

# 74AXP1G06

Low-power inverter with open-drain output

Rev. 2 — 20 July 2021

Product data sheet

## 1. General description

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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

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- 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;  $I_{CC} = 0.6$   $\mu$ A (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

### 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	plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.32 mm	SOT1226-3

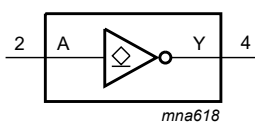

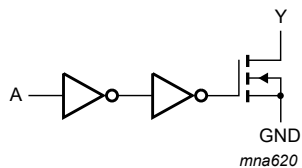
### 4. Marking

Table 2. Marking

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

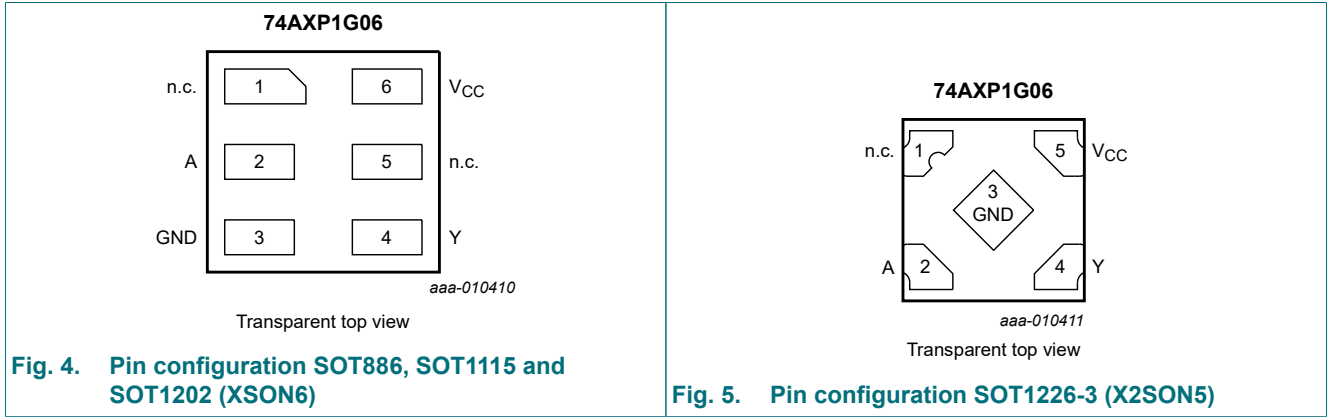
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

### 5. Functional diagram

 <p><i>mna618</i></p>	 <p><i>mna619</i></p>	 <p><i>mna620</i></p>
<b>Fig. 1. Logic symbol</b>	<b>Fig. 2. IEC logic symbol</b>	<b>Fig. 3. Logic diagram</b>

## 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)
Y	4	4	data output
n.c.	-	5	not connected
V <sub>CC</sub>	5	6	supply voltage

## 7. Functional description

Table 4. Function table

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

Input	Output
A	Y
L	Z
H	L

## 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		-0.5	+3.3	V
$I_{OK}$	output clamping current	$V_O < 0$ V	-50	-	mA
$V_O$	output voltage		-0.5	+3.3	V
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	$\pm 20$	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.

- [2] For SOT886 (XSON6) package:  $P_{tot}$  derates linearly with 3.3 mW/K above 74 °C.  
 For SOT1115 (XSON6) package:  $P_{tot}$  derates linearly with 3.2 mW/K above 71 °C.  
 For SOT1202 (XSON6) package:  $P_{tot}$  derates linearly with 3.3 mW/K above 74 °C.  
 For SOT1226-3 (X2SON5) package:  $P_{tot}$  derates linearly with 3.0 mW/K above 67 °C.

