# DATA SHEET

## 74ALVCH162244

16-bit buffer/line driver
with 30Ω termination resistor (3-State)

Product specification

1998 Jun 29

IC24 Data Handbook

Philips
Semiconductors

PHILIPS

# 16-bit buffer/line driver with 30Ω termination resistor (3-State)

# 74ALVCH162244

## FEATURES

- Wide supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A
- CMOS low power consumption
- MULTIBYTE™ flow-through standard pin-out architecture
- Low inductance multiple $V_{CC}$ and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- Bus hold on all data inputs
- Integrated 30Ω termination resistor

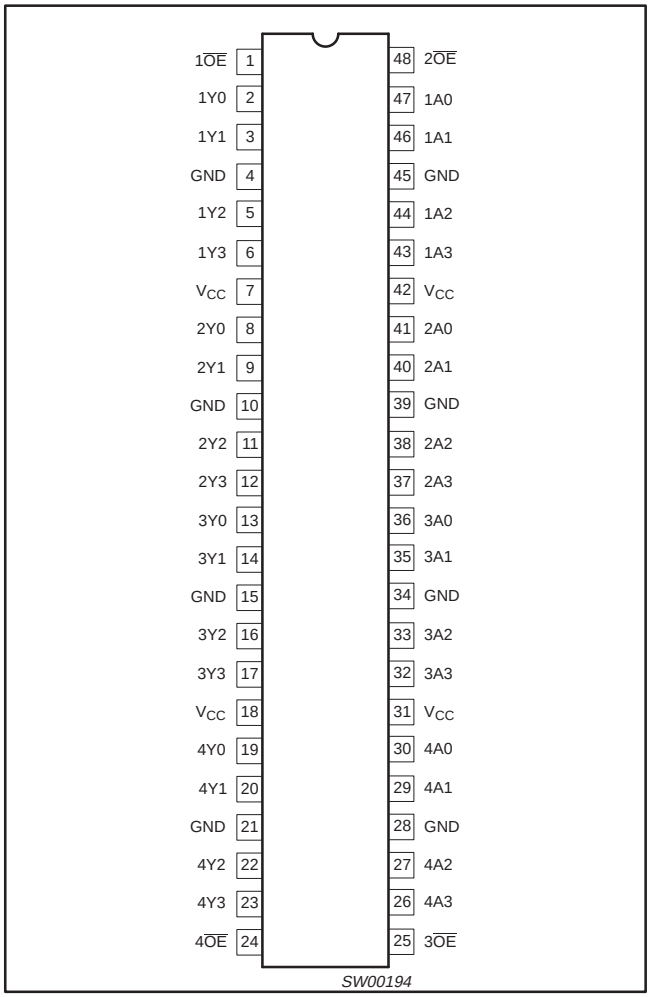
## DESCRIPTION

The 74ALVCH162244 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

The 74ALVCH162244 is a 16-bit non-inverting 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 3-State outputs are controlled by the output enable inputs $1\overline{OE}$ and $2\overline{OE}$. A HIGH on $n\overline{OE}$ causes the outputs to assume a high impedance OFF-state. The 74ALVCH162244 is designed with 30Ω series resistors in both HIGH and LOW output states.

The 74ALVCH162244 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.

## PIN CONFIGURATION




## QUICK REFERENCE DATA

GND = 0 V; $T_{amb}$ = 25°C; $t_r = t_f \leq 2.5$ ns

| SYMBOL | PARAMETER | CONDITIONS | | TYPICAL | UNIT |
|---|---|---|---|---|---|
| $t_{PHL}/t_{PLH}$ | Propagation delay An to Yn | $V_{CC}$ = 2.5V, $C_L$ = 30pF<br>$V_{CC}$ = 3.3V, $C_L$ = 50pF | | 3.0<br>2.7 | ns |
| $C_I$ | Input capacitance | | | 5.0 | pF |
| $C_{PD}$ | Power dissipation capacitance per buffer | $V_I$ = GND to $V_{CC}$[1] | Outputs enabled | 25 | pF |
| | | | Outputs disabled | 4 | |

**NOTES:**

1. $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW):
   $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where: $f_i$ = input frequency in MHz; $C_L$ = output load capacitance in pF; $f_o$ = output frequency in MHz; $V_{CC}$ = supply voltage in V; $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

