

74AVCH16245

16-bit transceiver with direction pin; 3.6 V tolerant; 3-state

Rev. 3 — 8 January 2013

Product data sheet

1. General description

The 74AVCH16245 is a 16-bit transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. The device features two output enable inputs ($\overline{\text{nOE}}$) for easy cascading and two send/receive inputs (nDIR) for direction control. Inputs $\overline{\text{nOE}}$ control the outputs so that the buses are effectively isolated. This device can be used as two 8-bit transceivers or one 16-bit transceiver.

The 74AVCH16245 is designed to have an extremely fast propagation delay and a minimum amount of power consumption.

To ensure the high-impedance output state during power-up or power-down, tie pins $\overline{\text{nOE}}$ to V_{CC} through a pull-up resistor (Live Insertion).

A Dynamic Controlled Output (DCO) circuitry is implemented to support termination line drive during transient (see [Figure 4](#) and [Figure 5](#))

The 74AVCH16245 has active bus-hold circuitry to hold unused or floating data inputs at a valid logic level. This feature eliminates the need for external pull-up or pull-down resistors.

2. Features and benefits

- Wide supply voltage range from 1.2 V to 3.6 V
- Complies with JEDEC standards:
 - ◆ JESD8-7 (1.2 V to 1.95 V)
 - ◆ JESD8-5 (1.8 V to 2.7 V)
 - ◆ JESD8-1A (2.7 V to 3.6 V)
- CMOS low power consumption
- Input/output tolerant up to 3.6 V
- Dynamic Controlled Output (DCO) circuit dynamically changes output impedance, resulting in noise reduction without speed degradation
- Low inductance multiple VCC and GND pins to minimize noise and ground bounce
- Supports Live Insertion
- All inputs have bus-hold

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|----------------|-------------------|---------|--|----------|
| | Temperature range | Name | Description | |
| 74AVCH16245DGG | -40 °C to +85 °C | TSSOP48 | plastic thin shrink small outline package; 48 leads; body width 6.1 mm | SOT362-1 |

