



**THE DATASHEET OF  
NCX2202GM**



# NCX2202

Low voltage comparator; open-drain output

Rev. 5.1 — 21 November 2019

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	Topside marking <sup>[1]</sup>	Package		
		Name	Description	Version
NCX2202GW	qa	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
NCX2202GM	qa	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
NCX2202GM	X2	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm; requires SSB	SOT886

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

### 4.1 Ordering options

Table 2. Ordering options

Type number	Orderable part number	Package	Packing method	Minimum order quantity	Temperature
NCX2202GW	NCX2202GW,125	TSSOP5	REEL 7" Q3/T4 NDP	3000	T <sub>amb</sub> = -40 °C to +85 °C
NCX2202GM	NCX2202GM,115 <sup>[1]</sup>	XSON6	REEL 7" Q1/T1 NDP	5000	T <sub>amb</sub> = -40 °C to +85 °C
NCX2202GM	NCX2202GMZ	XSON6	REEL 7" Q1/T1 NDP SSB <sup>[2]</sup>	5000	T <sub>amb</sub> = -40 °C to +85 °C

[1] Will go EOL - migrate to new leadframe orderable part number NCX2202GMZ.

[2] This packing method uses a Static Shielding Bag (SSB) solution. Material is to be kept in the sealed bag between uses.

## 5. Functional diagram

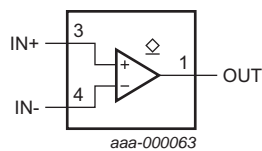


Fig 1. Logic symbol

## 6. Pinning information

### 6.1 Pinning

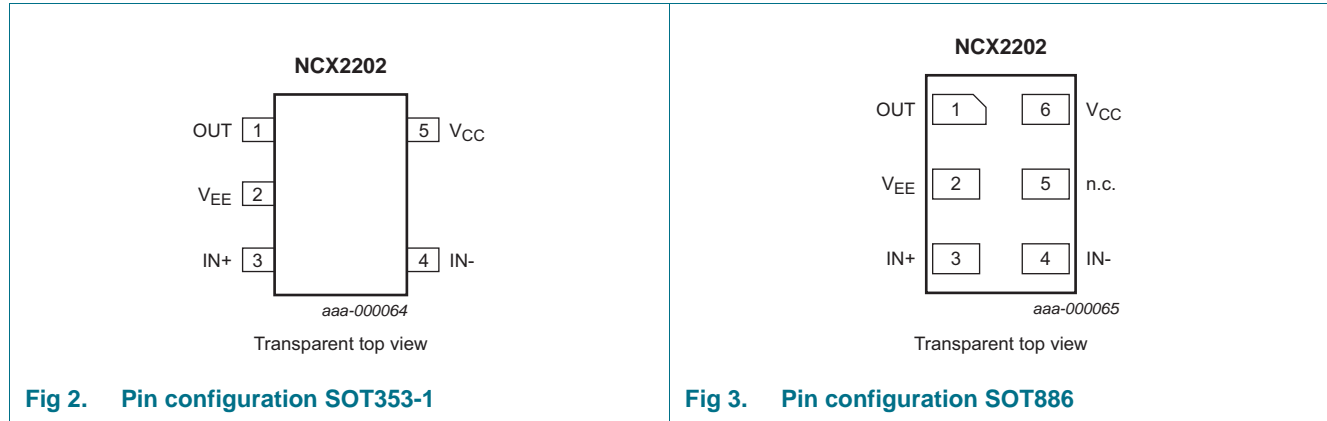


Fig 2. Pin configuration SOT353-1

Fig 3. Pin configuration SOT886

### 6.2 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

## 7. 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.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage	$V_{CC}$ to $V_{EE}$				
		full spec operating range	1.6	-	5.5	V
		functional operating range	1.3	-	5.5	V
$V_I$	input voltage		$V_{EE}$	-	$V_{CC}$	V
$V_O$	output voltage		$V_{EE}$	-	5.5	V
$T_{amb}$	ambient temperature		-40	-	+85	°C

## 9. 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] $V_{CC} = 1.3\text{ V}$	-30	0.5	+30	-30	+30	mV
		[1] $V_{CC} = 1.3\text{ V}$	-	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	μA

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

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

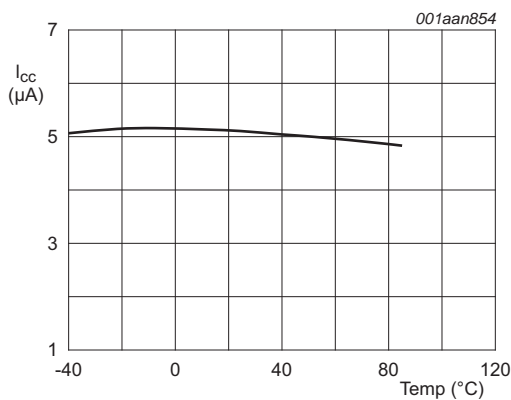
Voltages are referenced to  $V_{EE}$  ( $V_{EE} = 0$  V);  $V_{CC} = 1.6$  V to 5.5 V;  $V_{CM} = 0.5V_{CC}$  unless otherwise specified.

