NCX2200

Low voltage comparator

Rev. 6 — 9 July 2014 Product data sheet

1. General description

The NCX2200 provides a single low voltage low power comparator.

The NCX2200 has a very low supply current of 6 μA 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

- 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 μA (typical)
- Very low-power consumption
- No phase inversion with overdriven input signals
- Internal hysteresis
- Propagation delay of 0.8 μs (typical)
- ESD protection:
  - HBM JESD22-A114F Class 3A. Exceeds 2000 V
  - CDM JESD22-C101E exceeds 1000 V
- Multiple package options
- Specified from −40 °C to +85 °C

3. Applications

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

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
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[1]
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

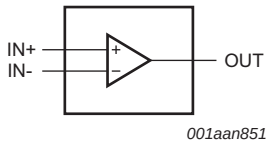


Fig 1. Logic symbol

7. Pinning information

7.1 Pinning

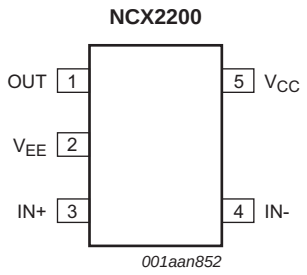


Fig 2. Pin configuration SOT353-1

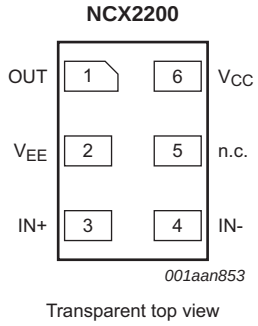


Fig 3. Pin configuration SOT886

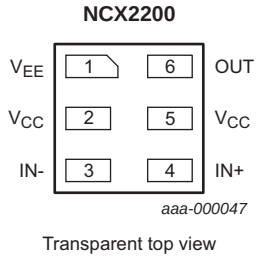


Fig 4. Pin configuration SOT891 and SOT1202

7.2 Pin description

Table 3. Pin description

Symbol	Pin				Description
	SOT353-1	SOT886	SOT891	SOT1202	
OUT	1	1	6	6	comparator output
V_{EE}	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_{CC}	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_{EE}.

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-	7.0	V
V_I	input voltage	IN–, IN+ inputs	–0.5	V_{CC} + 0.5	V
$t_{sc(o)}$	output short-circuit time	[1]	-	indefinite	s
$T_{j(max)}$	maximum junction temperature		-	+150	°C
T_{stg}	storage temperature		–65	+150	°C
P_{tot}	total power dissipation	T_{amb} = –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_{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
T_{amb}	ambient temperature		–40	-	+85	°C

10. Static characteristics

Table 6. Static characteristics

At recommended operating conditions. V_{CC} = 1.6 V to 5.5 V, V_{EE} = 0 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 V	-	20	-	-	-	mV
$V_{I(offset)}$	offset input voltage	[1]	–30	0.5	+30	–30	+30	mV
		V_{CC} = 1.3 V [1]	-	3	-	-	-	mV
V_{OH}	HIGH-level output voltage	I_O = –0.5 mA; V_{CC} = 1.3 V	-	1.24	-	-	-	V
		I_O = –0.5 mA; V_{CC} = 1.6 V	-	1.55	-	1.35	-	V
		I_O = –3 mA; V_{CC} = 3.0 V	-	2.85	-	2.7	-	V
		I_O = –5 mA; V_{CC} = 5.5 V	-	5.33	-	5.2	-	V
V_{OL}	LOW-level output voltage	I_O = 0.5 mA; V_{CC} = 1.3 V	-	0.05	-	-	-	V
		I_O = 0.5 mA; V_{CC} = 1.6 V	-	0.04	-	-	0.25	V
		I_O = 3 mA; V_{CC} = 3.0 V	-	0.14	-	-	0.3	V
		I_O = 5 mA; V_{CC} = 5.5 V	-	0.20	-	-	0.3	V
V_{CM}	common-mode voltage	V_{CC} = 1.3 V to 5.5 V	-	V_{EE} to V_{CC}	-	-	-	V
I_{OS}	output short-circuit current	V_{CC} = 5.5 V; V_O = V_{EE} or V_{CC}	-	68	-	-	-	mA
CMRR	common-mode rejection ratio	ΔV_{CM} = V_{CC}	-	70	-	-	-	dB
PSRR	power supply rejection ratio	ΔV_{CC} = 1.95 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.

