74AXP1G06

Low-power inverter with open-drain output

Rev. 1 — 15 January 2014 Product data sheet

1. General description

The 74AXP1G06 is a single inverter with open-drain output.

Schmitt-trigger action at the input makes the circuit tolerant of slower input rise and fall times.

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 = 0.7 pF (typical)
- Low dynamic power consumption; C_{PD} = 1.0 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
- Input accepts 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

nexperia

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AXP1G06GM	–40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74AXP1G06GN	–40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74AXP1G06GS	–40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202
74AXP1G06GX	–40 °C to +85 °C	X2SON5	X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.35 mm	SOT1226

4. Marking

Table 2. Marking

Type number	Marking code[1]
74AXP1G06GM	rR
74AXP1G06GN	rR
74AXP1G06GS	rR
74AXP1G06GX	rR

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

5. Functional diagram

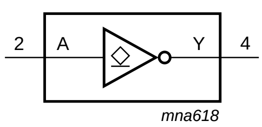


Fig 1. Logic symbol

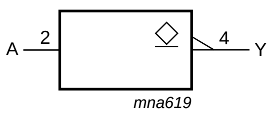


Fig 2. IEC logic symbol

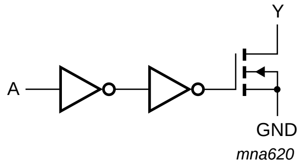


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

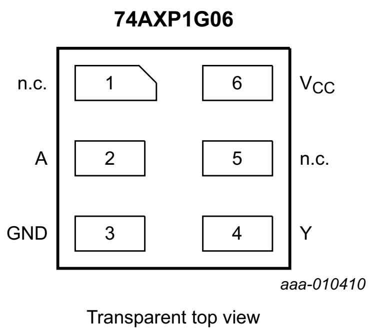


Fig 4. Pin configuration SOT886, SOT1115 and SOT1202 (XSON6)

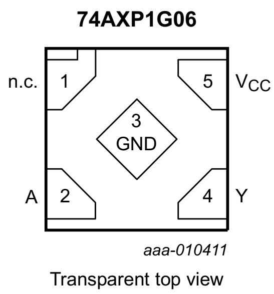


Fig 5. Pin configuration SOT1226 (X2SON5)

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)
Y	4	4	data output
n.c.	-	5	not connected
V_{CC}	5	6	supply voltage

7. Functional description

Table 4. Function table[1]

Input	Output
A	Y
L	Z
H	L

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

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
V_I	input voltage		[1]	–0.5	+3.3	V
I_{OK}	output clamping current	$V_O < 0$ V		–50	-	mA
V_O	output voltage		[1]	–0.5	+3.3	V
I_O	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		-	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
V_I	input voltage		0	2.75	V
V_O	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
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 0.7 V to 2.75 V	0	200	ns/V

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} = –40 °C to +85 °C				Unit
				Min	Typ 25 °C	Max 25 °C	Max 85 °C	
V_{IH}	HIGH-level input voltage	V_{CC} = 0.75 V to 0.85 V		0.75V_{CC}	-	-	-	V
		V_{CC} = 1.1 V to 1.95 V		0.65V_{CC}	-	-	-	V
		V_{CC} = 2.3 V to 2.7 V		1.6	-	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 0.75 V to 0.85 V		-	-	0.25V_{CC}	0.25V_{CC}	V
		V_{CC} = 1.1 V to 1.95 V		-	-	0.35V_{CC}	0.35V_{CC}	V
		V_{CC} = 2.3 V to 2.7 V		-	-	0.7	0.7	V
V_{OL}	LOW-level output voltage	I_O = 20 μA; V_{CC} = 0.7 V		-	0.01	-	-	V
		I_O = 100 μA; V_{CC} = 0.75 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_I	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
I_{OZ}	OFF-state output current	V_I = V_{IL}; V_O = 0 V to 2.75 V	[1]	-	0.02	±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_I or V_O = 0 V or 2.75 V; V_{CC} = 0 V to 0.1 V	[1]	-	0.02	±0.1	±0.5	μA
I_{CC}	supply current	V_I = 0 V or V_{CC}; I_O = 0 A	[1]	-	0.01	0.3	0.6	μA
ΔI_{CC}	additional supply current	V_I = V_{CC} – 0.5 V; I_O = 0 A; V_{CC} = 2.5 V		-	2	100	150	μA

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

11. Dynamic characteristics

Table 8. Dynamic characteristics
Voltages are referenced to GND (ground = 0 V); for test circuit, see Figure 12.

