



**THE DATASHEET OF  
NCX2222GTX**



# NCX2222

Low voltage comparator; open-drain output

Rev. 1 — 20 December 2012

Product data sheet

## 1. General description

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The NCX2222 provides a dual, low voltage, low-power comparator with open-drain outputs.

The NCX2222 has a very low supply current of 5  $\mu$ A per comparator and is guaranteed to operate at a low voltage of 1.3 V. It is fully operational up to 5.5 V which makes it convenient for use in both 3.0 V and 5.0 V systems.

## 2. Features and benefits

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- Wide supply voltage range from 1.3 V to 5.5 V (functional operating range)
- Rail-to-rail input/output performance
- Very low supply current of 5  $\mu$ A (typical) per comparator
- Very low-power consumption
- No phase inversion with overdriven input signals
- Internal hysteresis
- Propagation delay of 0.8  $\mu$ s (typical)
- ESD protection:
  - ◆ HBM JESD22-A114F Class 1C. Exceeds 1500 V
  - ◆ CDM JESD22-C101E exceeds 1000 V
- Multiple package options
- Specified from  $-40$  °C to  $+85$  °C

## 3. Applications

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- Cellular telephones
- Alarm and security systems
- Personal Digital assistants



## 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
NCX2222DP	-40 °C to +85 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2
NCX2222GU	-40 °C to +85 °C	HXSON8	plastic, thermal enhanced extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.7 × 0.5 mm	SOT972-2 <sup>[1]</sup>
NCX2222GT	-40 °C to +85 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm	SOT833-1
NCX2222GF	-40 °C to +85 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm	SOT1089
NCX2222GM	-40 °C to +85 °C	XQFN8	plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 × 1.6 × 0.5 mm	SOT902-2

[1] Lead pitch is 0.4 mm.

## 5. Marking

Table 2. Marking codes

Type number	Marking <sup>[1]</sup>
NCX2222DP	gb
NCX2222GU	gb
NCX2222GT	gb
NCX2222GF	gb
NCX2222GM	gb

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

## 6. Functional diagram

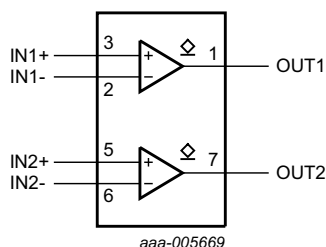
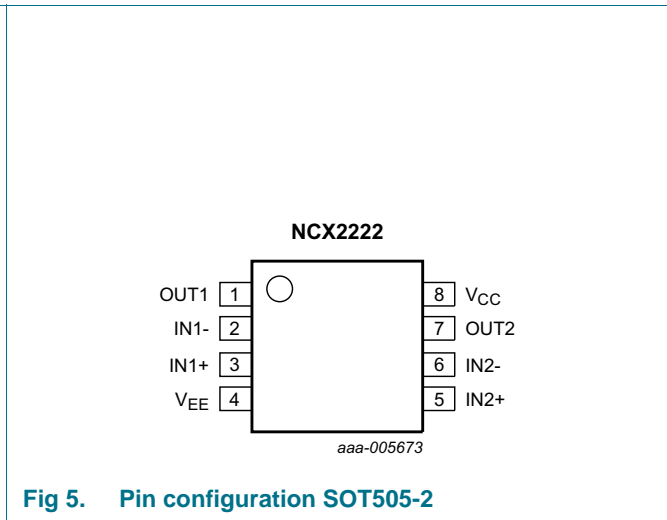
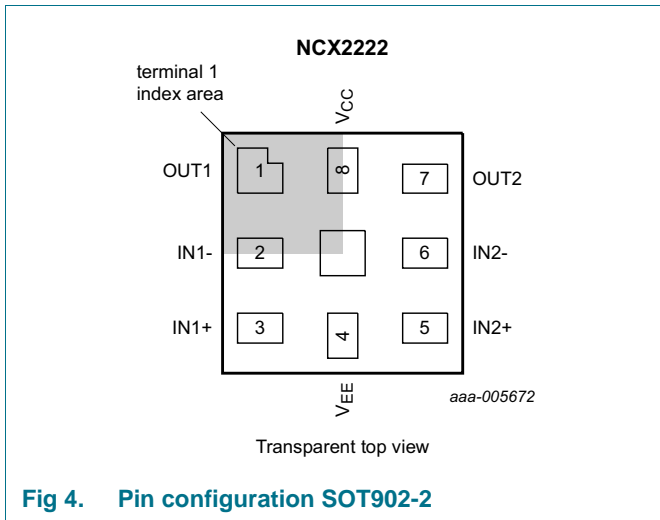
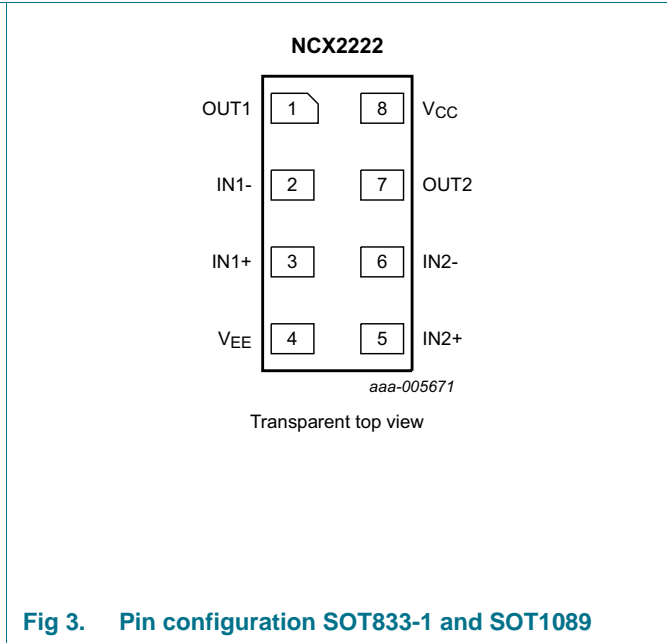
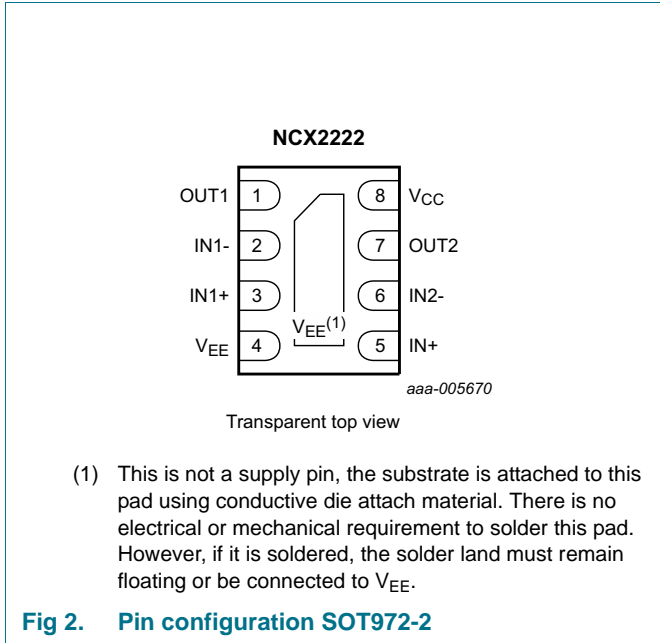


