NCX2202

Low voltage comparator; open-drain output

Rev. 5.1 — 21 November 2019 Product data sheet

1. General description

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

The NCX2202 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. These characteristics make the 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 1C exceeds 1500 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	Topside marking[1]	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_{amb} = –40 °C to +85 °C
NCX2202GM	NCX2202GM,115[1]	XSON6	REEL 7" Q1/T1 NDP	5000	T_{amb} = –40 °C to +85 °C
NCX2202GM	NCX2202GMZ	XSON6	REEL 7" Q1/T1 NDP SSB[2]	5000	T_{amb} = –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

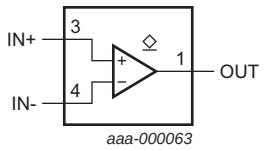
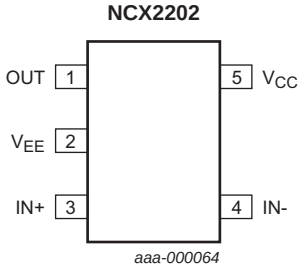


Fig 1. Logic symbol

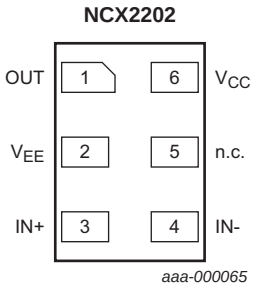
6. Pinning information

6.1 Pinning



Transparent top view

Fig 2. Pin configuration SOT353-1



Transparent top view

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_{EE}	2	2	supply voltage
IN+	3	3	comparator input (positive)
IN–	4	4	comparator input (negative)
n.c.	-	5	not connected
V_{CC}	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_{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
V_O	output voltage			V_{EE} – 0.5	7.0	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.

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 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_{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
I_{OZ}	OFF-state output current	IN– = V_{EE}; IN+ = V_{CC}; V_O = 5.5 V		-	3	-	-	-	nA
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_{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.

10. Dynamic characteristics

Table 7. Dynamic characteristics

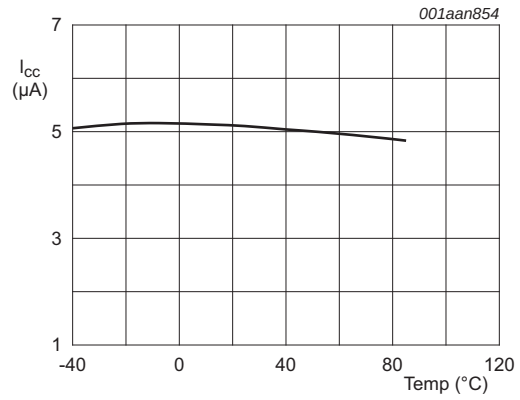
Voltages are referenced to V_{EE} (V_{EE} = 0 V);V_{CC} = 1.6 V to 5.5 V; V_{CM} = 0.5V_{CC} unless otherwise specified.

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

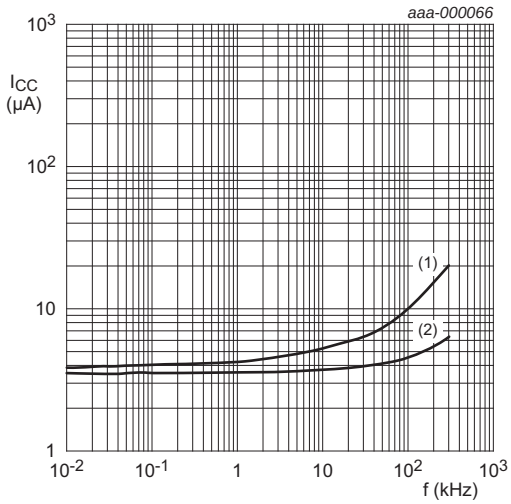
[2] Input signal: 1 kHz, square wave signal with 10 ns edge rate.

11. Graphs



V_{CC} = 5.0 V.

