



**THE DATASHEET OF  
NCX2200GSH**



# NCX2200

## Low voltage comparator

Rev. 6 — 9 July 2014

Product data sheet

### 1. General description

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The NCX2200 provides a single low voltage low power comparator.

The NCX2200 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 which makes this 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 3A. Exceeds 2000 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	
NCX2200GW	-40 °C to +85 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
NCX2200GM	-40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
NCX2200GF3	-40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm	SOT891
NCX2200GS	-40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202

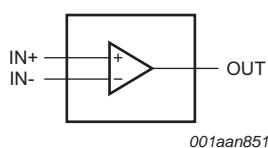
## 5. Marking

**Table 2. Marking codes**

Type number	Marking <sup>[1]</sup>
NCX2200GM	q1
NCX2200GW	q1
NCX2200GF3	q3
NCX2200GS	q1

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

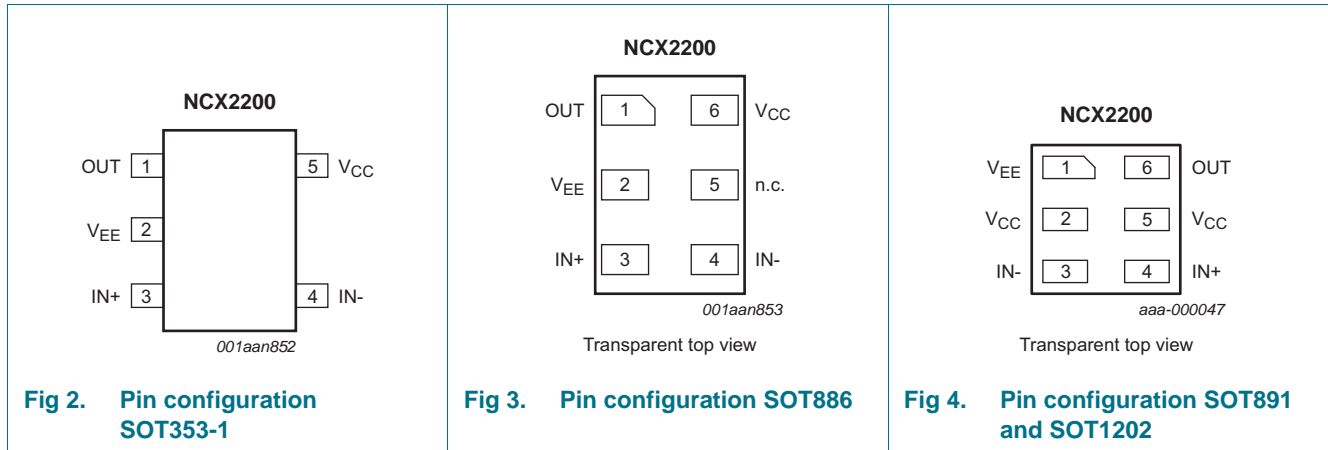
## 6. Functional diagram



**Fig 1. Logic symbol**

## 7. Pinning information

### 7.1 Pinning



### 7.2 Pin description

**Table 3. Pin description**

Symbol	Pin				Description
	SOT353-1	SOT886	SOT891	SOT1202	
OUT	1	1	6	6	comparator output
V <sub>EE</sub>	2	2	1	1	supply voltage
IN+	3	3	4	4	comparator input (positive)
IN-	4	4	3	3	comparator input (negative)
n.c.	-	5	-	-	not connected
V <sub>CC</sub>	5	6	2, 5	2, 5	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
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
T <sub>amb</sub>	ambient temperature		-40	-	+85	°C

## 10. Static characteristics

Table 6. Static characteristics

At recommended operating conditions. V<sub>CC</sub> = 1.6 V to 5.5 V, V<sub>EE</sub> = 0 V; V<sub>CM</sub> = 0.5V<sub>CC</sub> unless otherwise specified.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		Unit
			Min	Typ	Max	Min	Max	
V <sub>H</sub>	hysteresis voltage		6	9	13	-	-	mV
		V <sub>CC</sub> = 1.3 V	-	20	-	-	-	mV
V <sub>I(offset)</sub>	offset input voltage	[1] -	-30	0.5	+30	-30	+30	mV
		V <sub>CC</sub> = 1.3 V [1] -	-	3	-	-	-	mV
V <sub>OH</sub>	HIGH-level output voltage	I <sub>O</sub> = -0.5 mA; V <sub>CC</sub> = 1.3 V	-	1.24	-	-	-	V
		I <sub>O</sub> = -0.5 mA; V <sub>CC</sub> = 1.6 V	-	1.55	-	1.35	-	V
		I <sub>O</sub> = -3 mA; V <sub>CC</sub> = 3.0 V	-	2.85	-	2.7	-	V
		I <sub>O</sub> = -5 mA; V <sub>CC</sub> = 5.5 V	-	5.33	-	5.2	-	V
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub> = 0.5 mA; V <sub>CC</sub> = 1.3 V	-	0.05	-	-	-	V
		I <sub>O</sub> = 0.5 mA; V <sub>CC</sub> = 1.6 V	-	0.04	-	-	0.25	V
		I <sub>O</sub> = 3 mA; V <sub>CC</sub> = 3.0 V	-	0.14	-	-	0.3	V
		I <sub>O</sub> = 5 mA; V <sub>CC</sub> = 5.5 V	-	0.20	-	-	0.3	V
V <sub>CM</sub>	common-mode voltage	V <sub>CC</sub> = 1.3 V to 5.5 V	-	V <sub>EE</sub> to V <sub>CC</sub>	-	-	-	V
I <sub>OS</sub>	output short-circuit current	V <sub>CC</sub> = 5.5 V; V <sub>O</sub> = V <sub>EE</sub> or V <sub>CC</sub>	-	68	-	-	-	mA
CMRR	common-mode rejection ratio	ΔV <sub>CM</sub> = V <sub>CC</sub>	-	70	-	-	-	dB
PSRR	power supply rejection ratio	ΔV <sub>CC</sub> = 1.95 V	45	80	-	-	-	dB
I <sub>IB</sub>	input bias current		-	1.0	-	-	-	pA
I <sub>CC</sub>	supply current		-	6.0	-	-	9.0	μA