4. Functional diagram

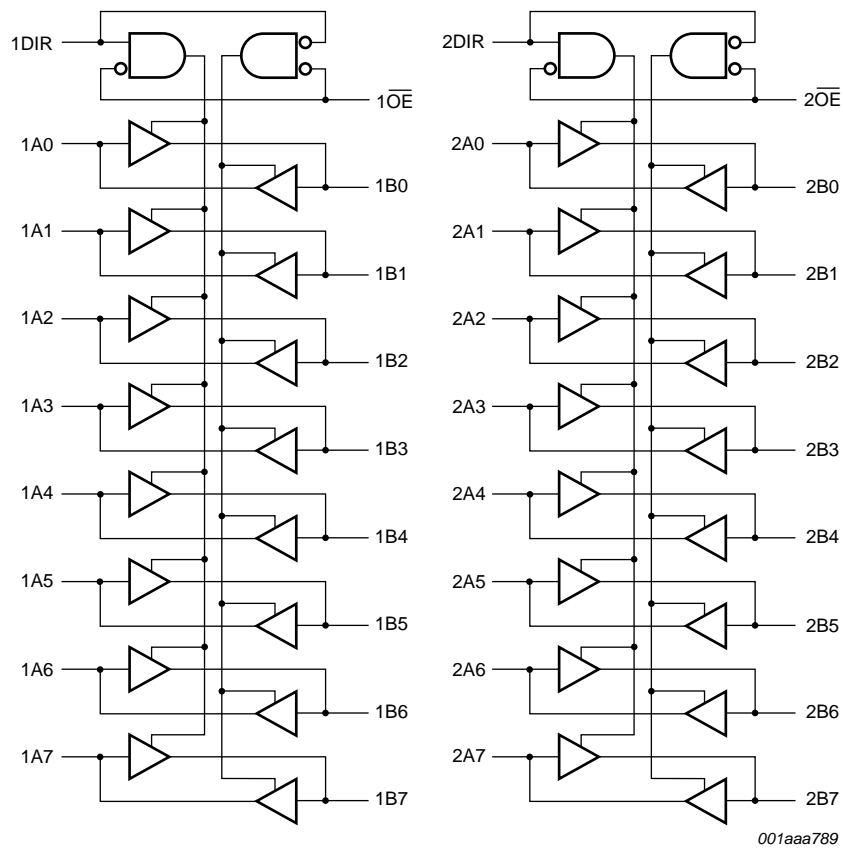


Fig 1. Logic symbol

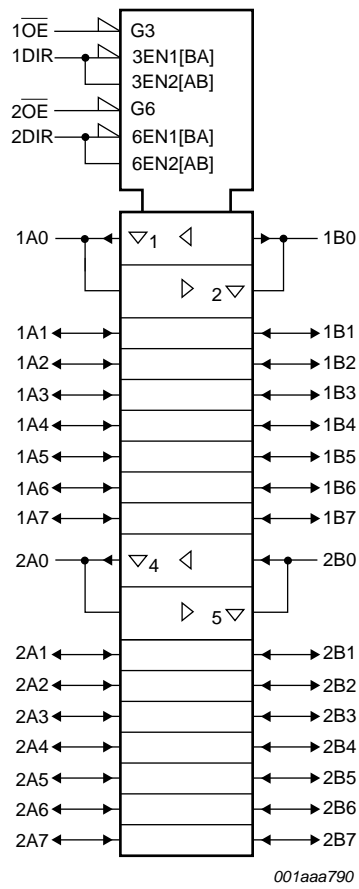
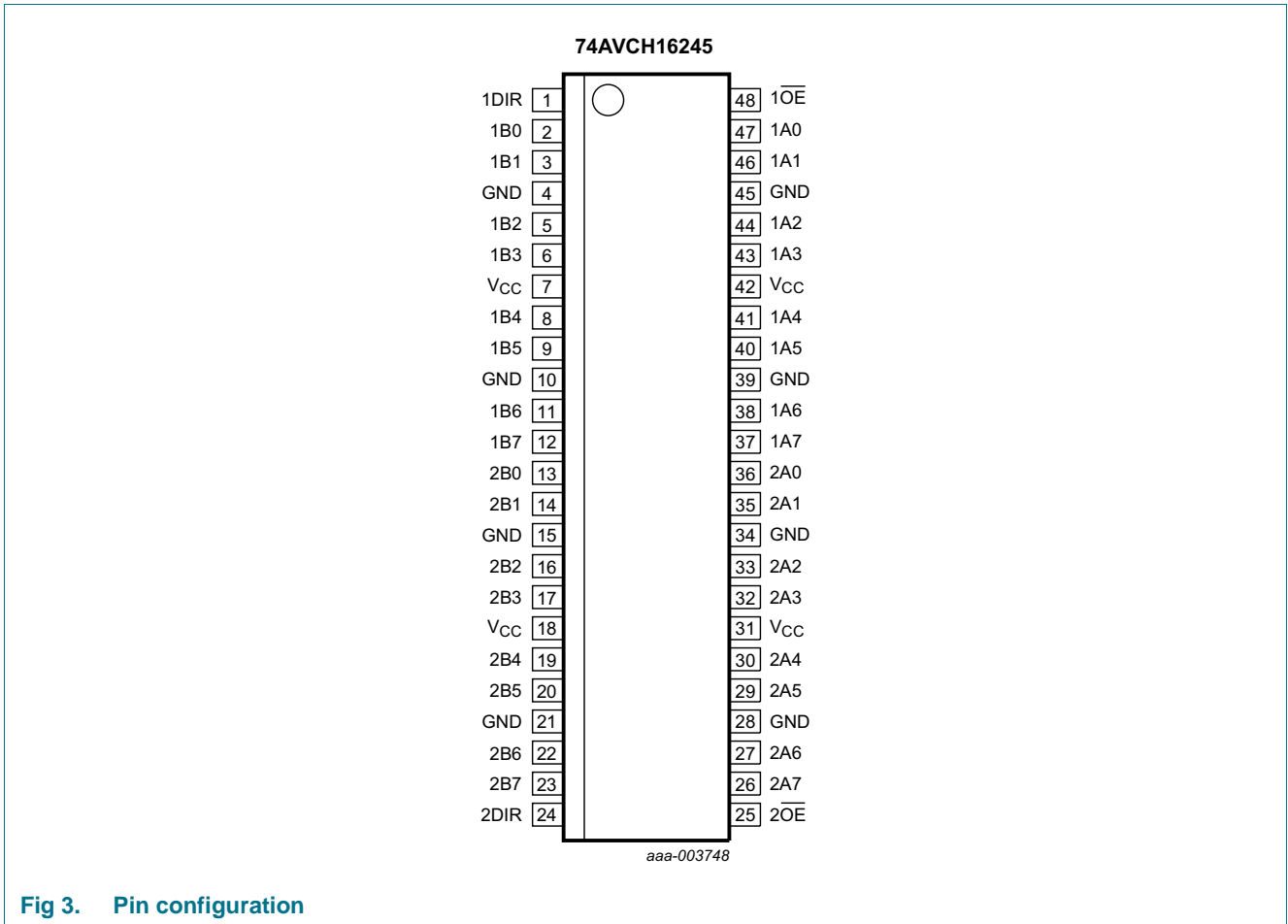