## 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 <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		Unit
			Min	Typ	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 0.75 V to 0.85 V	0.75V <sub>CC</sub>	-	-	0.75V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 1.1 V to 1.95 V	0.65V <sub>CC</sub>	-	-	0.65V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.6	-	-	1.6	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 0.75 V to 0.85 V	-	-	0.25V <sub>CC</sub>	-	0.25V <sub>CC</sub>	V
		V <sub>CC</sub> = 1.1 V to 1.95 V	-	-	0.35V <sub>CC</sub>	-	0.35V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.7 V	-	0.01	-	-	-	V
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 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 <sub>O</sub> = 3 mA; V <sub>CC</sub> = 1.4 V	-	-	0.35	-	0.35	V
		I <sub>O</sub> = 4.5 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	-	0.45	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.7	-	0.7	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 0 V to 2.75 V; V <sub>CC</sub> = 0 V to 2.75 V [1]	-	0.001	±0.1	-	±0.5	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IL</sub> ; V <sub>O</sub> = 0 V to 2.75 V [1]	-	0.02	±0.1	-	±0.5	μA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V to 2.75 V; V <sub>CC</sub> = 0 V [1]	-	0.01	±0.1	-	±0.5	μA
ΔI <sub>OFF</sub>	additional power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V or 2.75 V; V <sub>CC</sub> = 0 V to 0.1 V [1]	-	0.02	±0.1	-	±0.5	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = 0 V or V <sub>CC</sub> ; I <sub>O</sub> = 0 A [1]	-	0.01	0.3	-	0.6	μA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 0.5 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 2.5 V	-	2	100	-	150	μA

[1] All typical values are measured at V<sub>CC</sub> = 1.2 V.

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit, see Fig. 12.

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A to Y; see Fig. 6 [2] [3]						
		V <sub>CC</sub> = 0.75 V to 0.85 V	3	12	33	3	104	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	2.2	5.1	7.9	2.0	8.3	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	1.7	3.7	5.2	1.5	5.6	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.4	3.5	5.3	1.2	5.6	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.2	2.6	3.8	1.0	4.0	ns
t <sub>t</sub>	transition time	V <sub>CC</sub> = 2.7 V; see Fig. 6 [4]	-	-	-	0.9	-	ns
C <sub>I</sub>	input capacitance	V <sub>I</sub> = 0 V or V <sub>CC</sub> ; V <sub>CC</sub> = 0 V to 2.75 V	-	0.5	-	-	-	pF
C <sub>O</sub>	output capacitance	V <sub>O</sub> = 0 V; V <sub>CC</sub> = 0 V	-	0.7	-	-	-	pF
C <sub>PD</sub>	power dissipation capacitance	f <sub>i</sub> = 1 MHz; V <sub>I</sub> = 0 V to V <sub>CC</sub> [5]						
		V <sub>CC</sub> = 0.75 V to 0.85 V	-	0.9	-	-	-	pF
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	1.0	-	-	-	pF
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	1.0	-	-	-	pF
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	1.1	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	1.3	-	-	-	pF

[1] All typical values are measured at nominal V<sub>CC</sub>.

[2] t<sub>pd</sub> is the same as t<sub>PZL</sub> and t<sub>PLZ</sub>.

[3] For additional propagation delay (t<sub>PZL</sub>) values at different load capacitances see Fig. 7 to Fig. 11.

[4] t<sub>t</sub> is the same as t<sub>TZL</sub> and t<sub>TLZ</sub>.

[5] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

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

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V.