[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**

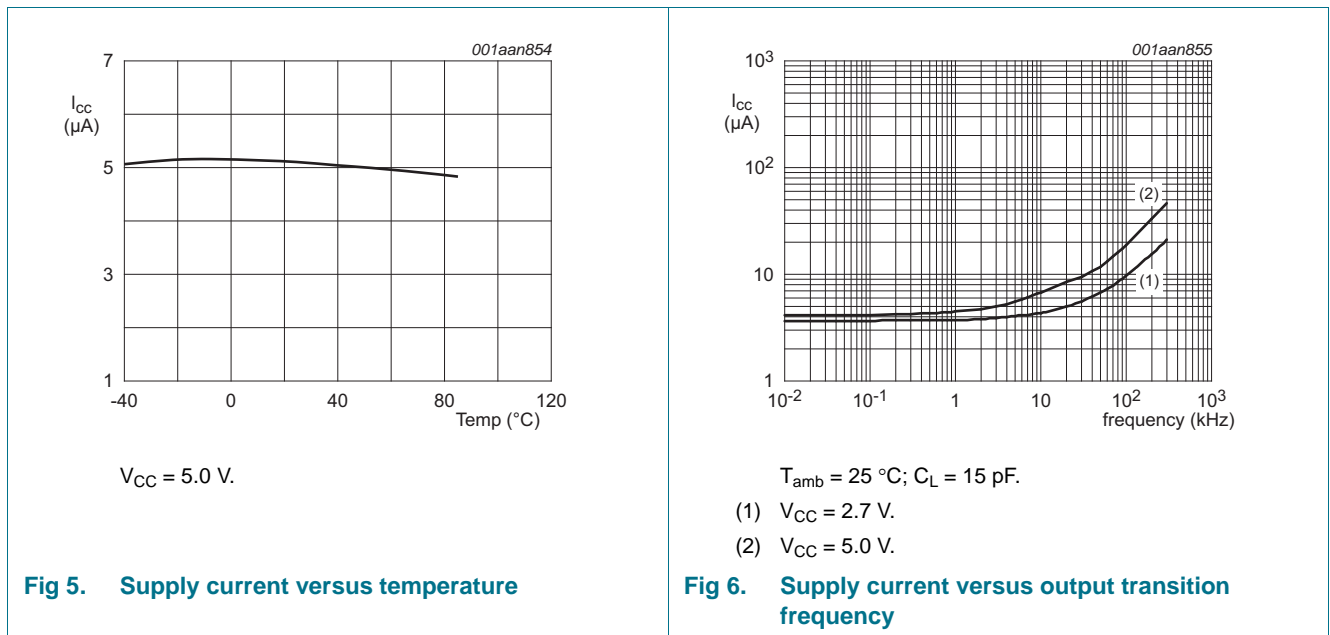
Voltages are referenced to  $V_{EE}$  ( $V_{EE} = 0$  V);  $V_{CC} = 1.6$  V to 5.5 V;  $V_{CM} = 0.5V_{CC}$  unless otherwise specified.

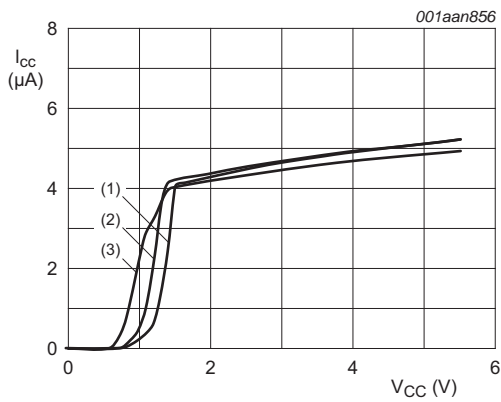
Symbol	Parameter	Conditions	25 °C			Unit
			Min	Typ	Max	
$t_{pd}$	propagation delay	20 mV overdrive; $C_L = 15$ pF	[1]	0.8	-	$\mu$ s
$t_{THL}$	HIGH to LOW output transition time	$V_{CC} = 5.5$ V; $C_L = 50$ pF	[2]	10	-	ns
$t_{TLH}$	LOW to HIGH output transition time	$V_{CC} = 5.5$ V; $C_L = 50$ pF	[2]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

