

NCX2200

Low voltage comparator

Rev. 1 — 22 March 2011

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 $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

3. Applications

- 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 |

[1] Lead pitch is 0.4 mm.

5. Marking

Table 2. Marking codes

| Type number | Marking ^[1] |
|-------------|------------------------|
| NCX2200GM | q1 |
| NCX2200GW | q1 |

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

6. Functional diagram

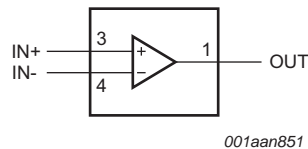


Fig 1. Logic symbol

7. Pinning information

7.1 Pinning

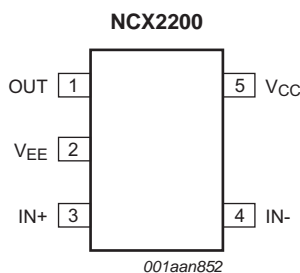


Fig 2. Pin configuration SOT353-1

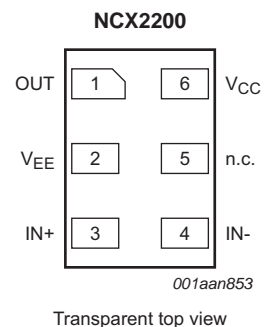


Fig 3. Pin configuration SOT886

7.2 Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|-----------------|----------|--------|-----------------------------|
| | SOT353-1 | SOT886 | |
| OUT | 1 | 1 | comparator output |
| 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 |

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 | -0.2 | V _{CC} + 0.2 | 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. $V_{CC} = 1.6\text{ V to }5.5\text{ V}$, $V_{EE} = 0\text{ V}$; $V_{CM} = 0.5V_{CC}$ 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_{OH} | HIGH-level output voltage | $I_O = -0.5\text{ mA}$; $V_{CC} = 1.3\text{ V}$ | - | 1.24 | - | - | - | V |
| | | $I_O = -0.5\text{ mA}$; $V_{CC} = 1.6\text{ V}$ | - | 1.55 | - | 1.35 | - | V |
| | | $I_O = -3\text{ mA}$; $V_{CC} = 3.0\text{ V}$ | - | 2.85 | - | 2.7 | - | V |
| | | $I_O = -5\text{ mA}$; $V_{CC} = 5.5\text{ V}$ | - | 5.33 | - | 5.2 | - | V |
| 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 |
| 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 | $V_{CC} = 5.5\text{ V}$; $V_O = V_{EE}$ or 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.

