

# 74LVTN16245B

## 3.3 V 16-bit transceiver; 3-state

Rev. 6 — 30 October 2018

Product data sheet

## 1. General description

The 74LVTN16245B is a high-performance BiCMOS product designed for  $V_{CC}$  operation at 3.3 V.

This device is a 16-bit transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. The control function implementation minimizes external timing requirements. The device features an output enable input ( $\overline{nOE}$ ) for easy cascading and a direction input ( $\overline{nDIR}$ ) for direction control.

## 2. Features and benefits

- 16-bit bus interface
- 3-state buffers
- Output capability: +64 mA and -32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Power-up 3-state
- Live insertion and extraction permitted
- No bus current loading when output is tied to 5 V bus
- Latch-up protection
  - JESD78B Class II exceeds 500 mA
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V

## 3. Ordering information

Table 1. Ordering information

| Type number     | Package           |         |                                                                           |          |
|-----------------|-------------------|---------|---------------------------------------------------------------------------|----------|
|                 | Temperature range | Name    | Description                                                               | Version  |
| 74LVTN16245BDGG | -40 °C to +85 °C  | TSSOP48 | plastic thin shrink small outline package;<br>48 leads; body width 6.1 mm | SOT362-1 |

4. Functional diagram

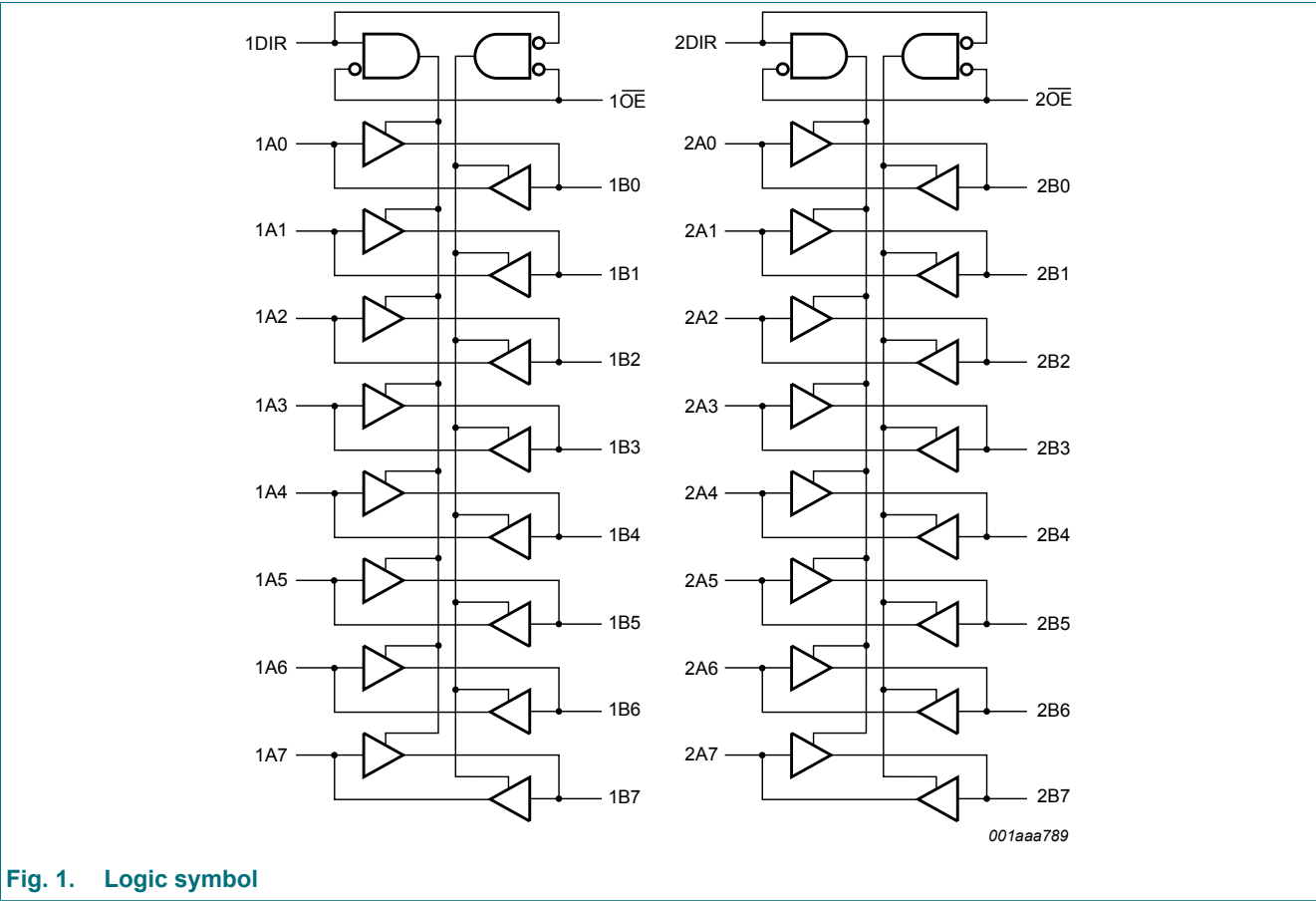


Fig. 1. Logic symbol

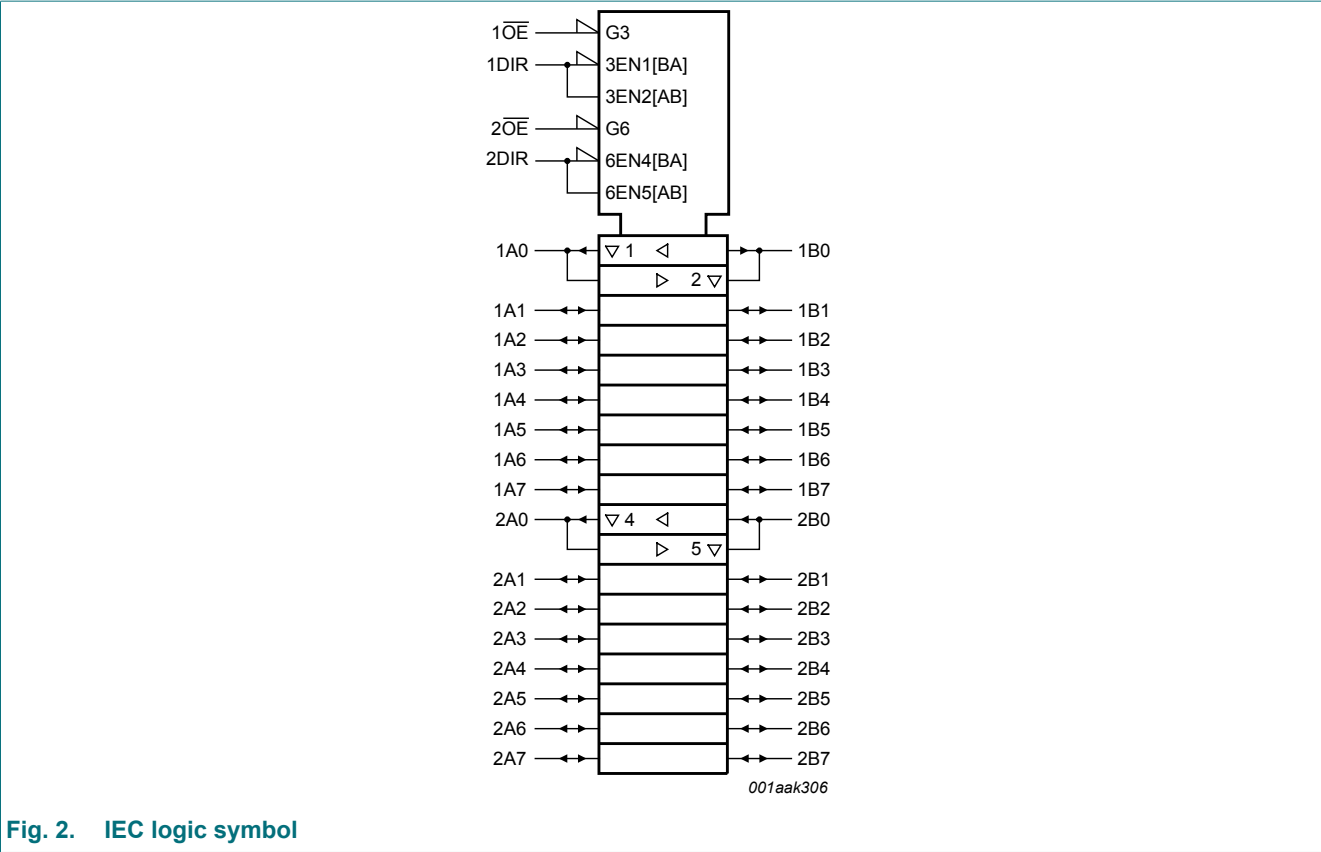


Fig. 2. IEC logic symbol

5. Pinning information

5.1. Pinning

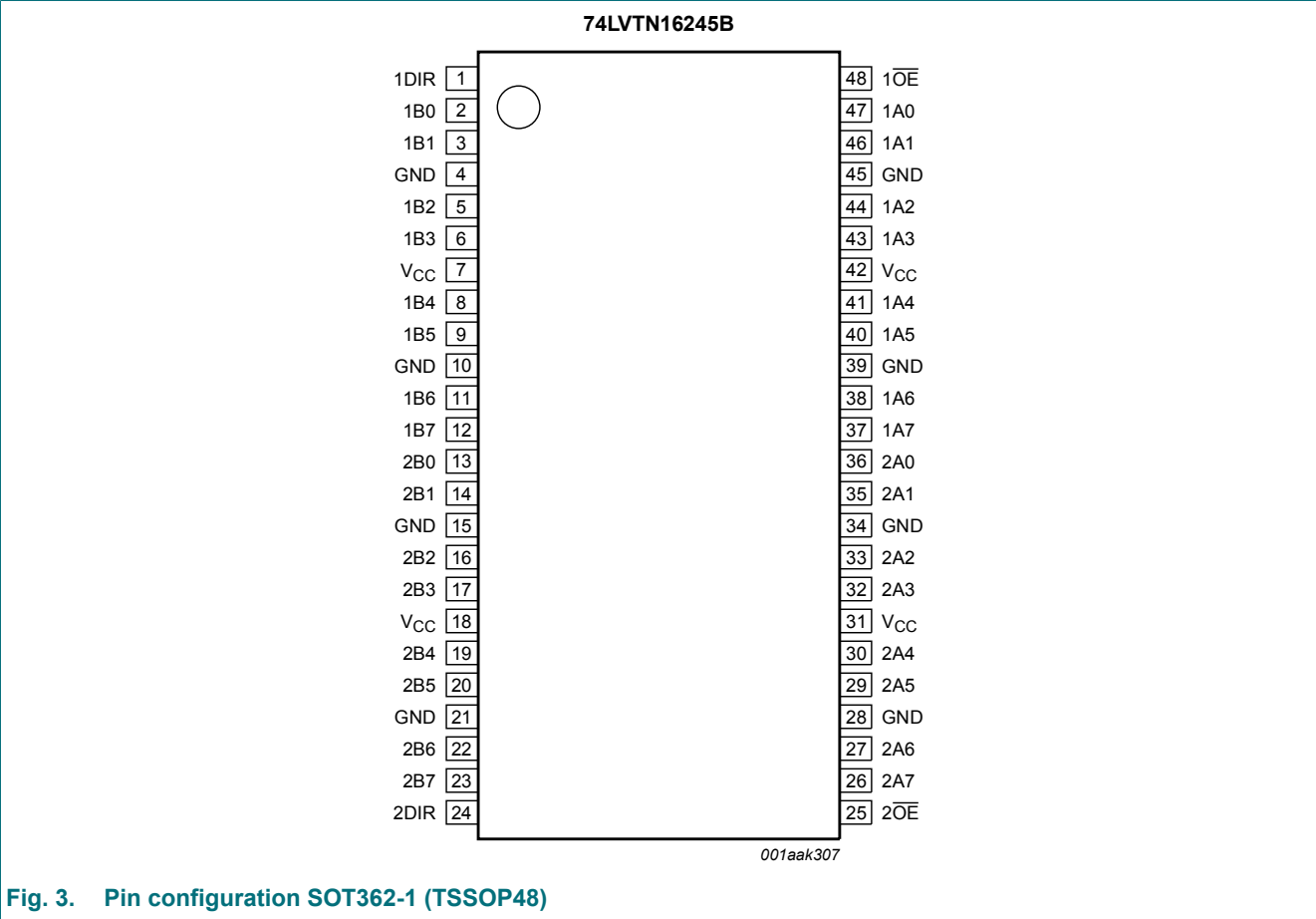


Fig. 3. Pin configuration SOT362-1 (TSSOP48)

5.2. Pin description

Table 2. Pin description

| Symbol                                 | Pin                            | Description                      |
|----------------------------------------|--------------------------------|----------------------------------|
| 1DIR, 2DIR                             | 1, 24                          | direction control input          |
| 1B0, 1B1, 1B2, 1B3, 1B4, 1B5, 1B6, 1B7 | 2, 3, 5, 6, 8, 9, 11, 12       | data input/output                |
| 2B0, 2B1, 2B2, 2B3, 2B4, 2B5, 2B6, 2B7 | 13, 14, 16, 17, 19, 20, 22, 23 | data input/output                |
| GND                                    | 4, 10, 15, 21, 28, 34, 39, 45  | ground (0 V)                     |
| V <sub>CC</sub>                        | 7, 18, 31, 42                  | supply voltage                   |
| 1OE, 2OE                               | 48, 25                         | output enable input (active LOW) |
| 2A0, 2A1, 2A2, 2A3, 2A4, 2A5, 2A6, 2A7 | 36, 35, 33, 32, 30, 29, 27, 26 | data input/output                |
| 1A0, 1A1, 1A2, 1A3, 1A4, 1A5, 1A6, 1A7 | 47, 46, 44, 43, 41, 40, 38, 37 | data input/output                |

