

# 74AHC132; 74AHCT132

## Quad 2-input NAND Schmitt trigger

Rev. 7 — 3 July 2020

Product data sheet

## 1. General description

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The 74AHC132; 74AHCT132 is a quad 2-input NAND gate with Schmitt-trigger inputs. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

## 2. Features and benefits

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- Wide supply voltage range from 2.0 V to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- Input levels:
  - For 74AHC132: CMOS level
  - For 74AHCT132: TTL level
- ESD protection:
  - HBM JESD22-A114E exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101C exceeds 1000 V
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

### 3. Ordering information

Table 1. Ordering information

| Type number | Package           |          |  | Version  |
|-------------|-------------------|----------|--|----------|
|             | Temperature range | Name     | Description  |          |
| 74AHC132D   | -40 °C to +125 °C | SO14     | plastic small outline package; 14 leads; body width 3.9 mm   | SOT108-1 |
| 74AHCT132D  |                   |          |  |          |
| 74AHC132PW  | -40 °C to +125 °C | TSSOP14  | plastic thin shrink small outline package; 14 leads; body width 4.4 mm   | SOT402-1 |
| 74AHCT132PW |                   |          |  |          |
| 74AHC132BQ  | -40 °C to +125 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm | SOT762-1 |
| 74AHCT132BQ |                   |          |  |          |