11.1. Waveform, graphs and test circuit

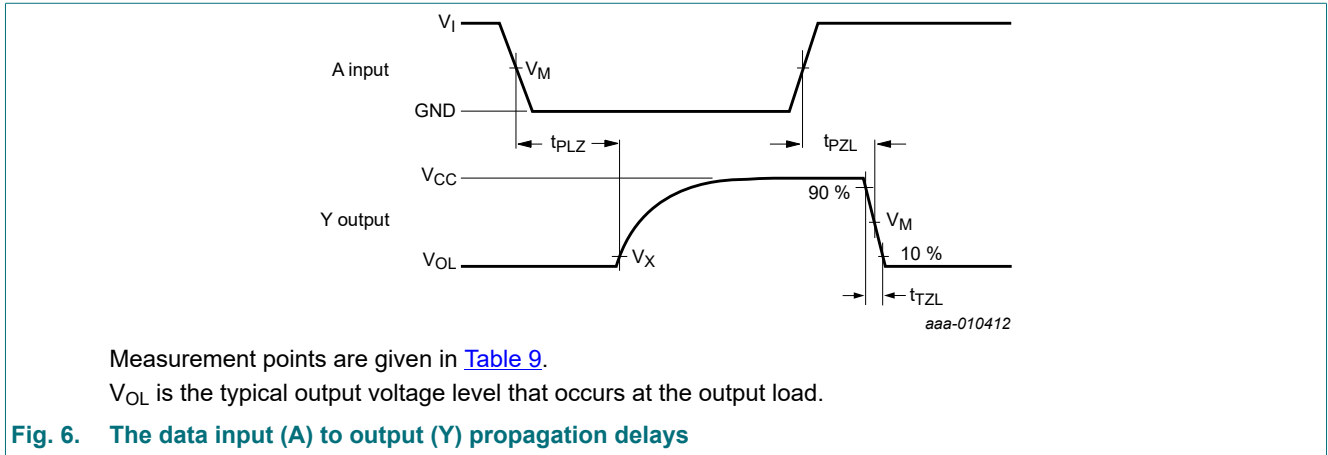
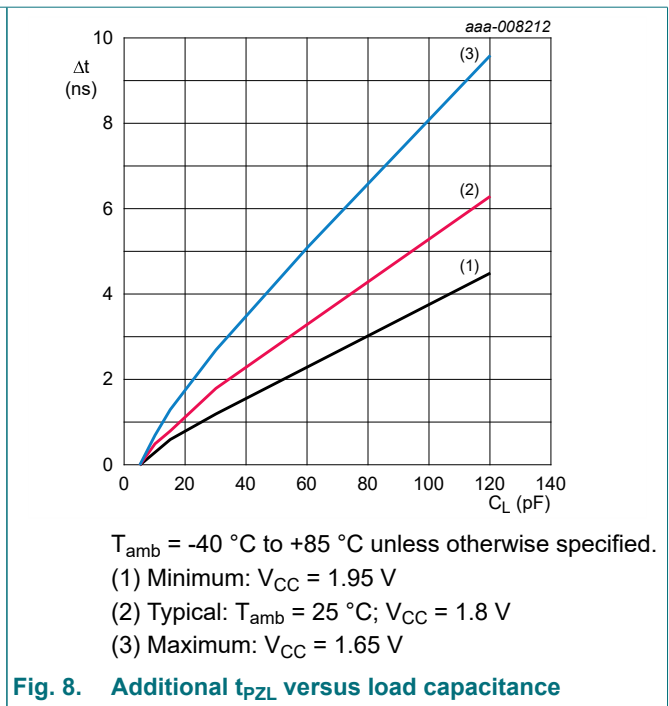
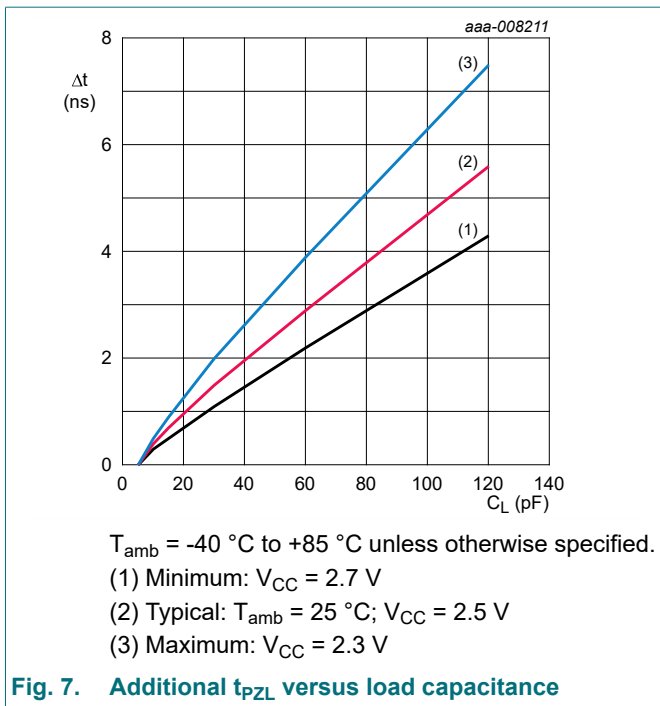