Fig 4. Supply current versus temperature

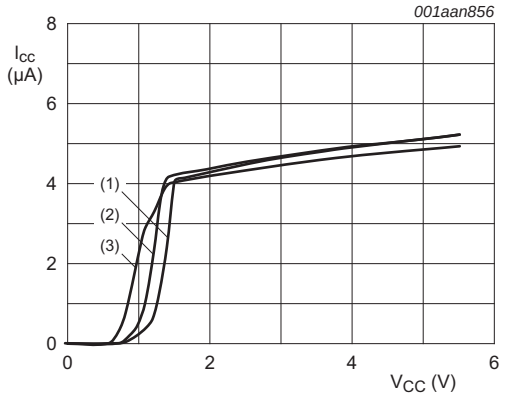


T_{amb} = 25 °C; C_L = 15 pF.

(1) V_{CC} = 5.0 V.

(2) V_{CC} = 2.7 V.

Fig 5. Supply current versus output transition frequency

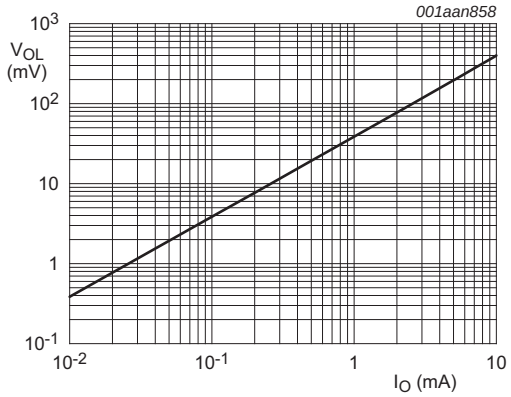


(1) T_{amb} = −40 °C.

(2) T_{amb} = 25 °C.

(3) T_{amb} = 85 °C.

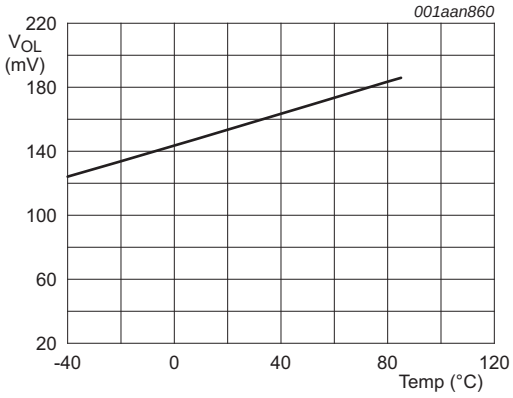
Fig 6. Supply current versus supply voltage



T_{amb} = 25 °C.

V_{CC} = 5.0 V.

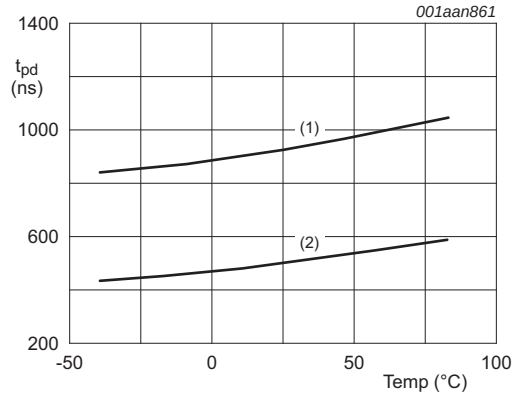
Fig 7. LOW-level output voltage versus output current



I_O = 4.0 mA.

V_{CC} = 5.0 V.

Fig 8. LOW-level output voltage versus temperature

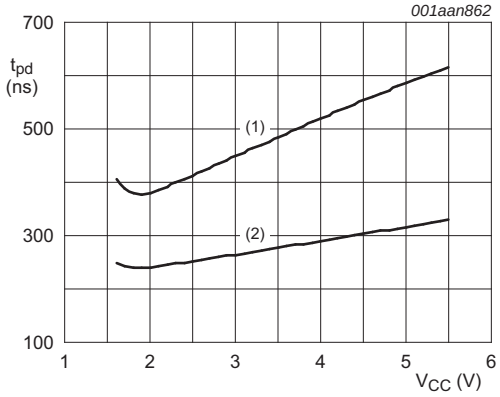


V_{CC} = 5.0 V; input overdrive = 50 mV.

(1) t_{PLZ}.

(2) t_{PZL}.