11. Dynamic characteristics

Table 7. Dynamic characteristics

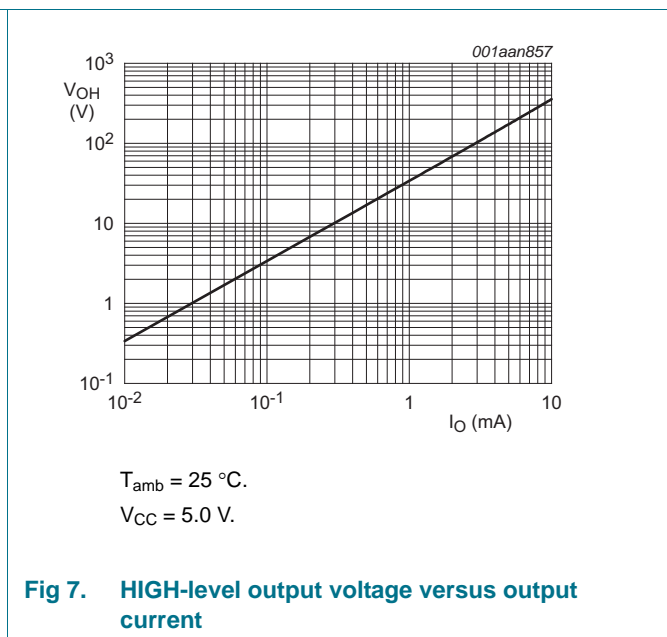
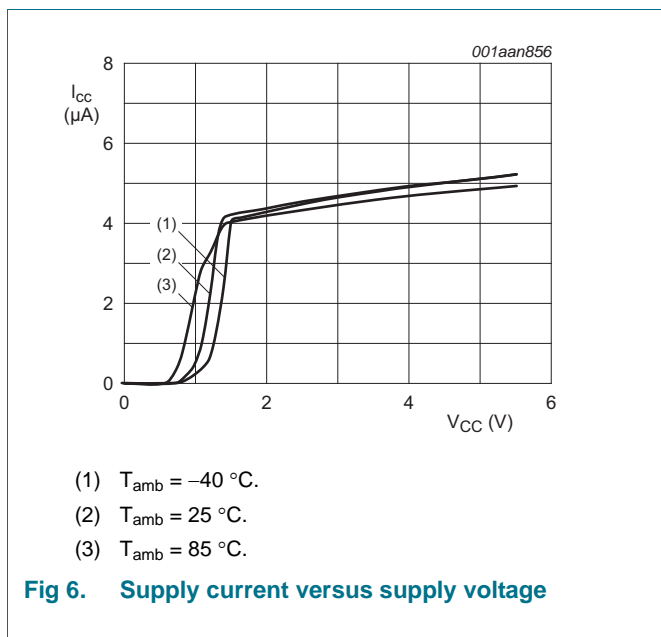
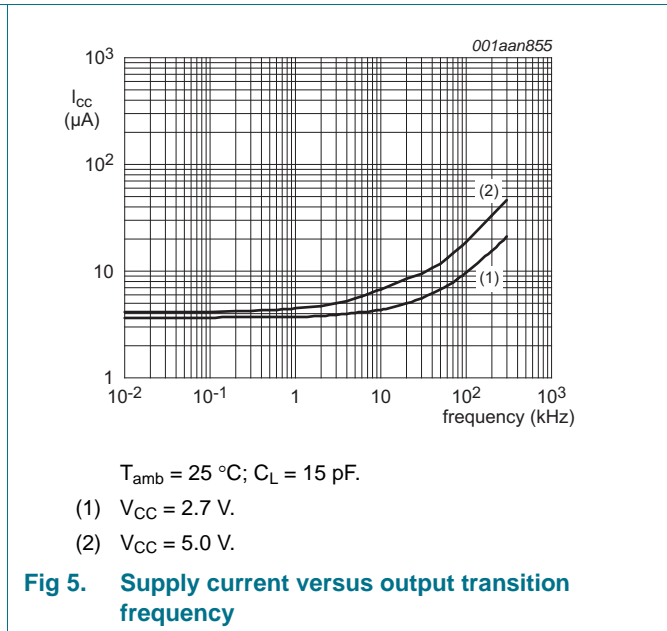
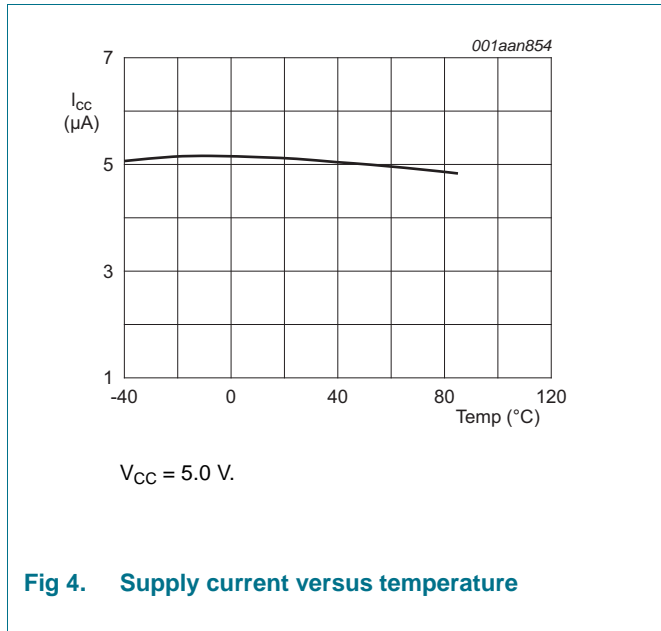
Voltages are referenced to V_{EE} ($V_{EE} = 0\text{ V}$); $V_{CC} = 1.6\text{ V to }5.5\text{ V}$; $V_{CM} = 0.5V_{CC}$ unless otherwise specified.

