# 74ALVC16244; 74ALVCH16244

## 2.5 V / 3.3 V 16-bit buffer/line driver; 3-state

Rev. 6 — 22 July 2021 Product data sheet

## 1. General description

The 74ALVC16244; 74ALVCH16244 is a 16-bit buffer/line driver with 3-state outputs. The device can be used as four 4-bit buffers, two 8-bit buffers or one 16-bit buffer. The device features four output enables (1$\overline{OE}$, 2$\overline{OE}$, 3$\overline{OE}$ and 4$\overline{OE}$), each controlling four of the 3-state outputs. A HIGH on n$\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. This device is fully specified for partial power down applications using $I_{OFF}$. The $I_{OFF}$ circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

The 74ALVCH16244 has active bus hold circuitry which is provided 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
- CMOS low power consumption
- MultiByte flow-through standard pin-out architecture
- Low inductance multiple $V_{CC}$ and GND pins for minimum noise and ground bounce
- Overvoltage tolerant inputs to 5.5 V
- Direct interface with TTL levels
- $I_{OFF}$ circuitry provides partial Power-down mode operation
- All data inputs have bushold (74ALVCH16244 only)
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8C (2.7 V to 3.6 V)
- Output drive capability 50 Ω transmission lines at 85 °C
- Current drive ±24 mA at 3.0 V
- ESD protection:
  - HBM JESD22-A114-A 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 |
| 74ALVC16244DGG | -40 °C to +85 °C | TSSOP48 | plastic thin shrink small outline package; 48 leads; body width 6.1 mm | SOT362-1 |
| 74ALVCH16244DGG | | | | |

