

# NCX2202

Low voltage comparator; open-drain output

Rev. 5 — 30 October 2012

Product data sheet

## 1. General description

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The NCX2202 is a single low voltage, low power, comparator with open-drain output.

The NCX2202 has a very low supply current of 6  $\mu\text{A}$  and is guaranteed to operate at a low voltage of 1.3 V and is fully operational up to 5.5 V. These characteristics make the device 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 6  $\mu\text{A}$  (typical)
- Very low-power consumption
- No phase inversion with overdriven input signals
- Internal hysteresis
- Propagation delay of 0.8  $\mu\text{s}$  (typical)
- ESD protection:
  - ◆ HBM JESD22-A114F Class 1C exceeds 1500 V
  - ◆ CDM JESD22-C101E exceeds 1000 V
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$

## 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	
NCX2202GW	-40 °C to +85 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
NCX2202GM	-40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886

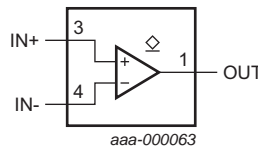
## 5. Marking

**Table 2. Marking codes**

Type number	Marking <sup>[1]</sup>
NCX2202GW	qa
NCX2202GM	qa

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

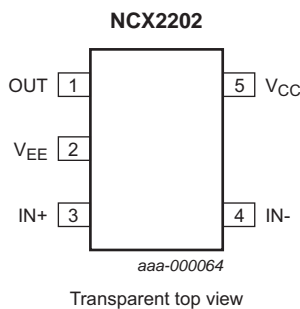
## 6. Functional diagram



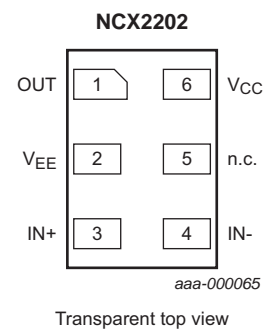
**Fig 1. Logic symbol**

## 7. Pinning information

### 7.1 Pinning



**Fig 2. Pin configuration SOT353-1**



**Fig 3. Pin configuration SOT886**

## 7.2 Pin description

**Table 3.** Pin description

Symbol	Pin		Description
	SOT353-1	SOT886	
OUT	1	1	comparator output (open-drain)
V <sub>EE</sub>	2	2	supply voltage
IN+	3	3	comparator input (positive)
IN-	4	4	comparator input (negative)
n.c.	-	5	not connected
V <sub>CC</sub>	5	6	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	IN-, IN+ 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] The maximum total power dissipation must not be exceeded.

## 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	$V_{CC} = 5.5\text{ V}$ ; $V_O = V_{CC}$	-	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		-	6.0	-	-	9.0	$\mu\text{A}$

[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**

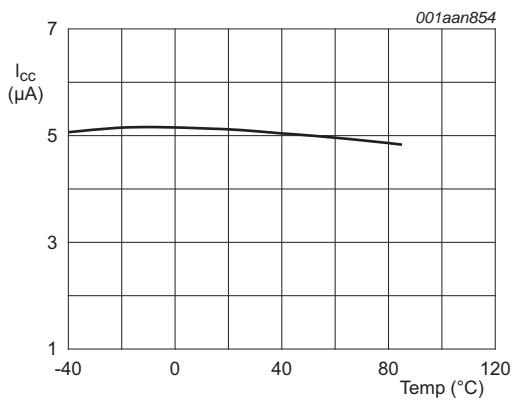
Voltages are referenced to  $V_{EE}$  ( $V_{EE} = 0$  V);  $V_{CC} = 1.6$  V to 5.5 V;  $V_{CM} = 0.5V_{CC}$  unless otherwise specified.

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

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

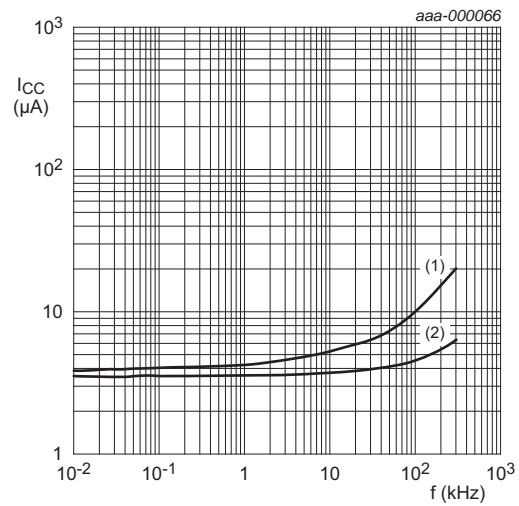
[2] Input signal: 1 kHz, square wave signal with 10 ns edge rate.

## 12. Graphs



$V_{CC} = 5.0$  V.