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.

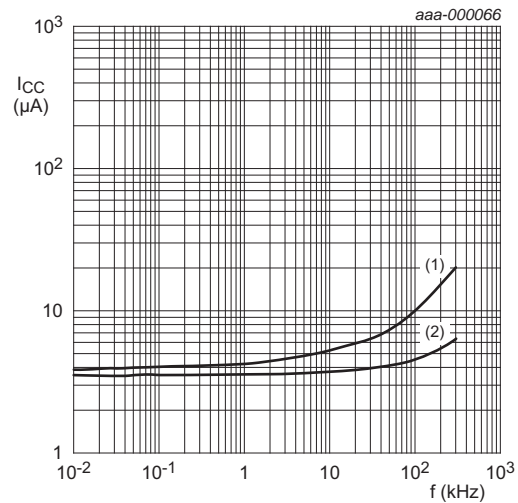
[2] Input signal: 1 kHz, square wave signal with 10 ns edge rate.

## 11. Graphs



$V_{CC} = 5.0$  V.

**Fig 4. Supply current versus temperature**

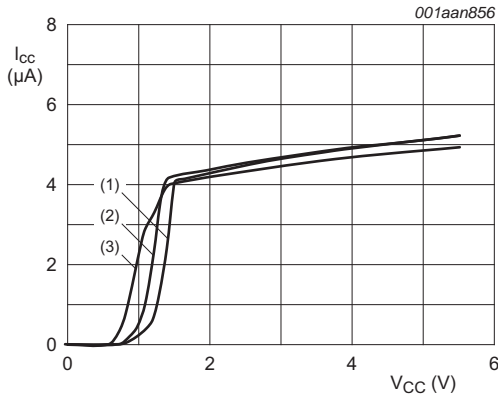


$T_{amb} = 25$  °C;  $C_L = 15$  pF.

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

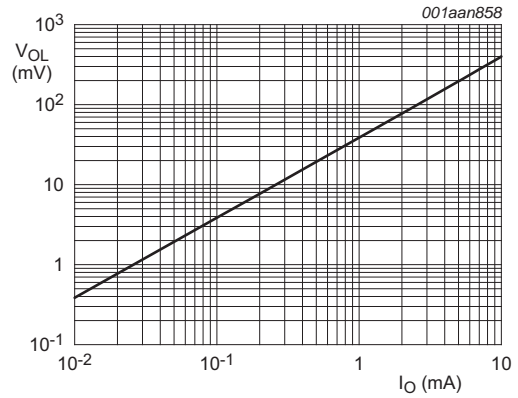
(2)  $V_{CC} = 2.7$  V.

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



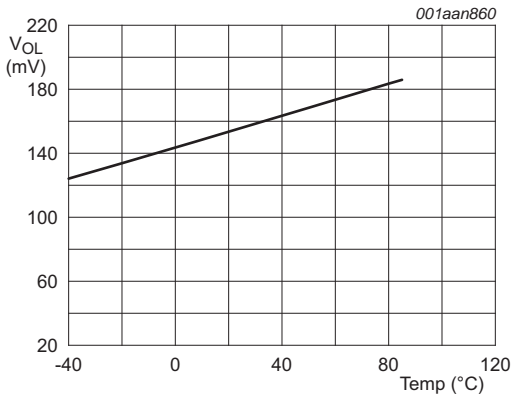
- (1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{amb} = 85\text{ }^{\circ}\text{C}$ .

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



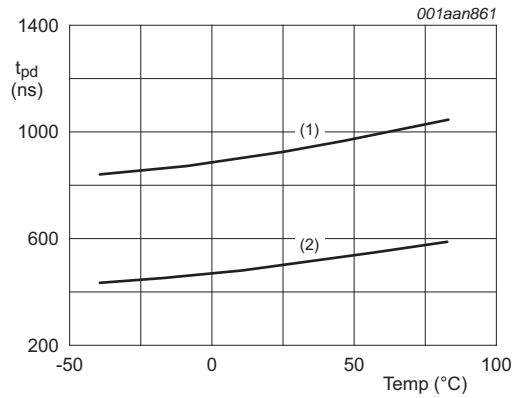
$T_{amb} = 25\text{ }^{\circ}\text{C}$ .  
 $V_{CC} = 5.0\text{ V}$ .