### 4. Functional diagram

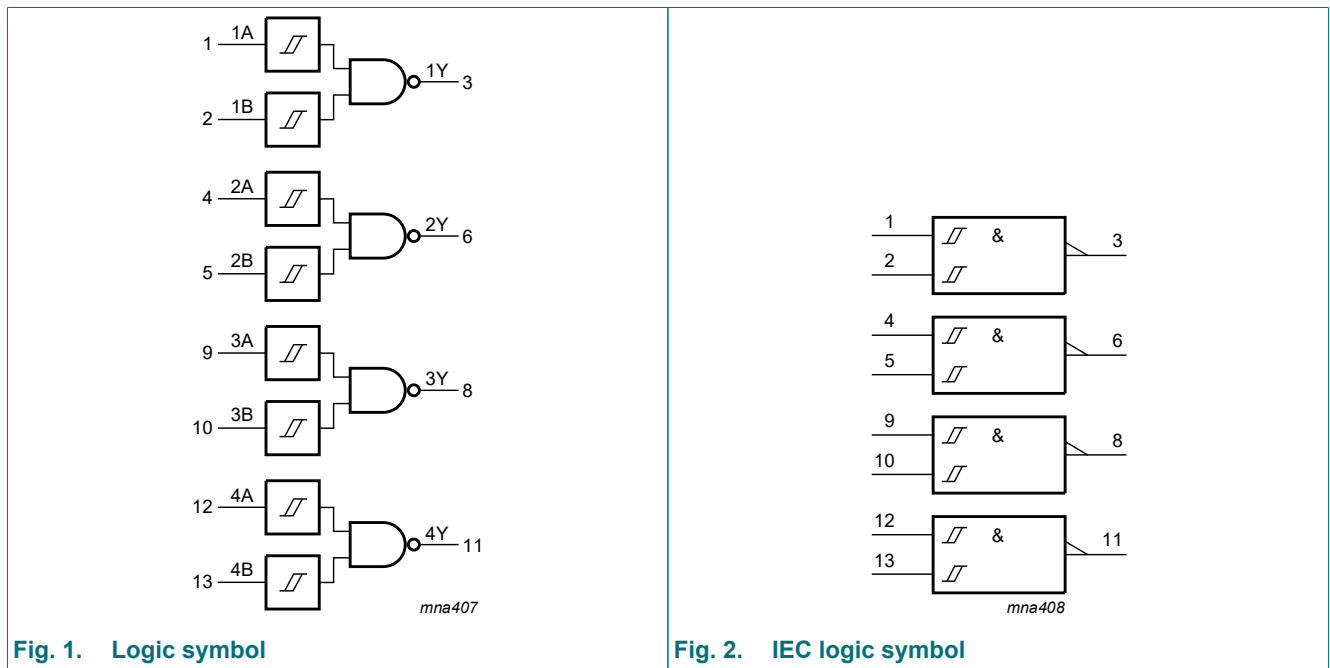


Fig. 1. Logic symbol

Fig. 2. IEC logic symbol

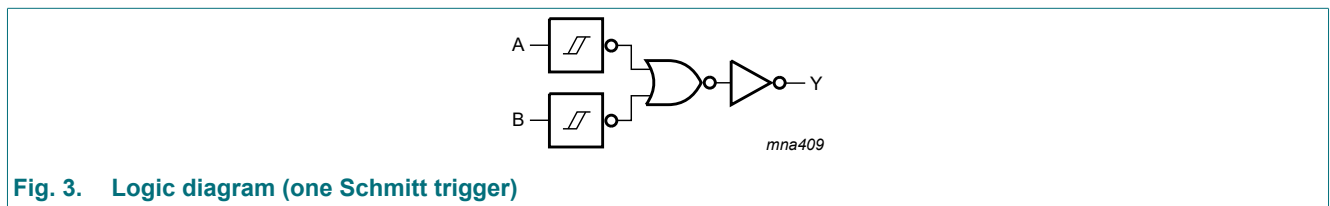
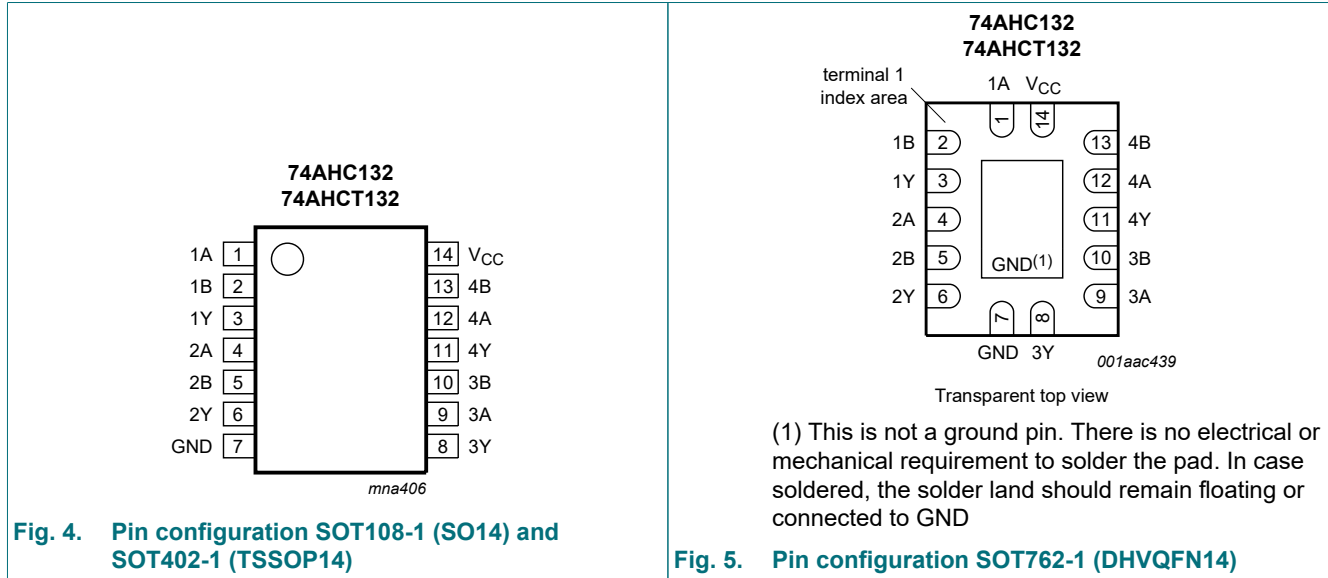


Fig. 3. Logic diagram (one Schmitt trigger)

## 5. Pinning information

### 5.1. Pinning



### 5.2. Pin description

Table 2. Pin description

| Symbol          | Pin          | Description    |
|-----------------|--------------|----------------|
| 1A, 2A, 3A, 4A  | 1, 4, 9, 12  | data input A   |
| 1B, 2B, 3B, 4B  | 2, 5, 10, 13 | data input B   |
| 1Y, 2Y, 3Y, 4Y  | 3, 6, 8, 11  | data output Y  |
| GND             | 7            | ground (0 V)   |
| V <sub>CC</sub> | 14           | supply voltage |

## 6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level.

| Input |    | Output |
|-------|----|--------|
| nA    | nB | nY     |
| L     | L  | H      |
| L     | H  | H      |
| H     | L  | H      |
| H     | H  | L      |

## 7. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol    | Parameter               | Conditions                                   | Min  | Max  | Unit |
|-----------|-------------------------|--|------|------|------|
| $V_{CC}$  | supply voltage          |  | -0.5 | +7.0 | V    |
| $V_I$     | input voltage           |  | -0.5 | +7.0 | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5$ V [1]                           | -20  | -    | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V [1] | -20  | +20  | mA   |
| $I_O$     | output current          | $V_O = -0.5$ V to $(V_{CC} + 0.5$ V)         | -25  | +25  | mA   |
| $I_{CC}$  | supply current          |  | -    | +75  | mA   |
| $I_{GND}$ | ground current          |  | -75  | -    | mA   |
| $T_{stg}$ | storage temperature     |  | -65  | +150 | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to $+125$ °C [2]          | -    | 500  | mW   |