Fig 2. IEC logic symbol

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|---|--------------------------------|----------------------------------|
| 1DIR, 2DIR | 1, 24 | direction control input |
| 1B0 to 1B7 | 2, 3, 5, 6, 8, 9, 11, 12 | data input/output |
| 2B0 to 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 _{CC} | 7, 18, 31, 42 | supply voltage |
| 1 $\overline{\text{OE}}$, 2 $\overline{\text{OE}}$ | 48, 25 | output enable input (active LOW) |
| 1A0 to 1A7 | 47, 46, 44, 43, 41, 40, 38, 37 | data input/output |
| 2A0 to 2A7 | 36, 35, 33, 32, 30, 29, 27, 26 | data input/output |

6. Functional description

Table 3. Function table^[1]

| Inputs | | Outputs | |
|--------------------------|------|---------|--------|
| n $\overline{\text{OE}}$ | nDIR | nAn | nBn |
| L | L | A = B | inputs |
| L | H | inputs | B = A |
| H | X | Z | Z |

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

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 | +4.6 | V |
| I _{IK} | input clamping current | V _I < 0 V | -50 | - | mA |
| V _I | input voltage | | [1] -0.5 | +4.6 | V |
| I _{OK} | output clamping current | V _O < 0 V | -50 | - | mA |
| V _O | output voltage | output HIGH or LOW | [1] -0.5 | V _{CC} + 0.5 | V |
| | | output 3-state | [1] -0.5 | +4.6 | V |
| I _O | output current | V _O = 0 V to V _{CC} | - | ±50 | mA |
| I _{CC} | supply current | | - | 100 | mA |
| I _{GND} | ground current | | -100 | - | 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] Above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|-------------------------------------|--|------|-----|-----------------|------|
| V _{CC} | supply voltage | according to JEDEC Low Voltage Standards | 1.4 | - | 1.6 | V |
| | | | 1.65 | - | 1.95 | V |
| | | | 2.3 | - | 2.7 | V |
| | | | 3.0 | - | 3.6 | V |
| | | for low-voltage applications | 1.2 | - | 3.6 | V |
| V _I | input voltage | | 0 | - | 3.6 | V |
| V _O | output voltage | output HIGH or LOW | 0 | - | V _{CC} | V |
| | | output 3-state | 0 | - | 3.6 | V |
| T _{amb} | ambient temperature | in free air | -40 | - | +85 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 1.4 V to 1.6 V | 0 | - | 40 | ns/V |
| | | V _{CC} = 1.65 V to 1.95 V | 0 | - | 30 | ns/V |
| | | V _{CC} = 2.3 V to 3.0 V | 0 | - | 20 | ns/V |
| | | V _{CC} = 3.0 V to 3.6 V | 0 | - | 10 | ns/V |