Symbol	Parameter	Conditions		T_{amb} = 25 °C			T_{amb} = –40 °C to +85 °C		Unit
				Min	Typ[1]	Max	Min	Max	
t_{pd}	propagation delay	A to Y; see Figure 6	[2][3]						
		V_{CC} = 0.75 V to 0.85 V		3	12	33	3	104	ns
		V_{CC} = 1.1 V to 1.3 V		2.2	5.1	7.9	2.0	8.3	ns
		V_{CC} = 1.4 V to 1.6 V		1.7	3.7	5.2	1.5	5.6	ns
		V_{CC} = 1.65 V to 1.95 V		1.4	3.5	5.3	1.2	5.6	ns
		V_{CC} = 2.3 V to 2.7 V		1.2	2.6	3.8	1.0	4.0	ns
t_t	transition time	V_{CC} = 2.7 V; see Figure 6	[4]	-	-	-	0.9	-	ns
C_I	input capacitance	V_I = 0 V or V_{CC}; V_{CC} = 0 V to 2.75 V		-	0.5	-	-	-	pF
C_O	output capacitance	V_O = 0 V; V_{CC} = 0 V		-	0.7	-	-	-	pF
C_{PD}	power dissipation capacitance	f_i = 1 MHz; V_I = 0 V to V_{CC}	[5]						
		V_{CC} = 0.75 V to 0.85 V		-	0.9	-	-	-	pF
		V_{CC} = 1.1 V to 1.3 V		-	1.0	-	-	-	pF
		V_{CC} = 1.4 V to 1.6 V		-	1.0	-	-	-	pF
		V_{CC} = 1.65 V to 1.95 V		-	1.1	-	-	-	pF
		V_{CC} = 2.3 V to 2.7 V		-	1.3	-	-	-	pF

[1] All typical values are measured at nominal V_{CC}.

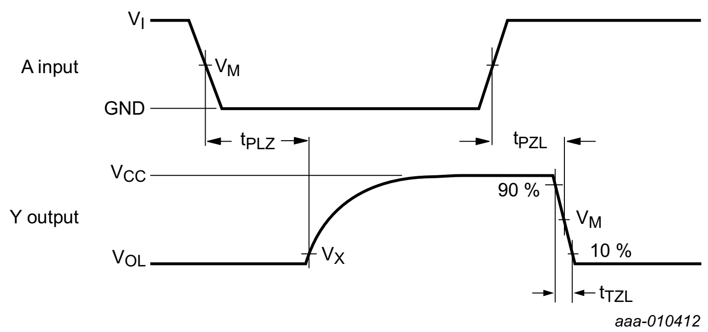
[2] t_{pd} is the same as t_{PZL} and t_{PLZ}.

[3] For additional propagation delay (t_{PZL}) values at different load capacitances see Figure 7 to Figure 11.

[4] t_t is the same as t_{TZL} and t_{TLZ}.

[5] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i + C_L \times V_{CC}^2 \times f_o$ 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.

12. Waveforms



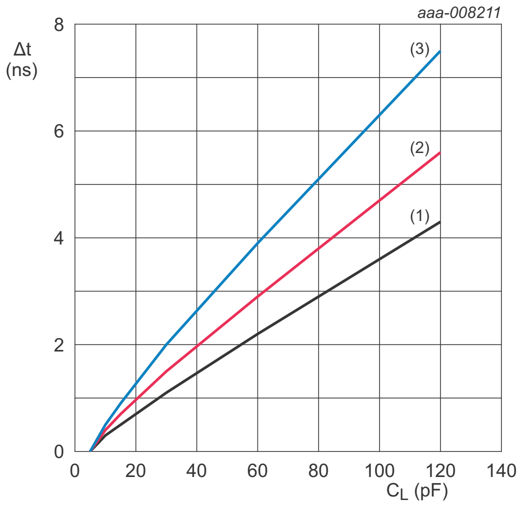
Measurement points are given in Table 9.