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT108-1 (SO14) package:  $P_{tot}$  derates linearly with 10.1 mW/K above 100 °C.  
 For SOT402-1 (TSSOP14) package:  $P_{tot}$  derates linearly with 7.3 mW/K above 81 °C.  
 For SOT762-1 (DHVQFN14) package:  $P_{tot}$  derates linearly with 9.6 mW/K above 98 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V).

| Symbol              | Parameter                           | Conditions                   | 74AHC132 |     |          | 74AHCT132 |     |          | Unit |
|---------------------|-------------------------------------|------------------------------|----------|-----|----------|-----------|-----|----------|------|
|                     |                                     |                              | Min      | Typ | Max      | Min       | Typ | Max      |      |
| $V_{CC}$            | supply voltage                      |                              | 2.0      | 5.0 | 5.5      | 4.5       | 5.0 | 5.5      | V    |
| $V_I$               | input voltage                       |                              | 0        | -   | 5.5      | 0         | -   | 5.5      | V    |
| $V_O$               | output voltage                      |                              | 0        | -   | $V_{CC}$ | 0         | -   | $V_{CC}$ | V    |
| $T_{amb}$           | ambient temperature                 |                              | -40      | +25 | +125     | -40       | +25 | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 3.3$ V $\pm$ 0.3 V | -        | -   | 100      | -         | -   | -        | ns/V |
|                     |                                     | $V_{CC} = 5.0$ V $\pm$ 0.5 V | -        | -   | 20       | -         | -   | 20       | ns/V |