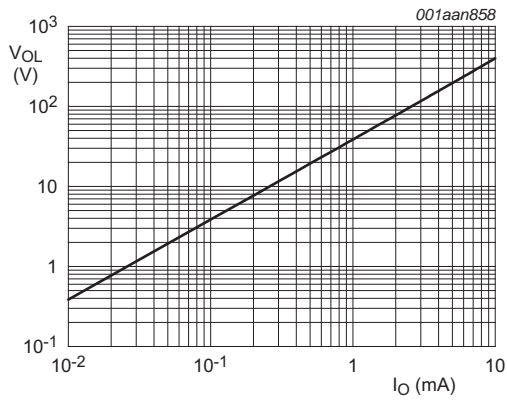
| Symbol | Parameter | Conditions | 25 °C | | | Unit |
|-----------|------------------------------------|--|-------|-----|-----|---------------|
| | | | Min | Typ | Max | |
| t_{pd} | propagation delay | 20 mV overdrive; $C_L = 15\text{ pF}$ | [1] - | 0.8 | - | μs |
| t_{THL} | HIGH to LOW output transition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

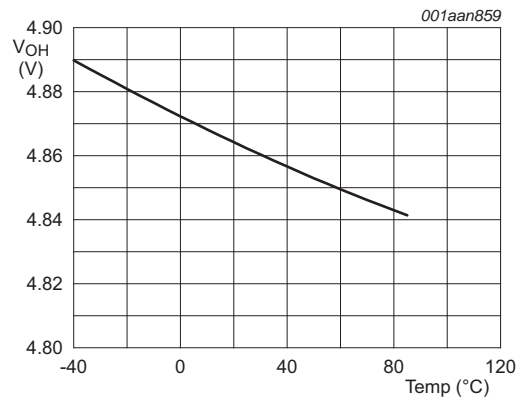
12. Graphs





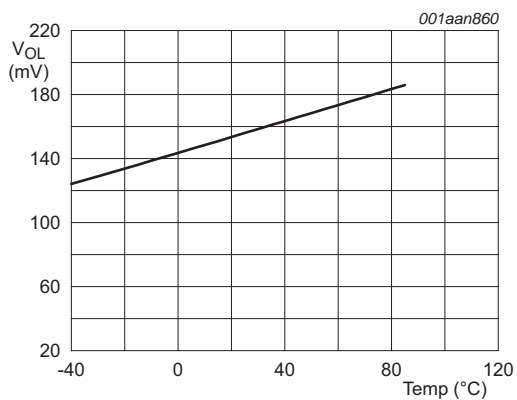
$T_{amb} = 25\text{ }^\circ\text{C}$.
 $V_{CC} = 5.0\text{ V}$.

Fig 8. LOW-level output voltage versus output current



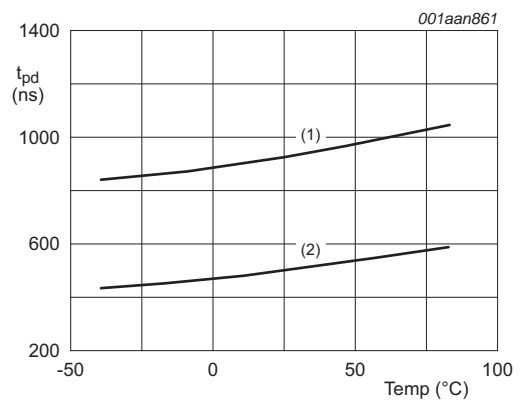
$I_O = -4.0\text{ mA}$.
 $V_{CC} = 5.0\text{ V}$.

Fig 9. HIGH-level output voltage versus temperature



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

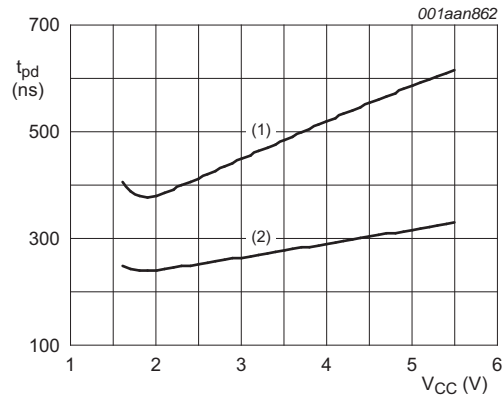
Fig 10. LOW-level output voltage versus temperature



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

- (1) t_{PLH} .
- (2) t_{PHL} .

Fig 11. Propagation delay versus temperature



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

- (1) t_{PLH}.
- (2) t_{PHL}.