## 6. Functional description

**Table 3. Function table**

*H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.*

| Control |      | Input/output     |                  |
|---------|------|------------------|------------------|
| nOE     | nDIR | nAn              | nBn              |
| L       | L    | output nAn = nBn | input            |
| L       | H    | input            | output nBn = nAn |
| H       | X    | Z                | Z                |

## 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 | +4.6 | V    |
| V <sub>I</sub>   | input voltage           | [1]                                     | -0.5 | +7.0 | V    |
| V <sub>O</sub>   | output voltage          | output in OFF-state or HIGH-state [1]   | -0.5 | +7.0 | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < 0 V                    | -50  | -    | mA   |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < 0 V                    | -50  | -    | mA   |
| I <sub>O</sub>   | output current          | output in LOW-state                     | -    | 128  | mA   |
|                  |                         | output in HIGH-state                    | -64  | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                         | -65  | +150 | °C   |
| T <sub>j</sub>   | junction temperature    | [2]                                     | -    | 150  | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +85 °C [3] | -    | 500  | mW   |

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

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

[3] Above 60 °C the value of P<sub>tot</sub> derates linearly with 5.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol           | Parameter                           | Conditions                                           | Min | Typ | Max | Unit |
|------------------|-------------------------------------|------------------------------------------------------|-----|-----|-----|------|
| V <sub>CC</sub>  | supply voltage                      |                                                      | 2.7 | -   | 3.6 | V    |
| V <sub>I</sub>   | input voltage                       |                                                      | 0   | -   | 5.5 | V    |
| V <sub>IH</sub>  | HIGH-level input voltage            |                                                      | 2.0 | -   | -   | V    |
| V <sub>IL</sub>  | LOW-level input voltage             |                                                      | -   | -   | 0.8 | V    |
| I <sub>OH</sub>  | HIGH-level output current           |                                                      | -32 | -   | -   | mA   |
| I <sub>OL</sub>  | LOW-level output current            | none                                                 | -   | -   | 32  | mA   |
|                  |                                     | current duty cycle ≤ 50 %;<br>f <sub>i</sub> ≥ 1 kHz | -   | -   | 64  | mA   |
| T <sub>amb</sub> | ambient temperature                 | in free-air                                          | -40 | -   | +85 | °C   |
| Δt/ΔV            | input transition rise and fall rate | outputs enabled                                      | -   | -   | 10  | ns/V |