Fig 1. Logic symbol

**7. Pinning information**

**7.1 Pinning**



## 7.2 Pin description

**Table 3.** Pin description

Symbol	Pin	Description
OUT1	1	comparator output 1
IN1-	2	comparator input 1 (negative)
IN1+	3	comparator input 1 (positive)
V <sub>EE</sub>	4	supply voltage
IN2+	5	comparator input 2 (positive)
IN2-	6	comparator input 2 (negative)
OUT2	7	comparator output 2
V <sub>CC</sub>	8	supply voltage

## 8. Limiting values

**Table 4.** Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to V<sub>EE</sub>.

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-	7.0	V
V <sub>I</sub>	input voltage	IN1-, IN1+, IN2-, IN2+ inputs	-0.5	V <sub>CC</sub> + 0.5	V
V <sub>O</sub>	output voltage		V <sub>EE</sub> - 0.5	7.0	V
t <sub>sc(o)</sub>	output short-circuit time		[1] -	indefinite	s
T <sub>j(max)</sub>	maximum junction temperature		-	+150	°C
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +85 °C	-	250	mW

[1] Do not exceed the maximum total power dissipation.

## 9. Recommended operating conditions

**Table 5.** Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage	V <sub>CC</sub> to V <sub>EE</sub>				
		full spec operating range	1.6	-	5.5	V
		functional operating range	1.3	-	5.5	V
V <sub>I</sub>	input voltage		V <sub>EE</sub>	-	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage		V <sub>EE</sub>	-	5.5	V
T <sub>amb</sub>	ambient temperature		-40	-	+85	°C

## 10. Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions.  $V_{CC} = 1.6\text{ V to }5.5\text{ V}$ ,  $V_{EE} = 0\text{ V}$ ;  $V_{CM} = 0.5V_{CC}$  unless otherwise specified.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		Unit
			Min	Typ	Max	Min	Max	
$V_H$	hysteresis voltage		6	9	13	-	-	mV
		$V_{CC} = 1.3\text{ V}$	-	20	-	-	-	mV
$V_{I(\text{offset})}$	offset input voltage		[1] -30	+0.5	+30	-30	+30	mV
		$V_{CC} = 1.3\text{ V}$	[1] -	3	-	-	-	mV
$V_{OL}$	LOW-level output voltage	$I_O = 0.5\text{ mA}$ ; $V_{CC} = 1.3\text{ V}$	-	0.05	-	-	-	V
		$I_O = 0.5\text{ mA}$ ; $V_{CC} = 1.6\text{ V}$	-	0.04	-	-	0.25	V
		$I_O = 3\text{ mA}$ ; $V_{CC} = 3.0\text{ V}$	-	0.14	-	-	0.3	V
		$I_O = 5\text{ mA}$ ; $V_{CC} = 5.5\text{ V}$	-	0.20	-	-	0.3	V
$I_{OZ}$	OFF-state output current	$I_{N-} = V_{EE}$ ; $I_{N+} = V_{CC}$ ; $V_O = 5.5\text{ V}$	-	3	-	-	-	nA
$V_{CM}$	common-mode voltage	$V_{CC} = 1.3\text{ V to }5.5\text{ V}$	-	$V_{EE}$ to $V_{CC}$	-	-	-	V
$I_{OS}$	output short-circuit current	$V_{CC} = 5.5\text{ V}$ ; $V_O = V_{EE}$ or $V_{CC}$	-	68	-	-	-	mA
CMRR	common-mode rejection ratio	$\Delta V_{CM} = V_{CC}$	-	70	-	-	-	dB
PSRR	power supply rejection ratio	$\Delta V_{CC} = 1.95\text{ V}$	45	80	-	-	-	dB
$I_{IB}$	input bias current		-	1.0	-	-	-	pA
$I_{CC}$	supply current	per comparator	-	5.0	-	-	7.0	$\mu\text{A}$

[1] Differential input switching level is guaranteed at the minimum or maximum offset voltage, minus or plus half the maximum hysteresis voltage.

