



# 74HC03; 74HCT03

Quad 2-input NAND gate; open-drain output

Rev. 7 — 16 February 2024

Product data sheet

## 1. General description

The 74HC03; 74HCT03 is a quad 2-input NAND gate with open-drain outputs. Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

## 2. Features and benefits

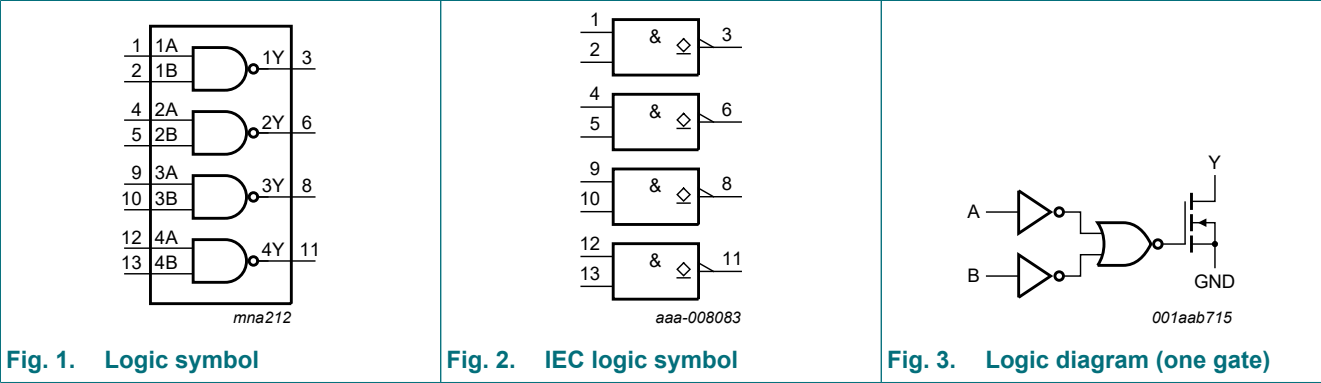
- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Input levels:
  - For 74HC03: CMOS level
  - For 74HCT03: TTL level
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

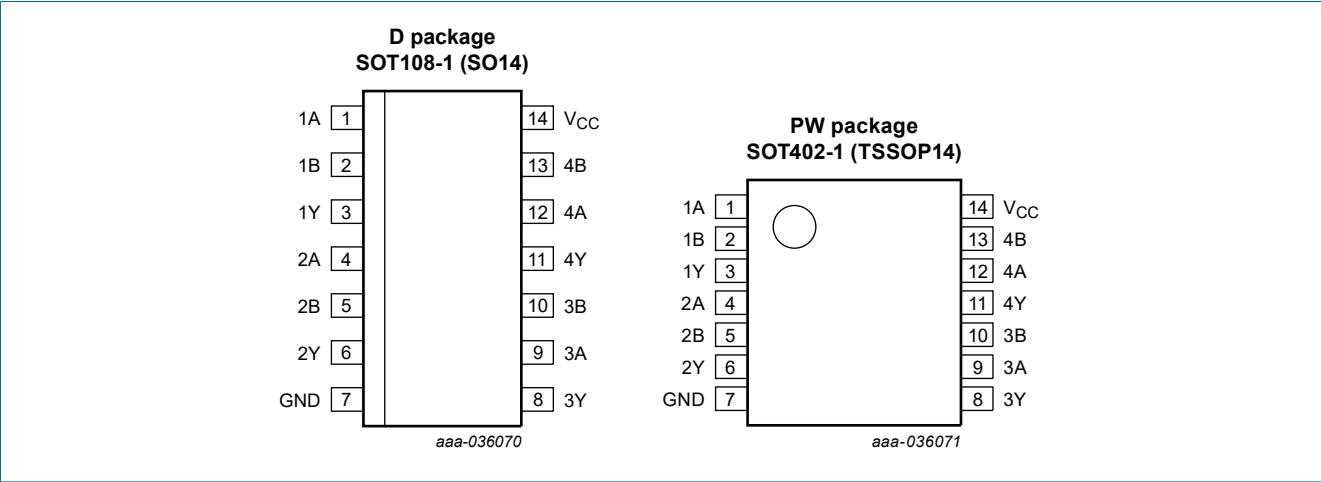
| Type number                                           | Package           |         |                                                                           |                          |
|-------------------------------------------------------|-------------------|---------|---------------------------------------------------------------------------|--------------------------|
|                                                       | Temperature range | Name    | Description                                                               | Version                  |
| <a href="#">74HC03D</a><br><a href="#">74HCT03D</a>   | -40 °C to +125 °C | SO14    | plastic small outline package; 14 leads;<br>body width 3.9 mm             | <a href="#">SOT108-1</a> |
| <a href="#">74HC03PW</a><br><a href="#">74HCT03PW</a> | -40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads;<br>body width 4.4 mm | <a href="#">SOT402-1</a> |