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



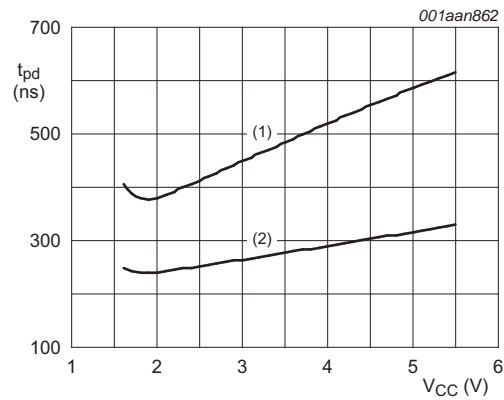
$I_O = 4.0\text{ mA}$ .  
 $V_{CC} = 5.0\text{ V}$ .

**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.**

## 12. Application information

### 12.1 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.

### 12.2 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](#)

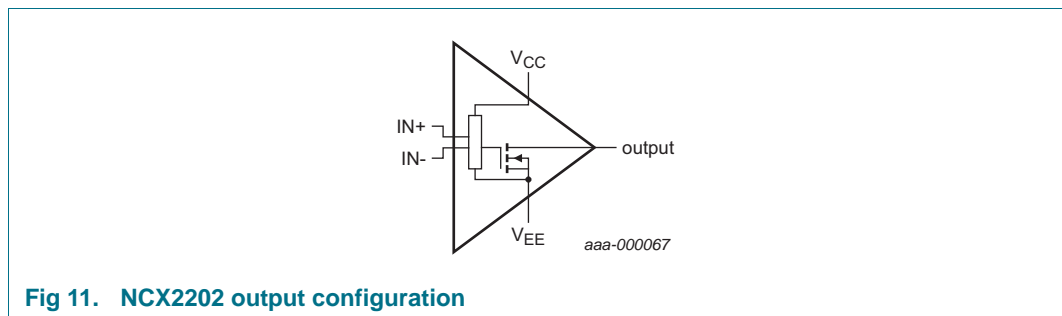


Fig 11. NCX2202 output configuration

### 12.3 Zero-crossing detector

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

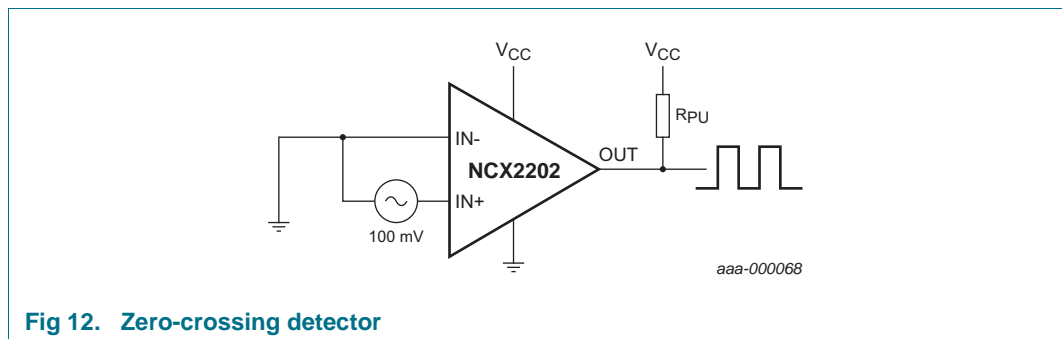
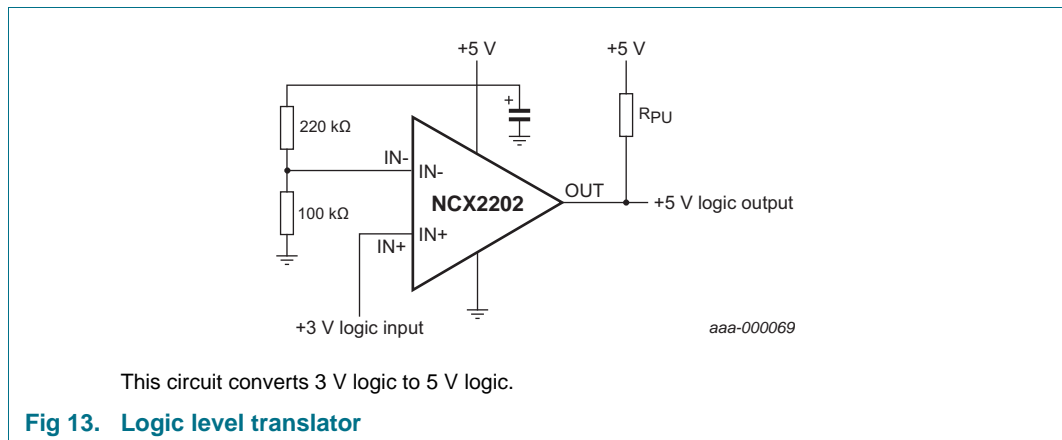