Table 9. Measurement points

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



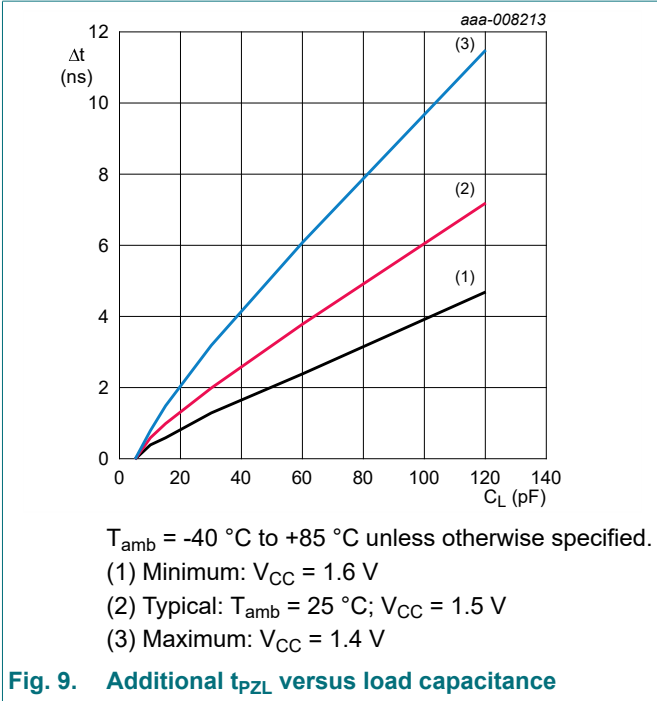


Fig. 9. Additional  $t_{pZL}$  versus load capacitance

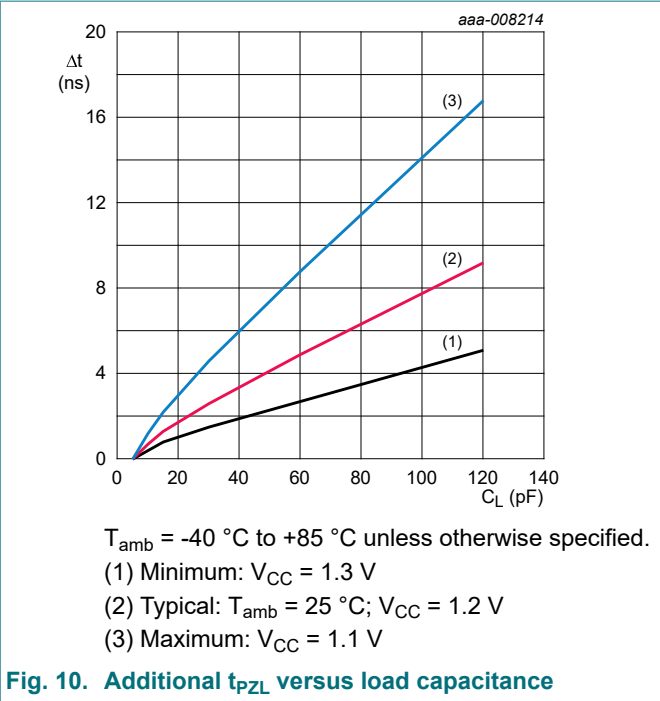


Fig. 10. Additional  $t_{pZL}$  versus load capacitance