## 9. Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions;  $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ; voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                          | Conditions                                                                                                                                   | Min            | Typ [1]  | Max       | Unit          |
|-----------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|-----------|---------------|
| $V_{IK}$        | input clamping voltage             | $V_{CC} = 2.7\text{ V}$ ; $I_{IK} = -18\text{ mA}$                                                                                           | -1.2           | -0.85    | -         | V             |
| $V_{OH}$        | HIGH-level output voltage          | $I_{OH} = -100\text{ }\mu\text{A}$ ; $V_{CC} = 2.7\text{ V}$ to $3.6\text{ V}$                                                               | $V_{CC} - 0.2$ | $V_{CC}$ | -         | V             |
|                 |                                    | $I_{OH} = -8\text{ mA}$ ; $V_{CC} = 2.7\text{ V}$                                                                                            | 2.4            | 2.5      | -         | V             |
|                 |                                    | $I_{OH} = -32\text{ mA}$ ; $V_{CC} = 3.0\text{ V}$                                                                                           | 2.0            | 2.3      | -         | V             |
| $V_{OL}$        | LOW-level output voltage           | $V_{CC} = 2.7\text{ V}$                                                                                                                      |                |          |           |               |
|                 |                                    | $I_{OL} = 100\text{ }\mu\text{A}$                                                                                                            | -              | 0.07     | 0.2       | V             |
|                 |                                    | $I_{OL} = 24\text{ mA}$                                                                                                                      | -              | 0.3      | 0.5       | V             |
|                 |                                    | $V_{CC} = 3.0\text{ V}$                                                                                                                      |                |          |           |               |
|                 |                                    | $I_{OL} = 16\text{ mA}$                                                                                                                      | -              | 0.25     | 0.4       | V             |
|                 |                                    | $I_{OL} = 32\text{ mA}$                                                                                                                      | -              | 0.3      | 0.5       | V             |
|                 |                                    | $I_{OL} = 64\text{ mA}$                                                                                                                      | -              | 0.4      | 0.55      | V             |
| $I_I$           | input leakage current              | control pins                                                                                                                                 |                |          |           |               |
|                 |                                    | $V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$ or GND                                                                                              | -              | 0.1      | $\pm 1$   | $\mu\text{A}$ |
|                 |                                    | $V_{CC} = 0\text{ V}$ or $3.6\text{ V}$ ; $V_I = 5.5\text{ V}$                                                                               | -              | 0.1      | 10        | $\mu\text{A}$ |
|                 |                                    | input/output data pins; $V_{CC} = 3.6\text{ V}$ [2]                                                                                          |                |          |           |               |
|                 |                                    | $V_I = 5.5\text{ V}$                                                                                                                         | -              | 0.1      | 20        | $\mu\text{A}$ |
|                 |                                    | $V_I = V_{CC}$                                                                                                                               | -              | 0.5      | 10        | $\mu\text{A}$ |
|                 |                                    | $V_I = 0\text{ V}$                                                                                                                           | -5             | -0.1     | -         | $\mu\text{A}$ |
| $I_{OFF}$       | power-off leakage current          | $V_{CC} = 0\text{ V}$ ; $V_I$ or $V_O = 0\text{ V}$ to $4.5\text{ V}$                                                                        | -              | 0.1      | $\pm 100$ | $\mu\text{A}$ |
| $I_{LO}$        | output leakage current             | output in HIGH-state when $V_O > V_{CC}$ ;<br>$V_O = 5.5\text{ V}$ ; $V_{CC} = 3.0\text{ V}$                                                 | -              | 75       | 125       | $\mu\text{A}$ |
| $I_{O(pu/pd)}$  | power-up/power-down output current | $V_{CC} \leq 1.2\text{ V}$ ; $V_O = 0.5\text{ V}$ to $V_{CC}$ ;<br>$V_I = \text{GND}$ or $V_{CC}$ ; $n\overline{OE} = \text{don't care}$ [3] | -              | 40       | $\pm 100$ | $\mu\text{A}$ |
| $I_{CC}$        | supply current                     | $V_{CC} = 3.6\text{ V}$ ; $V_I = \text{GND}$ or $V_{CC}$ ; $I_O = 0\text{ A}$                                                                |                |          |           |               |
|                 |                                    | output HIGH                                                                                                                                  | -              | 0.07     | 0.12      | mA            |
|                 |                                    | output LOW                                                                                                                                   | -              | 4.0      | 6.0       | mA            |
|                 |                                    | outputs disabled [4]                                                                                                                         | -              | 0.07     | 0.12      | mA            |
| $\Delta I_{CC}$ | additional supply current          | per input pin; $V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ ;<br>one input at $V_{CC} - 0.6\text{ V}$ ,<br>other inputs at $V_{CC}$ or GND [5]  | -              | 0.1      | 0.2       | mA            |
| $C_I$           | input capacitance                  | pins nDIR and $n\overline{OE}$ , $V_O = 0\text{ V}$ or $3.0\text{ V}$                                                                        | -              | 3        | -         | pF            |
| $C_{io(off)}$   | off-state input/output capacitance | pins nAn and nBn, outputs disabled;<br>$V_O = \text{GND}$ or $V_{CC}$                                                                        | -              | 9        | -         | pF            |

[1] Typical values are measured at  $V_{CC} = 3.3\text{ V}$  and at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

[2] Unused pins at  $V_{CC}$  or GND.

[3] This parameter is valid for any  $V_{CC}$  between 0 V and 1.2 V with a transition time of up to 10 ms.  
From  $V_{CC} = 1.2\text{ V}$  to  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  a transition time of 100  $\mu\text{s}$  is permitted. This parameter is valid for  $T_{amb} = 25\text{ }^{\circ}\text{C}$  only.

[4]  $I_{CC}$  is measured with outputs pulled to  $V_{CC}$  or GND.

[5] This is the increase in supply current for each input at the specified voltage level other than  $V_{CC}$  or GND.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V);  $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ; for test circuit see [Fig. 6](#).

| Symbol    | Parameter                           | Conditions                                                 | Min | Typ [1] | Max | Unit |
|-----------|-------------------------------------|------------------------------------------------------------|-----|---------|-----|------|
| $t_{PLH}$ | LOW to HIGH propagation delay       | nAn to nBn or nBn to nAn; see <a href="#">Fig. 4</a>       |     |         |     |      |
|           |                                     | $V_{CC} = 2.7\text{ V}$                                    | -   | -       | 3.5 | ns   |
|           |                                     | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$                    | 1.0 | 1.9     | 3.3 | ns   |
| $t_{PHL}$ | HIGH to LOW propagation delay       | nAn to nBn or nBn to nAn; see <a href="#">Fig. 4</a>       |     |         |     |      |
|           |                                     | $V_{CC} = 2.7\text{ V}$                                    | -   | -       | 3.5 | ns   |
|           |                                     | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$                    | 1.0 | 1.7     | 3.3 | ns   |
| $t_{PZH}$ | OFF-state to HIGH propagation delay | $n\overline{OE}$ to nAn or nBn; see <a href="#">Fig. 5</a> |     |         |     |      |
|           |                                     | $V_{CC} = 2.7\text{ V}$                                    | -   | -       | 5.3 | ns   |
|           |                                     | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$                    | 1.0 | 2.8     | 4.5 | ns   |
| $t_{PZL}$ | OFF-state to LOW propagation delay  | $n\overline{OE}$ to nAn or nBn; see <a href="#">Fig. 5</a> |     |         |     |      |
|           |                                     | $V_{CC} = 2.7\text{ V}$                                    | -   | -       | 5.1 | ns   |
|           |                                     | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$                    | 1.0 | 2.8     | 4.1 | ns   |
| $t_{PHZ}$ | HIGH to OFF-state propagation delay | $n\overline{OE}$ to nAn or nBn; see <a href="#">Fig. 5</a> |     |         |     |      |
|           |                                     | $V_{CC} = 2.7\text{ V}$                                    | -   | -       | 5.7 | ns   |
|           |                                     | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$                    | 1.5 | 3.2     | 5.1 | ns   |
| $t_{PLZ}$ | LOW to OFF-state propagation delay  | $n\overline{OE}$ to nAn or nBn; see <a href="#">Fig. 5</a> |     |         |     |      |
|           |                                     | $V_{CC} = 2.7\text{ V}$                                    | -   | -       | 4.6 | ns   |
|           |                                     | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$                    | 1.5 | 3.0     | 4.6 | ns   |