9. Static characteristics

Table 6. Static characteristics

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

| Symbol | Parameter | Conditions | Min | Typ ^[1] | Max | Unit |
|---|---------------------------|---|------------------------|------------------------|------------------------|------|
| T_{amb} = -40 °C to +85 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 1.2 V | V _{CC} | - | - | V |
| | | V _{CC} = 1.4 V to 1.6 V | 0.65 × V _{CC} | 0.9 | - | V |
| | | V _{CC} = 1.65 V to 1.95 V | 0.65 × V _{CC} | 0.9 | - | V |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | 1.2 | - | V |
| | | V _{CC} = 3.0 V to 3.6 V | 2.0 | 1.5 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 1.2 V | - | - | GND | V |
| | | V _{CC} = 1.4 V to 1.6 V | - | 0.9 | 0.35 × V _{CC} | V |
| | | V _{CC} = 1.65 V to 1.95 V | - | 0.9 | 0.35 × V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | - | 1.2 | 0.7 | V |
| | | V _{CC} = 3.0 V to 3.6 V | - | 1.5 | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | I _O = -100 μA; V _{CC} = 1.65 V to 3.6 V | V _{CC} - 0.20 | V _{CC} | - | V |
| | | I _O = -3 mA; V _{CC} = 1.4 V | V _{CC} - 0.35 | V _{CC} - 0.21 | - | V |
| | | I _O = -4 mA; V _{CC} = 1.65 V | V _{CC} - 0.45 | V _{CC} - 0.25 | - | V |
| | | I _O = -8 mA; V _{CC} = 2.3 V | V _{CC} - 0.55 | V _{CC} - 0.37 | - | V |
| | | I _O = -12 mA; V _{CC} = 3.0 V | V _{CC} - 0.70 | V _{CC} - 0.47 | - | V |

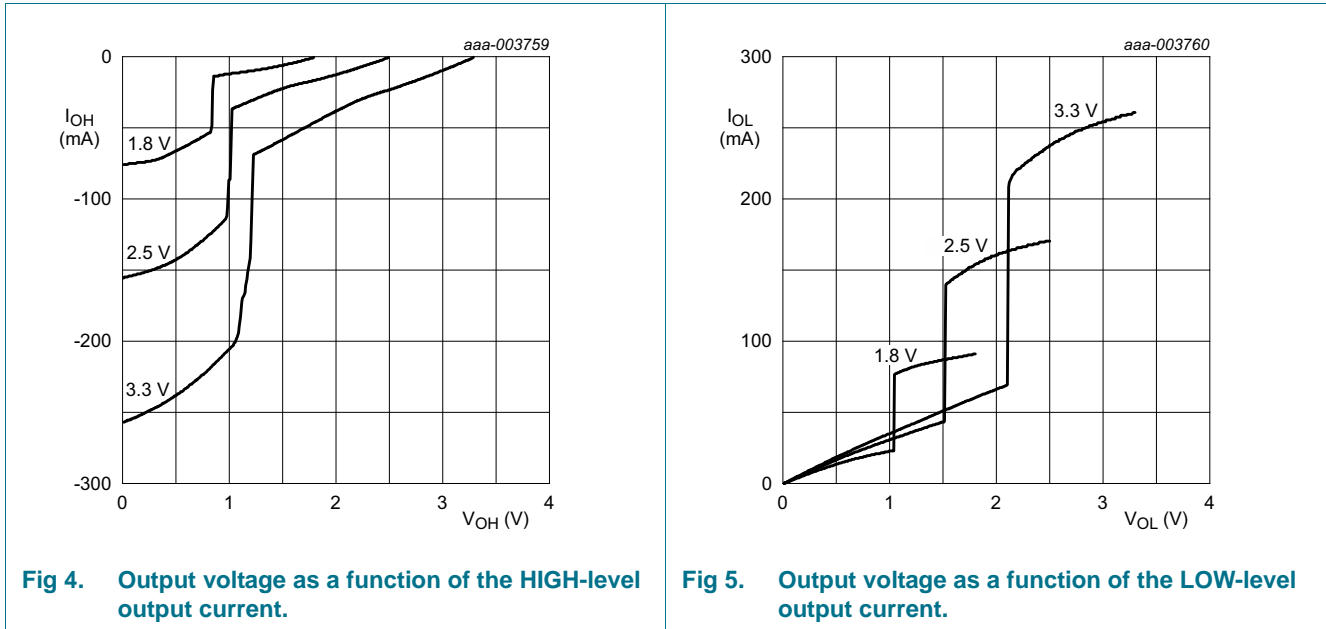
Table 6. Static characteristics ...continued

