

# 74VHC32; 74VHCT32

## Quad 2-input OR gate

Rev. 3 — 18 April 2024

Product data sheet

## 1. General description

The 74VHC32; 74VHCT32 are high-speed Si-gate CMOS devices and are pin compatible with Low-power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard No. 7-A.

The 74VHC32; 74VHCT32 provide the 2-input OR function.

## 2. Features and benefits

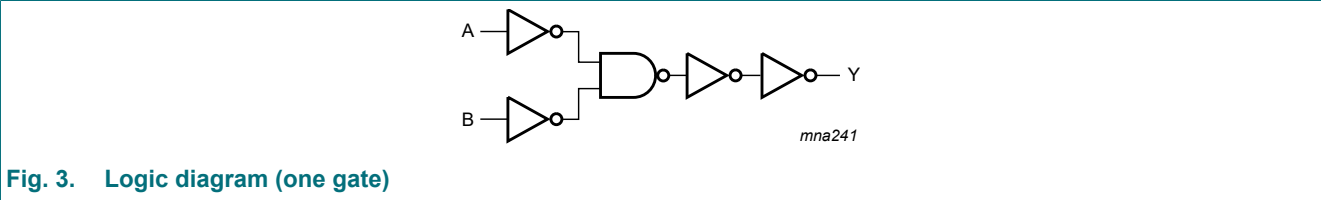
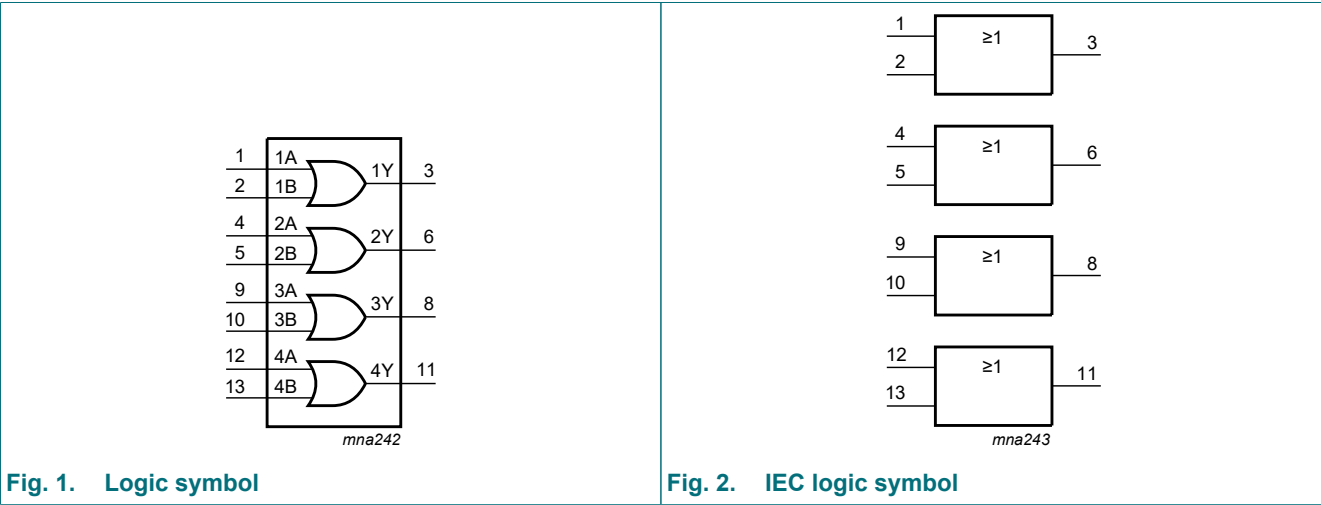
- Balanced propagation delays
- All inputs have Schmitt-trigger actions
- Inputs accept voltages higher than  $V_{CC}$
- Input levels:
  - The 74VHC32 operates with CMOS input level
  - The 74VHCT32 operates with TTL input level
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