## 4. Functional diagram

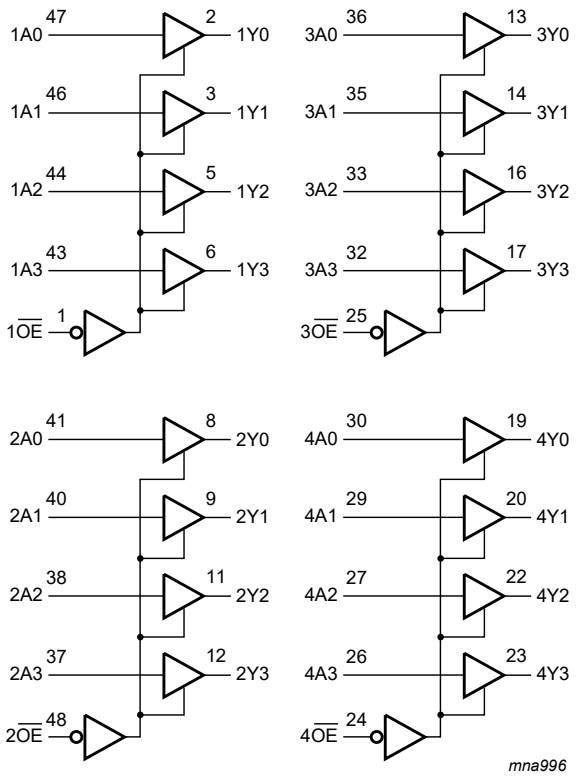



Fig. 1. Logic symbol

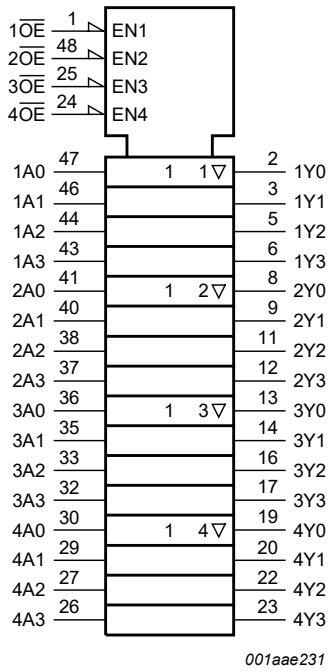



Fig. 2. IEC logic symbol

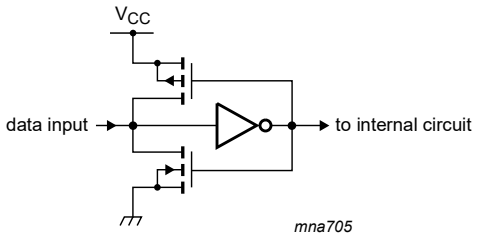



Fig. 3. Bus hold circuit

# 5. Pinning information

## 5.1. Pinning

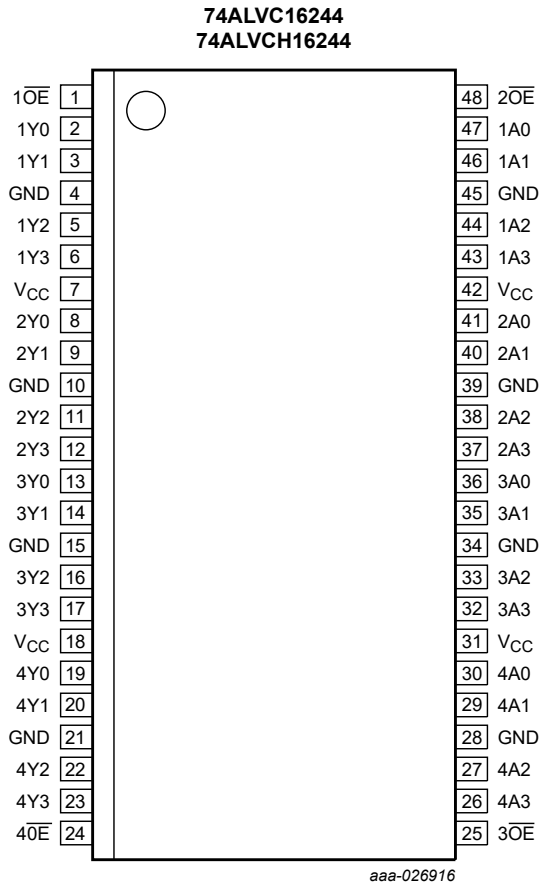



**Fig. 4. Pin configuration SOT362-1 (TSSOP48)**

## 5.2. Pin description

**Table 2. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| $1\overline{OE}$, $2\overline{OE}$, $3\overline{OE}$, $4\overline{OE}$ | 1, 48, 25, 24 | output enable inputs (active LOW) |
| 1A0, 1A1, 1A2, 1A3 | 47, 46, 44, 43 | data inputs |
| 2A0, 2A1, 2A2, 2A3 | 41, 40, 38, 37 | data inputs |
| 3A0, 3A1, 3A2, 3A3 | 36, 35, 33, 32 | data inputs |
| 4A0, 4A1, 4A2, 4A3 | 30, 29, 27, 26 | data inputs |
| 1Y0, 1Y1, 1Y2, 1Y3 | 2, 3, 5, 6 | data outputs |
| 2Y0, 2Y1, 2Y2, 2Y3 | 8, 9, 11, 12 | data outputs |
| 3Y0, 3Y1, 3Y2, 3Y3 | 13, 14, 16, 17 | data outputs |
| 4Y0, 4Y1, 4Y2, 4Y3 | 19, 20, 22, 23 | data outputs |
| GND | 4, 10, 15, 21, 28, 34, 39, 45 | ground (0 V) |
| $V_{CC}$ | 7, 18, 31, 42 | supply voltage |

# 6. Functional description

**Table 3. Function table**

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

| Input | | Output |
|---|---|---|
| **n$\overline{OE}$** | **nAn** | **nYn** |
| L | L | L |
| L | H | H |
| H | X | 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 |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | | -0.5 | +4.6 | V |
| $V_I$ | input voltage | 74ALVCH16244; data inputs | [1] | -0.5 | $V_{CC}$ + 0.5 | V |
| | | 74ALVC16244; data inputs | [1] | -0.5 | +5.5 | V |
| | | control inputs | [1] | -0.5 | +5.5 | V |
| $V_O$ | output voltage | | [1] | -0.5 | $V_{CC}$ + 0.5 | V |
| $I_{IK}$ | input clamping current | $V_I$ < 0 V | | -50 | - | mA |
| $I_{OK}$ | output clamping current | $V_O$ > $V_{CC}$ or $V_O$ < 0 V | | - | ±50 | mA |
| $I_O$ | 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 +85 °C | | - | 500 | mW |