V_{OL} is the typical output voltage level that occurs at the output load.

Fig 6. The data input (A) to output (Y) propagation delays

Table 9. Measurement points

Supply voltage	Input			Output	
V_{CC}	V_M	V_I	$t_r = t_f$	V_M	V_X
0.75 V to 1.6 V	$0.5V_{CC}$	V_{CC}	$\leq$ 3.0 ns	$0.5V_{CC}$	V_{OL} + 0.1 V
1.65 V to 2.7 V	$0.5V_{CC}$	V_{CC}	$\leq$ 3.0 ns	$0.5V_{CC}$	V_{OL} + 0.15 V



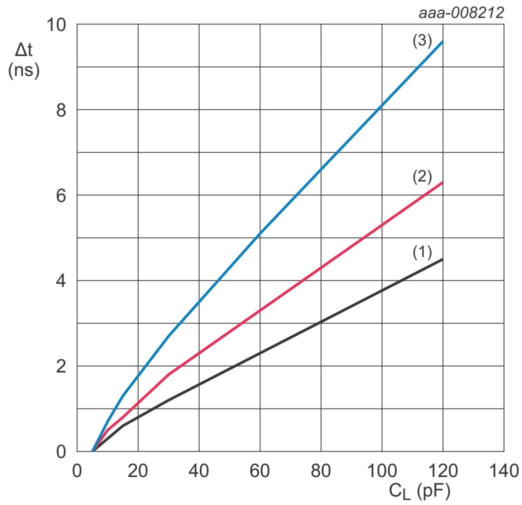
T_{amb} = −40 °C to +85 °C unless otherwise specified.

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

(2) Typical: T_{amb} = 25 °C; V_{CC} = 2.5 V

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

Fig 7. Additional t_{PZL} versus load capacitance



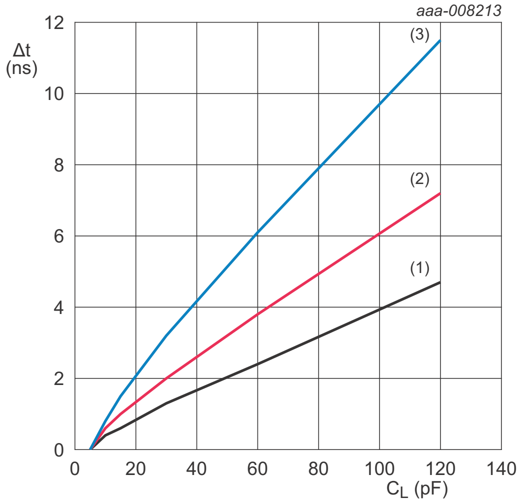
T_{amb} = −40 °C to +85 °C unless otherwise specified.

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

(2) Typical: T_{amb} = 25 °C; V_{CC} = 1.8 V

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

Fig 8. Additional t_{PZL} versus load capacitance



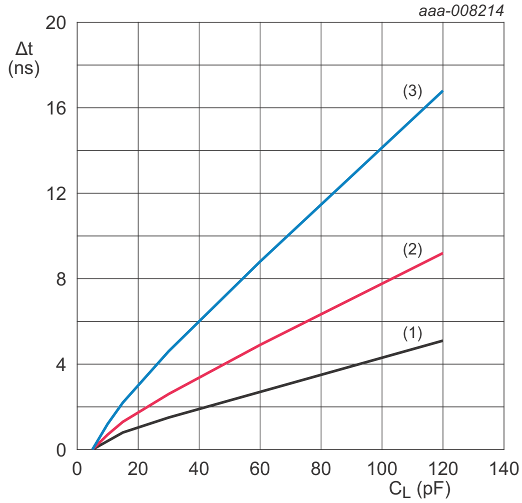
T_{amb} = –40 °C to +85 °C unless otherwise specified.