Fig 12. 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 13](#)

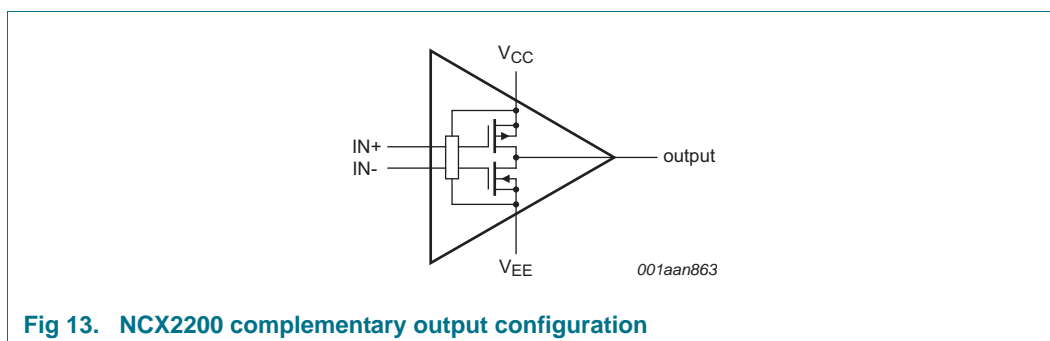
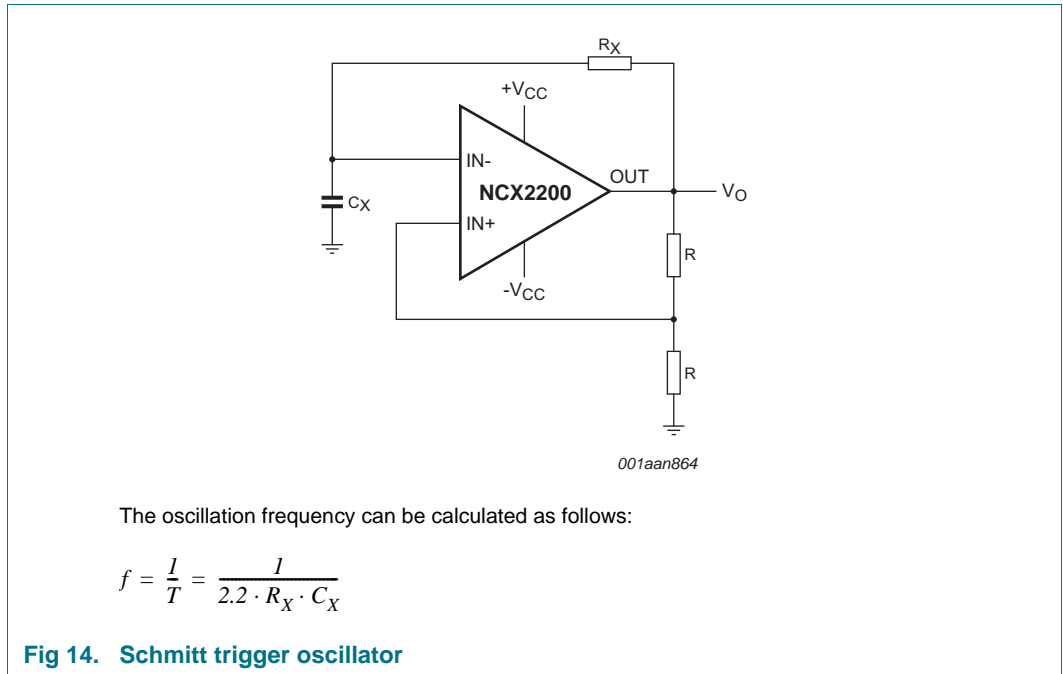