[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

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

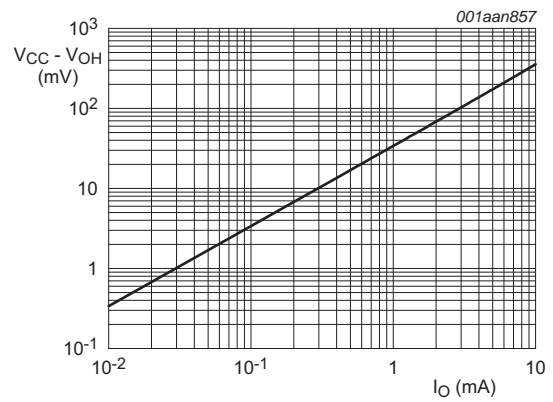
## 12. Graphs





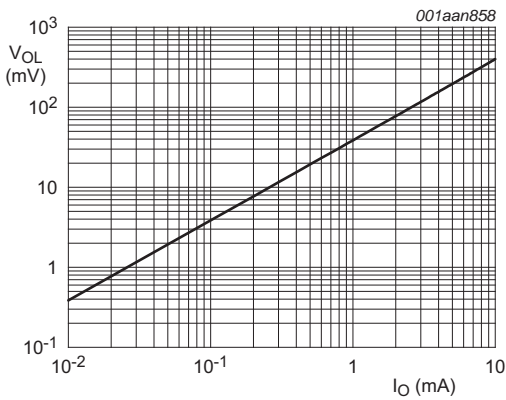
- (1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{amb} = 85\text{ }^{\circ}\text{C}$ .

**Fig 7. Supply current versus supply voltage**



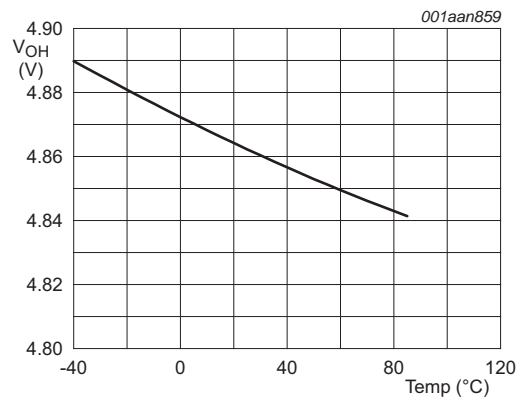
$T_{amb} = 25\text{ }^{\circ}\text{C}$ .  
 $V_{CC} = 5.0\text{ V}$ .

**Fig 8. HIGH-level output voltage versus output current**



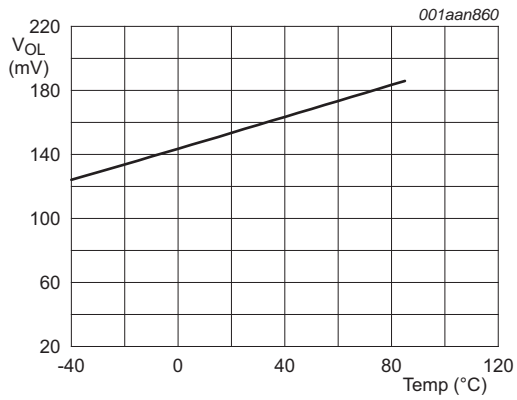
$T_{amb} = 25\text{ }^{\circ}\text{C}$ .  
 $V_{CC} = 5.0\text{ V}$ .

**Fig 9. LOW-level output voltage versus output current**



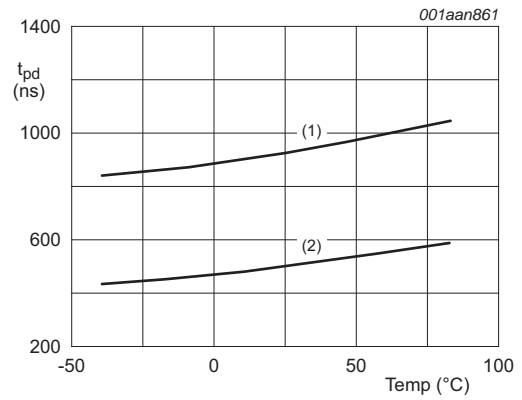
$I_O = -4.0\text{ mA}$ .  
 $V_{CC} = 5.0\text{ V}$ .

**Fig 10. HIGH-level output voltage versus temperature**



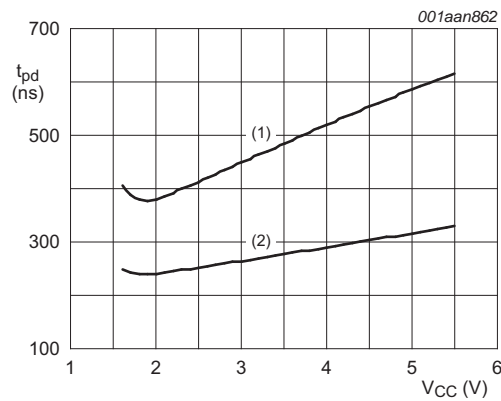
I<sub>O</sub> = 4.0 mA.  
V<sub>CC</sub> = 5.0 V.