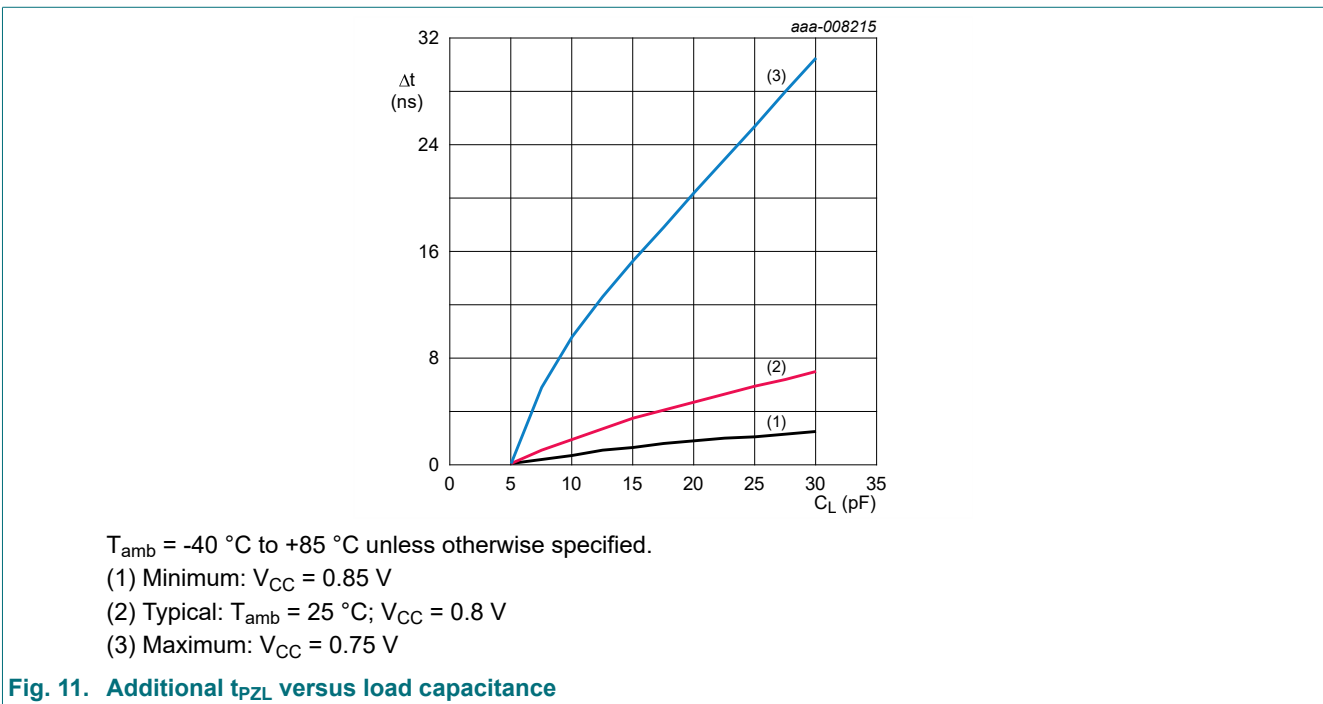
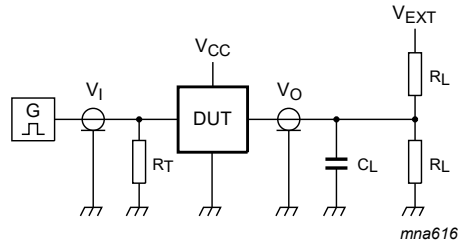


Fig. 11. Additional  $t_{pZL}$  versus load capacitance





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 k $\Omega$	0 V	$2 \times V_{CC}$

