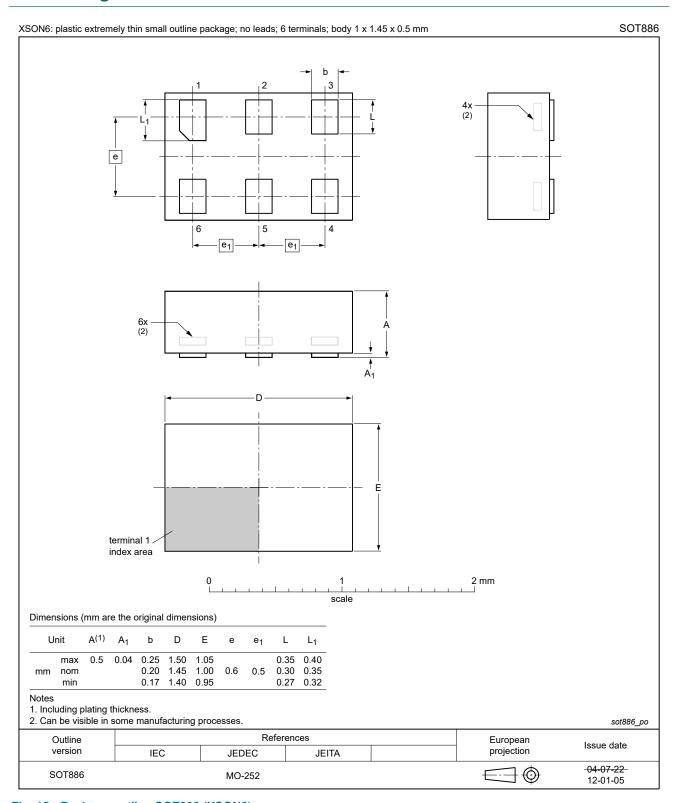


Fig. 15. Package outline SOT886 (XSON6)

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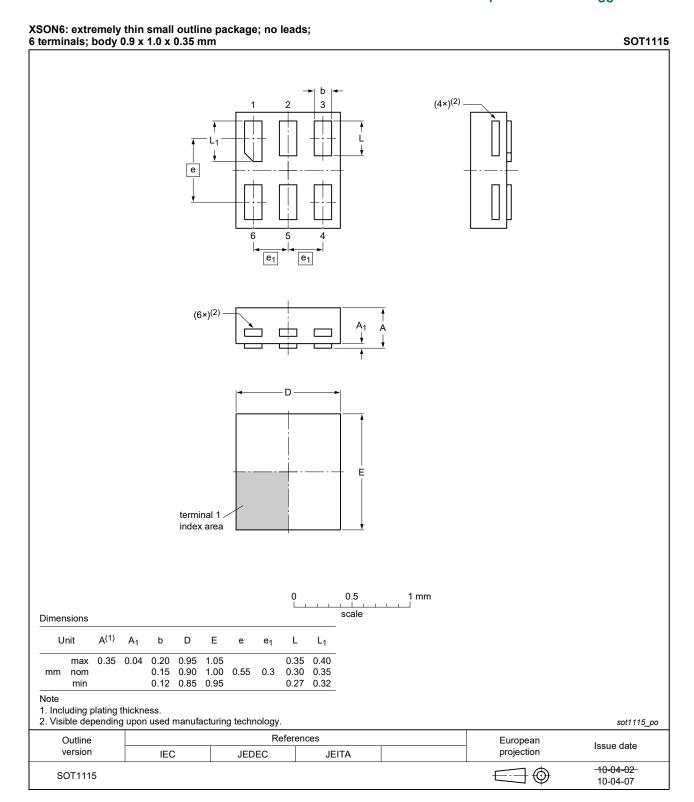


Fig. 16. Package outline SOT1115 (XSON6)