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

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

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

Fig 9. Additional t_{PZL} versus load capacitance



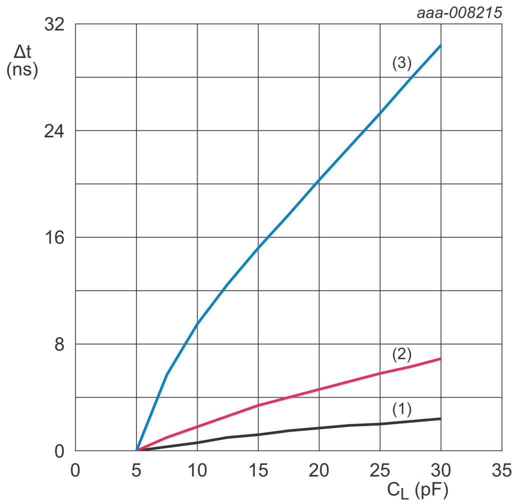
T_{amb} = –40 °C to +85 °C unless otherwise specified.

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

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

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

Fig 10. Additional t_{PZL} versus load capacitance



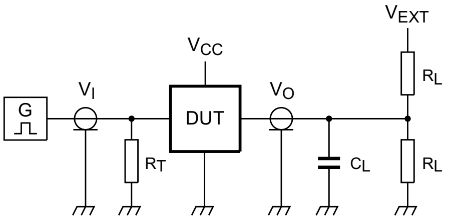
T_{amb} = –40 °C to +85 °C unless otherwise specified.

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

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

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

Fig 11. Additional t_{PZL} versus load capacitance



Test data is given in Table 10.

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_o of the pulse generator.

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

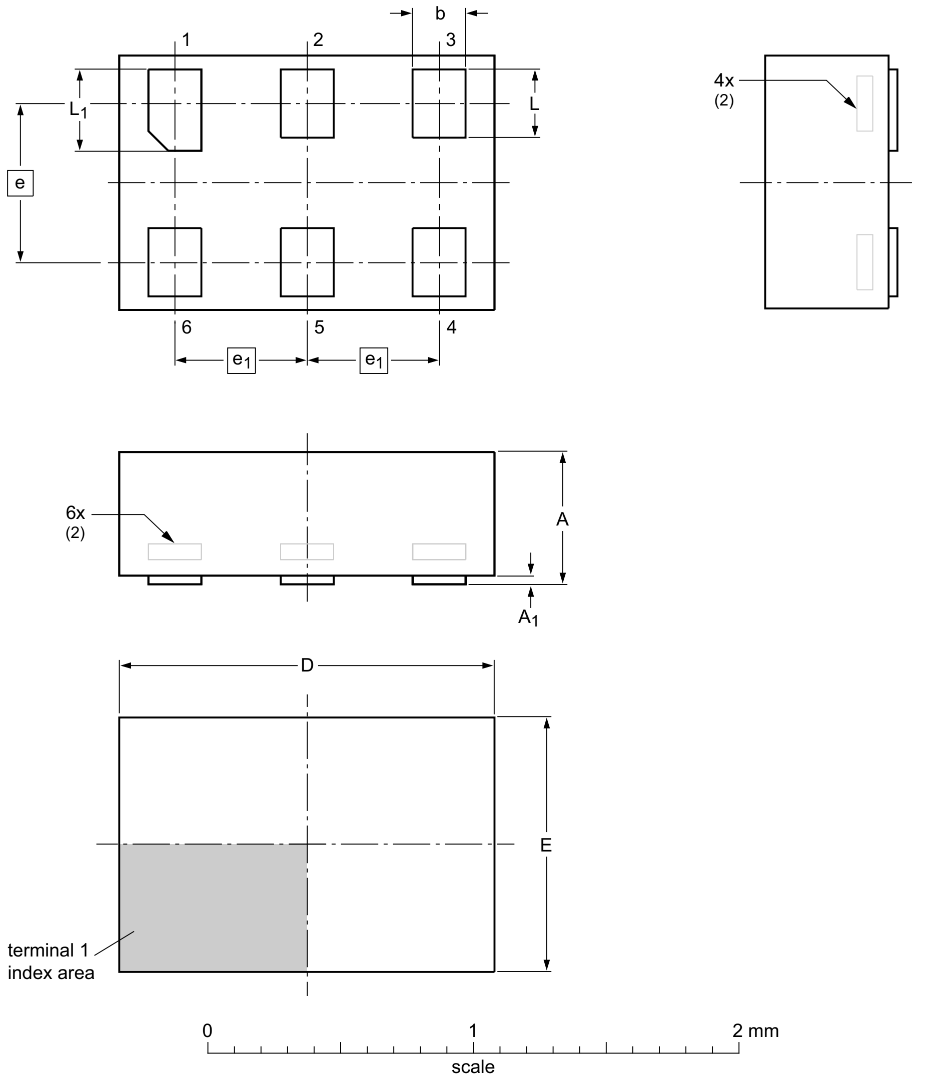
Fig 12. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Load		V_{EXT}	
V_{CC}	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZL}, t_{PLZ}
0.75 V to 2.7 V	5 pF	10 kΩ	0 V	2 × V_{CC}