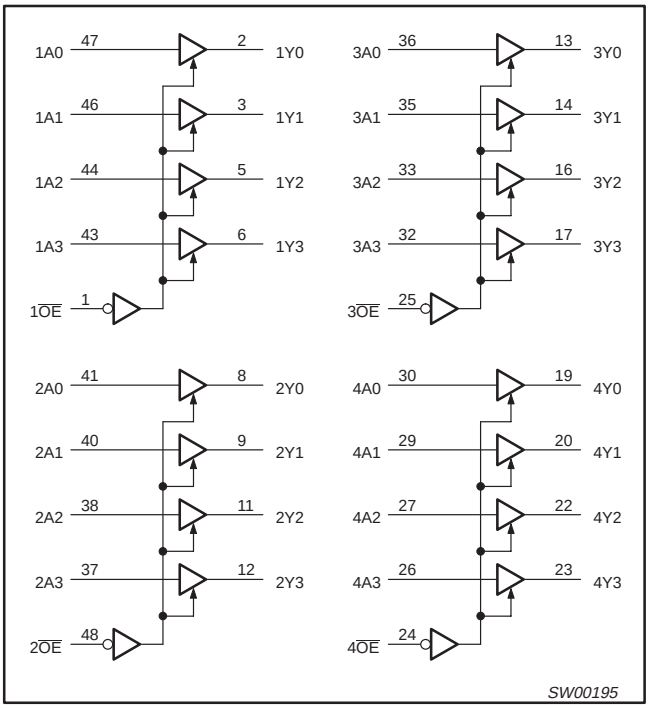
## ORDERING INFORMATION

| PACKAGES | TEMPERATURE RANGE | OUTSIDE NORTH AMERICA | NORTH AMERICA | DWG NUMBER |
|---|---|---|---|---|
| 48-Pin Plastic SSOP Type III | –40°C to +85°C | 74ALVCH162244 DL | ACH162244 DL | SOT370-1 |
| 48-Pin Plastic TSSOP Type II | –40°C to +85°C | 74ALVCH162244 DGG | ACH162244 DGG | SOT362-1 |

## PIN DESCRIPTION

| PIN NUMBER | SYMBOL | NAME AND FUNCTION |
|---|---|---|
| 1 | $1\overline{OE}$ | Output enable input (active LOW) |
| 2, 3, 5, 6 | 1Y0 to 1Y3 | Data outputs |
| 4, 10, 15, 21, 28, 34, 39, 45 | GND | Ground (0V) |
| 7, 18, 31, 42 | $V_{CC}$ | Positive supply voltage |
| 8, 9, 11, 12 | 2Y0 to 2Y3 | Data outputs |
| 13, 14, 16, 17 | 3Y0 to 3Y3 | |
| 19, 20, 22, 23 | 4Y0 to 4Y3 | |
| 24 | $4\overline{OE}$ | Output enable input (active LOW) |
| 25 | $3\overline{OE}$ | Output enable input (active LOW) |
| 30, 29, 27, 26 | 4A0 to 4A3 | Data inputs |
| 36, 35, 33, 32 | 3A0 to 3A3 | |
| 41, 40, 38, 37 | 2A0 to 2A3 | |
| 47, 46, 44, 43 | 1A0 to 1A3 | |
| 48 | $2\overline{OE}$ | Output enable input (active LOW) |