4. Functional diagram



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     |
| 1B, 2B, 3B, 4B  | 2, 5, 10, 13 | data input     |
| 1Y, 2Y, 3Y, 4Y  | 3, 6, 8, 11  | data output    |
| 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; Z = high-impedance OFF-state.

| Input |    | Output |
|-------|----|--------|
| nA    | nB | nY     |
| L     | L  | Z      |
| L     | H  | Z      |
| H     | L  | Z      |
| 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 <sub>CC</sub>  | supply voltage          |                                                                         | -0.5 | +7   | V    |
| V <sub>O</sub>   | output voltage          | [1]                                                                     | -0.5 | +7   | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V [1] | -    | ±20  | mA   |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < -0.5 V [1]                                             | -    | -20  | mA   |
| I <sub>O</sub>   | output current          | -0.5 V < V <sub>O</sub>                                                 | -    | -25  | mA   |
| I <sub>CC</sub>  | supply current          |                                                                         | -    | 50   | mA   |
| I <sub>GND</sub> | ground current          |                                                                         | -50  | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                                                         | -65  | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | [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<sub>tot</sub> derates linearly with 10.1 mW/K above 100 °C.  
For SOT402-1 (TSSOP14) package: P<sub>tot</sub> derates linearly with 7.3 mW/K above 81 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol           | Parameter                           | Conditions              | 74HC03 |      |                 | 74HCT03 |      |                 | Unit |
|------------------|-------------------------------------|-------------------------|--------|------|-----------------|---------|------|-----------------|------|
|                  |                                     |                         | Min    | Typ  | Max             | Min     | Typ  | Max             |      |
| V <sub>CC</sub>  | supply voltage                      |                         | 2.0    | 5.0  | 6.0             | 4.5     | 5.0  | 5.5             | V    |
| V <sub>I</sub>   | input voltage                       |                         | 0      | -    | V <sub>CC</sub> | 0       | -    | V <sub>CC</sub> | V    |
| V <sub>O</sub>   | output voltage                      |                         | 0      | -    | V <sub>CC</sub> | 0       | -    | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                         | -40    | +25  | +125            | -40     | +25  | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 2.0 V | -      | -    | 625             | -       | -    | -               | ns/V |
|                  |                                     | V <sub>CC</sub> = 4.5 V | -      | 1.67 | 139             | -       | 1.67 | 139             | ns/V |
|                  |                                     | V <sub>CC</sub> = 6.0 V | -      | -    | 83              | -       | -    | -               | 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  |      |
| 74HC03           |                           |                                                                                                                                                         |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                                                                                 | 1.5   | 1.2  | -    | 1.5              | -    | 1.5               | -    | V    |
|                  |                           | V <sub>CC</sub> = 4.5 V                                                                                                                                 | 3.15  | 2.4  | -    | 3.15             | -    | 3.15              | -    | V    |
|                  |                           | V <sub>CC</sub> = 6.0 V                                                                                                                                 | 4.2   | 3.2  | -    | 4.2              | -    | 4.2               | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                                                                                 | -     | 0.8  | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                  |                           | V <sub>CC</sub> = 4.5 V                                                                                                                                 | -     | 2.1  | 1.35 | -                | 1.35 | -                 | 1.35 | V    |
|                  |                           | V <sub>CC</sub> = 6.0 V                                                                                                                                 | -     | 2.8  | 1.8  | -                | 1.8  | -                 | 1.8  | V    |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                                     |       |      |      |                  |      |                   |      |      |
|                  |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V                                                                                                         | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V                                                                                                         | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V                                                                                                         | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                                                                                        | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
|                  |                           | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                                                                                        | -     | 0.16 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                                                                                        | -     | 0.1  | -    | -                | ±1   | -                 | ±1   | μA   |
| I <sub>OZ</sub>  | OFF-state output current  | V <sub>I</sub> = V <sub>IL</sub> ; V <sub>CC</sub> = 6.0 V; V <sub>O</sub> = V <sub>CC</sub> or GND                                                     | -     | -    | ±0.5 | -                | ±5.0 | -                 | ±10  | μA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V                                                                  | -     | 2.0  | -    | -                | 20   | -                 | 40   | μA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                                         | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |
| 74HCT03          |                           |                                                                                                                                                         |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                        | 2.0   | 1.6  | -    | 2.0              | -    | 2.0               | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                        | -     | 1.2  | 0.8  | -                | 0.8  | -                 | 0.8  | V    |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V                                                                           |       |      |      |                  |      |                   |      |      |
|                  |                           | I <sub>O</sub> = 20 μA                                                                                                                                  | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 4.0 mA                                                                                                                                 | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V                                                                                        | -     | -    | ±0.1 | -                | ±1   | -                 | ±1   | μA   |
| I <sub>OZ</sub>  | OFF-state output current  | V <sub>I</sub> = V <sub>IL</sub> ; V <sub>CC</sub> = 5.5 V; V <sub>O</sub> = V <sub>CC</sub> or GND                                                     | -     | -    | ±0.5 | -                | ±5.0 | -                 | ±10  | μA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; 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; I <sub>O</sub> = 0 A; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V | -     | 100  | 360  | -                | 450  | -                 | 490  | μA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                                         | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |

10. Dynamic characteristics

Table 7. Dynamic characteristics  
GND = 0 V; C<sub>L</sub> = 50 pF; for test circuit, see Fig. 5.

| Symbol          | Parameter                     | Conditions                                                       | 25 °C |     |     | -40 °C to +85 °C | -40 °C to +125 °C | Unit |
|-----------------|-------------------------------|------------------------------------------------------------------|-------|-----|-----|------------------|-------------------|------|
|                 |                               |                                                                  | Min   | Typ | Max | Max              | Max               |      |
| 74HC03          |                               |                                                                  |       |     |     |                  |                   |      |
| t <sub>pd</sub> | propagation delay             | nA, nB to nY; see <a href="#">Fig. 4</a> [1]                     |       |     |     |                  |                   |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                                          | -     | 28  | 95  | 120              | 145               | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                                          | -     | 10  | 19  | 24               | 29                | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                  | -     | 8   | -   | -                | -                 | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                                          | -     | 8   | 16  | 20               | 25                | ns   |
| t <sub>t</sub>  | transition time               | see <a href="#">Fig. 4</a> [2]                                   |       |     |     |                  |                   |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                                          | -     | 19  | 75  | 95               | 110               | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                                          | -     | 7   | 15  | 19               | 22                | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                                          | -     | 6   | 13  | 16               | 19                | ns   |
| C <sub>PD</sub> | power dissipation capacitance | per package; V <sub>I</sub> = GND to V <sub>CC</sub> [3]         | -     | 4   | -   | -                | -                 | pF   |
| 74HCT03         |                               |                                                                  |       |     |     |                  |                   |      |
| t <sub>pd</sub> | propagation delay             | nA, nB to nY; see <a href="#">Fig. 4</a> [1]                     |       |     |     |                  |                   |      |
|                 |                               | V <sub>CC</sub> = 4.5 V                                          | -     | 12  | 24  | 30               | 36                | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                  | -     | 10  | -   | -                | -                 | ns   |
| t <sub>t</sub>  | transition time               | V <sub>CC</sub> = 4.5 V; see <a href="#">Fig. 4</a> [2]          | -     | 7   | 15  | 19               | 22                | ns   |
| C <sub>PD</sub> | power dissipation capacitance | per package; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [3] | -     | 4   | -   | -                | -                 | pF   |

[1] t<sub>pd</sub> is the same as t<sub>PLZ</sub> and t<sub>PZL</sub>.  
[2] t<sub>t</sub> is the same as t<sub>THL</sub>.  
[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):  
P<sub>D</sub> = C<sub>PD</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> × N + Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) 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;  
Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