11. Dynamic characteristics

Table 7. Dynamic characteristics

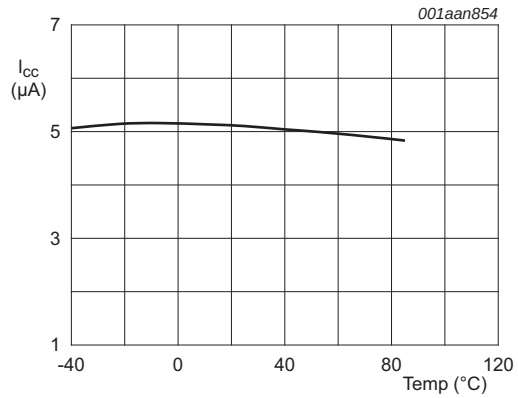
Voltages are referenced to V_{EE} (V_{EE} = 0 V);V_{CC} = 1.6 V to 5.5 V; V_{CM} = 0.5V_{CC} unless otherwise specified.

Symbol	Parameter	Conditions		25 °C			Unit
				Min	Typ	Max	
t_{pd}	propagation delay	20 mV overdrive; C_L = 15 pF	[1]	-	0.8	-	µs
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}.

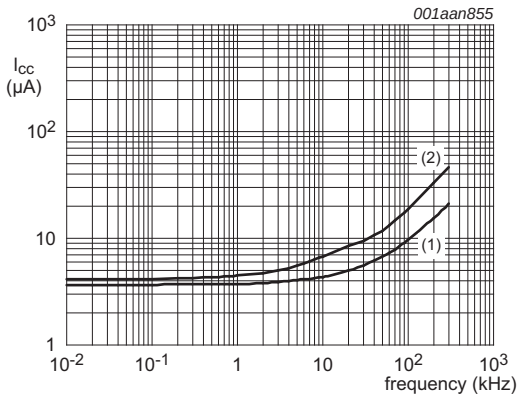
[2] Input signal: 1 kHz, squarewave signal with 10 ns edge rate.

12. Graphs



V_{CC} = 5.0 V.

Fig 5. Supply current versus temperature

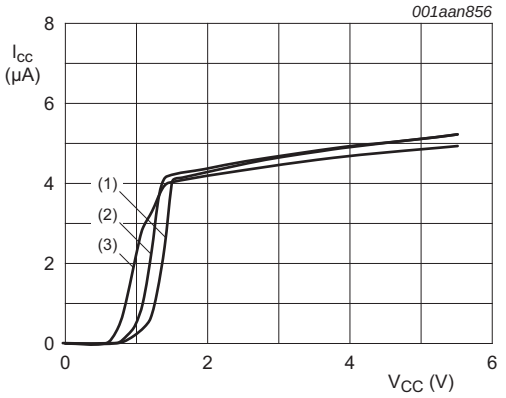


T_{amb} = 25 °C; C_L = 15 pF.

(1) V_{CC} = 2.7 V.

(2) V_{CC} = 5.0 V.

Fig 6. Supply current versus output transition frequency

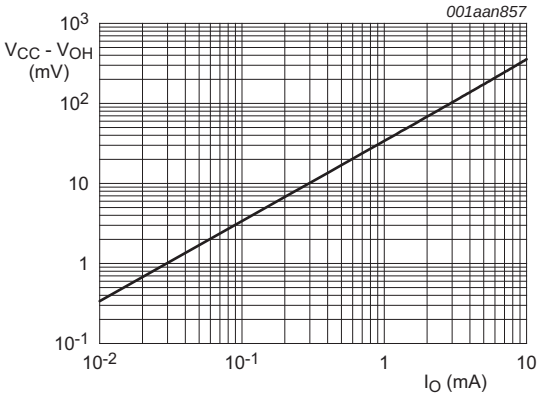


(1) T_{amb} = −40 °C.

(2) T_{amb} = 25 °C.

(3) T_{amb} = 85 °C.