## 9. Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol           | Parameter                 | Conditions  | 25 °C |     |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|---|-------|-----|------|------------------|------|-------------------|------|------|
|                  |                           |   | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| <b>74AHC132</b>  |                           |   |       |     |      |                  |      |                   |      |      |
| V <sub>OH</sub>  | HIGH-level output voltage | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>   |       |     |      |                  |      |                   |      |      |
|                  |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 2.0 V  | 1.9   | 2.0 | -    | 1.9              | 2.2  | 1.9               | -    | V    |
|                  |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 3.0 V  | 2.9   | 3.0 | -    | 2.9              | 3.15 | 2.9               | -    | V    |
|                  |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 4.5 V  | 4.4   | 4.5 | -    | 4.4              | 3.85 | 4.4               | -    | V    |
|                  |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V   | 2.58  | -   | -    | 2.48             | -    | 2.40              | -    | V    |
|                  |                           | I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V   | 3.94  | -   | -    | 3.80             | -    | 3.70              | -    | V    |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>   |       |     |      |                  |      |                   |      |      |
|                  |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 2.0 V   | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 3.0 V   | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 4.5 V   | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V  | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
|                  |                           | I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V  | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V to 5.5 V  | -     | -   | 0.1  | -                | 1.0  | -                 | 2.0  | μA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 5.5 V   | -     | -   | 2.0  | -                | 20   | -                 | 40   | μA   |
| C <sub>I</sub>   | input capacitance         | V <sub>I</sub> = V <sub>CC</sub> or GND   | -     | 3   | 10   | -                | 10   | -                 | 10   | pF   |
| C <sub>O</sub>   | output capacitance        |   | -     | 4   | -    | -                | -    | -                 | -    | pF   |
| <b>74AHCT132</b> |                           |   |       |     |      |                  |      |                   |      |      |
| V <sub>OH</sub>  | HIGH-level output voltage | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V   |       |     |      |                  |      |                   |      |      |
|                  |                           | I <sub>O</sub> = -50 μA   | 4.4   | 4.5 | -    | 4.4              | -    | 4.4               | -    | V    |
|                  |                           | I <sub>O</sub> = -8.0 mA  | 3.94  | -   | -    | 3.80             | -    | 3.70              | -    | V    |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V   |       |     |      |                  |      |                   |      |      |
|                  |                           | I <sub>O</sub> = 50 μA  | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 8.0 mA   | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V to 5.5 V  | -     | -   | 0.1  | -                | 1.0  | -                 | 2.0  | μA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 5.5 V   | -     | -   | 2.0  | -                | 20   | -                 | 40   | μA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V;<br>other pins at V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V | -     | -   | 1.35 | -                | 1.5  | -                 | 1.5  | mA   |
| C <sub>I</sub>   | input capacitance         | V <sub>I</sub> = V <sub>CC</sub> or GND   | -     | 3   | 10   | -                | 10   | -                 | 10   | pF   |
| C <sub>O</sub>   | output capacitance        |   | -     | 4   | -    | -                | -    | -                 | -    | pF   |

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

| Symbol  | Parameter                     | Conditions  | 25 °C |        |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|---|-------------------------------|---|-------|--------|------|------------------|------|-------------------|------|------|
|   |                               |   | Min   | Typ[1] | Max  | Min              | Max  | Min               | Max  |      |
| <b>74AHC132</b>                                   |                               |   |       |        |      |                  |      |                   |      |      |
| t <sub>pd</sub>                                   | propagation delay             | nA, nB to nY; see Fig. 6 [2]  |       |        |      |                  |      |                   |      |      |
|   |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                    |       |        |      |                  |      |                   |      |      |
|   |                               | C <sub>L</sub> = 15 pF  | -     | 4.4    | 11.9 | 1.0              | 14.0 | 1.0               | 15.0 | ns   |
|   |                               | C <sub>L</sub> = 50 pF  | -     | 6.2    | 15.4 | 1.0              | 17.5 | 1.0               | 19.5 | ns   |
|   |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                    |       |        |      |                  |      |                   |      |      |
|   |                               | C <sub>L</sub> = 15 pF  | -     | 3.3    | 7.7  | 1.0              | 9.0  | 1.0               | 10.0 | ns   |
|   |                               | C <sub>L</sub> = 50 pF  | -     | 4.7    | 9.7  | 1.0              | 11.0 | 1.0               | 12.5 | ns   |
| C <sub>PD</sub>                                   | power dissipation capacitance | f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> [3] | -     | 11     | -    | -                | -    | -                 | -    | pF   |
| <b>74AHCT132; V<sub>CC</sub> = 4.5 V to 5.5 V</b> |                               |   |       |        |      |                  |      |                   |      |      |
| t <sub>pd</sub>                                   | propagation delay             | nA, nB to nY; see Fig. 6 [2]  |       |        |      |                  |      |                   |      |      |
|   |                               | C <sub>L</sub> = 15 pF  | -     | 3.5    | 7.0  | 1.0              | 8.0  | 1.0               | 9.0  | ns   |
|   |                               | C <sub>L</sub> = 50 pF  | -     | 5.0    | 8.0  | 1.0              | 9.0  | 1.0               | 10.0 | ns   |
| C <sub>PD</sub>                                   | power dissipation capacitance | f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> [3] | -     | 14     | -    | -                | -    | -                 | -    | pF   |

[1] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 3.3 V and V<sub>CC</sub> = 5.0 V).