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

# 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | maximum speed performance | | | |
| | | $V_{CC}$ = 2.5 V: $C_L$ = 30 pF | 2.3 | 2.7 | V |
| | | $V_{CC}$ = 3.3 V: $C_L$ = 50 pF | 3.0 | 3.6 | V |
| | | LOW-voltage applications | 1.2 | 3.6 | V |
| $V_I$ | input voltage | 74ALVCH16244; data inputs | 0 | $V_{CC}$ | V |
| | | 74ALVC16244; data inputs | 0 | 5.5 | V |
| | | control inputs | 0 | 5.5 | V |
| $V_O$ | output voltage | | 0 | $V_{CC}$ | V |
| $T_{amb}$ | ambient temperature | in free air | -40 | +85 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC}$ = 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). $T_{amb}$ = -40 °C to +85 °C*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 1.2 V | $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 1.8 V | 0.7 × $V_{CC}$ | 0.9 | - | V |
| | | $V_{CC}$ = 2.3 to 2.7 V | 1.7 | 1.2 | - | V |
| | | $V_{CC}$ = 2.7 to 3.6 V | 2.0 | 1.5 | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 1.2 V | - | - | GND | V |
| | | $V_{CC}$ = 1.8 V | - | 0.9 | 0.2 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 to 2.7 V | - | 1.2 | 0.7 | V |
| | | $V_{CC}$ = 2.7 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; $V_{CC}$ = 1.8 V to 3.6 V | $V_{CC}$ - 0.2 | $V_{CC}$ | - | V |
| | | $I_O$ = -6 mA; $V_{CC}$ = 1.8 V | $V_{CC}$ - 0.4 | $V_{CC}$ - 0.10 | - | V |
| | | $I_O$ = -6 mA; $V_{CC}$ = 2.3 V | $V_{CC}$ - 0.3 | $V_{CC}$ - 0.08 | - | V |
| | | $I_O$ = -12 mA; $V_{CC}$ = 2.3 V | $V_{CC}$ - 0.5 | $V_{CC}$ - 0.17 | - | V |
| | | $I_O$ = -18 mA; $V_{CC}$ = 2.3 V | $V_{CC}$ - 0.6 | $V_{CC}$ - 0.26 | - | V |
| | | $I_O$ = -12 mA; $V_{CC}$ = 2.7 V | $V_{CC}$ - 0.5 | $V_{CC}$ - 0.14 | - | V |
| | | $I_O$ = -24 mA; $V_{CC}$ = 3.0 V | $V_{CC}$ - 1.0 | $V_{CC}$ - 0.28 | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 100 µA; $V_{CC}$ = 1.8 V to 3.6 V | - | GND | 0.20 | V |
| | | $I_O$ = 6 mA; $V_{CC}$ = 1.8 V | - | 0.09 | 0.30 | V |
| | | $I_O$ = 6 mA; $V_{CC}$ = 2.3 V | - | 0.07 | 0.20 | V |
| | | $I_O$ = 12 mA; $V_{CC}$ = 2.3 V | - | 0.15 | 0.40 | V |
| | | $I_O$ = 18 mA; $V_{CC}$ = 2.3 V | - | 0.23 | 0.60 | V |
| | | $I_O$ = 12 mA; $V_{CC}$ = 2.7 V | - | 0.14 | 0.40 | V |
| | | $I_O$ = 24 mA; $V_{CC}$ = 3.0 V | - | 0.27 | 0.55 | V |