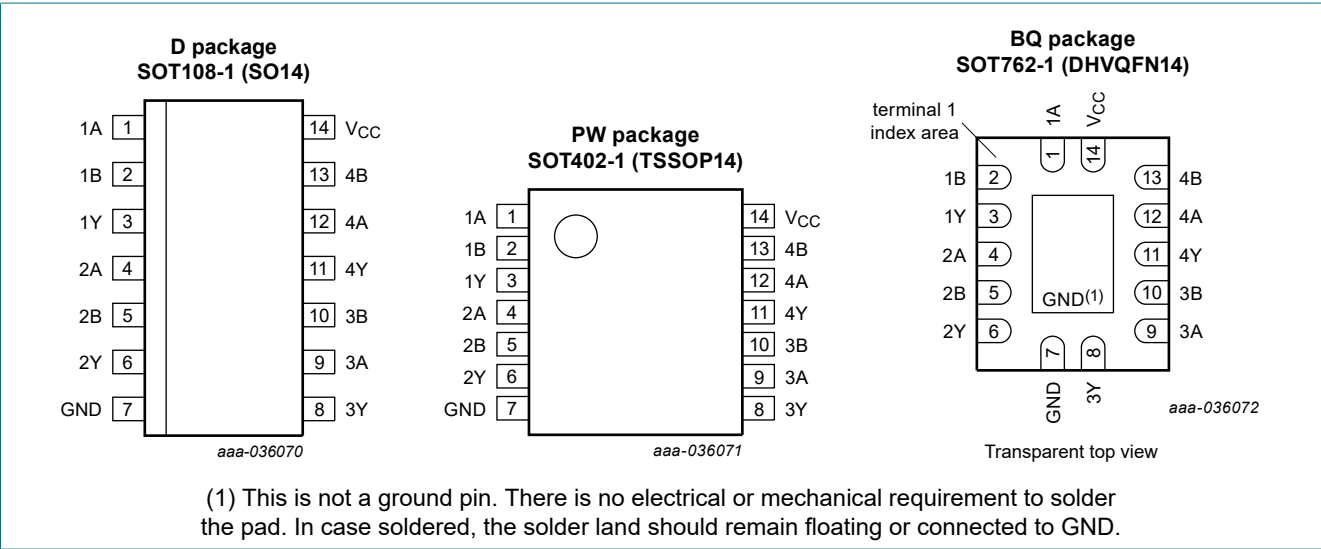
| Type number   | Package           |          |  |                          |
|---|-------------------|----------|--|--------------------------|
|   | Temperature range | Name     | Description  | Version                  |
| <a href="#">74VHC32D</a><br><a href="#">74VHCT32D</a>   | -40 °C to +125 °C | SO14     | plastic small outline package; 14 leads;<br>body width 3.9 mm  | <a href="#">SOT108-1</a> |
| <a href="#">74VHC32PW</a><br><a href="#">74VHCT32PW</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> |
| <a href="#">74VHC32BQ</a><br><a href="#">74VHCT32BQ</a> | -40 °C to +125 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced<br>very thin quad flat package; no leads; 14 terminals;<br>body 2.5 × 3 × 0.85 mm | <a href="#">SOT762-1</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; X = don't care.

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

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 | +7.0 | V    |
| V <sub>I</sub>   | input voltage           |   | -0.5 | +7.0 | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < -0.5 V [1]   | -20  | -    | mA   |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V [1] | -20  | +20  | mA   |
| I <sub>O</sub>   | output current          | V <sub>O</sub> = -0.5 V to (V <sub>CC</sub> + 0.5 V)                    | -25  | +25  | mA   |
| I <sub>CC</sub>  | supply current          |   | -    | +75  | mA   |
| I <sub>GND</sub> | ground current          |   | -75  | -    | mA   |
| T <sub>stg</sub> | storage temperature     |   | -65  | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -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<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.  
For SOT762-1 (DHVQFN14) package: P<sub>tot</sub> derates linearly with 9.6 mW/K above 98 °C.