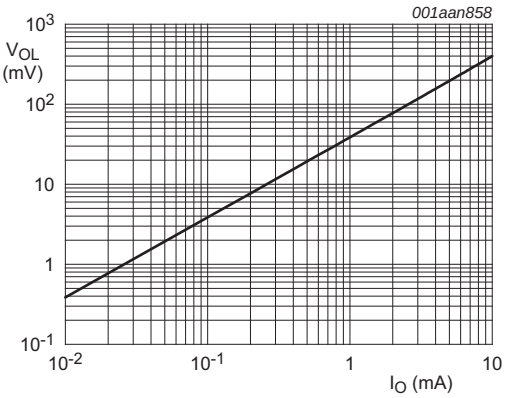
Fig 7. Supply current versus supply voltage



T_{amb} = 25 °C.

V_{CC} = 5.0 V.

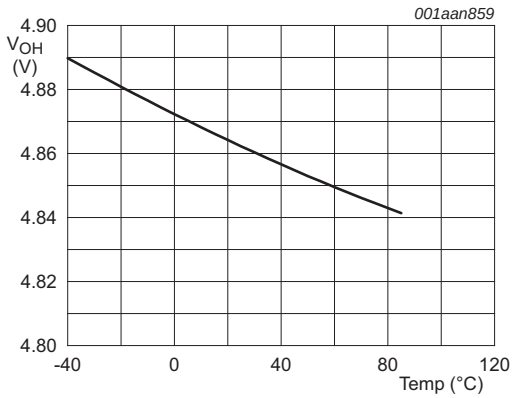
Fig 8. HIGH-level output voltage versus output current



T_{amb} = 25 °C.

V_{CC} = 5.0 V.

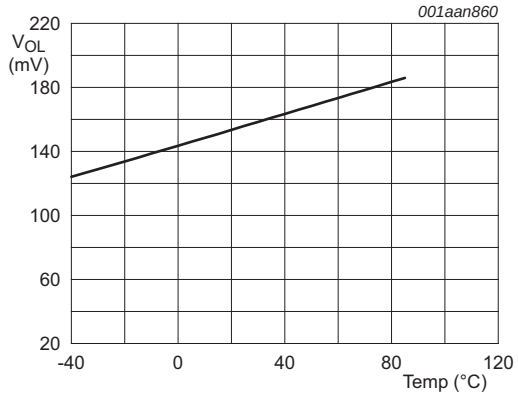
Fig 9. LOW-level output voltage versus output current



I_O = −4.0 mA.

V_{CC} = 5.0 V.

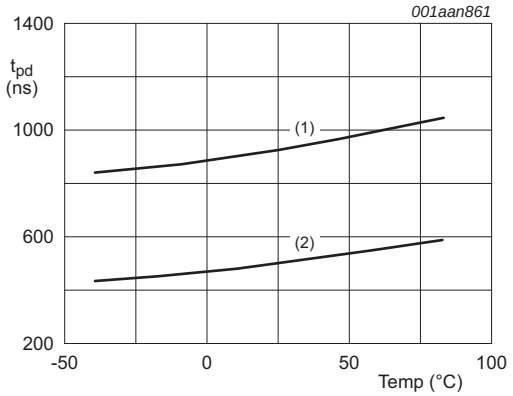
Fig 10. HIGH-level output voltage versus temperature



I_O = 4.0 mA.

V_{CC} = 5.0 V.

Fig 11. LOW-level output voltage versus temperature

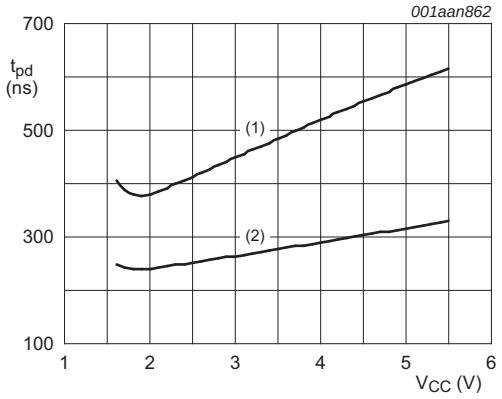


V_{CC} = 5.0 V; input overdrive = 50 mV.

(1) t_{PLH}.

(2) t_{PHL}.