[1] Typical values are measured at  $V_{CC} = 3.3\text{ V}$  and  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

10.1. Waveforms and test circuit

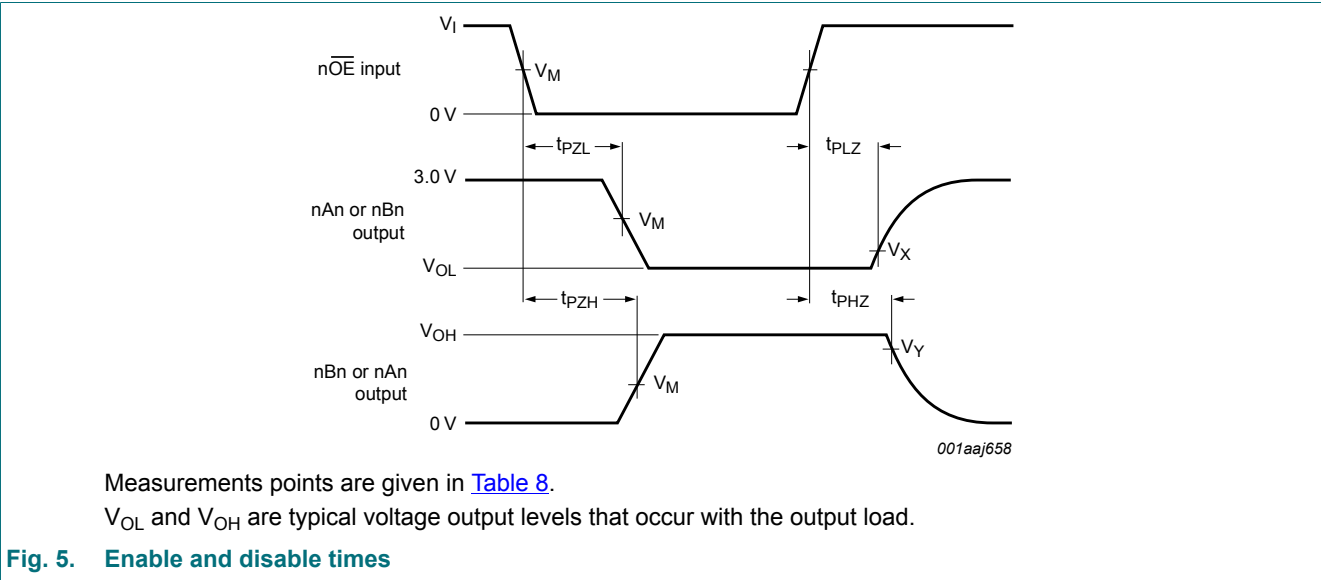
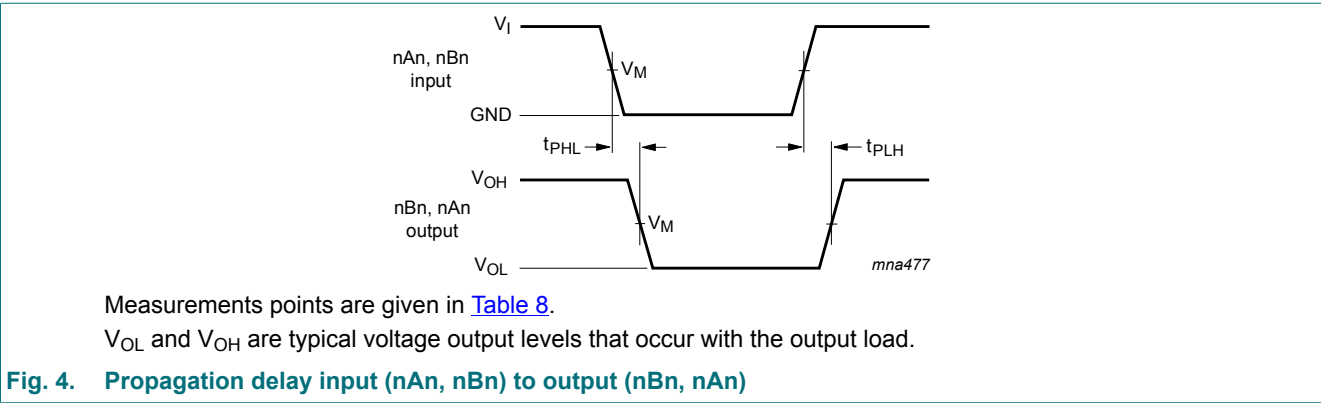
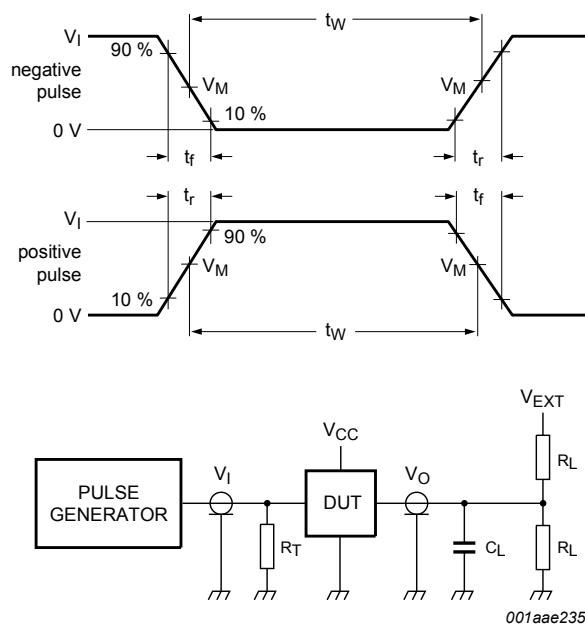