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Unit |
|---|---|---|---|---|---|---|
| $I_I$ | input leakage current | 74ALVCH16244; data inputs; $V_I = V_{CC}$ or GND; $V_{CC}$ = 1.8 V to 3.6 V | - | 0.1 | 5 | µA |
| | | 74ALVC16244; data inputs; $V_I$ = 5.5 V or GND; $V_{CC}$ = 1.8 V to 3.6 V | - | 0.1 | 5 | µA |
| | | control inputs; $V_I$ = 5.5 V or GND; $V_{CC}$ = 1.8 V to 3.6 V | - | 0.1 | 5 | µA |
| $I_{BHL}$ | bus hold LOW current | $V_{CC}$ = 2.3 V; $V_I$ = 0.7 V [2] | 45 | - | - | µA |
| | | $V_{CC}$ = 3.0 V; $V_I$ = 0.8 V [2] | 75 | 150 | - | µA |
| $I_{BHH}$ | bus hold HIGH current | $V_{CC}$ = 2.3 V; $V_I$ = 1.7 V [2] | -45 | - | - | µA |
| | | $V_{CC}$ = 3.0 V; $V_I$ = 2.0 V [2] | -75 | -175 | - | µA |
| $I_{BHLO}$ | bus hold LOW overdrive current | $V_{CC}$ = 2.7 V [2] | 300 | - | - | µA |
| | | $V_{CC}$ = 3.6 V [2] | 450 | - | - | µA |
| $I_{BHHO}$ | bus hold HIGH overdrive current | $V_{CC}$ = 2.7 V [2] | -300 | - | - | µA |
| | | $V_{CC}$ = 3.6 V [2] | -450 | - | - | µA |
| $I_{OZ}$ | OFF-state output current | $V_{CC}$ = 1.8 to 2.7 V; $V_I = V_{IH}$ or $V_{IL}$; $V_O = V_{CC}$ or GND | - | 0.1 | 5 | µA |
| | | $V_{CC}$ = 3.6 V; $V_I = V_{IH}$ or $V_{IL}$; $V_O = V_{CC}$ or GND | - | 0.1 | 10 | µA |
| $I_{CC}$ | supply current | $V_{CC}$ = 1.8 to 2.7 V; $V_I = V_{CC}$ or GND; $I_O$ = 0 A | - | 0.1 | 20 | µA |
| | | $V_{CC}$ = 2.3 to 3.6 V; $V_I = V_{CC}$ or GND; $I_O$ = 0 A | - | 0.2 | 40 | µA |
| $\Delta I_{CC}$ | additional supply current | per input pin; $V_I = V_{CC}$ - 0.6 V; $I_O$ = 0 A; $V_{CC}$ = 2.7 V to 3.6 V | | | | |
| | | 74ALVCH16244; data inputs | - | 150 | 750 | µA |
| | | 74ALVC16244; data inputs | - | 5 | 500 | µA |
| | | control pins | - | 5 | 500 | µA |
| $C_I$ | input capacitance | | - | 5.0 | - | pF |

[1] All typical values are measured at $T_{amb}$ = 25 °C.
[2] Valid for data inputs of bus hold parts.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V). For test circuit, see Fig. 7.*

| Symbol | Parameter | Conditions | $T_{amb}$ = -40 °C to +85 °C | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | |
| $t_{pd}$ | propagation delay | nAn to nYn; see Fig. 5 [2] | | | | |
| | | $V_{CC}$ = 1.2 V | - | 5.8 | - | ns |
| | | $V_{CC}$ = 1.8 V | 1.5 | 2.8 | 5.1 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.0 | 1.9 | 3.7 | ns |
| | | $V_{CC}$ = 2.7 V | 1.0 | 2.1 | 3.6 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.0 | 1.9 | 3.0 | ns |
| $t_{en}$ | enable time | $n\overline{OE}$ to nYn; see Fig. 6 [3] | | | | |
| | | $V_{CC}$ = 1.2 V | - | 8.4 | - | ns |
| | | $V_{CC}$ = 1.8 V | 1.5 | 3.8 | 7.1 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.0 | 2.5 | 4.9 | ns |
| | | $V_{CC}$ = 2.7 V | 1.0 | 2.9 | 4.9 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.0 | 2.3 | 4.0 | ns |
| $t_{dis}$ | disable time | $n\overline{OE}$ to nYn; see Fig. 6 [4] | | | | |
| | | $V_{CC}$ = 1.2 V | - | 5.9 | - | ns |
| | | $V_{CC}$ = 1.8 V | 1.5 | 3.1 | 5.4 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.0 | 2.1 | 4.1 | ns |
| | | $V_{CC}$ = 2.7 V | 1.0 | 3.0 | 4.5 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.0 | 2.7 | 4.1 | ns |
| $C_{PD}$ | power dissipation capacitance | per buffer; $V_I$ = GND to $V_{CC}$ [5] | | | | |
| | | outputs enabled | - | 25 | - | pF |
| | | outputs disabled | - | 4 | - | pF |