## 11. Dynamic characteristics

**Table 7. Dynamic characteristics**

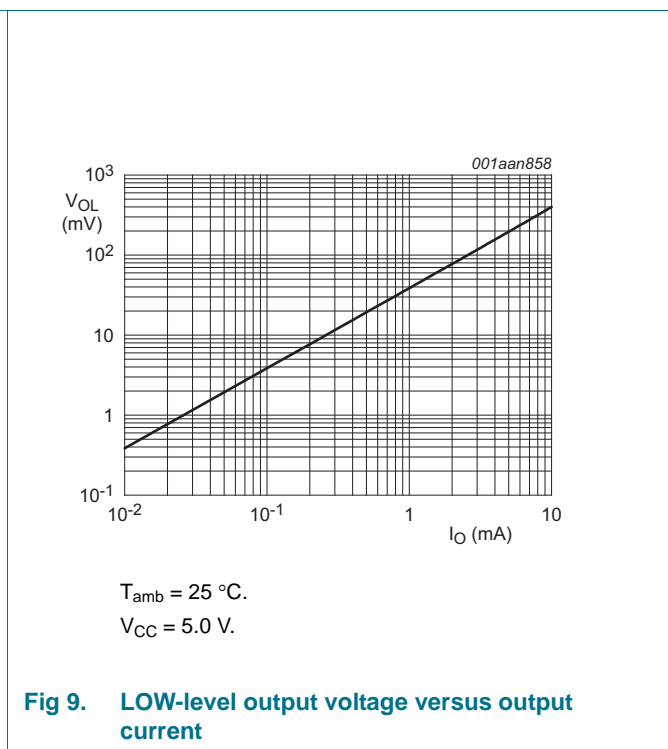
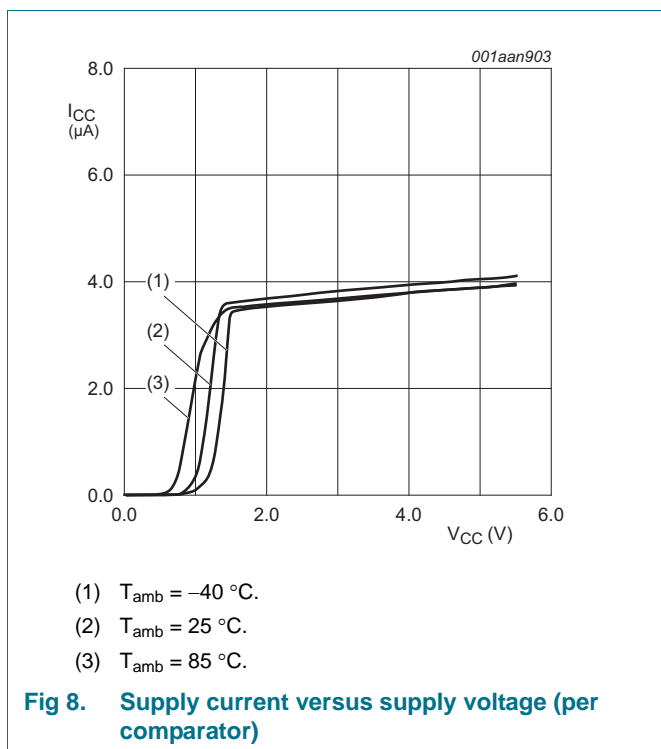
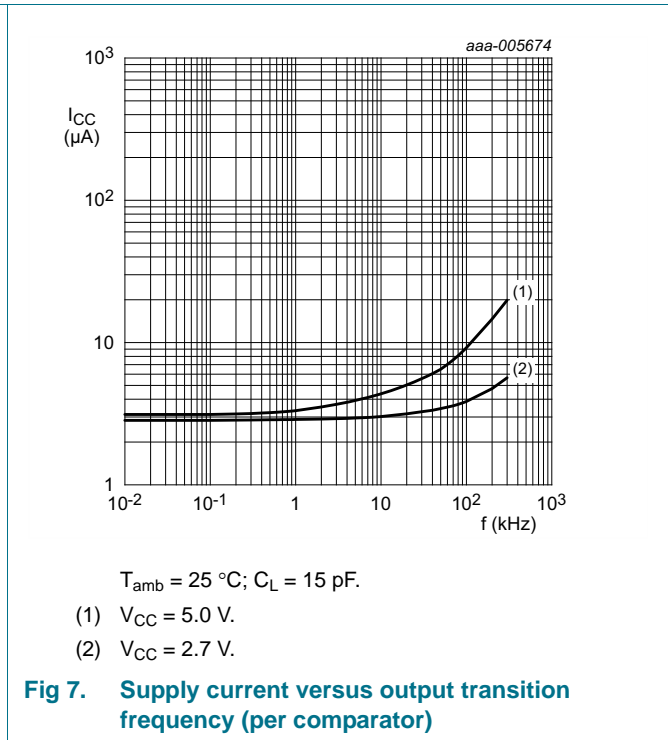
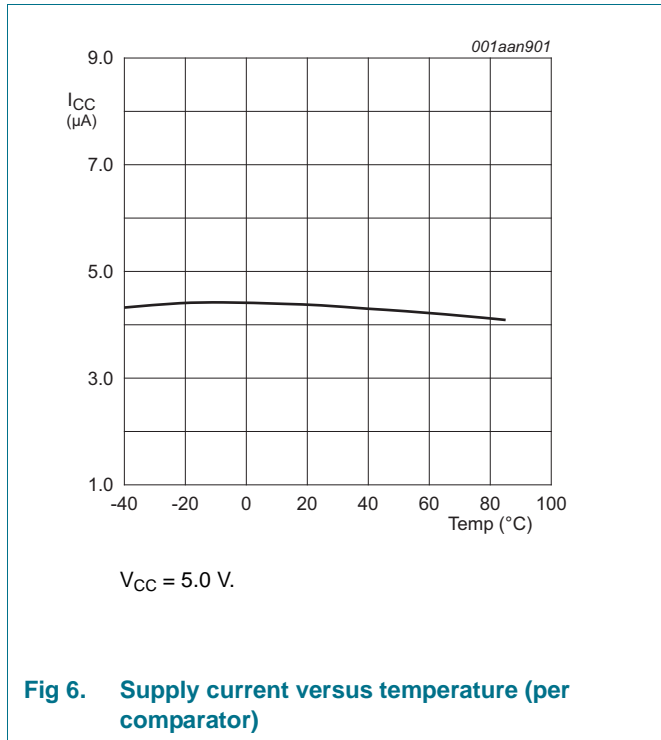
Voltages are referenced to  $V_{EE}$  ( $V_{EE} = 0\text{ V}$ );  $V_{CC} = 1.6\text{ V to }5.5\text{ V}$ ;  $V_{CM} = 0.5V_{CC}$  unless otherwise specified.