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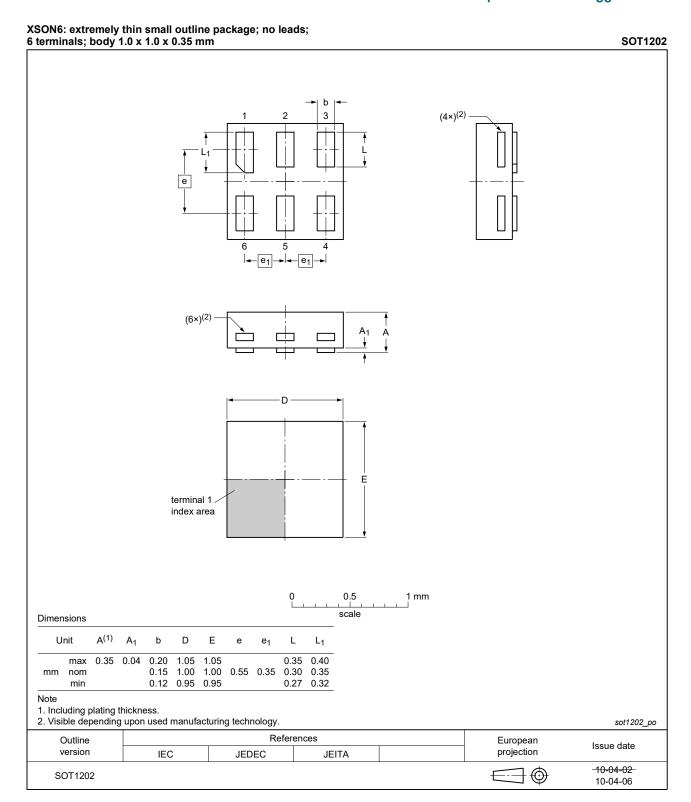


Fig. 17. Package outline SOT1202 (XSON6)

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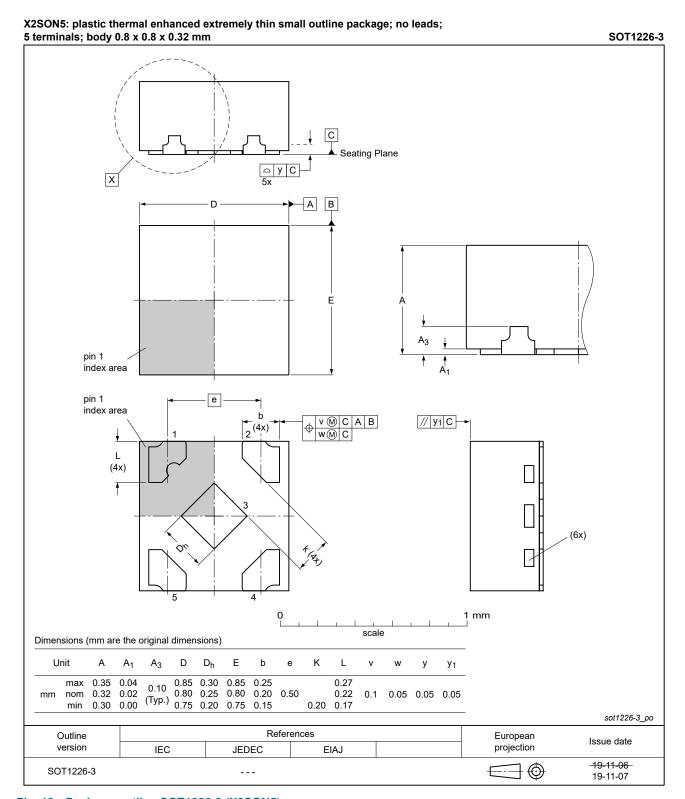


Fig. 18. Package outline SOT1226-3 (X2SON5)

Product data sheet

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13. Abbreviations

Table 11. Abbreviations

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

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes			
74AXP1G14 v.3	20210929	Product data sheet	-	74AXP1G14 v.2			
Modifications:	 SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package. Table 5: Derating values for P_{tot} total power dissipation updated. 						
74AXP1G14 v.2	20191009	Product data sheet	-	74AXP1G14 v.1			
Modifications:	 The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Fig. 5: Pin configuration drawing aligned with Package outline drawing. Table 5: Derating values for Ptot total power dissipation added. 						
74AXP1G14 v.1	20140828	Product data sheet	-	-			

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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.
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Product [short] data sheet	Production	This document contains the product specification.

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