10.1. Waveforms and test circuit

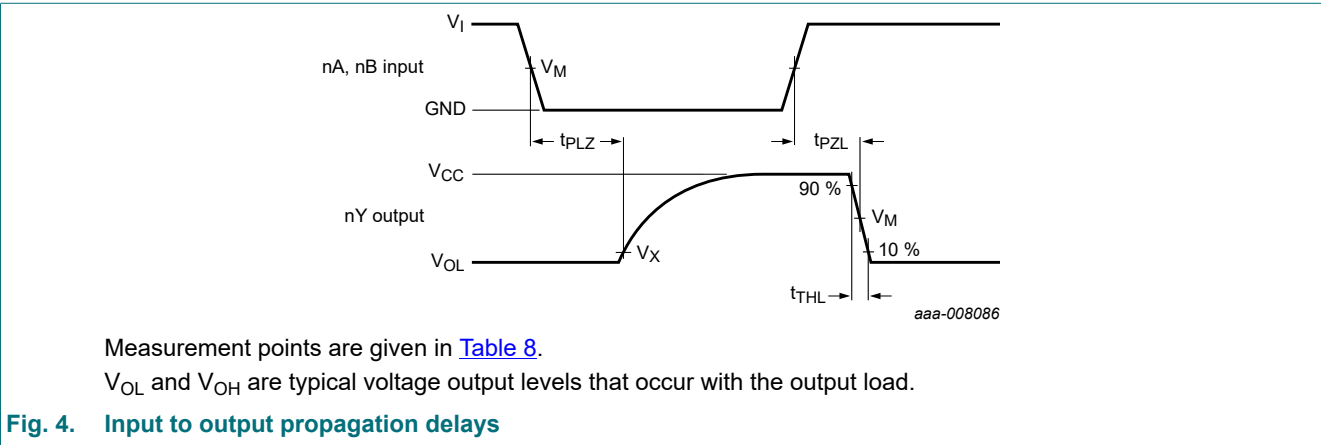


Table 8. Measurement points

| Type    | Input               | Output              |                     |
|---------|---------------------|---------------------|---------------------|
|         | $V_M$               | $V_M$               | $V_X$               |
| 74HC03  | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $0.1 \times V_{CC}$ |
| 74HCT03 | 1.3 V               | 1.3 V               | $0.1 \times V_{CC}$ |