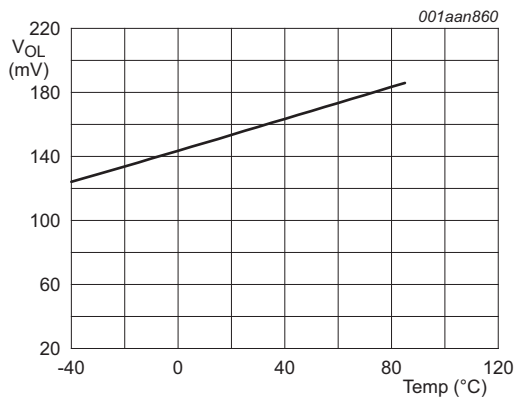
Symbol	Parameter	Conditions	25 °C			Unit
			Min	Typ	Max	
$t_{pd}$	propagation delay	20 mV overdrive; $C_L = 15\text{ pF}$	[1] -	0.8	-	$\mu\text{s}$
$t_t$	transition time	HIGH to LOW; $V_{CC} = 5.5\text{ V}$ ; $C_L = 50\text{ pF}$	[2] -	10	-	ns

[1]  $t_{pd}$  is the same as  $t_{PLZ}$  and  $t_{PZL}$ ;  $t_{PLZ}$  is the actual time that the output is disabled.

[2] Input signal: 1 kHz, square wave signal with 10 ns edge rate.

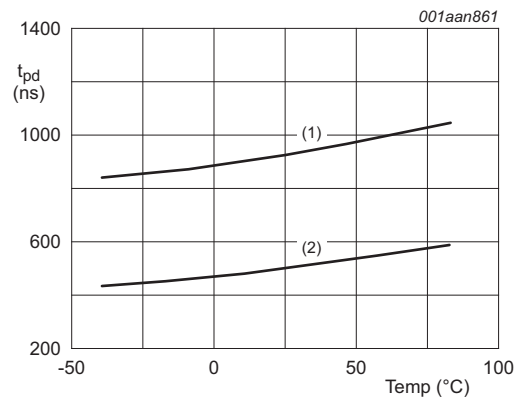
## 12. Graphs





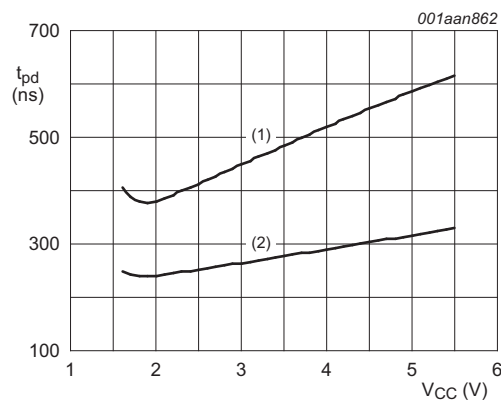
I<sub>O</sub> = 4.0 mA.  
V<sub>CC</sub> = 5.0 V.

Fig 10. LOW-level output voltage versus temperature



V<sub>CC</sub> = 5.0 V; input overdrive = 50 mV.  
(1) t<sub>PLZ</sub>.  
(2) t<sub>PZL</sub>.

Fig 11. Propagation delay versus temperature



T<sub>amb</sub> = 25 °C; input overdrive = 100 mV.  
(1) t<sub>PLZ</sub>.  
(2) t<sub>PZL</sub>.

Fig 12. Propagation delay versus supply voltage.

## 13. Application information

### 13.1 Operating description

The NCX2222 is a dual, low voltage, low-power comparator with open-drain output. This device is designed for use with a pull-up resistor to define the output switching levels. This device consumes only 5  $\mu$ A per comparator of supply current while achieving a typical propagation delay of 0.8  $\mu$ s at a 20 mV input overdrive. [Figure 11](#) and [Figure 12](#) show propagation delay with various input overdrives. This comparator is guaranteed to operate at a low voltage of 1.3 V up to 5.5 V. The common-mode input voltage range extends 0.1 V beyond the upper and lower rail without phase inversion or other adverse effects. This device has a typical internal hysteresis of 9.0 mV which allows for greater noise immunity and clean output switching.

### 13.2 Output stage

The NCX2222 has an N-channel output stage that has the capability of sinking the output to  $V_{EE}$  with a load ranging up to 5.0 mA (see [Figure 13](#)).

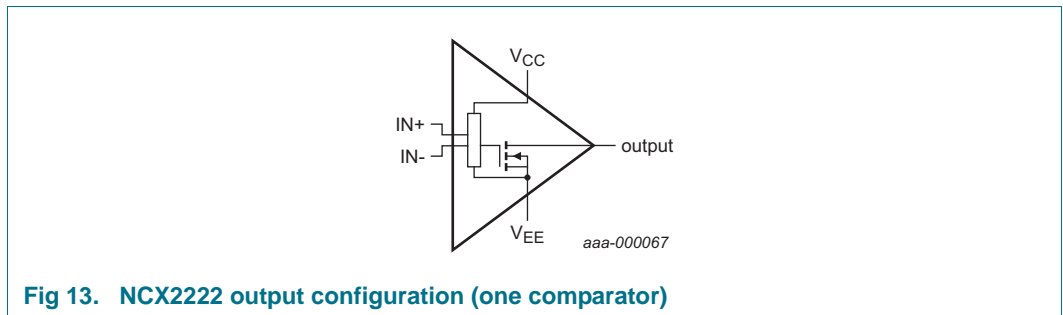


Fig 13. NCX2222 output configuration (one comparator)

### 13.3 Zero-crossing detector

[Figure 14](#) shows the NCX2222 configured as a zero-crossing detector.