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

∑(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

10.1. Waveform and test circuit

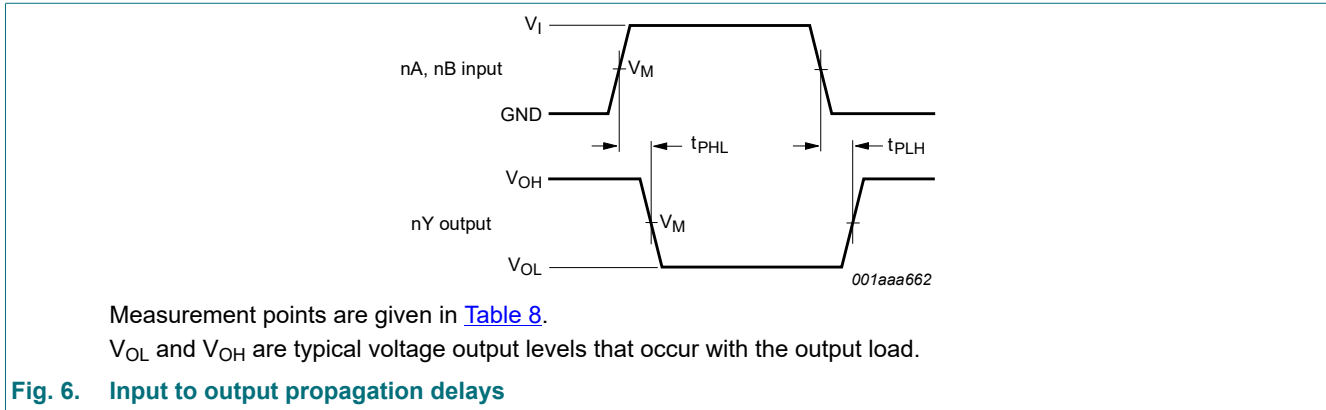


Table 8. Measurement points

| Type      | Input               |  | Output              |
|-----------|---------------------|--|---------------------|
|           | $V_M$               |  | $V_M$               |
| 74AHC132  | $0.5 \times V_{CC}$ |  | $0.5 \times V_{CC}$ |
| 74AHCT132 | 1.5 V               |  | $0.5 \times V_{CC}$ |