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

| Symbol | Parameter | Conditions | Min | Typ ^[1] | Max | Unit |
|-------------------|---------------------------------|---|------|--------------------|------|------|
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | I _O = 100 μA; V _{CC} = 1.65 V to 3.6 V | - | GND | 0.20 | V |
| | | I _O = 3 mA; V _{CC} = 1.4 V | - | 0.22 | 0.35 | V |
| | | I _O = 4 mA; V _{CC} = 1.65 V | - | 0.24 | 0.45 | V |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | 0.38 | 0.55 | V |
| | | I _O = 12 mA; V _{CC} = 3.0 V | - | 0.53 | 0.70 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 1.4 V to 3.6 V | - | 0.1 | 2.5 | μA |
| I _{OFF} | power-off leakage current | V _I or V _O = 3.6 V; V _{CC} = 0.0 V | - | ±0.1 | ±10 | μA |
| I _{OZ} | OFF-state output current | V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND | | | | |
| | | V _{CC} = 1.4 V to 2.7 V | - | 0.1 | 5 | μA |
| | | V _{CC} = 3.0 V to 3.6 V | - | 0.1 | 10 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A | | | | |
| | | V _{CC} = 1.4 V to 2.7 V | - | 0.1 | 20 | μA |
| | | V _{CC} = 3.0 V to 3.6 V | - | 0.2 | 40 | μA |
| I _{BHL} | bus hold LOW current | V _{CC} = 1.65 V; V _I = 0.35 × V _{CC} | 25 | - | - | μA |
| | | V _{CC} = 2.3 V; V _I = 0.7 V | 45 | - | - | μA |
| | | V _{CC} = 3.0 V; V _I = 0.8 V | 75 | - | - | μA |
| I _{BHH} | bus hold HIGH current | V _{CC} = 1.65 V; V _I = 0.35 × V _{CC} | -25 | - | - | μA |
| | | V _{CC} = 2.3 V; V _I = 0.35 × V _{CC} | -45 | - | - | μA |
| | | V _{CC} = 3.0 V; V _I = 0.35 × V _{CC} | -75 | - | - | μA |
| I _{BHLO} | bus hold LOW overdrive current | V _{CC} = 1.95 V | 200 | - | - | μA |
| | | V _{CC} = 2.7 V | 300 | - | - | μA |
| | | V _{CC} = 3.6 V | 450 | - | - | μA |
| I _{BHHO} | bus hold HIGH overdrive current | V _{CC} = 1.95 V | -200 | - | - | μA |
| | | V _{CC} = 2.7 V | -300 | - | - | μA |
| | | V _{CC} = 3.6 V | -450 | - | - | μA |
| C _I | input capacitance | | - | 5.0 | - | pF |

[1] All typical values are measured at T_{amb} = 25 °C.

9.1 Graphs



10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Figure 8.

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | Unit |
|-----------|-------------------|---|------------------|--------------------|-----|------|
| | | | Min | Typ ^[2] | Max | |
| t_{pd} | propagation delay | nAn to nBn ; nBn to nAn ; see Figure 6 ^[1] | | | | |
| | | $V_{CC} = 1.2 V$ | - | 5.4 | - | ns |
| | | $V_{CC} = 1.4 V$ to $1.6 V$ | - | 3.1 | - | ns |
| | | $V_{CC} = 1.65 V$ to $1.95 V$ | 1.4 | 2.3 | 3.3 | ns |
| | | $V_{CC} = 2.3 V$ to $2.7 V$ | 0.5 | 1.6 | 2.2 | ns |
| | | $V_{CC} = 3.0 V$ to $3.6 V$ | 0.7 | 1.4 | 2.0 | ns |
| t_{en} | enable time | \overline{nOE} to nAn , nBn ; see Figure 7 ^[1] | | | | |
| | | $V_{CC} = 1.2 V$ | - | 7.4 | - | ns |
| | | $V_{CC} = 1.4 V$ to $1.6 V$ | - | 6.4 | - | ns |
| | | $V_{CC} = 1.65 V$ to $1.95 V$ | 1.4 | 4.4 | 7.0 | ns |
| | | $V_{CC} = 2.3 V$ to $2.7 V$ | 1.0 | 2.8 | 4.3 | ns |
| | | $V_{CC} = 3.0 V$ to $3.6 V$ | 0.7 | 2.3 | 3.7 | ns |
| t_{dis} | disable time | \overline{nOE} to nAn , nBn ; see Figure 7 ^[1] | | | | |
| | | $V_{CC} = 1.2 V$ | - | 7.3 | - | ns |
| | | $V_{CC} = 1.4 V$ to $1.6 V$ | - | 5.7 | - | ns |
| | | $V_{CC} = 1.65 V$ to $1.95 V$ | 2.2 | 4.2 | 7.0 | ns |
| | | $V_{CC} = 2.3 V$ to $2.7 V$ | 1.1 | 2.3 | 5.4 | ns |
| | | $V_{CC} = 3.0 V$ to $3.6 V$ | 1.2 | 2.5 | 3.9 | ns |