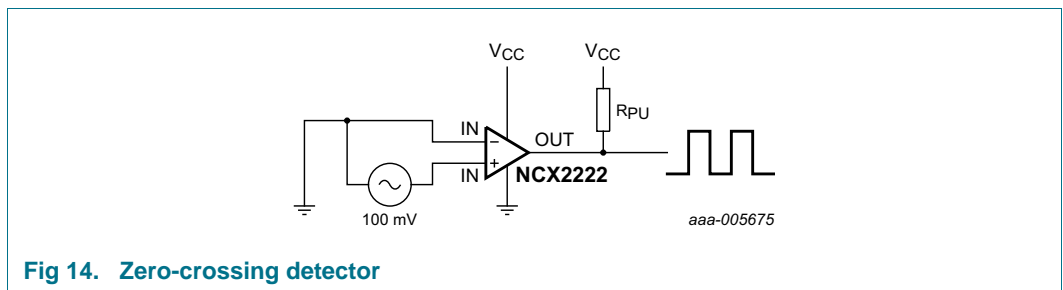
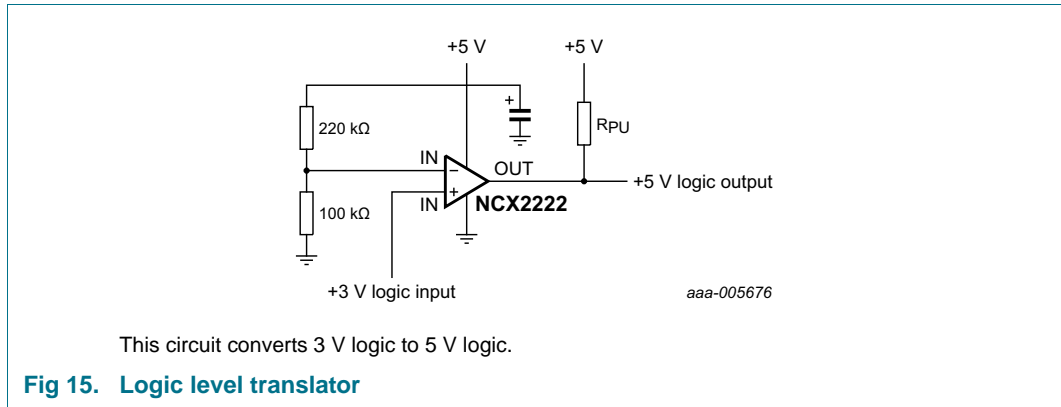