Table 8. Measurement points

| Input | Output |                          |                          |
|-------|--------|--------------------------|--------------------------|
| $V_M$ | $V_M$  | $V_X$                    | $V_Y$                    |
| 1.5 V | 1.5 V  | $V_{OL} + 0.3 \text{ V}$ | $V_{OH} - 0.3 \text{ V}$ |





Test data is given in [Table 9](#).  
Definitions test circuit:  
 $R_L$  = Load resistance.  
 $C_L$  = Load capacitance including jig and probe capacitance.  
 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.  
 $V_{EXT}$  = External voltage for measuring switching times.

Fig. 6. Test circuit for measuring switching times

Table 9. Test data

| Input |               |        |               | Load  |              | $V_{EXT}$          |                    |                    |
|-------|---------------|--------|---------------|-------|--------------|--------------------|--------------------|--------------------|
| $V_I$ | $f_i$         | $t_W$  | $t_r, t_f$    | $C_L$ | $R_L$        | $t_{PHZ}, t_{PZH}$ | $t_{PLZ}, t_{PZL}$ | $t_{PLH}, t_{PHL}$ |
| 2.7 V | $\leq 10$ MHz | 500 ns | $\leq 2.5$ ns | 50 pF | 500 $\Omega$ | GND                | 6 V                | open               |