Table 7. Dynamic characteristics ...continued

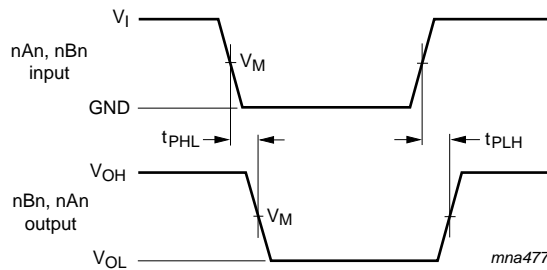
Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 8](#).

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | Unit |
|-----------------|-------------------------------|--|------------------|--------------------|-----|------|
| | | | Min | Typ ^[2] | Max | |
| C _{PD} | power dissipation capacitance | per input; V _I = GND to V _{CC} | | | | |
| | | outputs enabled | - | 42 | - | pF |
| | | outputs disabled | - | 2 | - | pF |

- [1] t_{pd} is the same as t_{PLH} and t_{PHL}.
t_{en} is the same as t_{PZL} and t_{PZH}.
t_{dis} is the same as t_{PLZ} and t_{PHZ}.
- [2] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.2 V, 1.5 V, 1.8 V, 2.5 V and 3.3 V respectively.
- [3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

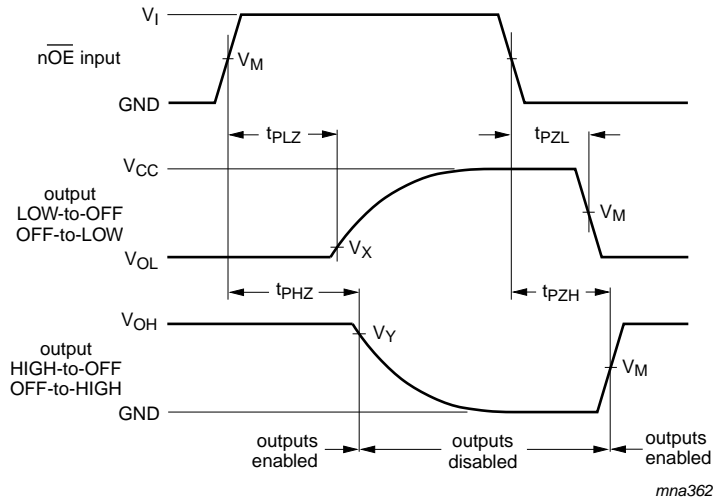
$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$$
 where:
 f_i = input frequency in MHz; f_o = output frequency in MHz
 C_L = output load capacitance in pF
 V_{CC} = supply voltage in Volts
 N = number of inputs switching
 Σ(C_L × V_{CC}² × f_o) = sum of the outputs.