13. Package outline

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm SOT886



Dimensions (mm are the original dimensions)

Unit		A(1)	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.5	0.04	0.25	1.50	1.05			0.35	0.40
	nom			0.20	1.45	1.00	0.6	0.5	0.30	0.35
	min			0.17	1.40	0.95			0.27	0.32

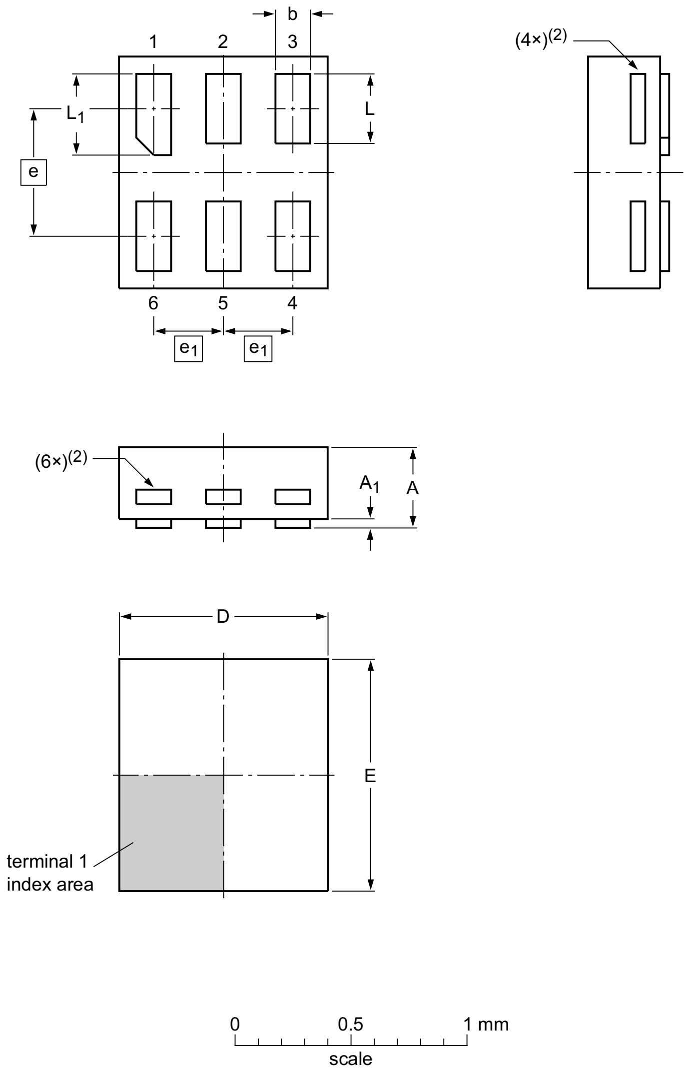
Notes
1. Including plating thickness.
2. Can be visible in some manufacturing processes.

sot886_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT886		MO-252				~~04-07-22~~ 12-01-05

Fig 13. Package outline SOT886 (XSON6)