Fig 13. NCX2200 complementary output configuration

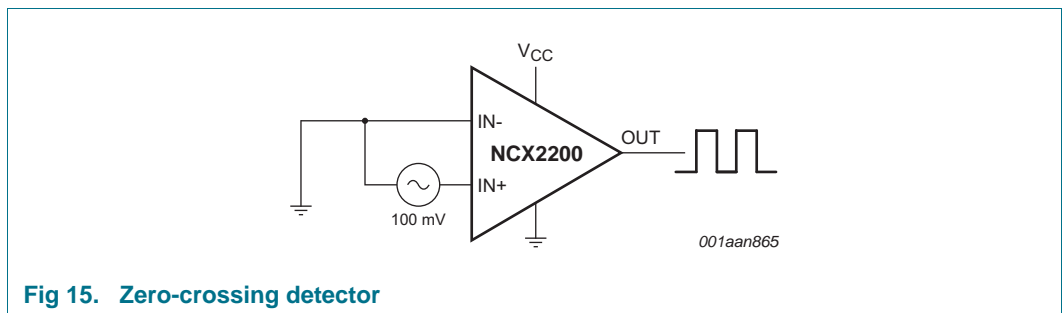
13.3 Schmitt trigger oscillator

Figure 14 shows the NCX2200 configured as a Schmitt trigger oscillator.



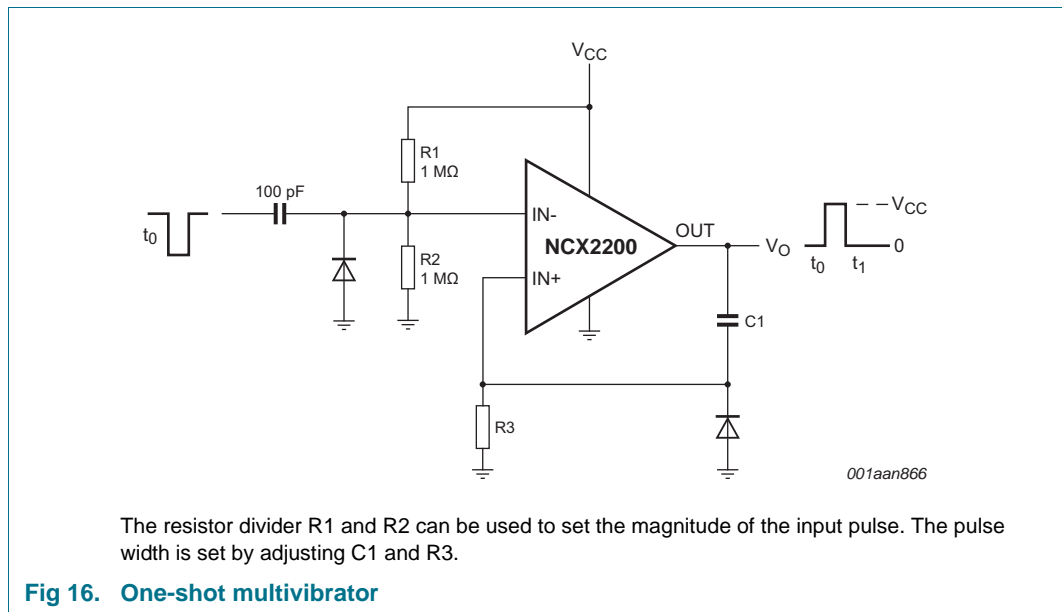
13.4 Zero-crossing detector

Figure 15 shows the NCX2200 configured as a zero-crossing detector.



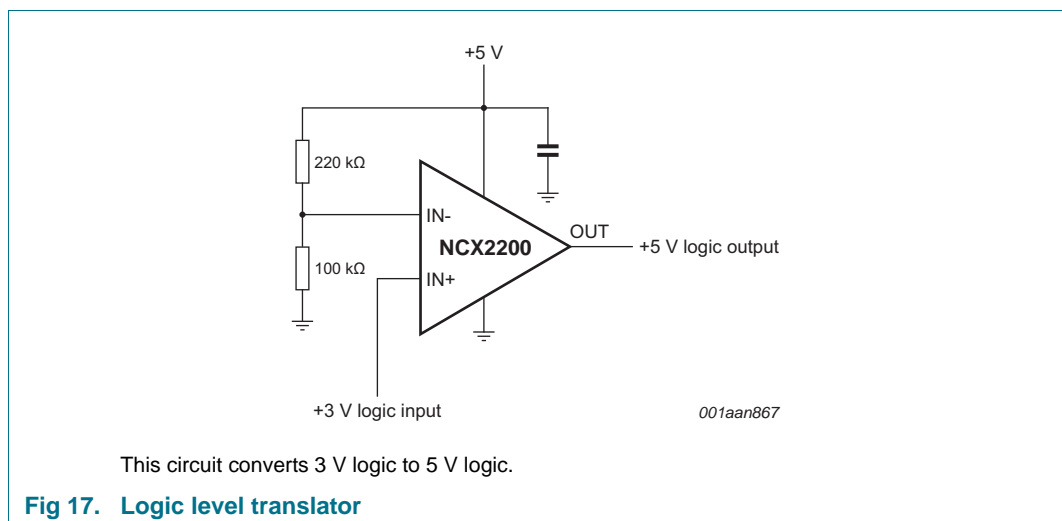
13.5 One-shot multivibrator

Figure 16 shows the NCX2200 configured as a one-shot multivibrator.