## LOGIC SYMBOL

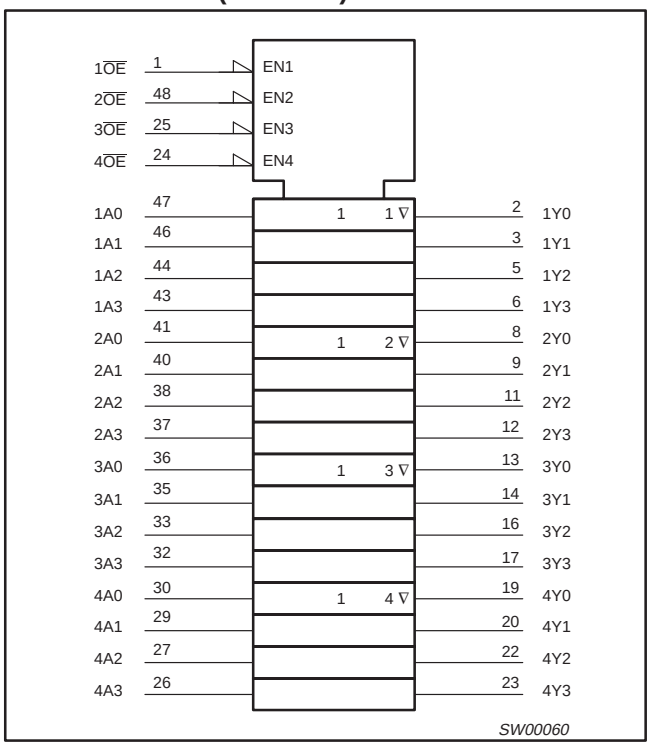



## FUNCTION TABLE

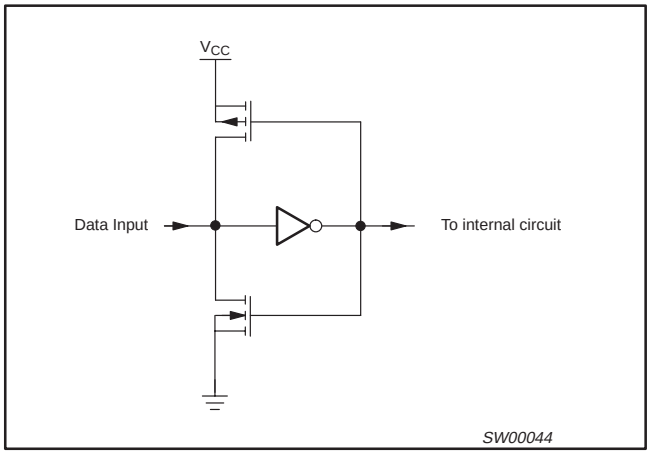
| INPUTS | | OUTPUT |
|---|---|---|
| $n\overline{OE}$ | nAn | nYn |
| L | L | L |
| L | H | H |
| H | X | Z |

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

## LOGIC SYMBOL (IEEE/IEC)




## BUS HOLD CIRCUIT



## RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | CONDITIONS | LIMITS | | UNIT |
|---|---|---|---|---|---|
| | | | MIN | MAX | |
| $V_{CC}$ | DC supply voltage 2.5V range (for max. speed performance @ 30 pF output load) | | 2.3 | 2.7 | V |
| | DC supply voltage 3.3V range (for max. speed performance @ 50 pF output load) | | 3.0 | 3.6 | |
| $V_I$ | DC Input voltage range | | 0 | $V_{CC}$ | V |
| $V_O$ | DC output voltage range | | 0 | $V_{CC}$ | V |
| $T_{amb}$ | Operating free-air temperature range | | –40 | +85 | °C |
| $t_r$, $t_f$ | Input rise and fall times | $V_{CC}$ = 2.3 to 3.0V<br>$V_{CC}$ = 3.0 to 3.6V | 0<br>0 | 20<br>10 | ns/V |

## ABSOLUTE MAXIMUM RATINGS

In accordance with the Absolute Maximum Rating System (IEC 134)
Voltages are referenced to GND (ground = 0V)

| SYMBOL | PARAMETER | CONDITIONS | RATING | UNIT |
|---|---|---|---|---|
| $V_{CC}$ | DC supply voltage | | –0.5 to +4.6 | V |
| $I_{IK}$ | DC input diode current | $V_I < 0$ | –50 | mA |
| $V_I$ | DC input voltage | For data inputs with bus hold[1] | –0.5 to $V_{CC}$ +0.5 | V |
| | | For control pins[1] | –0.5 to +4.6 | |
| $I_{OK}$ | DC output diode current | $V_O > V_{CC}$ or $V_O < 0$ | ±50 | mA |
| $V_O$ | DC output voltage | Note 1 | –0.5 to $V_{CC}$ +0.5 | V |
| $I_O$ | DC output source or sink current | $V_O$ = 0 to $V_{CC}$ | ±50 | mA |
| $I_{GND}$, $I_{CC}$ | DC $V_{CC}$ or GND current | | ±100 | mA |
| $T_{stg}$ | Storage temperature range | | –65 to +150 | °C |
| $P_{TOT}$ | Power dissipation per package<br>–plastic medium-shrink (SSOP)<br>–plastic thin-medium-shrink (TSSOP) | For temperature range: –40 to +125 °C<br>above +55°C derate linearly with 11.3 mW/K<br>above +55°C derate linearly with 8 mW/K | <br>850<br>600 | mW |