## 12. Package outline

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

SOT886

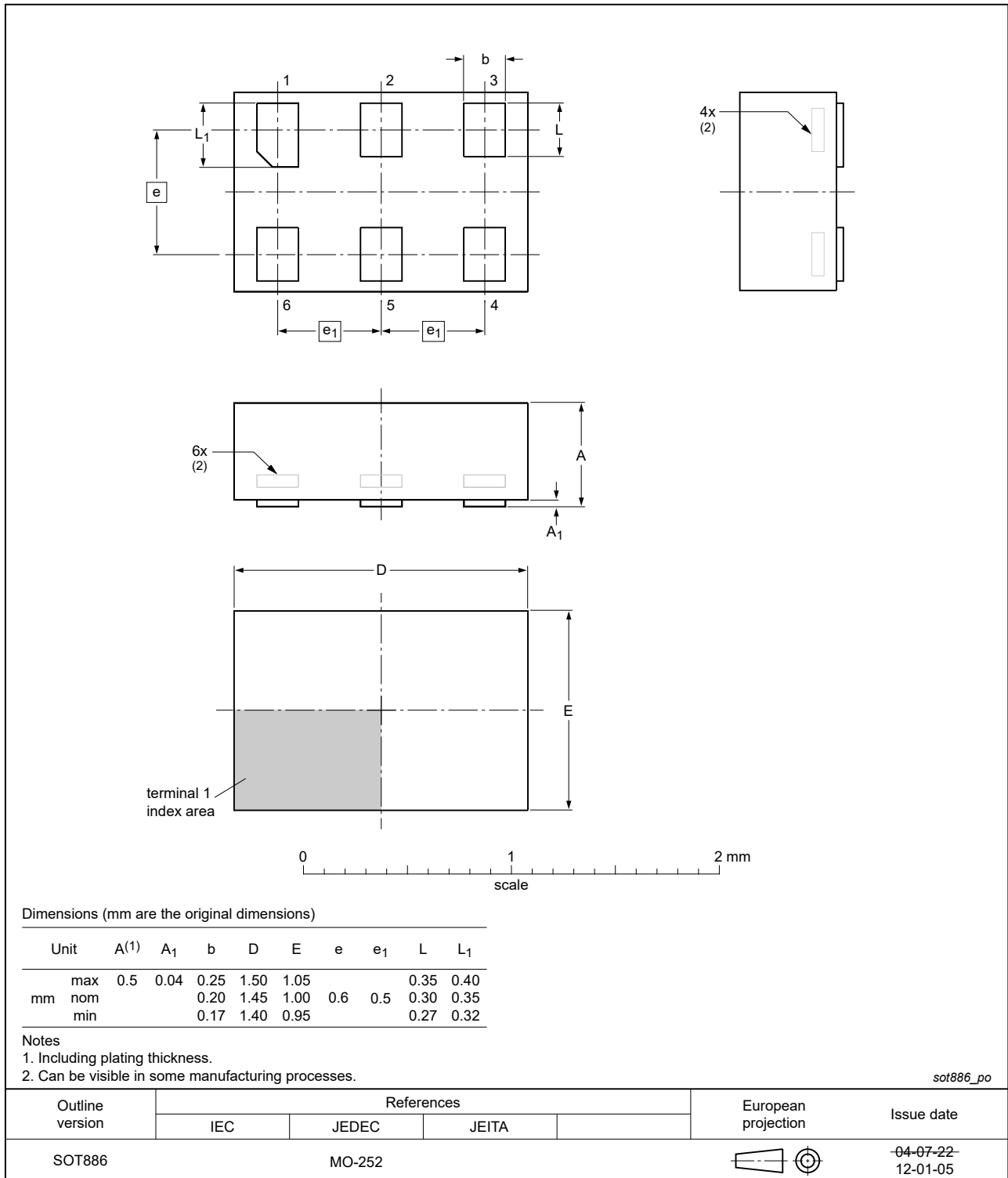


Fig. 13. Package outline SOT886 (XSON6)