11. Waveforms



Measurement points are given in [Table 8](#).
 Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 6. The input (nAn, nBn) to output (nBn, nAn) propagation delays



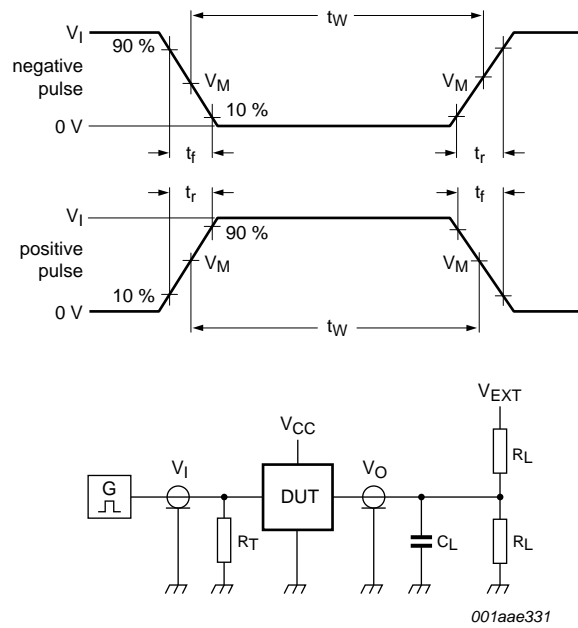
Measurement points are given in [Table 8](#).

Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 7. 3-state enable and disable times

Table 8. Measurement points

| Supply voltage | V_M | Input | | | |
|------------------|---------------------|----------|-------------|-------------------|-------------------|
| | | V_I | $t_r = t_f$ | V_X | V_Y |
| 1.2 V | $0.5 \times V_{CC}$ | V_{CC} | ≤ 2 ns | $V_{OL} + 0.15$ V | $V_{OH} - 0.15$ V |
| 1.4 V to 1.6 V | $0.5 \times V_{CC}$ | V_{CC} | ≤ 2 ns | $V_{OL} + 0.15$ V | $V_{OH} - 0.15$ V |
| 1.65 V to 1.95 V | $0.5 \times V_{CC}$ | V_{CC} | ≤ 2 ns | $V_{OL} + 0.15$ V | $V_{OH} - 0.15$ V |
| 2.3 V to 2.7 V | $0.5 \times V_{CC}$ | V_{CC} | ≤ 2 ns | $V_{OL} + 0.15$ V | $V_{OH} - 0.15$ V |
| 3.0 V to 3.6 V | $0.5 \times V_{CC}$ | V_{CC} | ≤ 2 ns | $V_{OL} + 0.3$ V | $V_{OH} - 0.3$ V |



Test data is given in [Table 9](#).

Definitions for 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 8. Test circuit for measuring switching times

Table 9. Test data

| Supply voltage | Input | | Load | | V_{EXT} | | |
|------------------|----------|-------------|-------|--------------|--------------------|--------------------|--------------------|
| | V_I | t_r, t_f | C_L | R_L | t_{PLH}, t_{PHL} | t_{PLZ}, t_{PZL} | t_{PHZ}, t_{PZH} |
| 1.2 V | V_{CC} | ≤ 2 ns | 15 pF | 2 k Ω | open | $2 \times V_{CC}$ | GND |
| 1.4 V to 1.6 V | V_{CC} | ≤ 2 ns | 15 pF | 2 k Ω | open | $2 \times V_{CC}$ | GND |
| 1.65 V to 1.95 V | V_{CC} | ≤ 2 ns | 30 pF | 1 k Ω | open | $2 \times V_{CC}$ | GND |
| 2.3 V to 2.7 V | V_{CC} | ≤ 2 ns | 30 pF | 500 Ω | open | $2 \times V_{CC}$ | GND |
| 3.0 V to 3.6 V | V_{CC} | ≤ 2 ns | 30 pF | 500 Ω | open | $2 \times V_{CC}$ | GND |