**NOTE:**
1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions. Voltage are referenced to GND (ground = 0 V).

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | Temp = -40°C to +85°C | | | |
| | | | MIN | TYP[1] | MAX | |
| $V_{IH}$ | HIGH level Input voltage | $V_{CC}$ = 2.3 to 2.7V | 1.7 | 1.2 | | V |
| | | $V_{CC}$ = 2.7 to 3.6V | 2.0 | 1.5 | | |
| $V_{IL}$ | LOW level Input voltage | $V_{CC}$ = 2.3 to 2.7V | | 1.2 | 0.7 | V |
| | | $V_{CC}$ = 2.7 to 3.6V | | 1.5 | 0.8 | |
| $V_{OH}$ | HIGH level output voltage | $V_{CC}$ = 2.3 to 3.6V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = –100µA | $V_{CC}$ – 0.2 | $V_{CC}$ | | V |
| | | $V_{CC}$ = 2.3V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = –4mA | $V_{CC}$ – 0.4 | $V_{CC}$ – 0.11 | | |
| | | $V_{CC}$ = 2.3V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = –6mA | $V_{CC}$ – 0.6 | $V_{CC}$ – 0.17 | | |
| | | $V_{CC}$ = 2.7V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = –4mA | $V_{CC}$ – 0.5 | $V_{CC}$ – 0.09 | | |
| | | $V_{CC}$ = 2.7V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = –8mA | $V_{CC}$ – 0.7 | $V_{CC}$ – 0.19 | | |
| | | $V_{CC}$ = 3.0V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = –6mA | $V_{CC}$ – 0.6 | $V_{CC}$ – 0.13 | | |
| | | $V_{CC}$ = 3.0V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = –12mA | $V_{CC}$ – 1.0 | $V_{CC}$ – 0.27 | | |
| $V_{OL}$ | LOW level output voltage | $V_{CC}$ = 2.3 to 3.6V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = 100µA | | GND | 0.20 | V |
| | | $V_{CC}$ = 2.3V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = 4mA | | 0.07 | 0.40 | |
| | | $V_{CC}$ = 2.3V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = 6mA | | 0.11 | 0.55 | |
| | | $V_{CC}$ = 2.7V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = 4mA | | 0.06 | 0.40 | |
| | | $V_{CC}$ = 2.7V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = 8mA | | 0.13 | 0.60 | |
| | | $V_{CC}$ = 3.0V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = 6mA | | 0.09 | 0.55 | |
| | | $V_{CC}$ = 3.0V; $V_I$ = $V_{IH}$ or $V_{IL}$; $I_O$ = 12mA | | 0.19 | 0.80 | |
| $I_I$ | Input leakage current | $V_{CC}$ = 2.3 to 3.6V; $V_I$ = $V_{CC}$ or GND | | 0.1 | 5 | µA |
| $I_{OZ}$ | 3-State output OFF-state current | $V_{CC}$ = 2.3 to 3.6V; $V_I$ = $V_{IH}$ or $V_{IL}$; $V_O$ = $V_{CC}$ or GND | | 0.1 | 10 | µA |
| $I_{CC}$ | Quiescent supply current | $V_{CC}$ = 2.3 to 3.6V; $V_I$ = $V_{CC}$ or GND; $I_O$ = 0 | | 0.2 | 40 | µA |
| $\Delta I_{CC}$ | Additional quiescent supply current | $V_{CC}$ = 2.3V to 3.6V; $V_I$ = $V_{CC}$ – 0.6V; $I_O$ = 0 | | 150 | 750 | µA |
| $I_{BHL}$[2] | Bus hold LOW sustaining current | $V_{CC}$ = 2.3V; $V_I$ = 0.7V | 45 | – | | µA |
| | | $V_{CC}$ = 3.0V; $V_I$ = 0.8V | 75 | 150 | | |
| $I_{BHH}$[2] | Bus hold HIGH sustaining current | $V_{CC}$ = 2.3V; $V_I$ = 1.7V | –45 | | | µA |
| | | $V_{CC}$ = 3.0V; $V_I$ = 2.0V | –75 | –175 | | |
| $I_{BHLO}$[2] | Bus hold LOW overdrive current | $V_{CC}$ = 3.6V | 500 | | | µA |
| $I_{BHHO}$[2] | Bus hold HIGH overdrive current | $V_{CC}$ = 3.6V | –500 | | | µA |

**NOTES:**

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

## AC CHARACTERISTICS FOR $V_{CC}$ = 2.3V TO 2.7V RANGE AND $V_{CC}$ < 2.3V

GND = 0V; $t_r = t_f \leq 2.0$ns; $C_L$ = 30pF

| SYMBOL | PARAMETER | WAVEFORM | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | $V_{CC}$ = 2.3 to 2.7V | | | |
| | | | MIN | TYP[1] | MAX | |
| $t_{PHL}/t_{PLH}$ | Propagation delay nAn to nYn | 1, 3 | 1.0 | 3.0 | 4.9 | ns |
| $t_{PZH}/t_{PZL}$ | 3-State output enable time n$\overline{OE}$ to nYn | 2, 3 | 1.0 | 4.0 | 6.8 | ns |
| $t_{PHZ}/t_{PLZ}$ | 3-State output disable time n$\overline{OE}$ to nYn | 2, 3 | 1.0 | 2.3 | 6.3 | ns |