XSON6: extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm **SOT1115**



Dimensions

Unit		A(1)	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.35	0.04	0.20	0.95	1.05			0.35	0.40
	nom			0.15	0.90	1.00	0.55	0.3	0.30	0.35
	min			0.12	0.85	0.95			0.27	0.32

Note

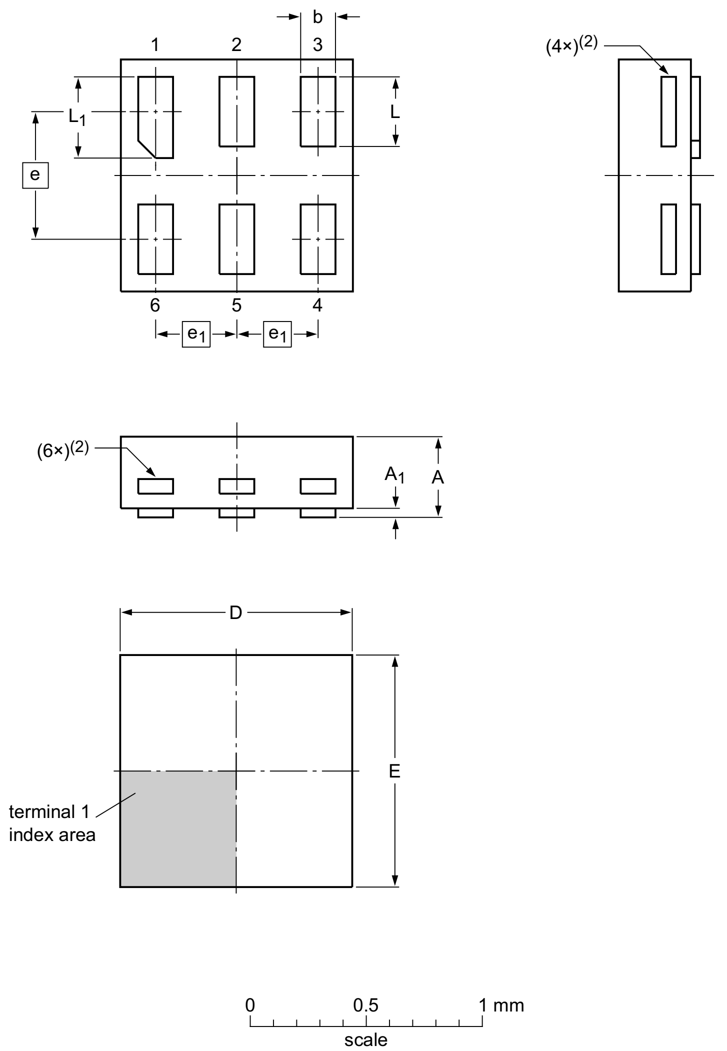
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1115_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1115						~~10-04-02~~ 10-04-07

Fig 14. Package outline SOT1115 (XSON6)

XSON6: extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm **SOT1202**



Dimensions

Unit		$A^{(1)}$	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.35	0.04	0.20	1.05	1.05			0.35	0.40
	nom			0.15	1.00	1.00	0.55	0.35	0.30	0.35
	min			0.12	0.95	0.95			0.27	0.32