13.6 Logic level translator

Figure 17 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

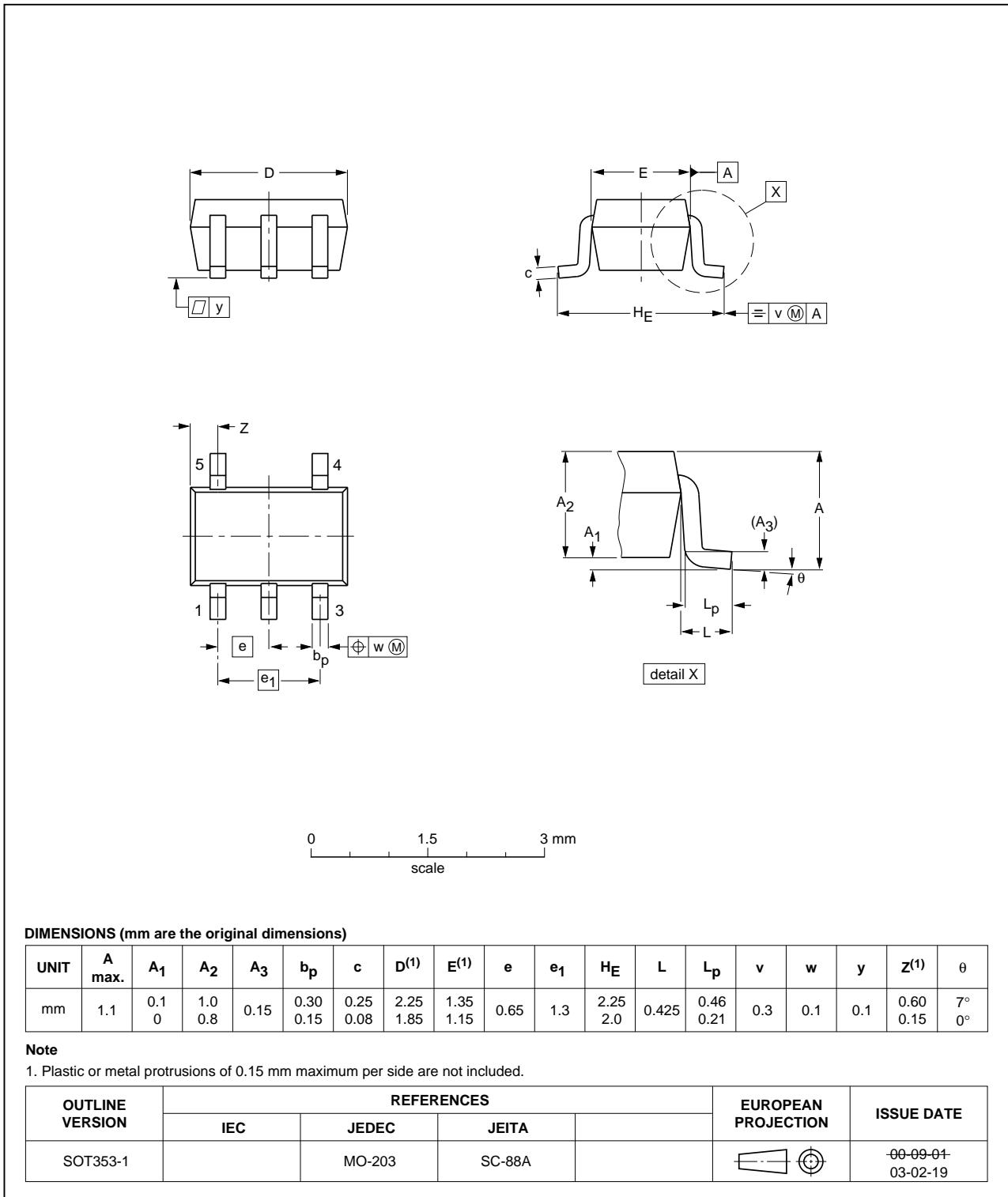


Fig 18. Package outline SOT353-1 (TSSOP5)