8. Recommended operating conditions

Table 5. Operating conditions

| Symbol           | Parameter                           | Conditions                       | Min | Typ | Max             | Unit |
|------------------|-------------------------------------|----------------------------------|-----|-----|-----------------|------|
| 74VHC32          |                                     |                                  |     |     |                 |      |
| V <sub>CC</sub>  | supply voltage                      |                                  | 2.0 | 5.0 | 5.5             | V    |
| V <sub>I</sub>   | input voltage                       |                                  | 0   | -   | 5.5             | V    |
| V <sub>O</sub>   | output voltage                      |                                  | 0   | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                                  | -40 | +25 | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 3.0 V to 3.6 V | -   | -   | 100             | ns/V |
|                  |                                     | V <sub>CC</sub> = 4.5 V to 5.5 V | -   | -   | 20              | ns/V |
| 74VHCT32         |                                     |                                  |     |     |                 |      |
| V <sub>CC</sub>  | supply voltage                      |                                  | 4.5 | 5.0 | 5.5             | V    |
| V <sub>I</sub>   | input voltage                       |                                  | 0   | -   | 5.5             | V    |
| V <sub>O</sub>   | output voltage                      |                                  | 0   | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                                  | -40 | +25 | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 4.5 V to 5.5 V | -   | -   | 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  |      |
| 74VHC32         |                           |   |       |     |      |                  |      |                   |      |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V   | 1.5   | -   | -    | 1.5              | -    | 1.5               | -    | V    |
|                 |                           | V <sub>CC</sub> = 3.0 V   | 2.1   | -   | -    | 2.1              | -    | 2.1               | -    | V    |
|                 |                           | V <sub>CC</sub> = 5.5 V   | 3.85  | -   | -    | 3.85             | -    | 3.85              | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V   | -     | -   | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                 |                           | V <sub>CC</sub> = 3.0 V   | -     | -   | 0.9  | -                | 0.9  | -                 | 0.9  | V    |
|                 |                           | V <sub>CC</sub> = 5.5 V   | -     | -   | 1.65 | -                | 1.65 | -                 | 1.65 | V    |
| V <sub>OH</sub> | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                       |       |     |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 2.0 V  | 1.9   | 2.0 | -    | 1.9              | -    | 1.9               | -    | V    |
|                 |                           | I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 3.0 V  | 2.9   | 3.0 | -    | 2.9              | -    | 2.9               | -    | V    |
|                 |                           | I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 4.5 V  | 4.4   | 4.5 | -    | 4.4              | -    | 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>IH</sub> or V <sub>IL</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   |

| Symbol           | Parameter                 | Conditions  | 25 °C |     |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|---|-------|-----|------|------------------|------|-------------------|------|------|
|                  |                           |   | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| 74VHCT32         |                           |   |       |     |      |                  |      |                   |      |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V  | 2.0   | -   | -    | 2.0              | -    | 2.0               | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V  | -     | -   | 0.8  | -                | 0.8  | -                 | 0.8  | V    |
| V <sub>OH</sub>  | HIGH-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> = -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>IH</sub> or V <sub>IL</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;<br>V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other pins at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>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. 5.

| Symbol          | Parameter                     | Conditions  | 25 °C |        |      | -40 °C to +85 °C |     | -40 °C to +125 °C |      | Unit |
|-----------------|-------------------------------|---|-------|--------|------|------------------|-----|-------------------|------|------|
|                 |                               |   | Min   | Typ[1] | Max  | Min              | Max | Min               | Max  |      |
| 74VHC32         |                               |   |       |        |      |                  |     |                   |      |      |
| t <sub>pd</sub> | propagation delay             | nA, nB to nY; see <a href="#">Fig. 4</a> [2]                        |       |        |      |                  |     |                   |      |      |
|                 |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                    |       |        |      |                  |     |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF  | -     | 3.9    | 7.9  | 1.0              | 9.5 | 1.0               | 10.0 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF  | -     | 5.6    | 11.4 | 1.0              | 13  | 1.0               | 14.5 | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                    |       |        |      |                  |     |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF  | -     | 2.8    | 5.5  | 1.0              | 6.5 | 1.0               | 7.0  | 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] | -     | 10     | -    | -                | -   | -                 | -    | pF   |
|                 |                               |   |       |        |      |                  |     |                   |      |      |

| Symbol                                     | Parameter                     | Conditions  | 25 °C |        |     | -40 °C to +85 °C |     | -40 °C to +125 °C |      | Unit |
|--|-------------------------------|---|-------|--------|-----|------------------|-----|-------------------|------|------|
|  |                               |   | Min   | Typ[1] | Max | Min              | Max | Min               | Max  |      |
| 74VHCT32; V <sub>CC</sub> = 4.5 V to 5.5 V |                               |   |       |        |     |                  |     |                   |      |      |
| t <sub>pd</sub>                            | propagation delay             | nA, nB to nY; see Fig. 4 [2]  |       |        |     |                  |     |                   |      |      |
|  |                               | C <sub>L</sub> = 15 pF  | -     | 3.1    | 6.9 | 1.0              | 8.0 | 1.0               | 9.0  | ns   |
|  |                               | C <sub>L</sub> = 50 pF  | -     | 4.3    | 7.9 | 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] | -     | 12     | -   | -                | -   | -                 | -    | 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).
- $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  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 the outputs.