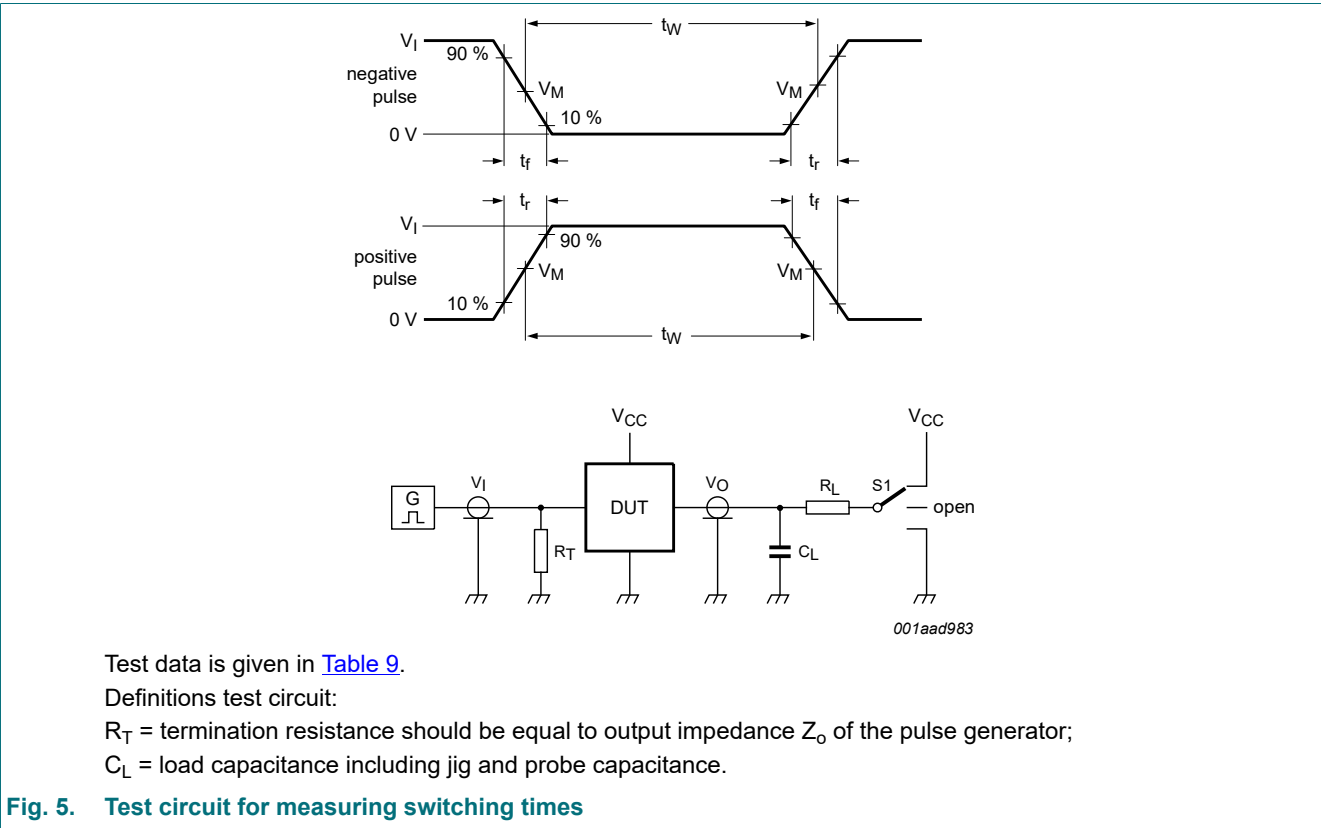


Table 9. Test data

| Type    | Input    |            | Load         |              | S1 position        |
|---------|----------|------------|--------------|--------------|--------------------|
|         | $V_I$    | $t_r, t_f$ | $C_L$        | $R_L$        | $t_{PZL}, t_{PLZ}$ |
| 74HC03  | $V_{CC}$ | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | $V_{CC}$           |
| 74HCT03 | 3.0 V    | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | $V_{CC}$           |

11. Package outline

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

SOT108-1



Fig. 6. Package outline SOT108-1 (SO14)

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

SOT402-1



Fig. 7. Package outline SOT402-1 (TSSOP14)

12. Abbreviations

Table 10. Abbreviations

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

13. Revision history

Table 11. Revision history

| Document ID        | Release date                                                                                                                                                                                                                                                                                                                                                                                        | Data sheet status     | Change notice | Supersedes         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|--------------------|
| 74HC_HCT03 v.7     | 20240216                                                                                                                                                                                                                                                                                                                                                                                            | Product data sheet    | -             | 74HC_HCT03 v.6     |
| Modifications:     | <ul style="list-style-type: none"><li>Section 2: ESD specification updated according to the latest JEDEC standard.</li><li>Fig. 6, Fig. 7: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153</li></ul>                                                                                                                                                                       |                       |               |                    |
| 74HC_HCT03 v.6     | 20210810                                                                                                                                                                                                                                                                                                                                                                                            | Product data sheet    | -             | 74HC_HCT03 v.5     |
| Modifications:     | <ul style="list-style-type: none"><li>Section 2 updated.</li><li>Type number 74HC03DB (SOT337-1/SSOP14) removed.</li></ul>                                                                                                                                                                                                                                                                          |                       |               |                    |
| 74HC_HCT03 v.5     | 20210107                                                                                                                                                                                                                                                                                                                                                                                            | Product data sheet    | -             | 74HC_HCT03 v.4     |
| 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>Type number 74HCT03DB (SOT337-1 / SSOP14) removed.</li><li>Section 7: Derating values for P<sub>tot</sub> total power dissipation have been updated.</li></ul> |                       |               |                    |
| 74HC_HCT03 v.4     | 20151127                                                                                                                                                                                                                                                                                                                                                                                            | Product data sheet    | -             | 74HC_HCT03 v.3     |
| Modifications:     | <ul style="list-style-type: none"><li>Type numbers 74HC03N and 74HCT03N (SOT27-1) removed.</li></ul>                                                                                                                                                                                                                                                                                                |                       |               |                    |
| 74HC_HCT03 v.3     | 20130627                                                                                                                                                                                                                                                                                                                                                                                            | Product data sheet    | -             | 74HC_HCT03_CNV v.2 |
| Modifications:     | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>Legal texts have been adapted to the new company name where appropriate.</li></ul>                                                                                                                                                |                       |               |                    |
| 74HC_HCT03_CNV v.2 | 19970827                                                                                                                                                                                                                                                                                                                                                                                            | Product specification | -             | -                  |

14. 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".
- [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 <https://www.nexperia.com>.

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