Fig 14. Zero-crossing detector

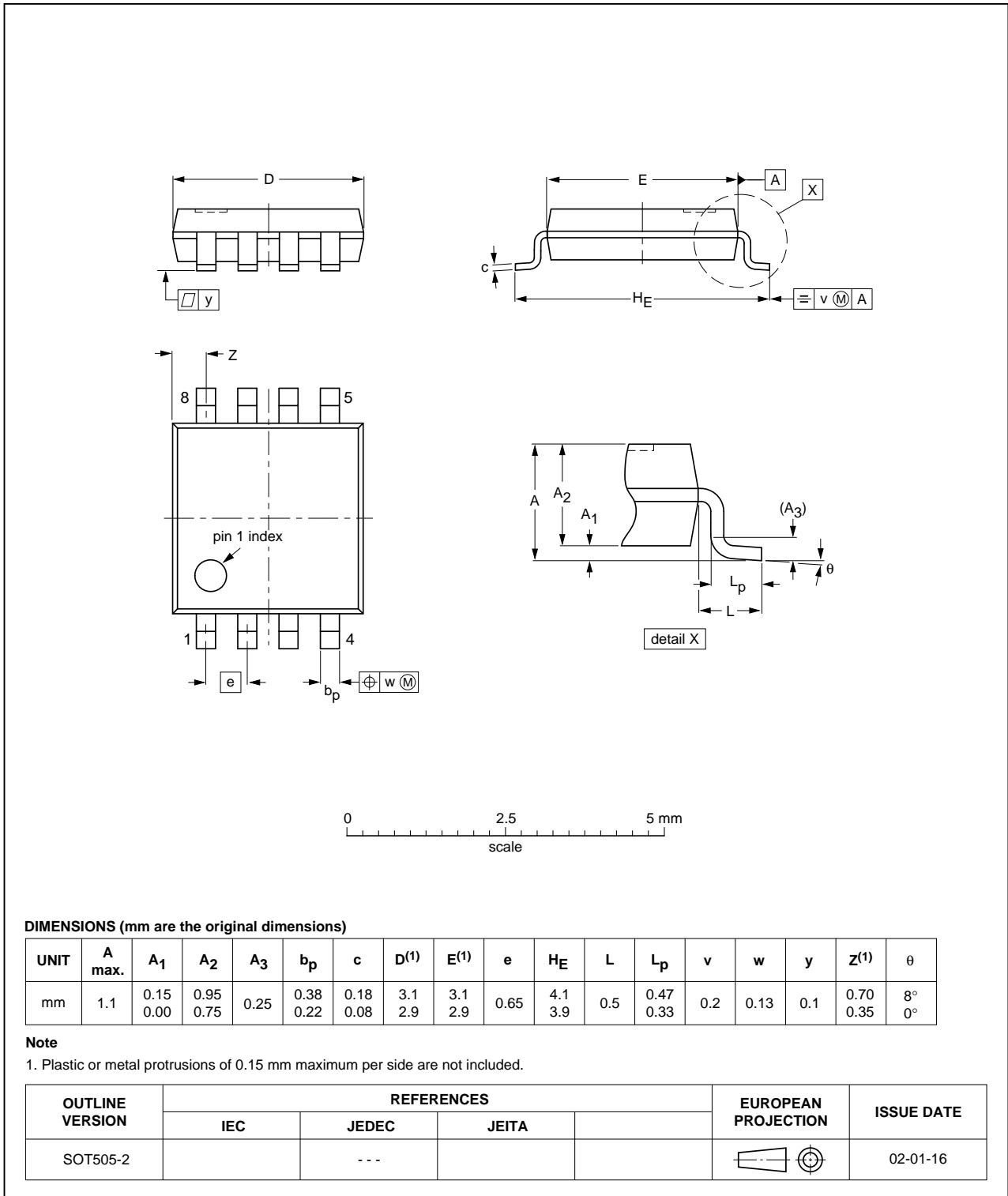
**13.4 Logic level translator**

Figure 15 shows the NCX2222 configured as a logic level translator.



**14. Package outline**

**TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm SOT505-2**



**Fig 16. Package outline SOT505-2 (TSSOP8)**

HXSON8: plastic, thermal enhanced extremely thin small outline package; no leads;  
8 terminals; body 1.35 x 1.7 x 0.5 mm

SOT972-2

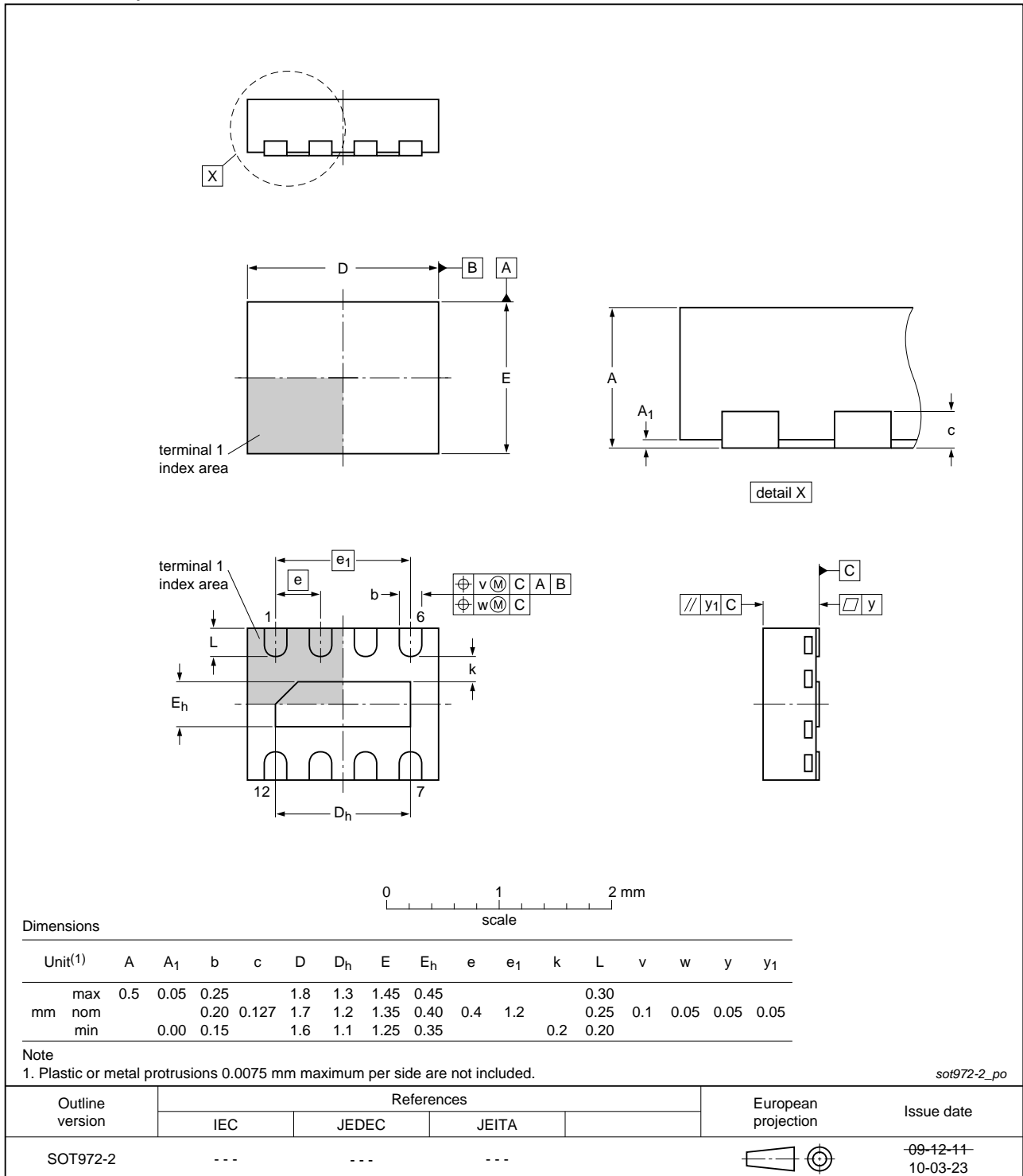


Fig 17. Package outline SOT972-2 (HXSON8)

XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm

SOT833-1

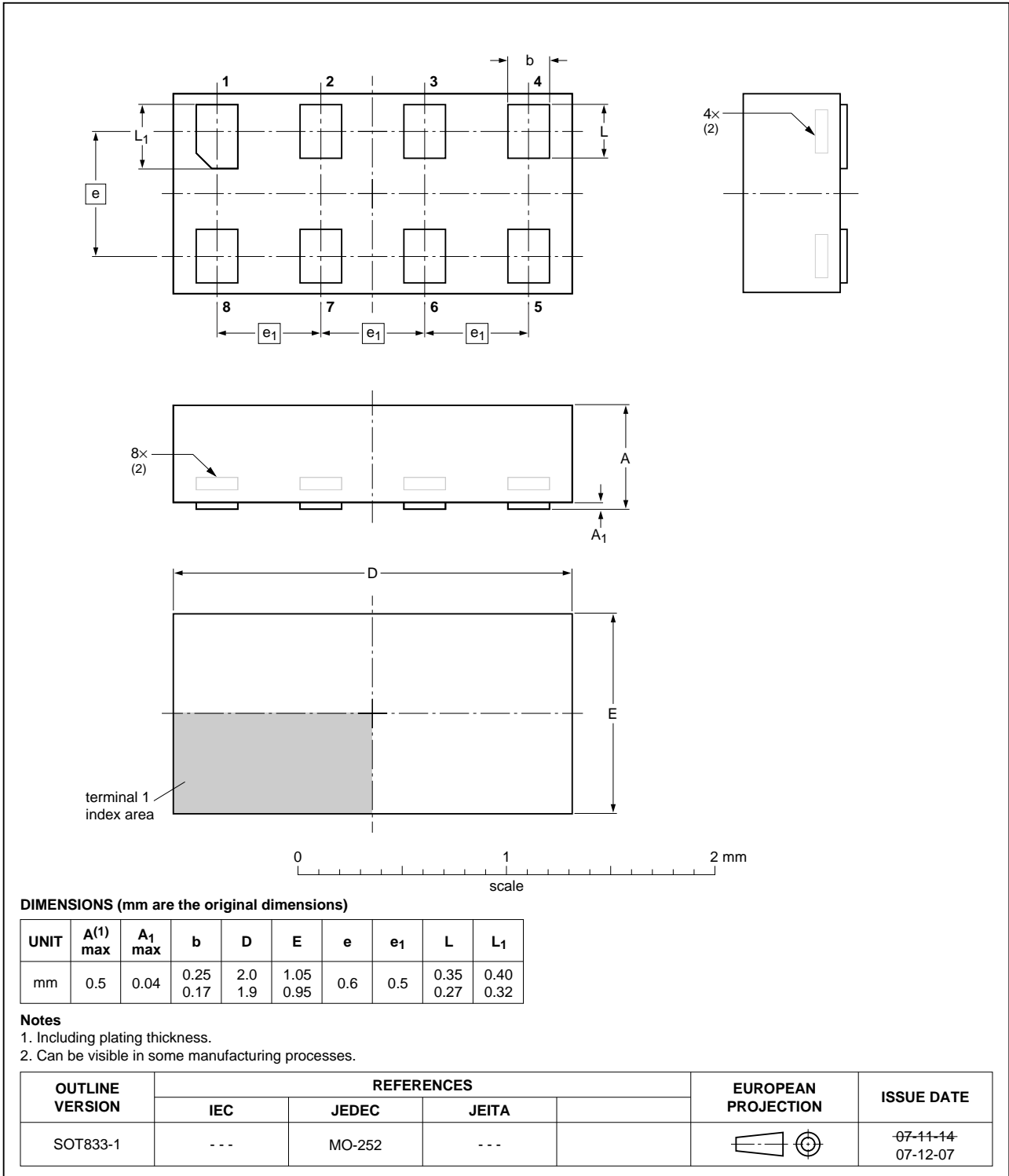
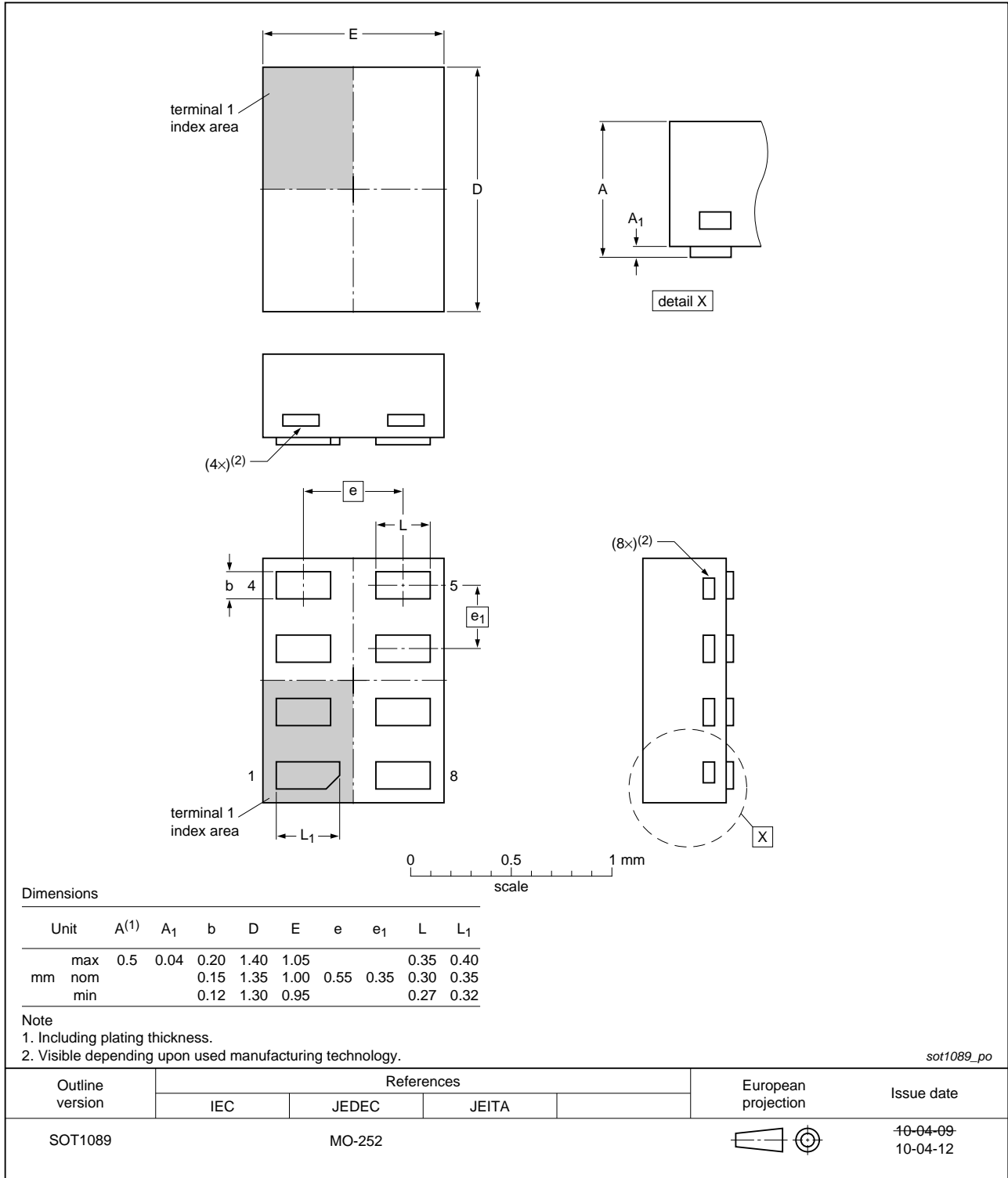