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

SOT886

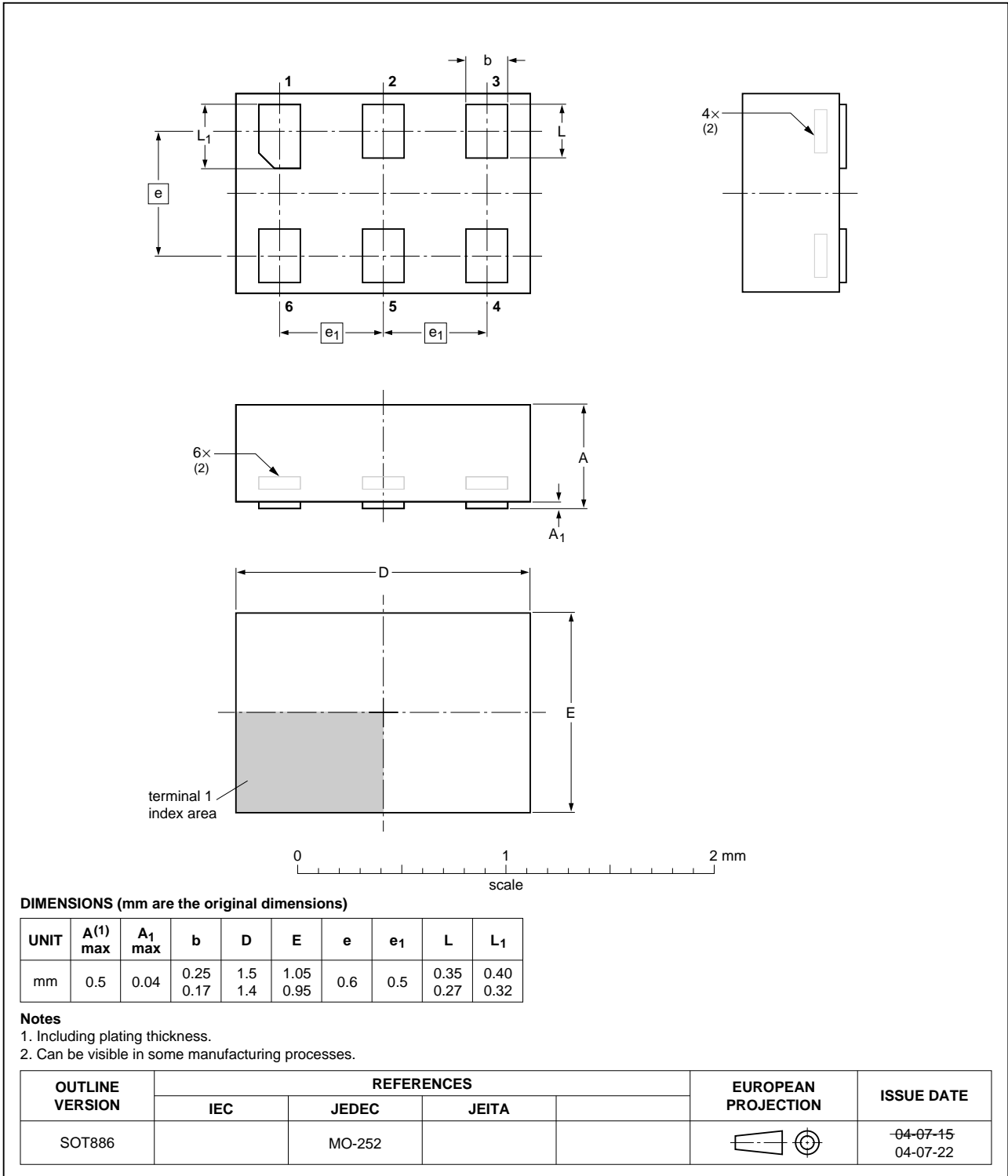


Fig 19. Package outline SOT886 (XSON6)

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 |
|-------------|--------------|--------------------|---------------|------------|
| NCX2200 v.1 | 20110322 | Product data sheet | - | - |

17. Legal information

17.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
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| 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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