**Fig 11. LOW-level output voltage versus temperature**



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

**Fig 12. Propagation delay versus temperature**



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

**Fig 13. Propagation delay versus supply voltage.**

## 13. Application information

### 13.1 Operating description

The NCX2200 is a single low voltage low power comparator. This device is designed for rail-to-rail input and output performance. 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. 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 NCX2200 has a complementary P and N Channel output stage that has capability of driving a rail-to-rail output swing with a load ranging up to 5.0 mA. It is designed such that shoot-through current is minimized while switching. This feature eliminates the need for bypass capacitors under most circumstances. See [Figure 14](#)

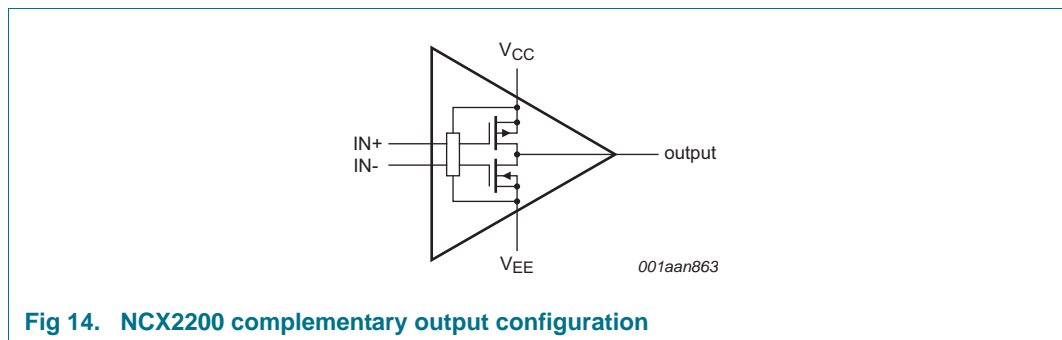
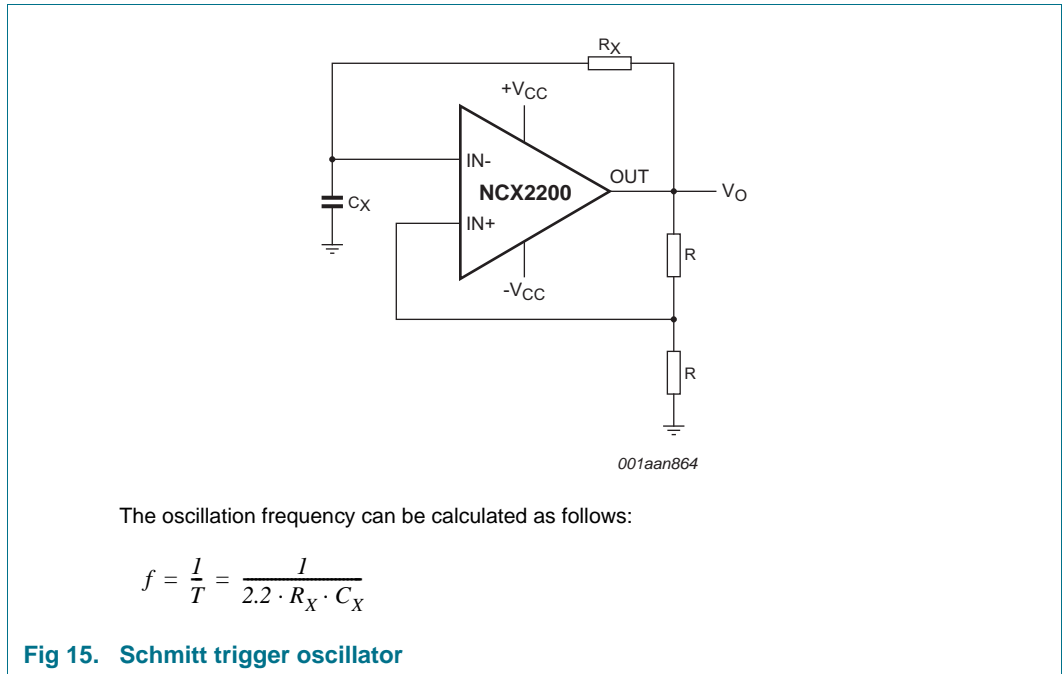


Fig 14. NCX2200 complementary output configuration

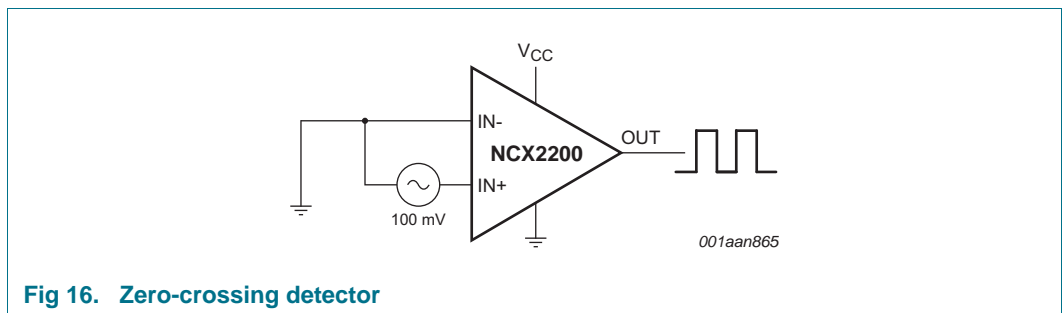
### 13.3 Schmitt trigger oscillator

Figure 15 shows the NCX2200 configured as a Schmitt trigger oscillator.