**Fig 4. Supply current versus temperature**

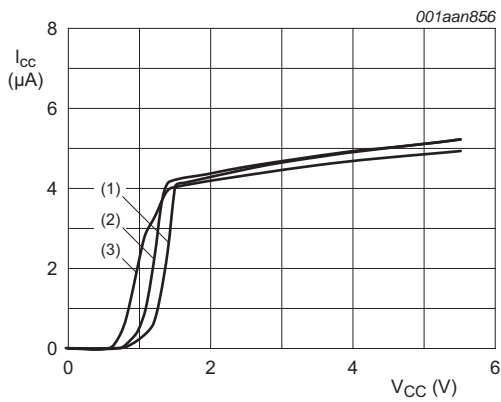


$T_{amb} = 25$  °C;  $C_L = 15$  pF.

(1)  $V_{CC} = 5.0$  V.

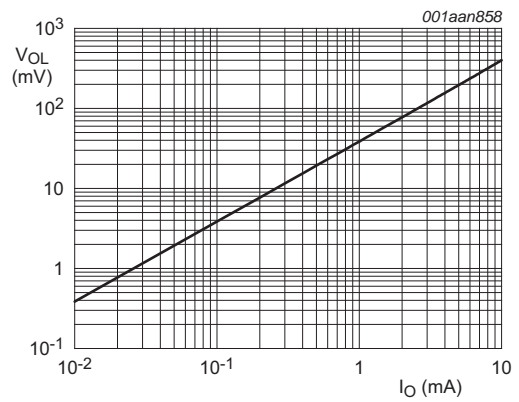
(2)  $V_{CC} = 2.7$  V.

**Fig 5. Supply current versus output transition frequency**



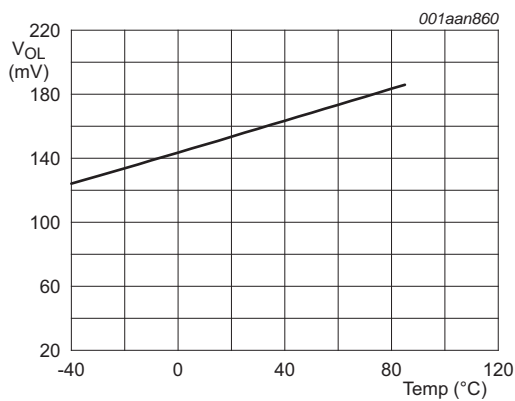
- (1)  $T_{amb} = -40\text{ °C}$ .
- (2)  $T_{amb} = 25\text{ °C}$ .
- (3)  $T_{amb} = 85\text{ °C}$ .

**Fig 6. Supply current versus supply voltage**



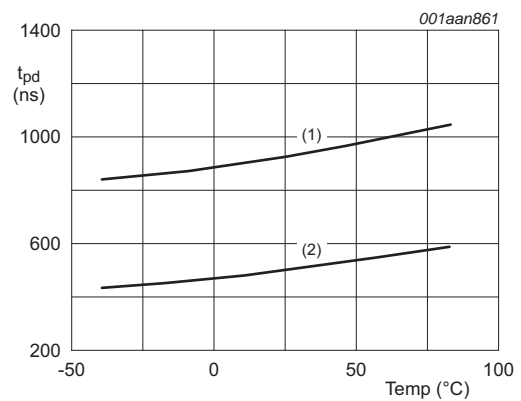
$T_{amb} = 25\text{ °C}$ .  
 $V_{CC} = 5.0\text{ V}$ .

**Fig 7. LOW-level output voltage versus output current**



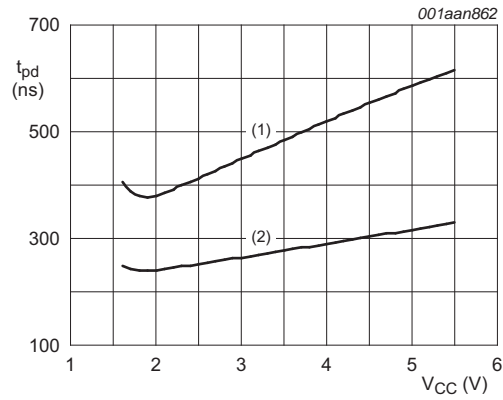
$I_O = 4.0\text{ mA}$ .  
 $V_{CC} = 5.0\text{ V}$ .

**Fig 8. LOW-level output voltage versus temperature**



$V_{CC} = 5.0\text{ V}$ ; input overdrive = 50 mV.  
 (1)  $t_{PLZ}$ .  
 (2)  $t_{PZL}$ .