12. Package outline

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

SOT362-1

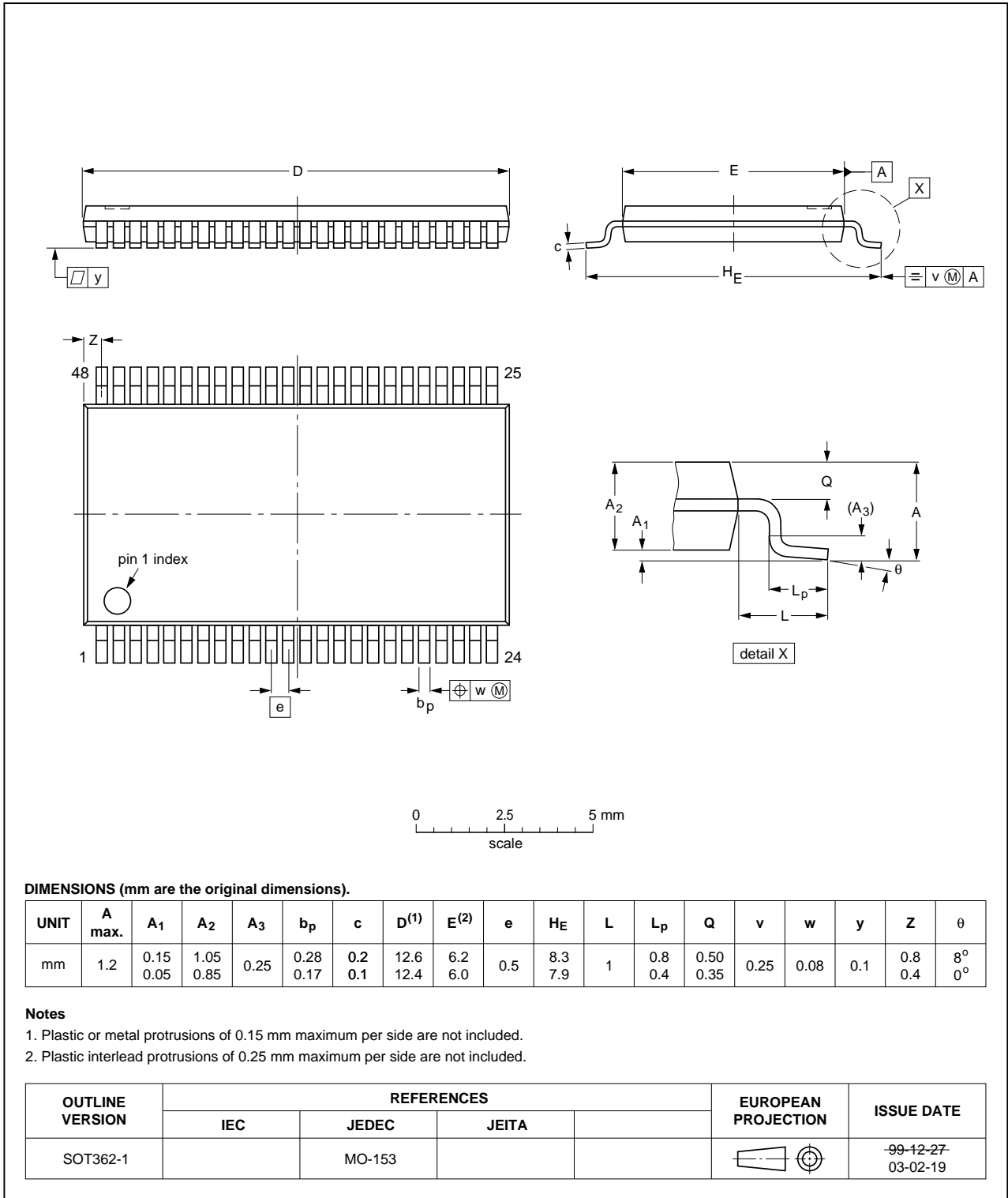


Fig 9. Package outline SOT362-1 (TSSOP48)

13. Abbreviations

Table 10. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| TTL | Transistor-Transistor Logic |

14. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Order number | Supersedes |
|-----------------|---|-----------------------|---------------|--------------|-----------------|
| 74AVCH16245 v.3 | 20130108 | Product data sheet | - | - | 74AVCH16245 v.2 |
| Modifications: | <ul style="list-style-type: none"> • ΔI_{CC} removed (errata). | | | | |
| 74AVCH16245 v.2 | 20120828 | Product data sheet | - | - | 74AVCH16245 v.1 |
| Modifications: | <ul style="list-style-type: none"> • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Ordering information table corrected (errata).ΔI_{CC} | | | | |
| 74AVCH16245 v.1 | 20000307 | Product specification | - | - | - |

15. Legal information

15.1 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 URL <http://www.nexperia.com>.

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16. Contact information

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For sales office addresses, please send an email to: salesaddresses@nexperia.com

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Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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