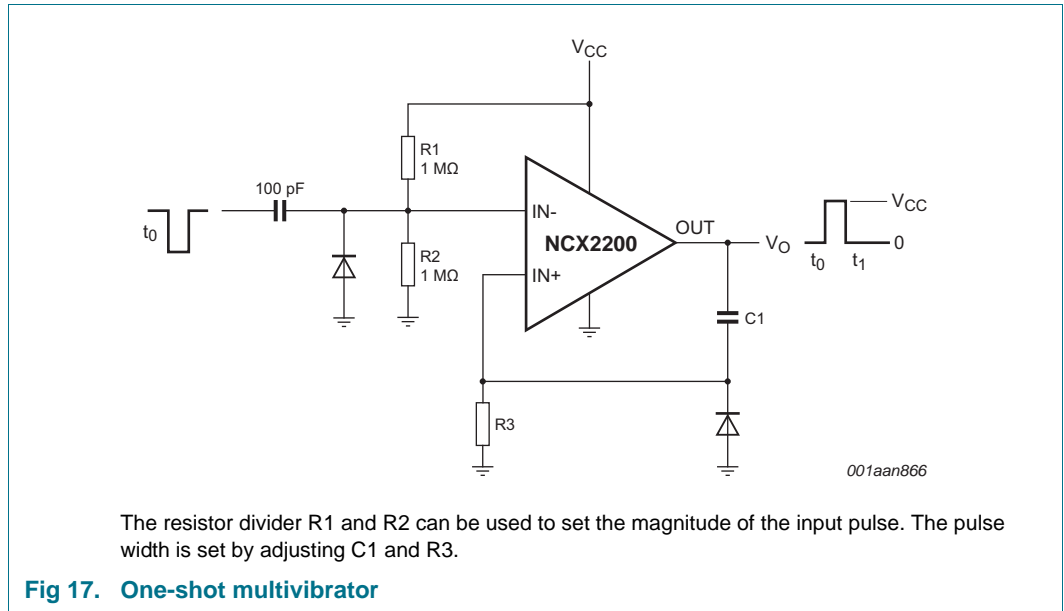
### 13.4 Zero-crossing detector

Figure 16 shows the NCX2200 configured as a zero-crossing detector.



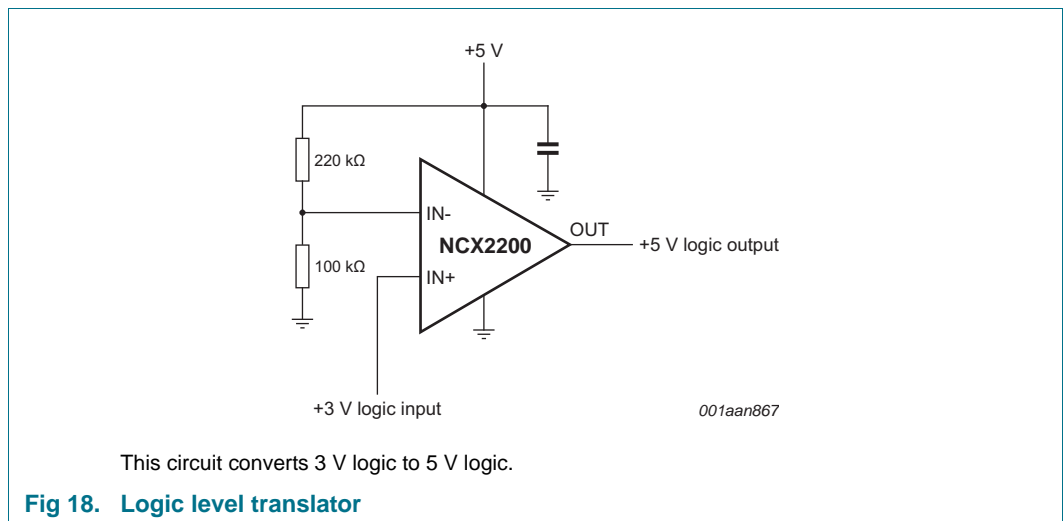
**13.5 One-shot multivibrator**

Figure 17 shows the NCX2200 configured as a one-shot multivibrator.