[1] Typical values are measured at $T_{amb}$ = 25 °C
Typical values for $V_{CC}$ = 2.3 V to 2.7 V are measured at $V_{CC}$ = 2.5 V
Typical values for $V_{CC}$ = 3.0 V to 3.6 V are measured at $V_{CC}$ = 3.3 V

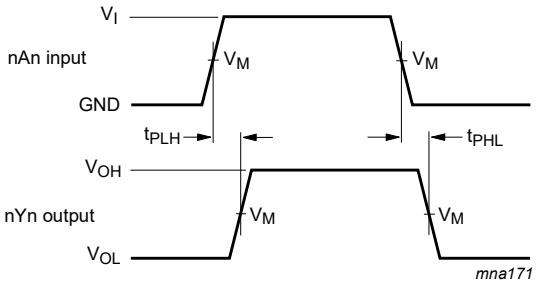
[2] $t_{pd}$ is the same as $t_{PHL}$ and $t_{PLH}$.

[3] $t_{en}$ is the same as $t_{PZH}$ and $t_{PZL}$.

[4] $t_{dis}$ is the same as $t_{PHZ}$ and $t_{PLZ}$.

[5] $C_{PD}$ 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 = total load switching outputs
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs

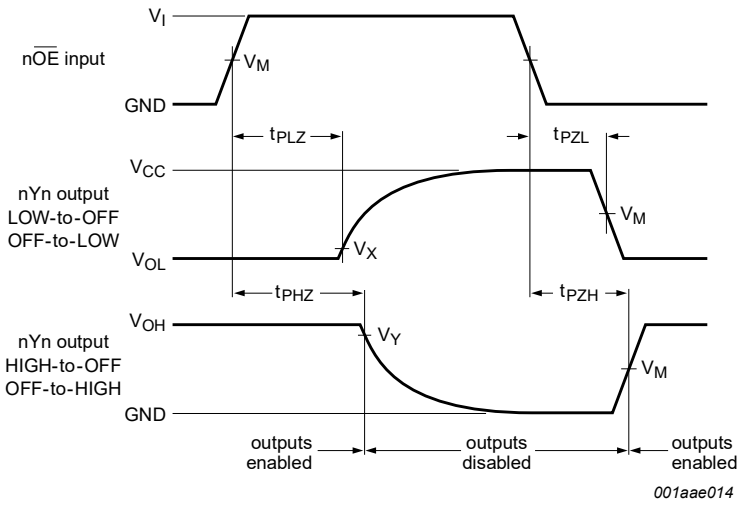
## 10.1. Waveforms and test circuit




Measurement points are given in Table 8.