Fig 9. Propagation delay versus temperature



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

(1) t_{PLZ}.

(2) t_{PZL}.

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

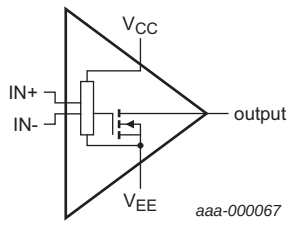


Fig 11. NCX2202 output configuration

12.3 Zero-crossing detector

Figure 12 shows the NCX2202 configured as a zero-crossing detector.

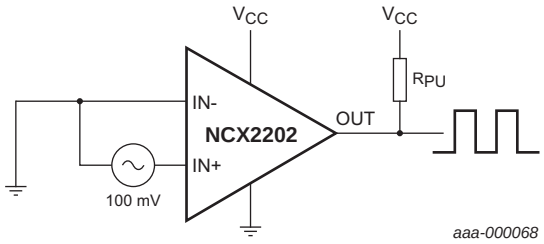
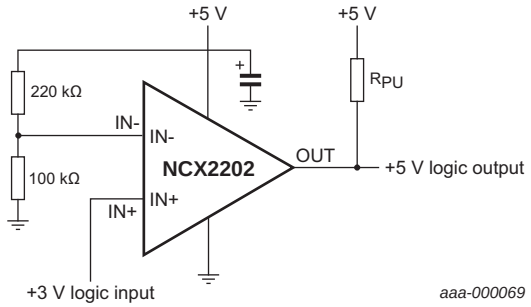


Fig 12. Zero-crossing detector

12.4 Logic level translator

Figure 13 shows the NCX2202 configured as a logic level translator.

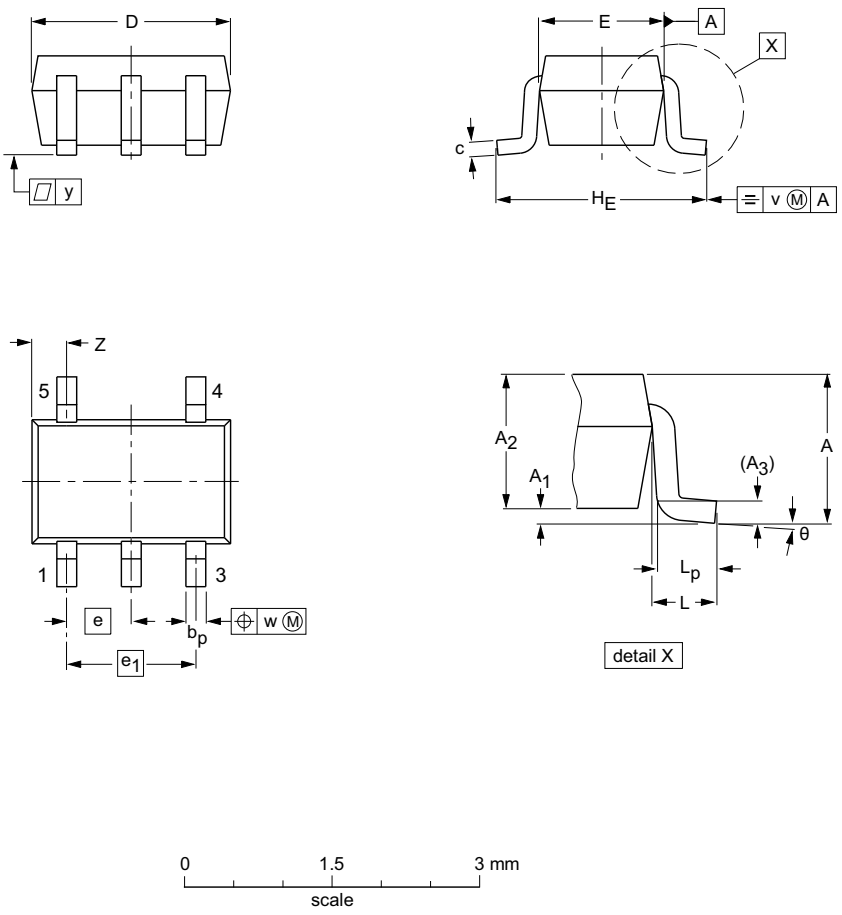


This circuit converts 3 V logic to 5 V logic.