**13.6 Logic level translator**

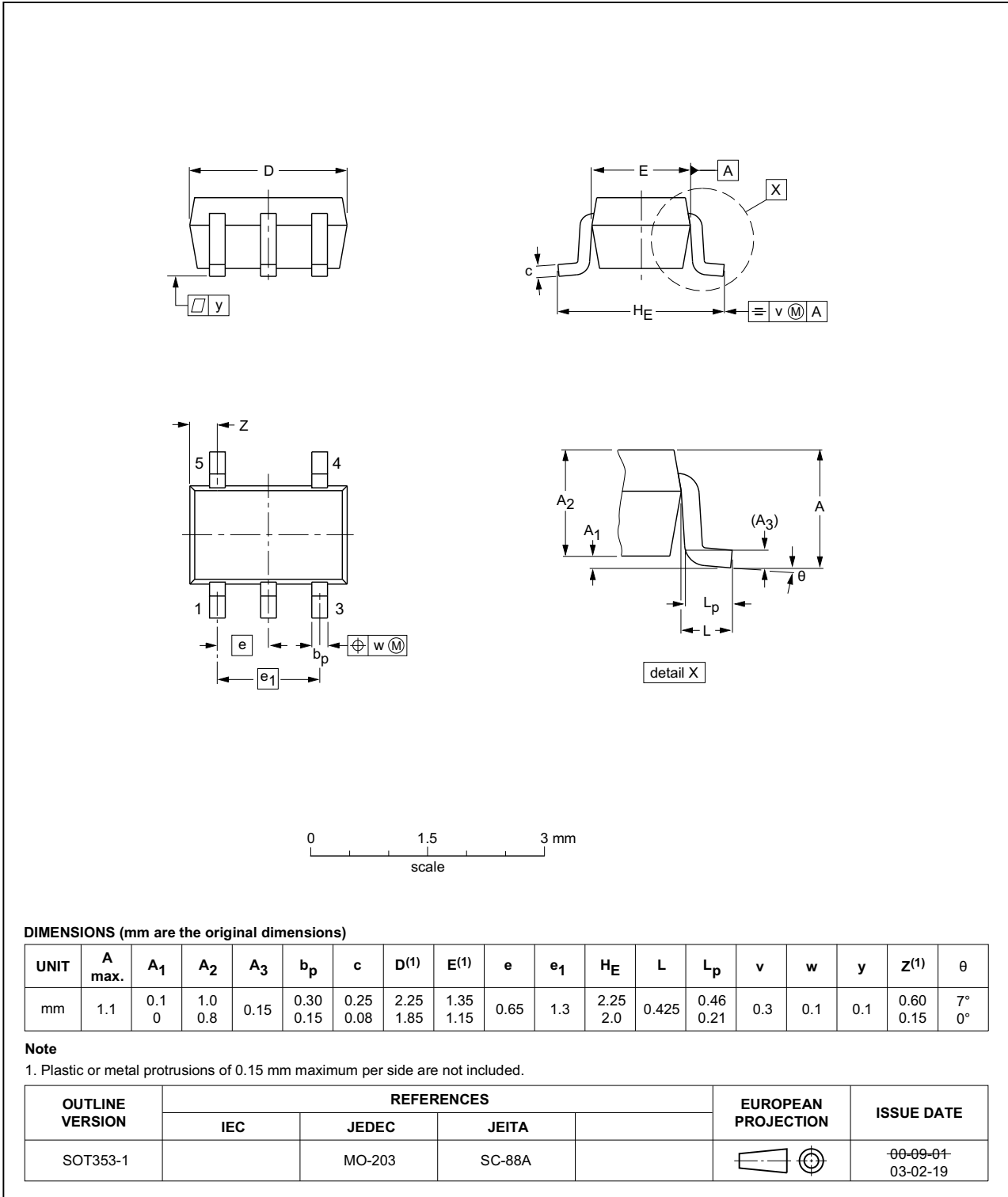
Figure 18 shows the NCX2200 configured as a logic level translator.