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

**Fig. 5. The input (nAn) to output (nYn) propagation delays**



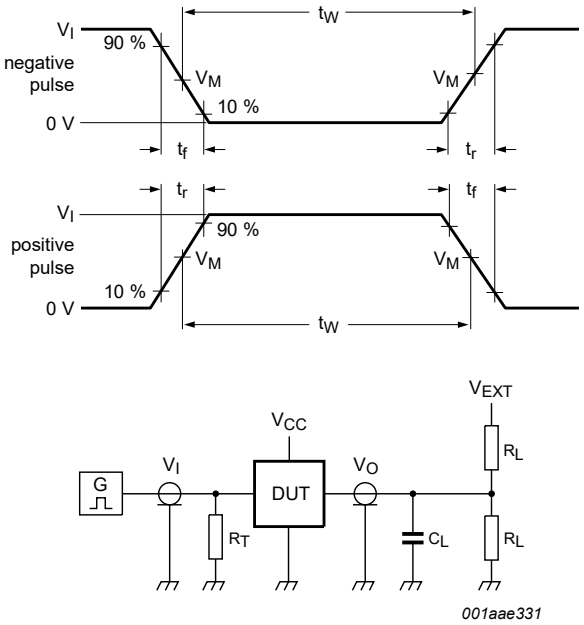

Measurement points are given in Table 8.

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

**Fig. 6. 3-state enable and disable times**

**Table 8. Measurement points**

| Supply voltage | Input | | Output | | |
|---|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $V_M$ | $V_M$ | $V_X$ | $V_Y$ |
| 1.2 | $V_{CC}$ | 0.5 x $V_{CC}$ | 0.5$V_{CC}$ | $V_{OL}$ + 0.15 V | $V_{OH}$ - 0.15 V |
| 1.8 V | $V_{CC}$ | 0.5 x $V_{CC}$ | 0.5$V_{CC}$ | $V_{OL}$ + 0.15 V | $V_{OH}$ - 0.15 V |
| 2.3 V to 2.7 V | $V_{CC}$ | 0.5 x $V_{CC}$ | 0.5$V_{CC}$ | $V_{OL}$ + 0.15 V | $V_{OH}$ - 0.15 V |
| 2.7 V | 2.7 V | 1.5 V | 1.5 V | $V_{OL}$ + 0.3 V | $V_{OH}$ - 0.3 V |
| 3.0 V to 3.6 V | 2.7 V | 1.5 V | 1.5 V | $V_{OL}$ + 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.

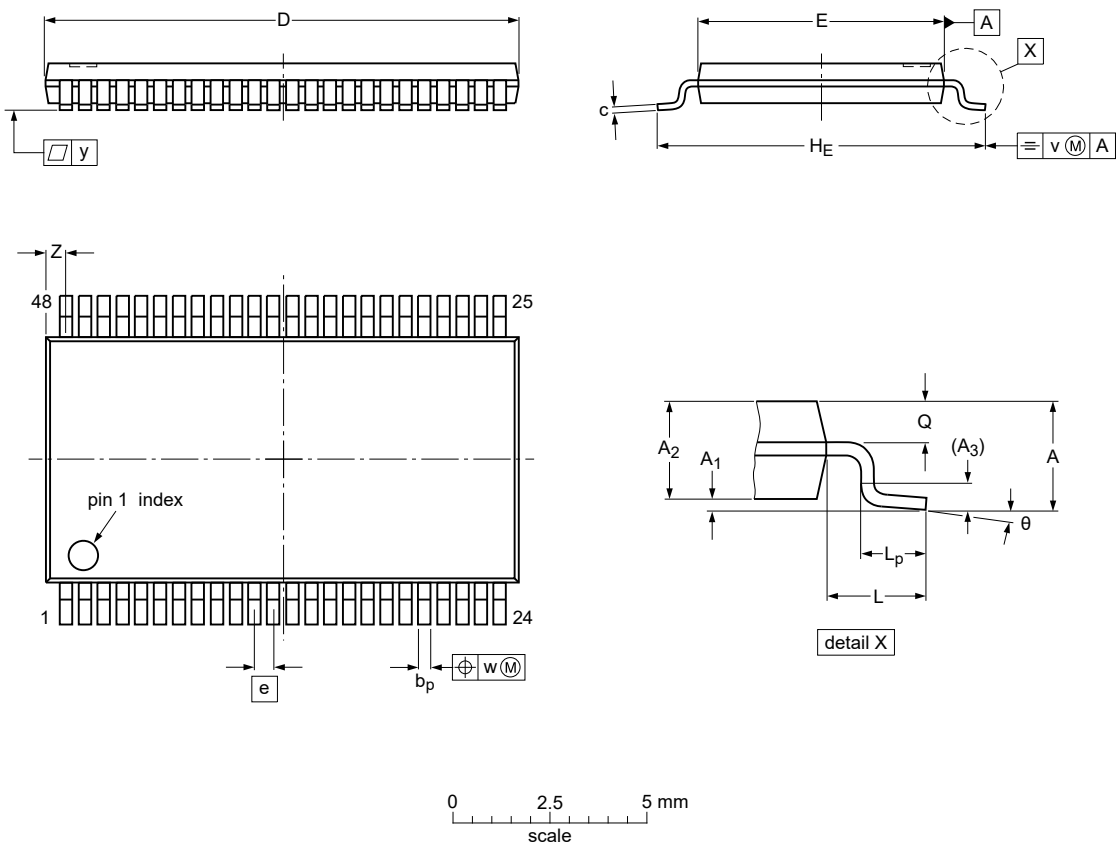
**Fig. 7. Test circuit for measuring switching times**