**Fig 9. 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 10. Propagation delay versus supply voltage.**

## 13. Application information

### 13.1 Operating description

The NCX2202 is a single 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 6  $\mu\text{A}$  of supply current while achieving a typical propagation delay of 0.8  $\mu\text{s}$  at a 20 mV input overdrive. [Figure 9](#) and [Figure 10](#) 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. This allows for greater noise immunity and clean output switching.

### 13.2 Output stage

The NCX2202 has an N-channel output stage that has capability of sinking the output to  $V_{EE}$  with a load ranging up to 5.0 mA. See [Figure 11](#)

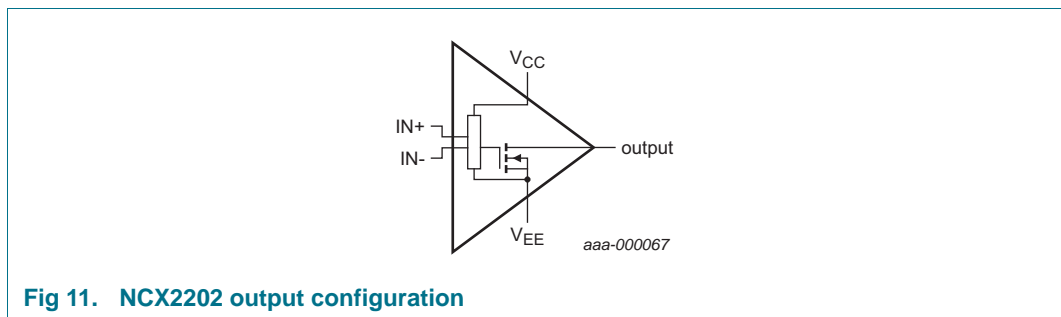


Fig 11. NCX2202 output configuration

### 13.3 Zero-crossing detector

[Figure 12](#) shows the NCX2202 configured as a zero-crossing detector.

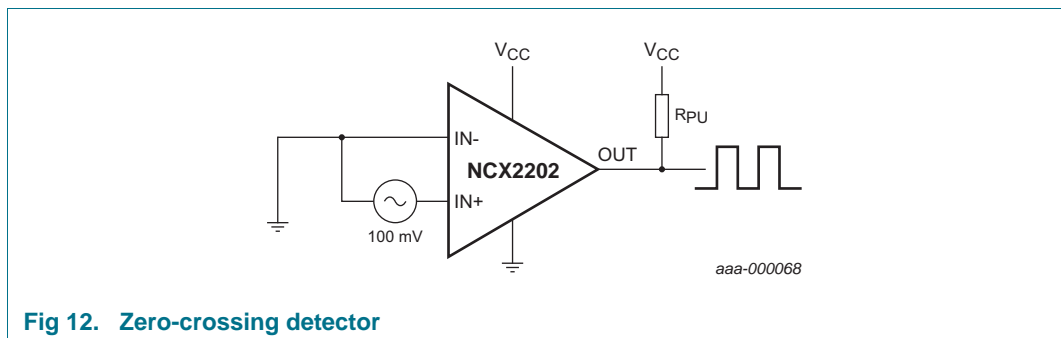
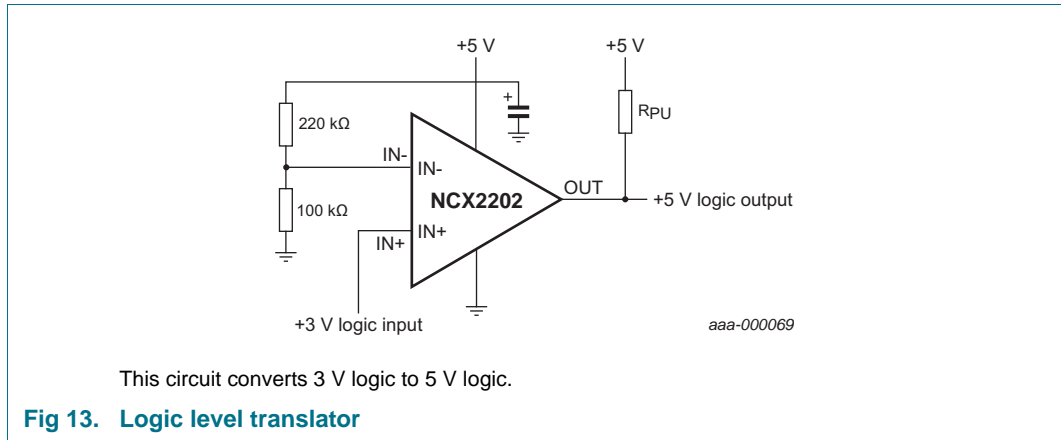


Fig 12. Zero-crossing detector

### 13.4 Logic level translator

[Figure 13](#) shows the NCX2202 configured as a logic level translator.





14. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



Fig 14. Package outline SOT353-1 (TSSOP5)

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

SOT886

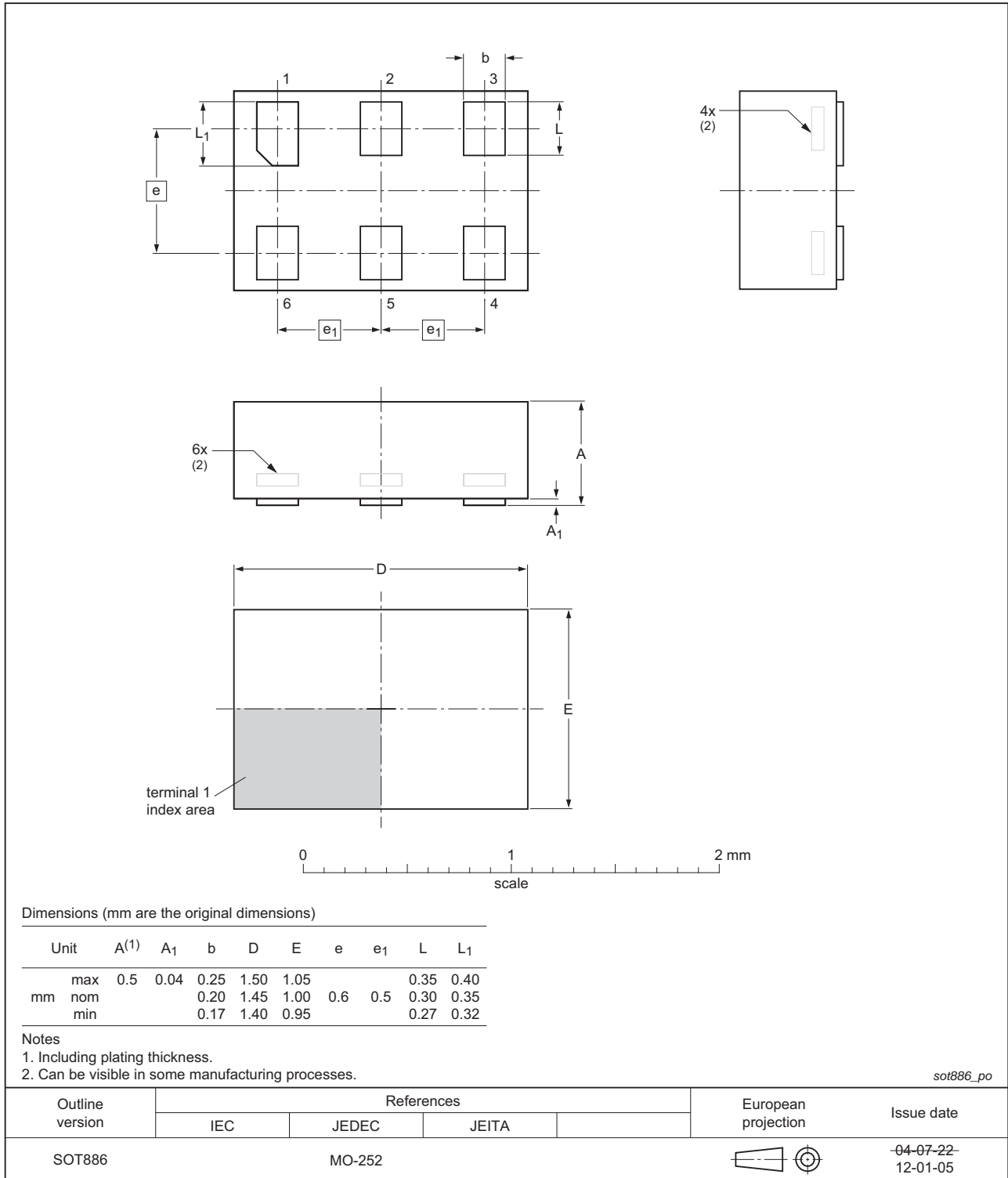


Fig 15. Package outline SOT886 (XSON6)

## 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
NCX2202 v.5	20121030	Product data sheet	-	NCX2202 v.4
Modifications:	<ul style="list-style-type: none"> <li>Class 3A changed into Class 1C (errata) in <a href="#">Section 2</a>.</li> </ul>			
NCX2202 v.4	20120806	Product data sheet	-	NCX2202 v.3
Modifications:	<ul style="list-style-type: none"> <li>Package outline drawing of SOT886 (<a href="#">Figure 15</a>) modified.</li> </ul>			
NCX2202 v.3	20111110	Product data sheet	-	NCX2202 v.2
Modifications:	<ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>			
NCX2202 v.2	20111020	Product data sheet	-	NCX2202 v.1
NCX2202 v.1	20110720	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".

[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.nxp.com>.

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