**14. Package outline**

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

SOT353-1



**Fig 19. 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

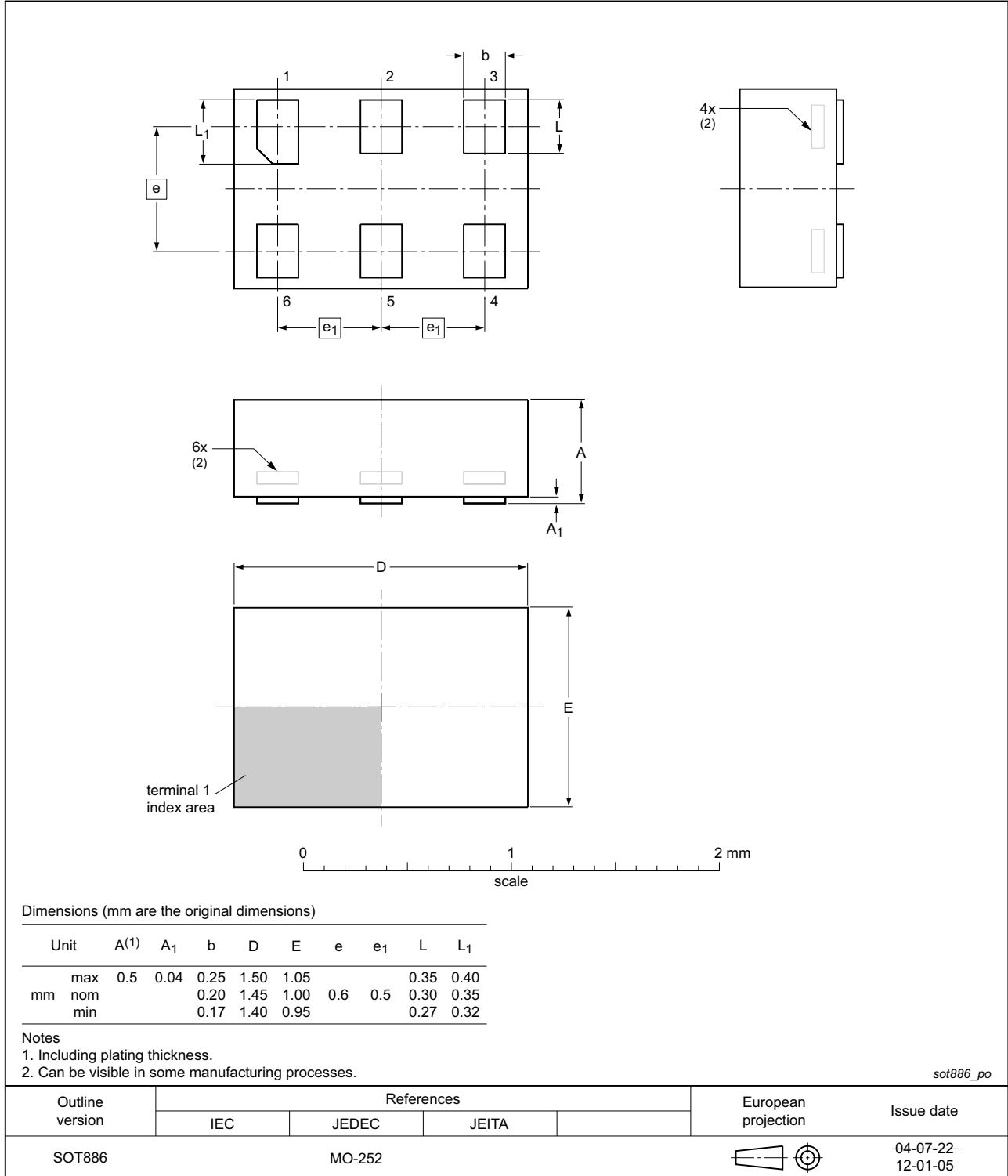


Fig 20. Package outline SOT886 (XSON6)

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

SOT891

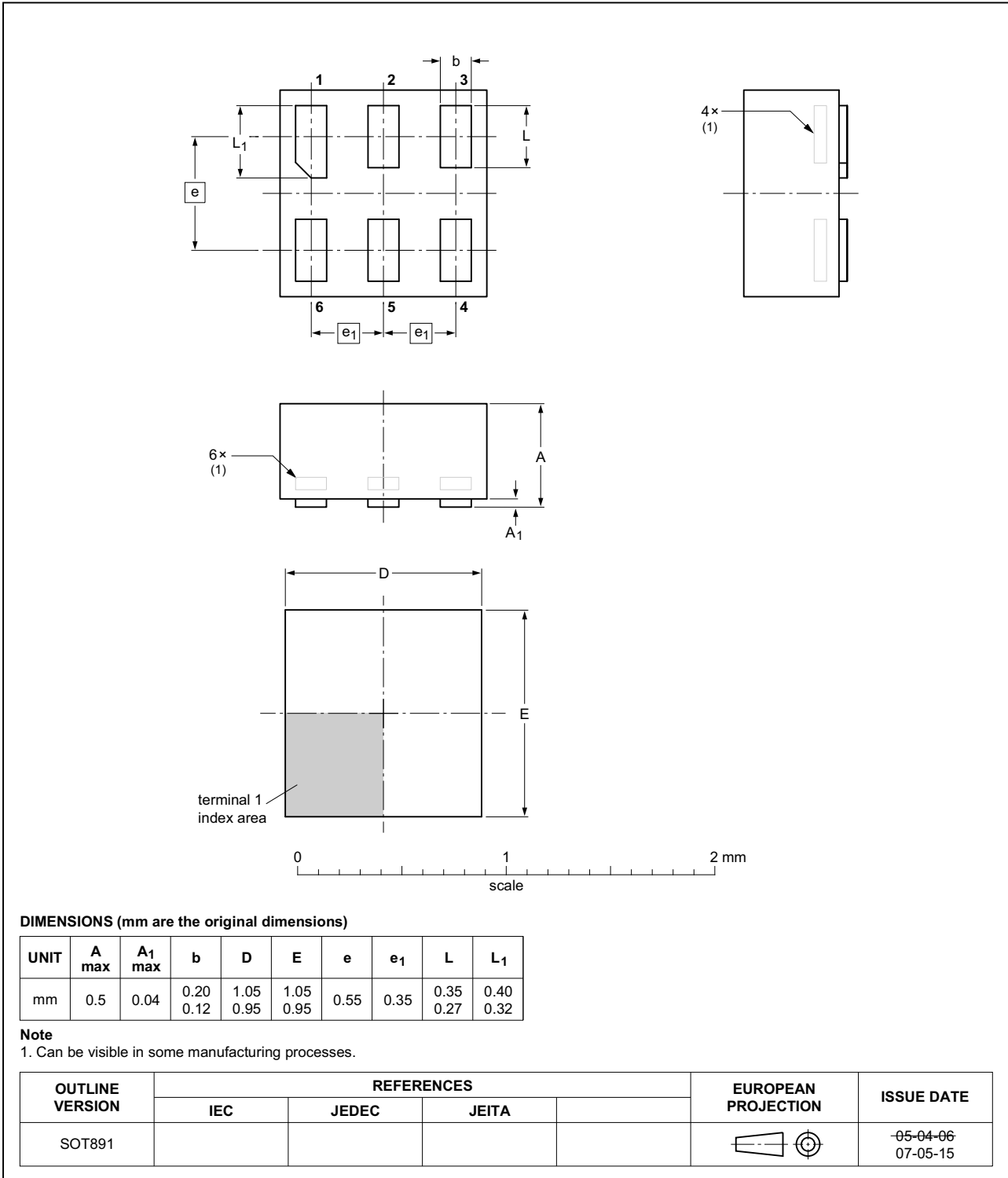


Fig 21. Package outline SOT891 (XSON6)