Fig 12. Propagation delay versus temperature



T_{amb} = 25 °C; input overdrive = 100 mV.

(1) t_{PLH}.

(2) t_{PHL}.

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 μA of supply current while achieving a typical propagation delay of 0.8 μs 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

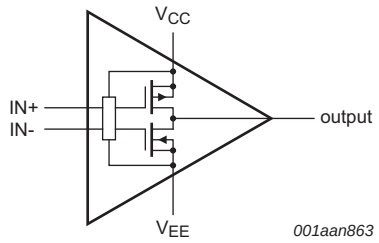
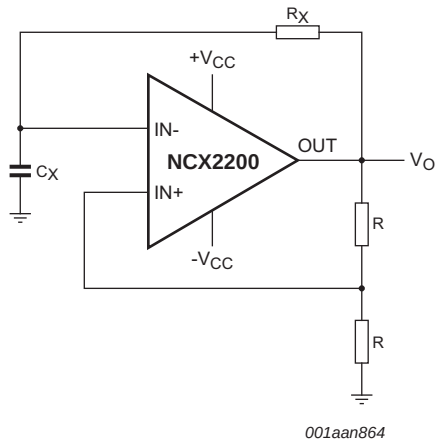


Fig 14. NCX2200 complementary output configuration

13.3 Schmitt trigger oscillator

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



The oscillation frequency can be calculated as follows:

$$f = \frac{1}{T} = \frac{1}{2.2 \cdot R_X \cdot C_X}$$

Fig 15. Schmitt trigger oscillator

13.4 Zero-crossing detector

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

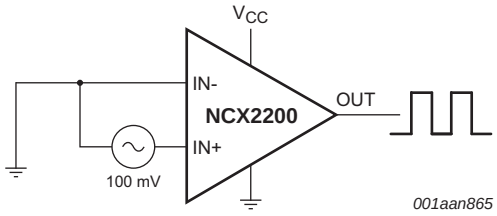
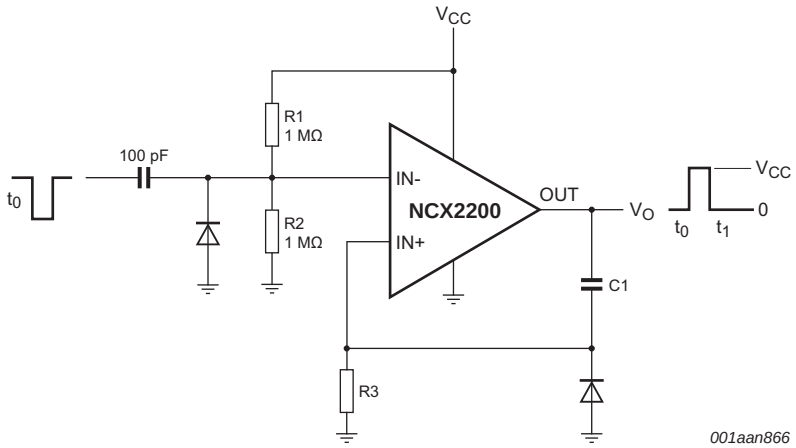


Fig 16. Zero-crossing detector

13.5 One-shot multivibrator

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

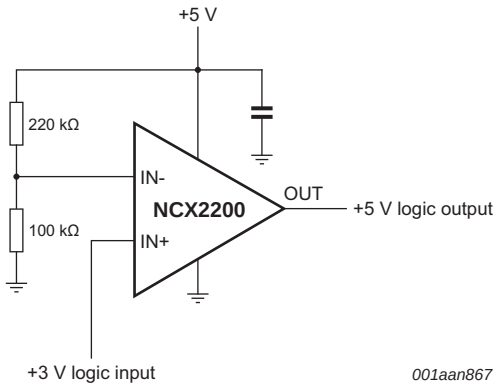


The resistor divider R1 and R2 can be used to set the magnitude of the input pulse. The pulse width is set by adjusting C1 and R3.