Fig 13. Logic level translator

13. 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°

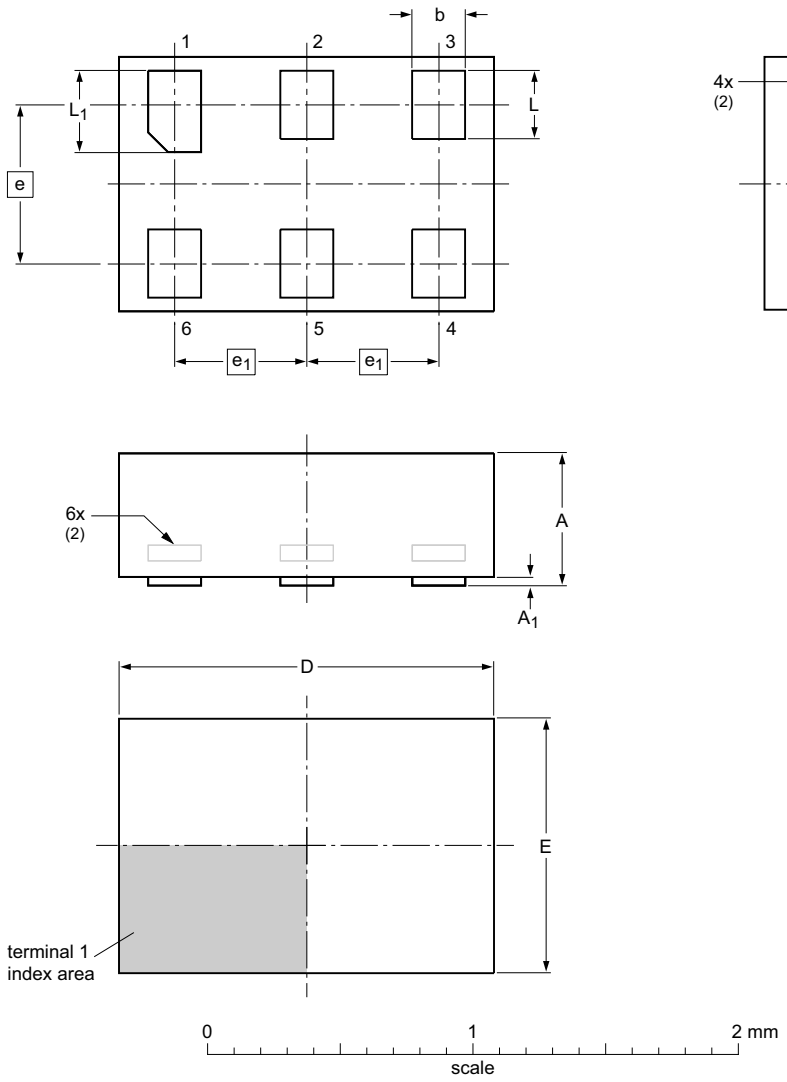
Note

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 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



Dimensions (mm are the original dimensions)

Unit		A(1)	A_1	b	D	E	e	e_1	L	L_1
	max	0.5	0.04	0.25	1.50	1.05			0.35	0.40
mm	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 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:	• Package SOT886 requiring SSB added. Refer to PCN number 201909001A XSON6 (SOT886) Assembly/Test Transfer from ATGD and ATSN to ATBK.			
NCX2202 v.5	20121030	Product data sheet	-	NCX2202 v.4
Modifications:	• Class 3A changed into Class 1C (errata) in Section 2.			
NCX2202 v.4	20120806	Product data sheet	-	NCX2202 v.3
Modifications:	• Package outline drawing of SOT886 (Figure 15) modified.			
NCX2202 v.3	20111110	Product data sheet	-	NCX2202 v.2
Modifications:	• Legal pages updated.			
NCX2202 v.2	20111020	Product data sheet	-	NCX2202 v.1
NCX2202 v.1	20110720	Product data sheet	-	-

16. Legal information

16.1 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".

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18. Contents

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Document identifier: NCX2202

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