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

SOT1115

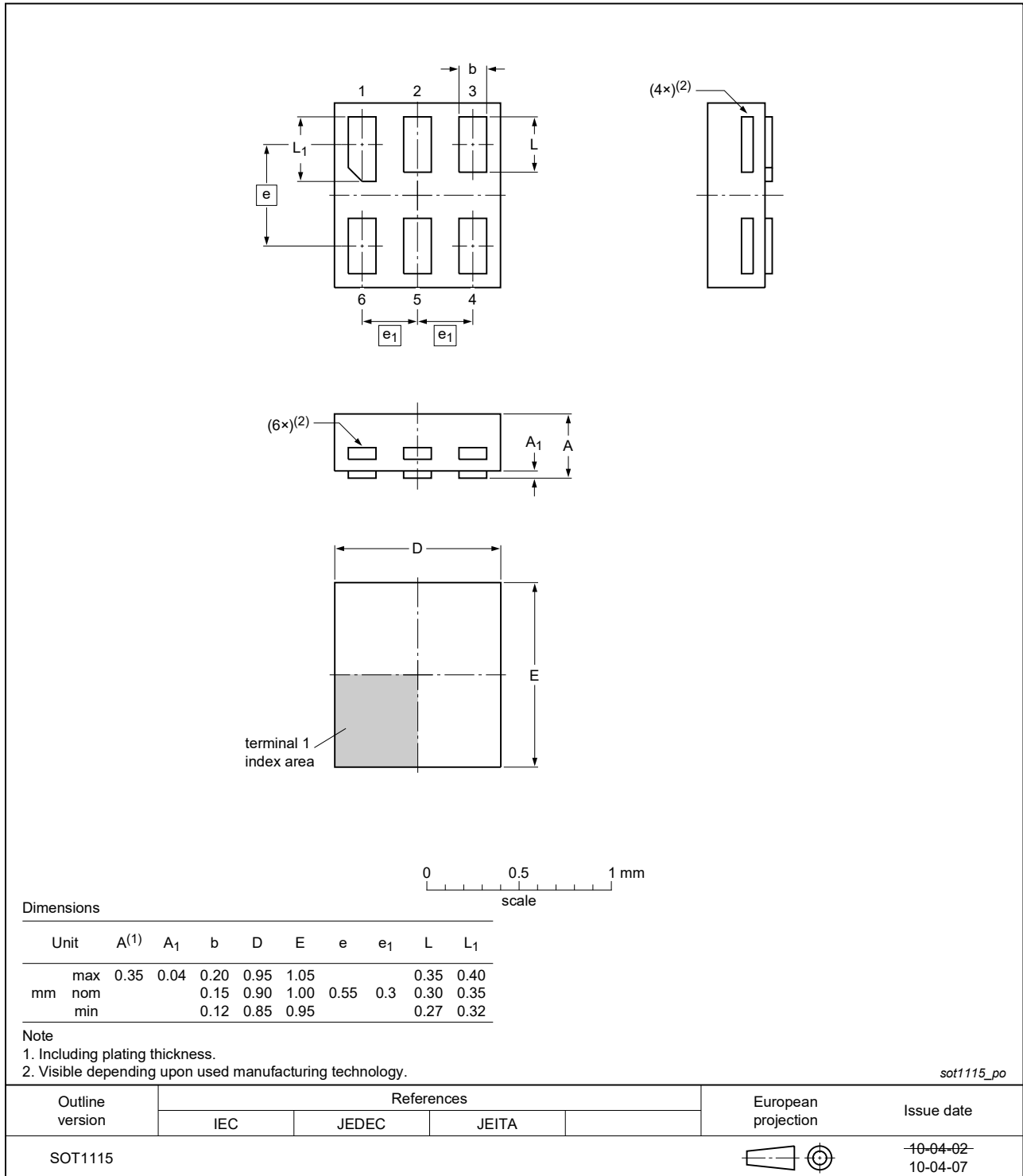


Fig. 14. Package outline SOT1115 (XSON6)

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

SOT1202



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 0.32 mm

SOT1226-3



Fig. 16. Package outline SOT1226-3 (X2SON5)

## 13. Abbreviations

Table 11. Abbreviations

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

## 14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AXP1G06 v.2	20210720	Product data sheet	-	74AXP1G06 v.1
Modifications:	<ul style="list-style-type: none"> <li>SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package.</li> <li><a href="#">Table 5</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
74AXP1G06 v.1	20140115	Product data sheet	-	-

## 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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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