Fig 12. Zero-crossing detector

### 12.4 Logic level translator

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



### 13. Package outline

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

SOT353-1

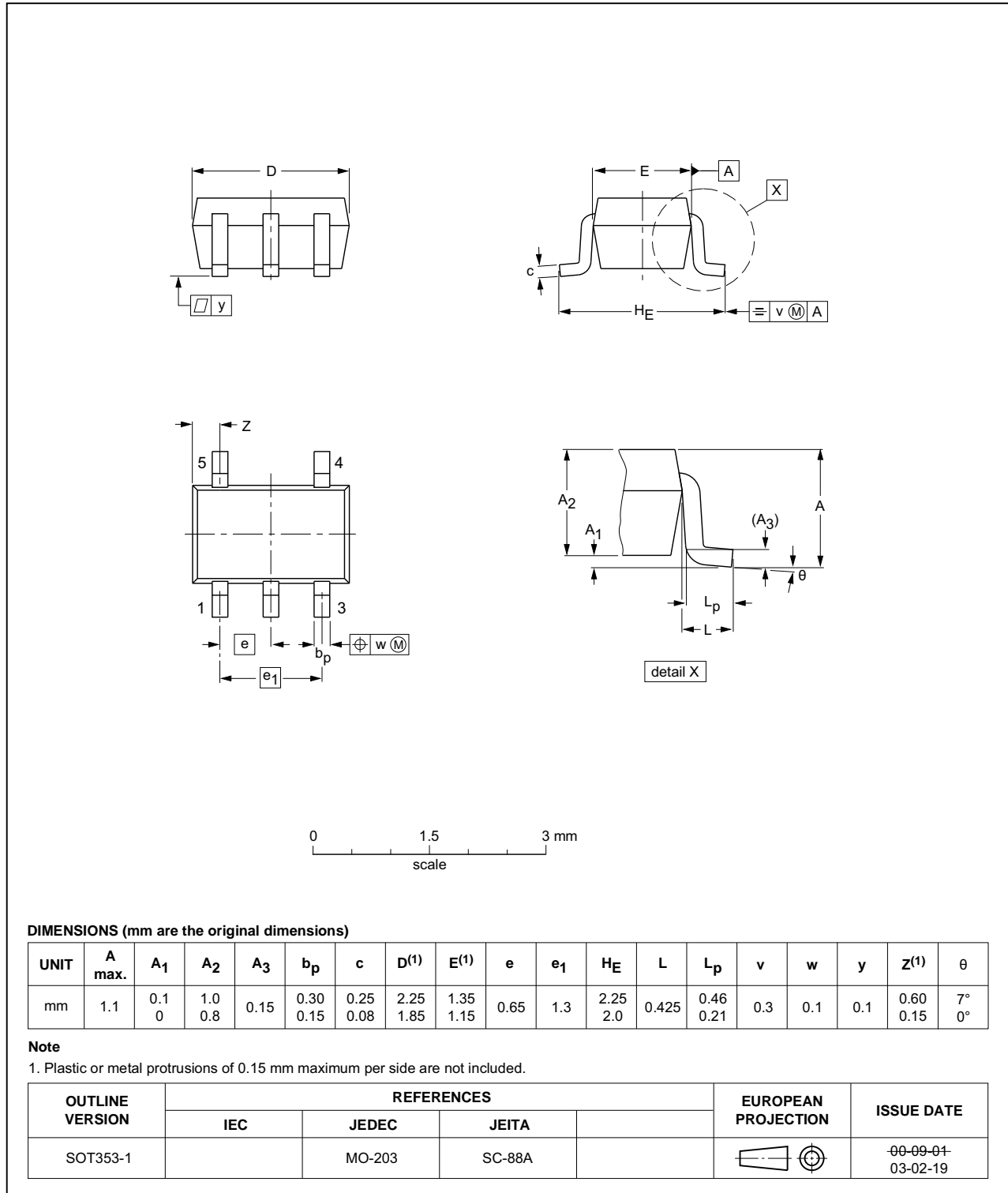


Fig 14. Package outline SOT353-1 (TSSOP5)