Fig 17. One-shot multivibrator

13.6 Logic level translator

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

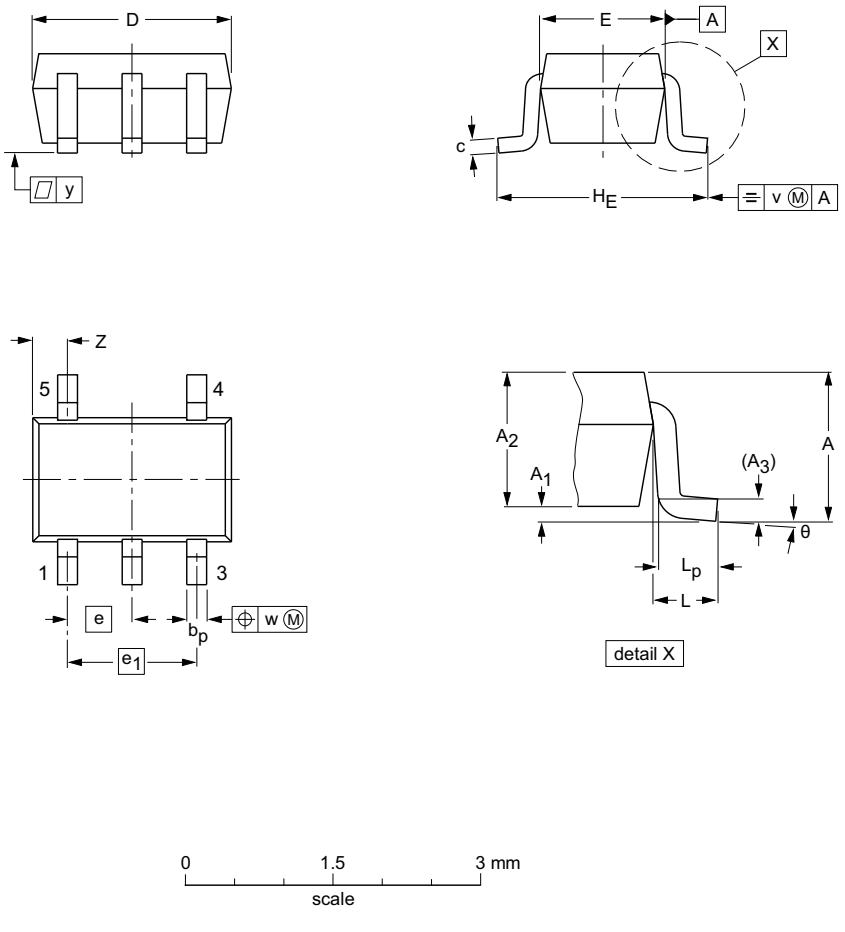


This circuit converts 3 V logic to 5 V logic.

Fig 18. Logic level translator

14. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm **SOT353-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	e_1	H_E	L	L_p	v	w	y	$Z^{(1)}$	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°