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

SOT1202

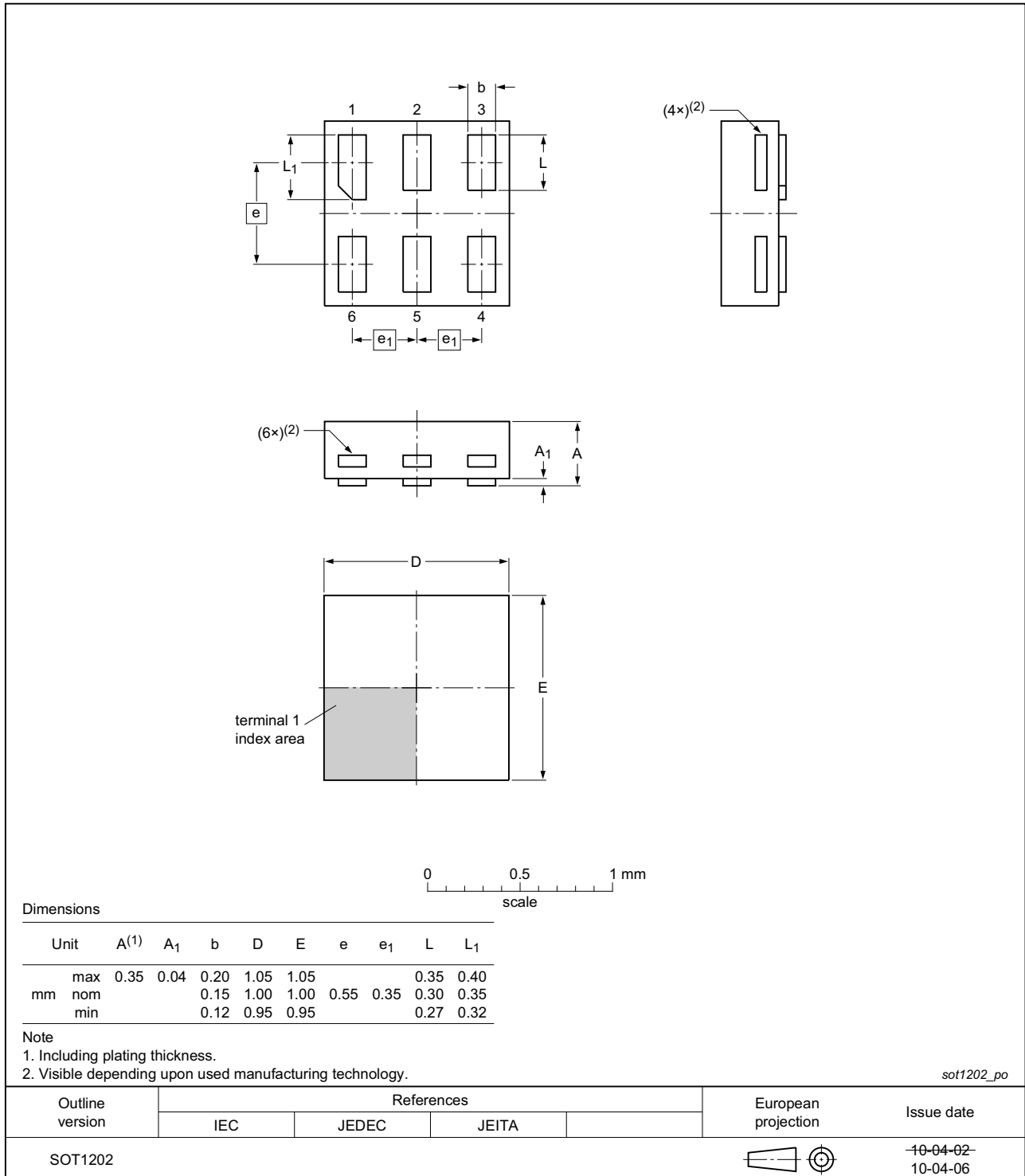


Fig 22. Package outline SOT1202 (XSON6)

## 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
NCX2200 v6	20140709	Product data sheet	-	NCX2200 v.5
Modifications:	<ul style="list-style-type: none"> <li>Package SOT1202 added.</li> </ul>			
NCX2200 v5	20120806	Product data sheet	-	NCX2200 v.4
Modifications:	<ul style="list-style-type: none"> <li>Package outline drawing of SOT886 (<a href="#">Figure 20</a>) modified.</li> </ul>			
NCX2200 v4	20111110	Product data sheet	-	NCX2200 v.3
Modifications:	<ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>			
NCX2200 v.3	20111014	Product data sheet	-	NCX2200 v.2
NCX2200 v.2	20110706	Product data sheet	-	NCX2200 v.1
NCX2200 v.1	20110322	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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For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

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