**Table 9. Test data**

| Supply voltage | Input | | Load | | $V_{EXT}$ | | |
|---|---|---|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $t_r$, $t_f$ | $C_L$ | $R_L$ | $t_{PLH}$, $t_{PHL}$ | $t_{PLZ}$, $t_{PZL}$ | $t_{PHZ}$, $t_{PZH}$ |
| 1.2 V | $V_{CC}$ | ≤ 2.0 ns | 30 pF | 500 Ω | open | 2 × $V_{CC}$ | GND |
| 1.8 V | $V_{CC}$ | ≤ 2.0 ns | 30 pF | 500 Ω | open | 2 × $V_{CC}$ | GND |
| 2.3 V to 2.7 V | $V_{CC}$ | ≤ 2.0 ns | 30 pF | 500 Ω | open | 2 × $V_{CC}$ | GND |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open | 2 × $V_{CC}$ | GND |
| 3.0 V to 3.6 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open | 2 × $V_{CC}$ | GND |

# 11. Package outline

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




Dimensions (mm are the original dimensions)

| Unit | A | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(2)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm max | | 0.15 | 1.05 | | 0.28 | 0.2 | 12.6 | 6.2 | | 8.3 | | 0.8 | 0.50 | | | | 0.8 | 8° |
| mm nom | 1.2 | | | 0.25 | | | | | 0.5 | | 1 | | | 0.25 | 0.08 | 0.1 | | |
| mm min | | 0.05 | 0.85 | | 0.17 | 0.1 | 12.4 | 6.0 | | 7.9 | | 0.4 | 0.35 | | | | 0.4 | 0° |

Note
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

*sot362-1_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT362-1 | | MO-153 | | | | ~~03-02-19~~ 13-08-05 |

**Fig. 8. Package outline SOT362-1 (TSSOP48)**

## 12. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description |
|---|---|
| CMOS | 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 |
|---|---|---|---|---|
| 74ALVC_ALVCH16244 v.6 | 20210722 | Product data sheet | - | 74ALVC_ALVCH16244 v.5 |
| Modifications: | • Type number 74ALVC16244DL (SOT370-1/SSOP48) removed.<br>• Section 1 and Section 2 updated.<br>• Section 7: derating values for $P_{tot}$ total power dissipation updated. | | | |
| 74ALVC_ALVCH16244 v.5 | 20190115 | Product data sheet | - | 74ALVC_ALVCH16244 v.4 |
| Modifications: | • Type number 74ALVCH16244DL (SOT370-1) removed. | | | |
| 74ALVC_ALVCH16244 v.4 | 20170612 | Product data sheet | - | 74ALVC_ALVCH16244 v.3 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate. | | | |
| 74ALVC_ALVCH16244 v.3 | 20030514 | Product specification | - | 74ALVC_ALVCH16244 v.2 |
| 74ALVC_ALVCH16244 v.2 | 19980629 | Product specification | - | 74ALVCH16244 v.1 |
| 74ALVCH16244 v.1 | 19970321 | 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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