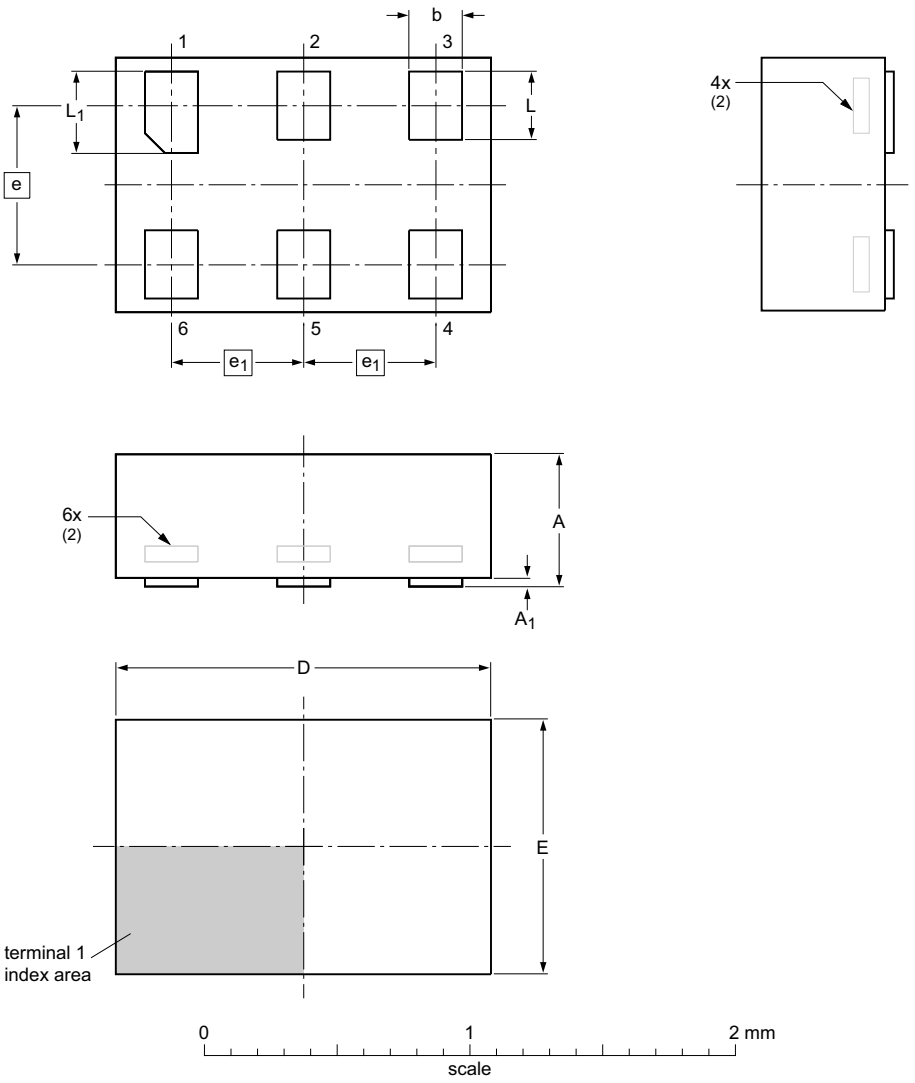
Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT353-1		MO-203	SC-88A			~~00-09-01~~ 03-02-19

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



Dimensions (mm are the original dimensions)

Unit		A(1)	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.5	0.04	0.25	1.50	1.05			0.35	0.40
	nom			0.20	1.45	1.00	0.6	0.5	0.30	0.35
	min			0.17	1.40	0.95			0.27	0.32

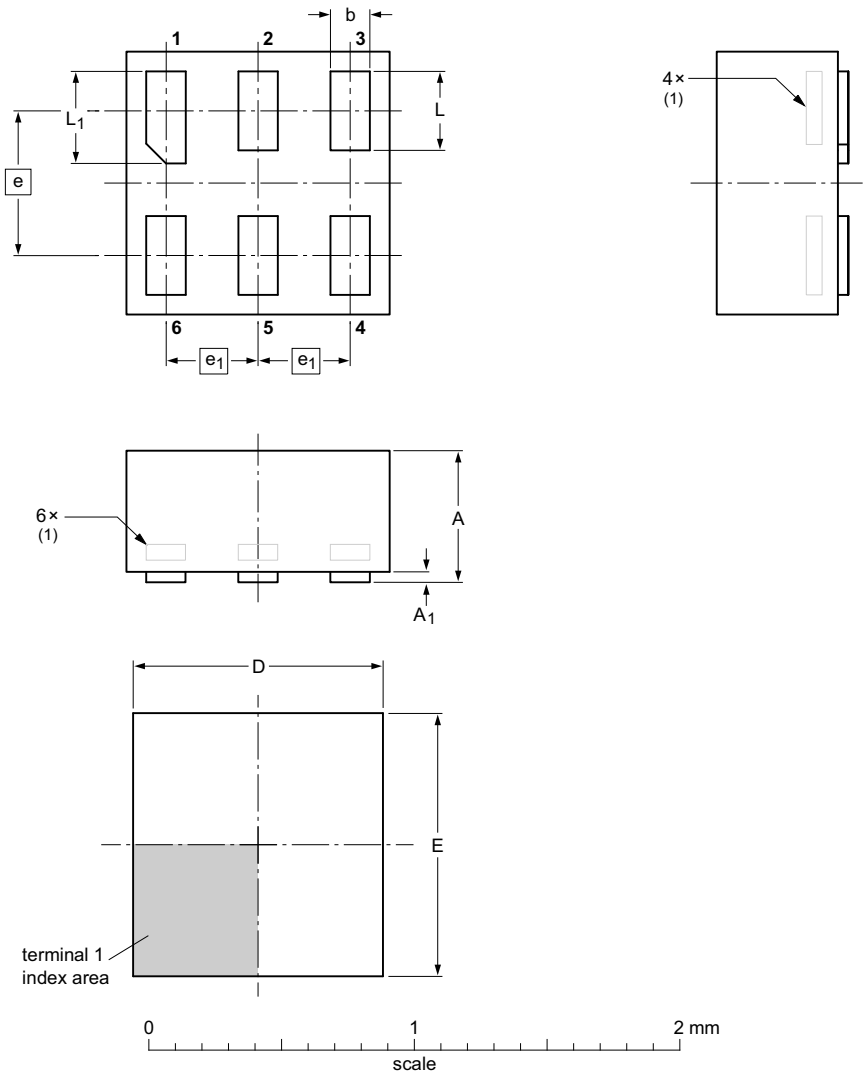
Notes
1. Including plating thickness.
2. Can be visible in some manufacturing processes.