10.1. Waveforms and test circuit

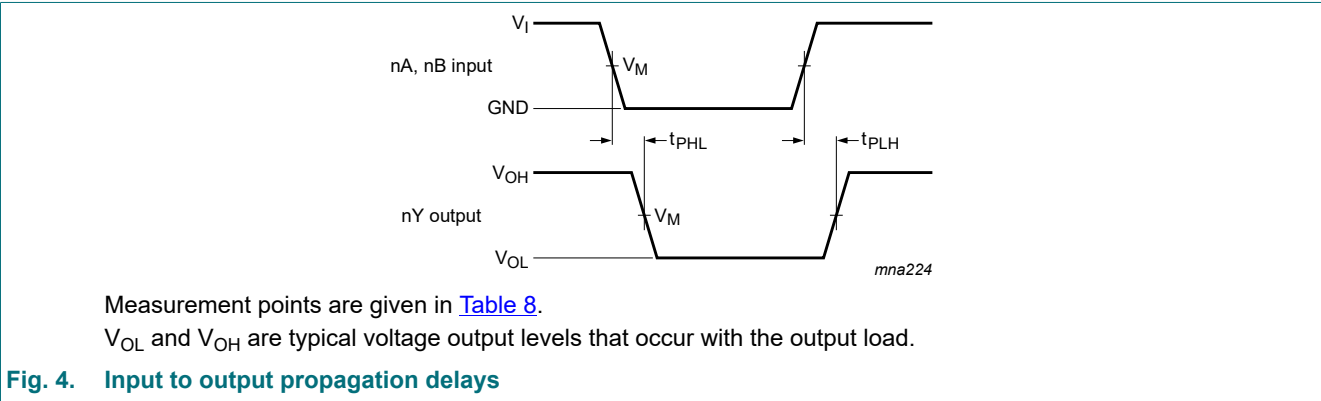
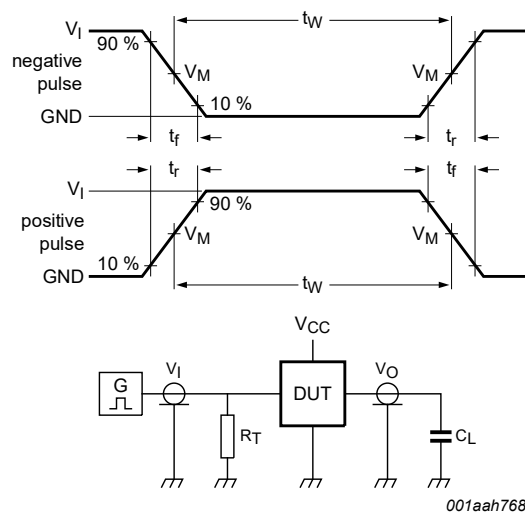


Table 8. Measurement points

| Type     | Input              | Output             |
|----------|--------------------|--------------------|
|          | V <sub>M</sub>     | V <sub>M</sub>     |
| 74VHC32  | 0.5V <sub>CC</sub> | 0.5V <sub>CC</sub> |
| 74VHCT32 | 1.5 V              | 0.5V <sub>CC</sub> |



Test data is given in [Table 9](#).  
Definitions test circuit:  
 $R_T$  = termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.  
 $C_L$  = load capacitance including jig and probe capacitance.

Fig. 5. Test circuit for measuring switching times

Table 9. Test data

| Type     | Input    |                       | Load         | Test               |
|----------|----------|-----------------------|--------------|--------------------|
|          | $V_I$    | $t_r, t_f$            | $C_L$        |                    |
| 74VHC32  | $V_{CC}$ | $\leq 3.0 \text{ ns}$ | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |
| 74VHCT32 | 3.0 V    | $\leq 3.0 \text{ ns}$ | 15 pF, 50 pF | $t_{PLH}, t_{PHL}$ |



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)

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. 8. Package outline SOT762-1 (DHVQFN14)

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                               |
| LSTTL   | Low-power Schottky Transistor-Transistor Logic |

13. Revision history

Table 11. Revision history

| Document ID      | Release date  | Data sheet status  | Change notice | Supersedes       |
|------------------|---|--------------------|---------------|------------------|
| 74VHC_VHCT32 v.3 | 20240418  | Product data sheet | -             | 74VHC_VHCT32 v.2 |
| Modifications:   | <ul style="list-style-type: none"><li>• <a href="#">Fig. 6</a>, <a href="#">Fig. 7</a>: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.</li><li>• <a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li></ul>  |                    |               |                  |
| 74VHC_VHCT32 v.2 | 20200903  | Product data sheet | -             | 74VHC_VHCT32 v.1 |
| 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="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation have been updated.</li><li>• <a href="#">Fig. 8</a>: Package outline drawing of SOT762-1 (DHVQFN14) updated.</li></ul> |                    |               |                  |
| 74VHC_VHCT32 v.1 | 20090813  | Product data sheet | -             | -                |

## 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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