11. Package outline

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm SOT362-1

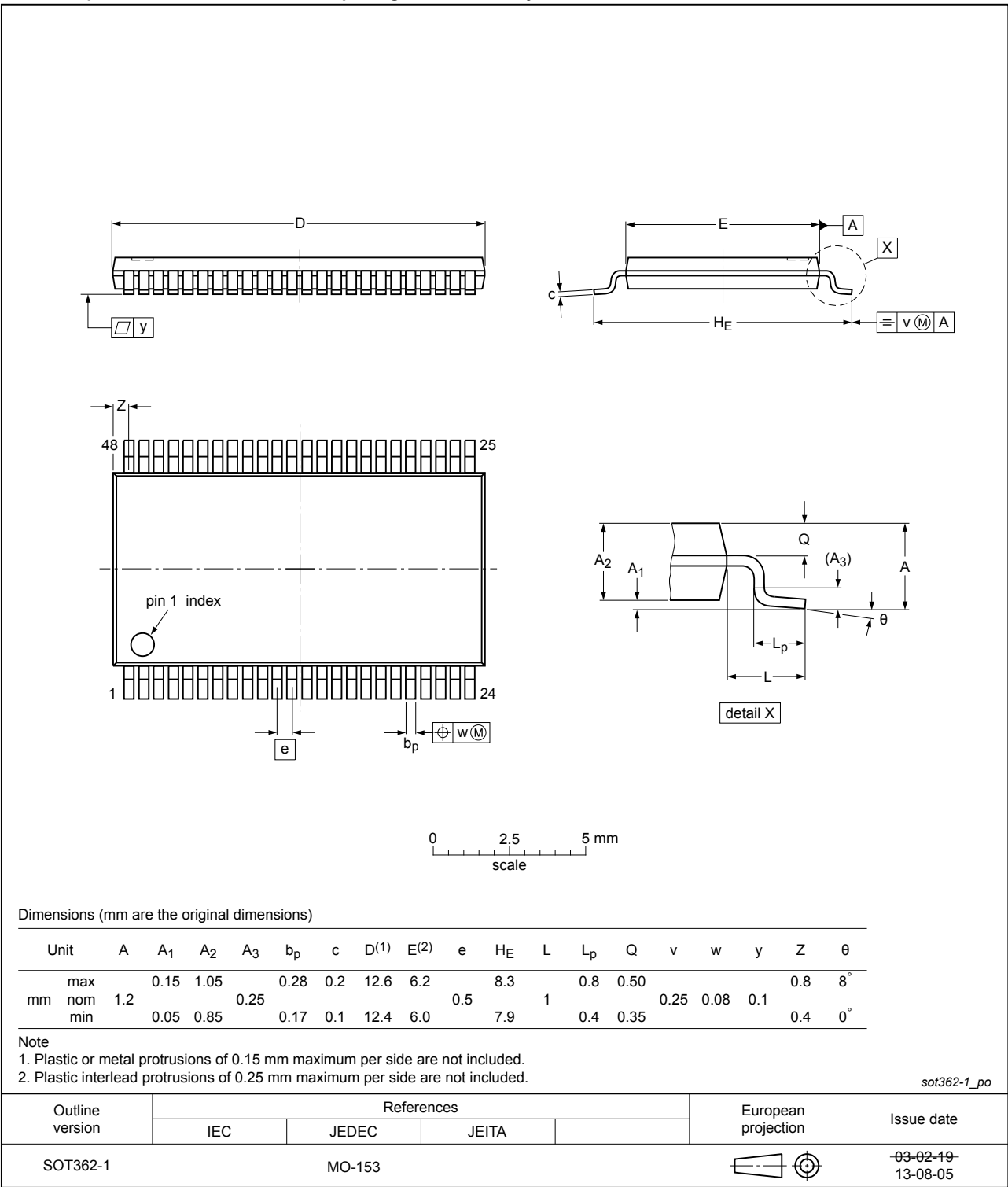


Fig. 7. Package outline SOT362-1 (TSSOP48)

## 12. Abbreviations

Table 10. Abbreviations

| Acronym | Description                                     |
|---------|-------------------------------------------------|
| BiCMOS  | Bipolar Complementary Metal Oxide Semiconductor |
| DUT     | Device Under Test                               |
| ESD     | ElectroStatic Discharge                         |
| HBM     | Human Body Model                                |
| MM      | Machine Model                                   |
| TTL     | Transistor-Transistor Logic                     |

## 13. Revision history

Table 11. Revision history

| Document ID      | Release date                                                                                                                                                                                                                                                                                                                                                           | Data sheet status  | Change notice | Supersedes       |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|------------------|
| 74LVTN16245B v.6 | 20181030                                                                                                                                                                                                                                                                                                                                                               | Product data sheet | -             | 74LVTN16245B v.5 |
| 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 numbers 74LVTN16245BBX (SOT1134-2) removed.</li> <li>Package outline drawing <a href="#">SOT362-1</a> updated.</li> </ul> |                    |               |                  |
| 74LVTN16245B v.5 | 20120405                                                                                                                                                                                                                                                                                                                                                               | Product data sheet | -             | 74LVTN16245B v.4 |
| Modifications:   | <ul style="list-style-type: none"> <li>For type number 74LVTN16245BBX the SOT code has changed to SOT1134-2</li> </ul>                                                                                                                                                                                                                                                 |                    |               |                  |
| 74LVTN16245B v.4 | 20111122                                                                                                                                                                                                                                                                                                                                                               | Product data sheet | -             | 74LVTN16245B v.3 |
| Modifications:   | <ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>                                                                                                                                                                                                                                                                                                 |                    |               |                  |
| 74LVTN16245B v.3 | 20110615                                                                                                                                                                                                                                                                                                                                                               | Product data sheet | -             | 74LVTN16245B v.2 |
| 74LVTN16245B v.2 | 20100323                                                                                                                                                                                                                                                                                                                                                               | Product data sheet | -             | 74LVTN16245B v.1 |
| 74LVTN16245B v.1 | 20090729                                                                                                                                                                                                                                                                                                                                                               | Product data sheet | -             | -                |

## 14. Legal information

### Data sheet status

| Document status<br>[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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Date of release: 30 October 2018