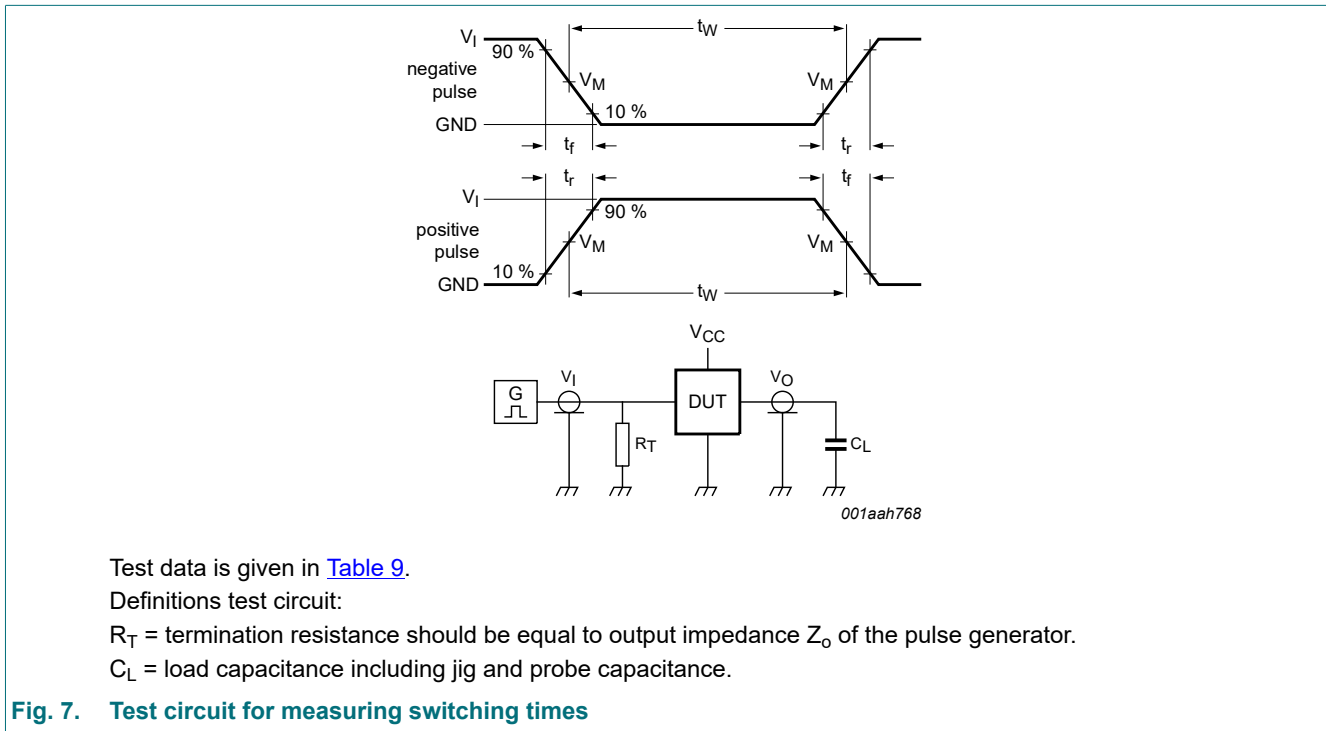


Table 9. Test data

| Type      | Input    |               | Load         | Test               |
|-----------|----------|---------------|--------------|--------------------|
|           | $V_I$    | $t_r, t_f$    | $C_L$        |                    |
| 74AHC132  | $V_{CC}$ | $\leq 3.0$ ns | 50 pF, 15 pF | $t_{PLH}, t_{PHL}$ |
| 74AHCT132 | 3.0 V    | $\leq 3.0$ ns | 50 pF, 15 pF | $t_{PLH}, t_{PHL}$ |

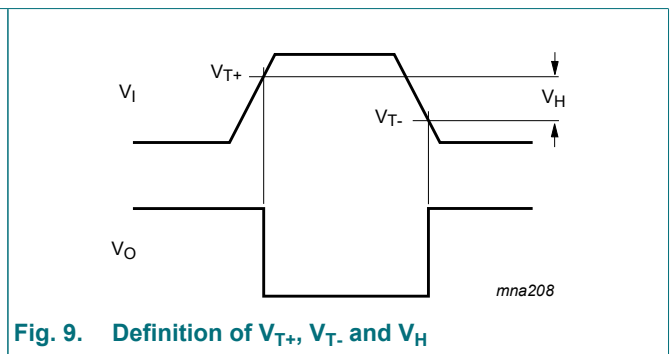
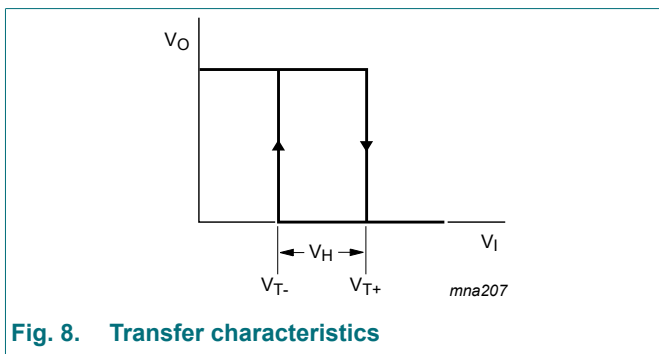
## 11. Transfer characteristics

**Table 10. Transfer characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol           | Parameter                        | Conditions              | 25 °C |     |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------|----------------------------------|-------------------------|-------|-----|------|------------------|------|-------------------|------|------|
|                  |                                  |                         | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| <b>74AHC132</b>  |                                  |                         |       |     |      |                  |      |                   |      |      |
| $V_{T+}$         | positive-going threshold voltage | $V_{CC} = 3.0\text{ V}$ | -     | -   | 2.2  | -                | 2.2  | -                 | 2.2  | V    |
|                  |                                  | $V_{CC} = 4.5\text{ V}$ | -     | -   | 3.15 | -                | 3.15 | -                 | 3.15 | V    |
|                  |                                  | $V_{CC} = 5.5\text{ V}$ | -     | -   | 3.85 | -                | 3.85 | -                 | 3.85 | V    |
| $V_{T-}$         | negative-going threshold voltage | $V_{CC} = 3.0\text{ V}$ | 0.9   | -   | -    | 0.9              | -    | 0.9               | -    | V    |
|                  |                                  | $V_{CC} = 4.5\text{ V}$ | 1.35  | -   | -    | 1.35             | -    | 1.35              | -    | V    |
|                  |                                  | $V_{CC} = 5.5\text{ V}$ | 1.65  | -   | -    | 1.65             | -    | 1.65              | -    | V    |
| $V_H$            | hysteresis voltage               | $V_{CC} = 3.0\text{ V}$ | 0.3   | -   | 1.2  | 0.3              | 1.2  | 0.25              | 1.2  | V    |
|                  |                                  | $V_{CC} = 4.5\text{ V}$ | 0.4   | -   | 1.4  | 0.4              | 1.4  | 0.35              | 1.4  | V    |
|                  |                                  | $V_{CC} = 5.5\text{ V}$ | 0.5   | -   | 1.6  | 0.5              | 1.6  | 0.45              | 1.6  | V    |
| <b>74AHCT132</b> |                                  |                         |       |     |      |                  |      |                   |      |      |
| $V_{T+}$         | positive-going threshold voltage | $V_{CC} = 4.5\text{ V}$ | -     | -   | 1.9  | -                | 1.9  | -                 | 1.9  | V    |
|                  |                                  | $V_{CC} = 5.5\text{ V}$ | -     | -   | 2.1  | -                | 2.1  | -                 | 2.1  | V    |
| $V_{T-}$         | negative-going threshold voltage | $V_{CC} = 4.5\text{ V}$ | 0.5   | -   | -    | 0.5              | -    | 0.5               | -    | V    |
|                  |                                  | $V_{CC} = 5.5\text{ V}$ | 0.6   | -   | -    | 0.6              | -    | 0.6               | -    | V    |
| $V_H$            | hysteresis voltage               | $V_{CC} = 4.5\text{ V}$ | 0.3   | -   | 1.4  | 0.3              | 1.4  | 0.3               | 1.4  | V    |
|                  |                                  | $V_{CC} = 5.5\text{ V}$ | 0.3   | -   | 1.5  | 0.3              | 1.5  | 0.3               | 1.5  | V    |