sot886_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT886		MO-252				~~04-07-22~~ 12-01-05

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**



DIMENSIONS (mm are the original dimensions)

UNIT	A max	A_1 max	b	D	E	e	e_1	L	L_1
mm	0.5	0.04	0.20 0.12	1.05 0.95	1.05 0.95	0.55	0.35	0.35 0.27	0.40 0.32

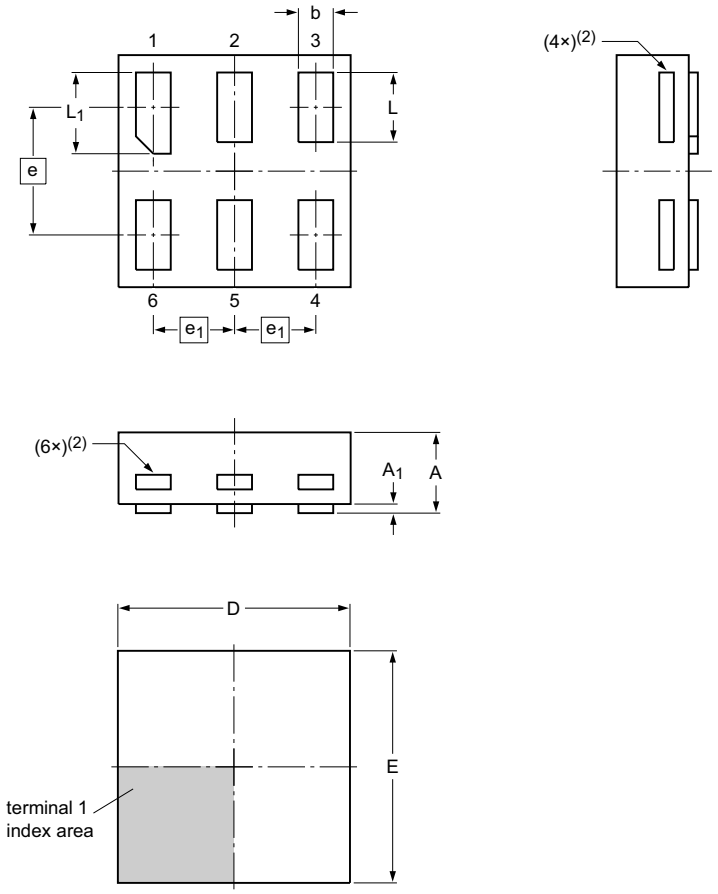
Note

1. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT891						~~05-04-06~~ 07-05-15

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**



Dimensions

Unit		A(1)	A1	b	D	E	e	e1	L	L1
mm	max	0.35	0.04	0.20	1.05	1.05			0.35	0.40
	nom			0.15	1.00	1.00	0.55	0.35	0.30	0.35
	min			0.12	0.95	0.95			0.27	0.32

Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1202_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1202						~~10-04-02~~ 10-04-06

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:	• Package SOT1202 added.			
NCX2200 v5	20120806	Product data sheet	-	NCX2200 v.4
Modifications:	• Package outline drawing of SOT886 (Figure 20) modified.			
NCX2200 v4	20111110	Product data sheet	-	NCX2200 v.3
Modifications:	• Legal pages updated.			
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[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.

[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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