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

SOT886

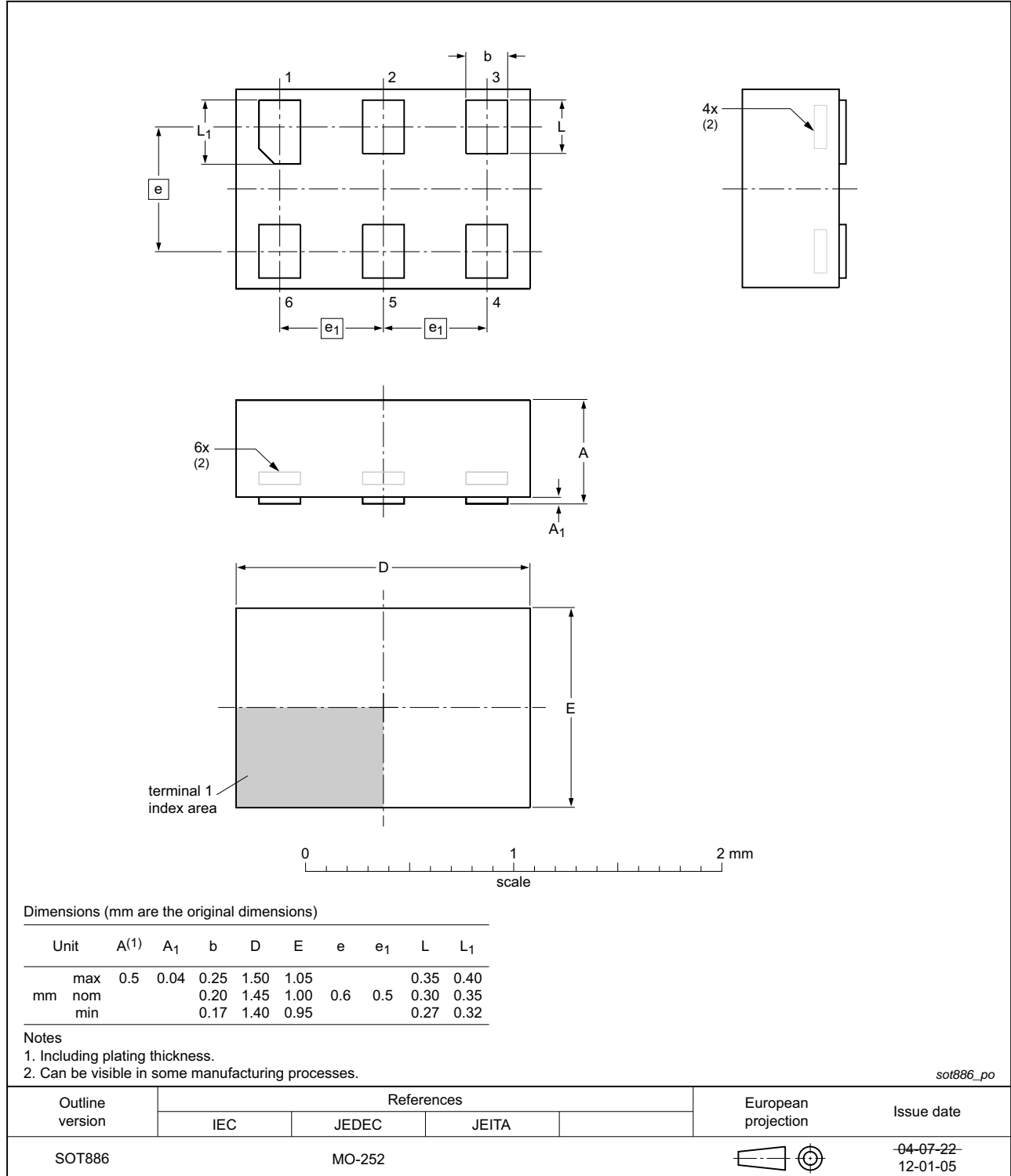


Fig 15. Package outline SOT886 (XSON6)

## 14. Abbreviations

Table 8. Abbreviations

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

## 15. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NCX2202 v.5.1	20191121	Product data sheet	201909001A	NCX2202 v.5.1
Modifications:	<ul style="list-style-type: none"> <li>Package SOT886 requiring SSB added. Refer to PCN number 201909001A XSON6 (SOT886) Assembly/Test Transfer from ATGD and ATSN to ATBK.</li> </ul>			
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	-	-

## 16. Legal information

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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.
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