### 11.1. Transfer characteristics waveforms





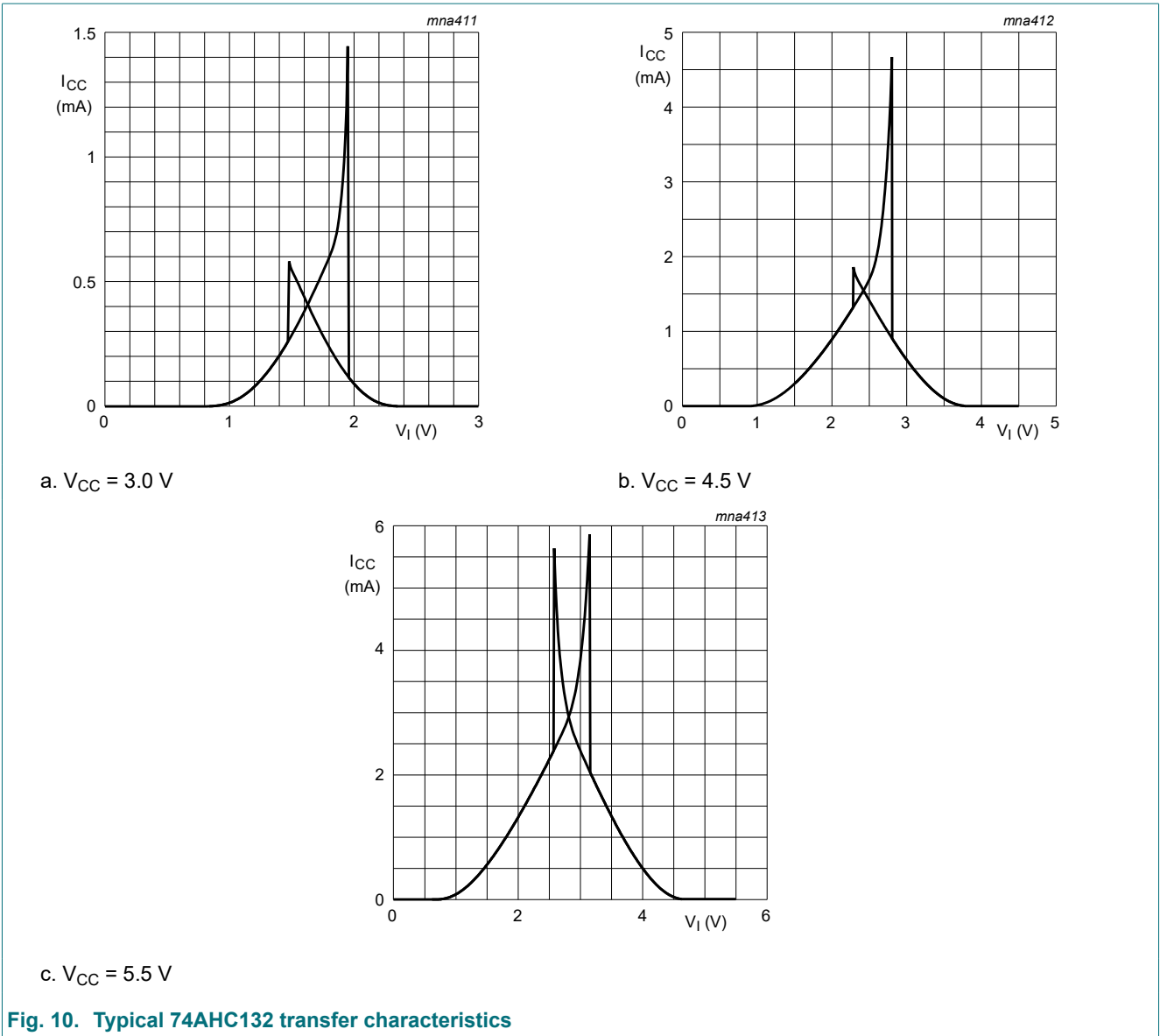


Fig. 10. Typical 74AHC132 transfer characteristics

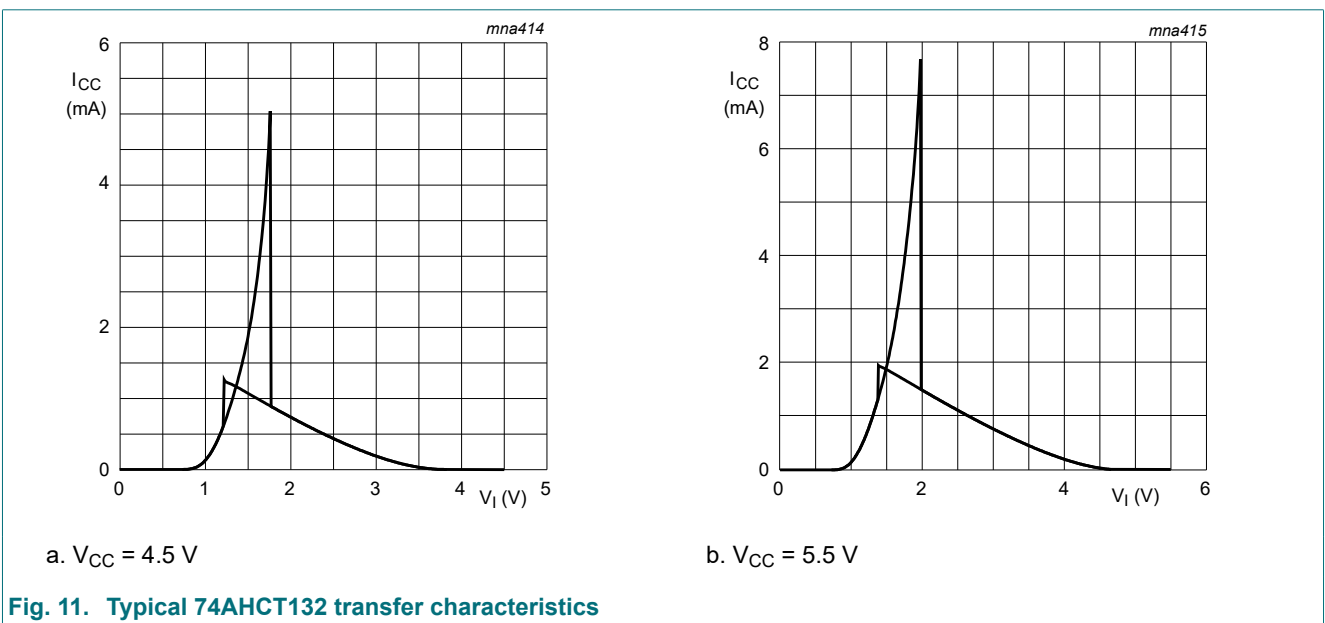
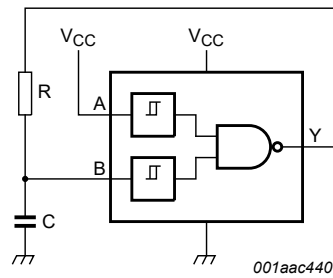