Fig 18. Package outline SOT833-1 (XSON8)

**XSON8: extremely thin small outline package; no leads;  
8 terminals; body 1.35 x 1 x 0.5 mm**

**SOT1089**



**Fig 19. Package outline SOT1089 (XSON8)**

XQFN8: plastic, extremely thin quad flat package; no leads;  
8 terminals; body 1.6 x 1.6 x 0.5 mm

SOT902-2

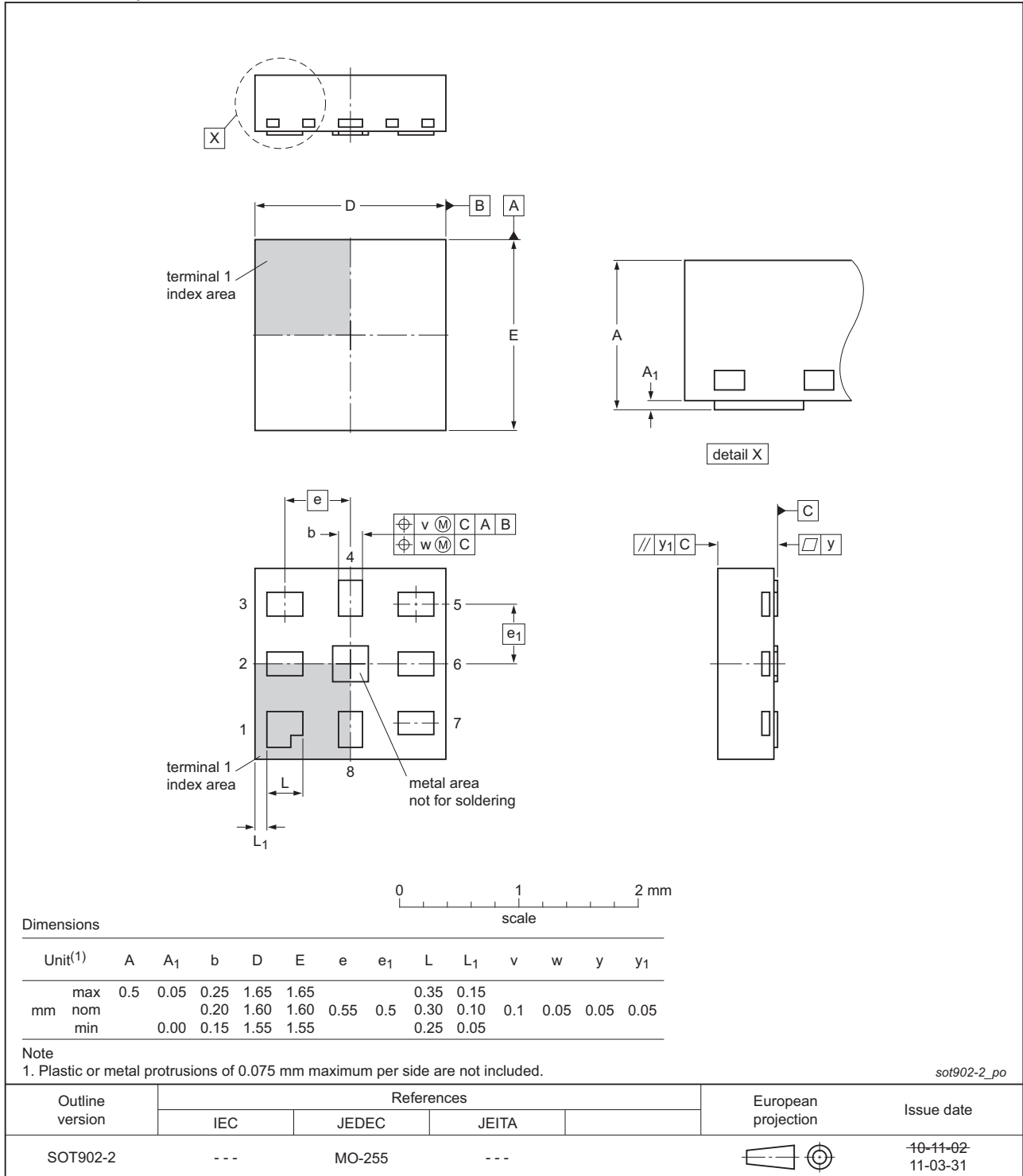


Fig 20. Package outline SOT902-2 (XQFN8)

## 15. Abbreviations

Table 8. Abbreviations

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

## 16. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NCX2222 v.1	20121220	Product data sheet	-	-

## 17. Legal information

### 17.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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