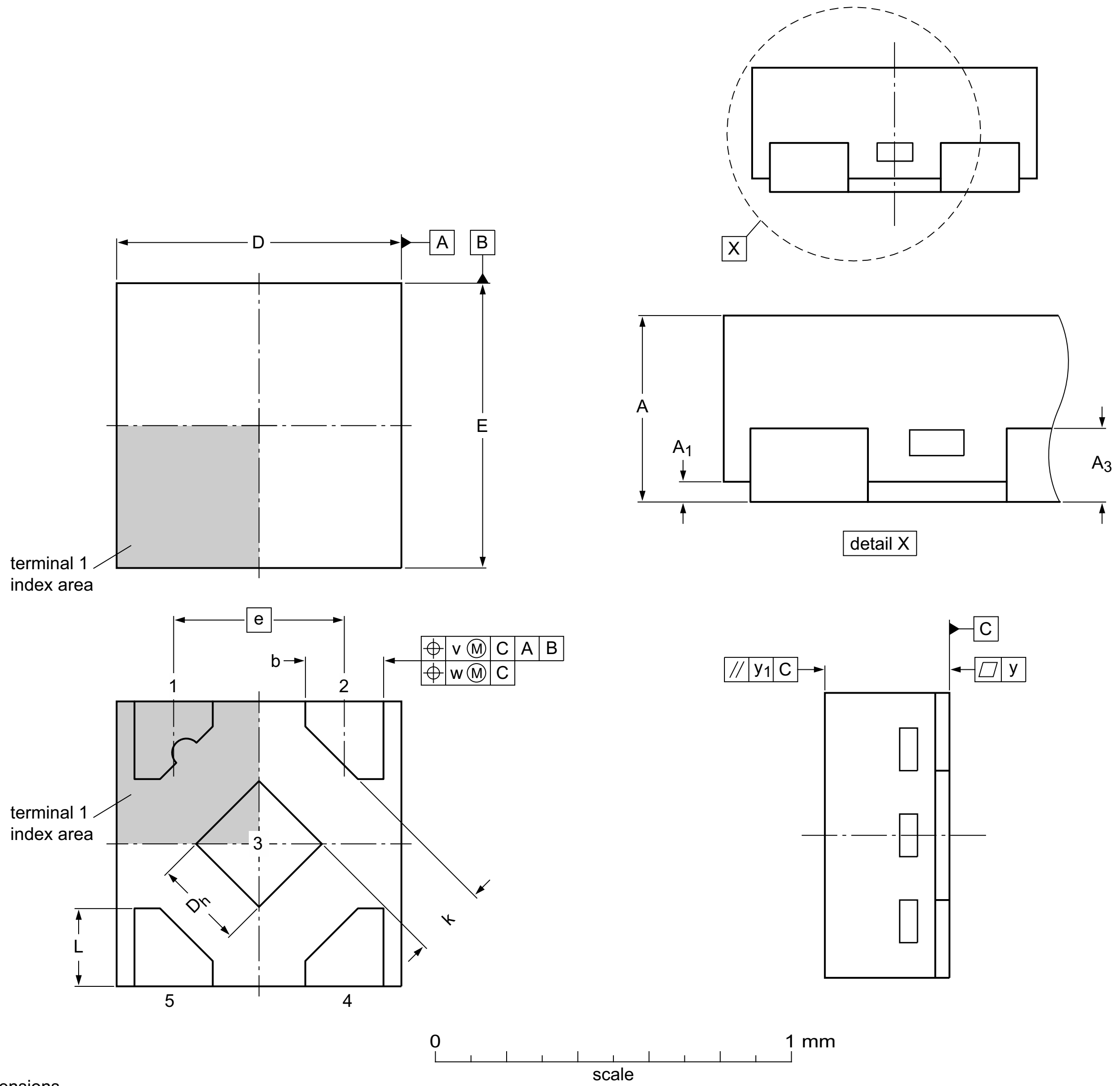
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1202_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1202						~~10-04-02~~ 10-04-06

Fig 15. Package outline SOT1202 (XSON6)

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.35 mm **SOT1226**



Dimensions

Unit		A(1)	A_1	A_3	D	D_h	E	b	e	k	L	v	w	y	y_1
	max	0.35	0.04	0.128	0.85	0.30	0.85	0.27			0.27				
mm	nom				0.80	0.25	0.80	0.22	0.48		0.22	0.1	0.05	0.05	0.05
	min			0.040	0.75	0.20	0.75	0.17		0.20	0.17				

Note
1. Dimension A is including plating thickness.
2. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1226_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	EIAJ			
SOT1226						~~12-04-10~~ 12-04-25

Fig 16. Package outline SOT1226 (X2SON5)

14. Abbreviations

Table 11. Abbreviations

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

15. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AXP1G06 v.1	20140115	Product data sheet	-	-

16. Legal information

16.1 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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17. Contact information

For more information, please visit: **http://www.nexperia.com**

For sales office addresses, please send an email to: **salesaddresses@nexperia.com**

18. Contents

For more information, please visit: http://www.nexperia.com
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Date of release: 15 January 2014