Fig. 11. Typical 74AHCT132 transfer characteristics

## 12. Application information



$$\text{For 74AHC132: } f = \frac{1}{T} \approx \frac{1}{0.55 \times RC}$$

$$\text{For 74AHCT132: } f = \frac{1}{T} \approx \frac{1}{0.60 \times RC}$$

Fig. 12. Relaxation oscillator

13. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1

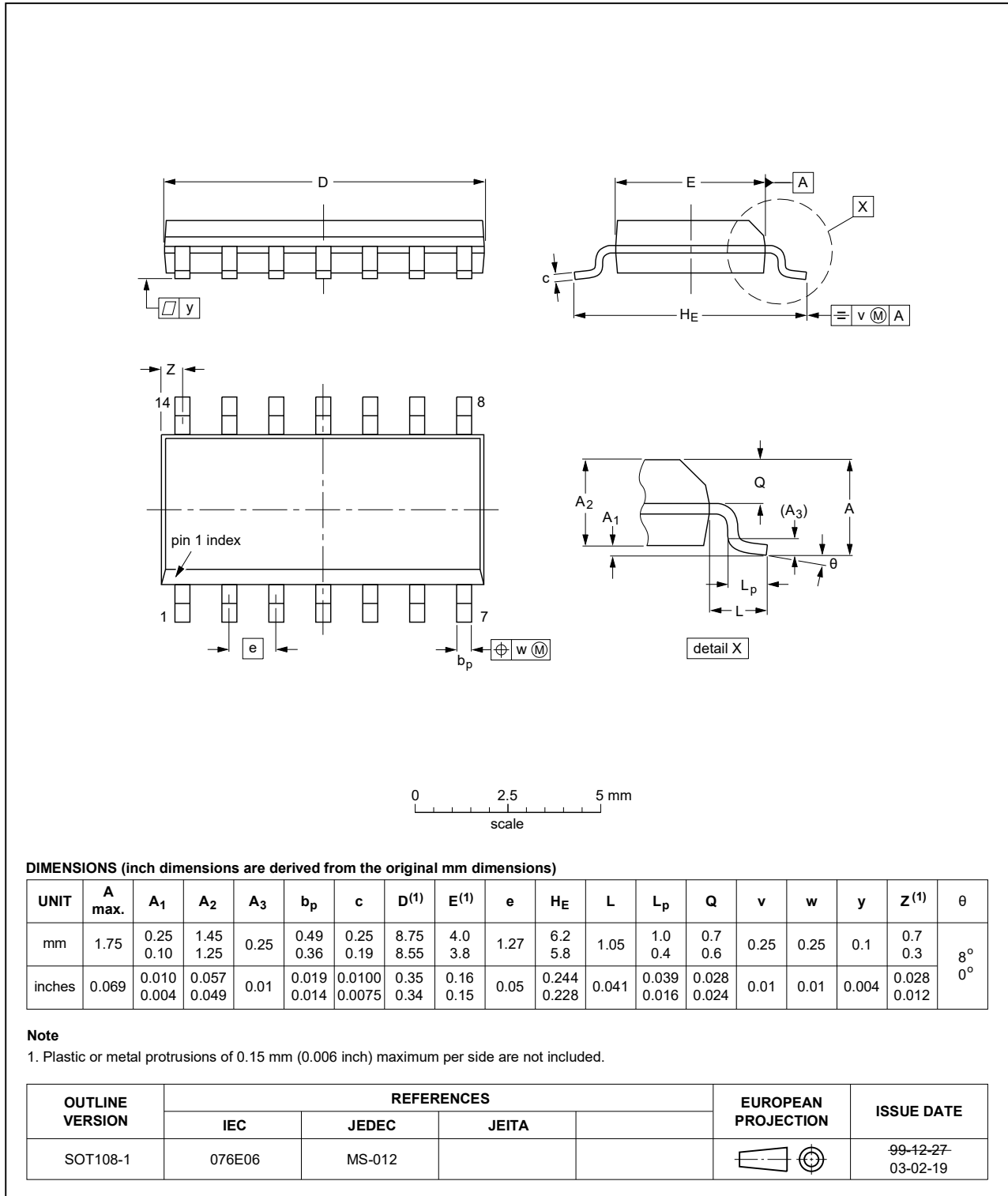


Fig. 13. Package outline SOT108-1 (SO14)

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



Fig. 14. Package outline SOT402-1 (TSSOP14)

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm

SOT762-1



Fig. 15. Package outline SOT762-1 (DHVQFN14)

## 14. Abbreviations

Table 11. Abbreviations

| Acronym | Description                             |
|---------|---|
| CDM     | Charged Device Model                    |
| CMOS    | Complementary Metal-Oxide Semiconductor |
| DUT     | Device Under Test                       |
| ESD     | ElectroStatic Discharge                 |
| HBM     | Human Body Model                        |
| MM      | Machine Model                           |

## 15. Revision history

Table 12. Revision history

| Document ID       | Release date   | Data sheet status     | Change notice | Supersedes        |
|-------------------|--|-----------------------|---------------|-------------------|
| 74AHC_AHCT132 v.7 | 20200703   | Product data sheet    | -             | 74AHC_AHCT132 v.6 |
| Modifications:    | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li><a href="#">Table 4</a>: Derating values for P<sub>tot</sub> total power dissipation updated.</li> <li>Package outline drawing of SOT762-1 (<a href="#">Fig. 15</a>) updated.</li> </ul> |                       |               |                   |
| 74AHC_AHCT132 v.6 | 20090504   | Product data sheet    | -             | 74AHC_AHCT132 v.5 |
| Modifications:    | <ul style="list-style-type: none"> <li><a href="#">Table 6</a>: the conditions for HIGH-level output voltage and LOW-level output voltage have been changed.</li> </ul>  |                       |               |                   |
| 74AHC_AHCT132 v.5 | 20080509   | Product data sheet    | -             | 74AHC_AHCT132 v.4 |
| 74AHC_AHCT132 v.4 | 20050207   | Product data sheet    | -             | 74AHC_AHCT132 v.3 |
| 74AHC_AHCT132 v.3 | 20040415   | Product specification | -             | 74AHC_AHCT132 v.2 |
| 74AHC_AHCT132 v.2 | 19990924   | Product specification | -             | 74AHC_AHCT132 v.1 |
| 74AHC_AHCT132 v.1 | 19990531   | Product specification | -             | -                 |

## 16. Legal information

### 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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## Contents

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|  |           |
|--|-----------|
| <b>1. General description</b> .....              | <b>1</b>  |
| <b>2. Features and benefits</b> .....            | <b>1</b>  |
| <b>3. Ordering information</b> .....             | <b>2</b>  |
| <b>4. Functional diagram</b> .....               | <b>2</b>  |
| <b>5. Pinning information</b> .....              | <b>3</b>  |
| 5.1. Pinning.....                                | 3         |
| 5.2. Pin description.....                        | 3         |
| <b>6. Functional description</b> .....           | <b>3</b>  |
| <b>7. Limiting values</b> .....                  | <b>4</b>  |
| <b>8. Recommended operating conditions</b> ..... | <b>4</b>  |
| <b>9. Static characteristics</b> .....           | <b>5</b>  |
| <b>10. Dynamic characteristics</b> .....         | <b>6</b>  |
| 10.1. Waveform and test circuit.....             | 7         |
| <b>11. Transfer characteristics</b> .....        | <b>8</b>  |
| 11.1. Transfer characteristics waveforms.....    | 8         |
| <b>12. Application information</b> .....         | <b>10</b> |
| <b>13. Package outline</b> .....                 | <b>11</b> |
| <b>14. Abbreviations</b> .....                   | <b>14</b> |
| <b>15. Revision history</b> .....                | <b>14</b> |
| <b>16. Legal information</b> .....               | <b>15</b> |

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For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

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