**NOTES:**

1. All typical values are measured at $T_{amb}$ = 25°C and $V_{CC}$ = 2.5V.

## AC CHARACTERISTICS FOR $V_{CC}$ = 3.0V TO 3.6V RANGE AND $V_{CC}$ = 2.7V

GND = 0V; $t_r = t_f \leq 2.5$ns; $C_L$ = 50pF

| SYMBOL | PARAMETER | WAVEFORM | LIMITS | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ = 3.3 ± 0.3V | | | $V_{CC}$ = 2.7V | | | |
| | | | MIN | TYP[1, 2] | MAX | MIN | TYP[1] | MAX | |
| $t_{PHL}/t_{PLH}$ | Propagation delay nAn to nYn | 1, 3 | 1.0 | 2.7 | 4.2 | 1.0 | 3.3 | 4.7 | ns |
| $t_{PZH}/t_{PZL}$ | 3-State output enable time n$\overline{OE}$ to nYn | 2, 3 | 1.0 | 3.5 | 5.6 | 1.0 | 4.6 | 6.7 | ns |
| $t_{PHZ}/t_{PLZ}$ | 3-State output disable time n$\overline{OE}$ to nYn | 2, 3 | 1.0 | 2.9 | 5.5 | 1.0 | 3.2 | 5.7 | ns |

**NOTES:**

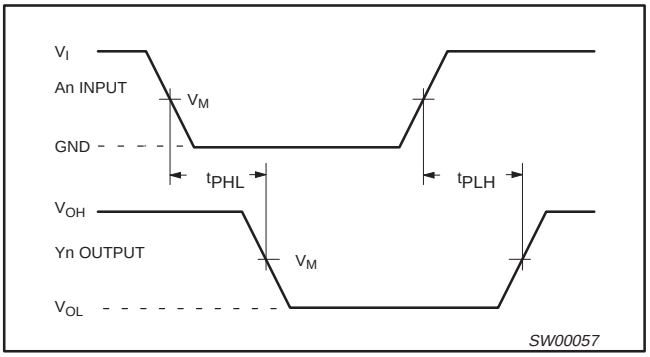
1. All typical values are measured at $T_{amb}$ = 25°C.
2. Typical value is measured at $V_{CC}$ = 3.3V

## AC WAVEFORMS FOR $V_{CC}$ = 2.3V TO 2.7V AND $V_{CC}$ < 2.3V RANGE

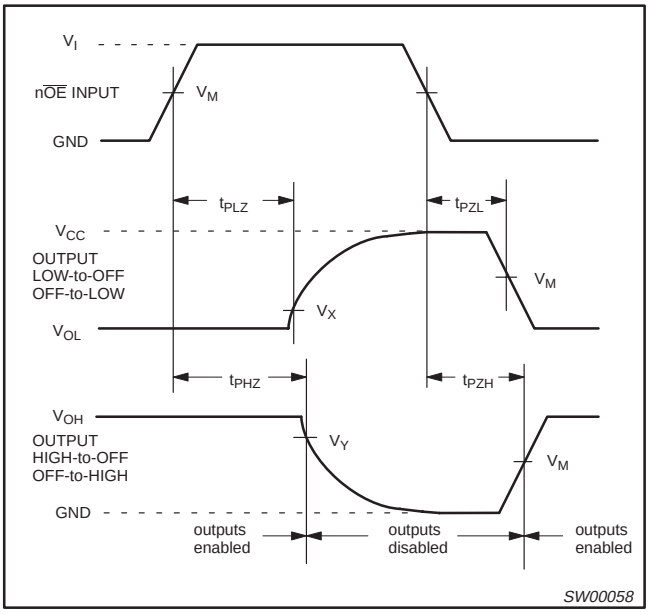
$V_M = 0.5\ V_{CC}$
$V_X = V_{OL} + 0.15V$
$V_Y = V_{OH} – 0.15V$
$V_{OL}$ and $V_{OH}$ are the typical output voltage drop that occur with the output load.
$V_I = V_{CC}$

## AC WAVEFORMS FOR $V_{CC}$ = 3.0V TO 3.6V AND $V_{CC}$ = 2.7V RANGE

$V_M = 1.5\ V$
$V_X = V_{OL} + 0.3V$
$V_Y = V_{OH} – 0.3V$
$V_{OL}$ and $V_{OH}$ are the typical output voltage drop that occur with the output load.
$V_I = 2.7V$

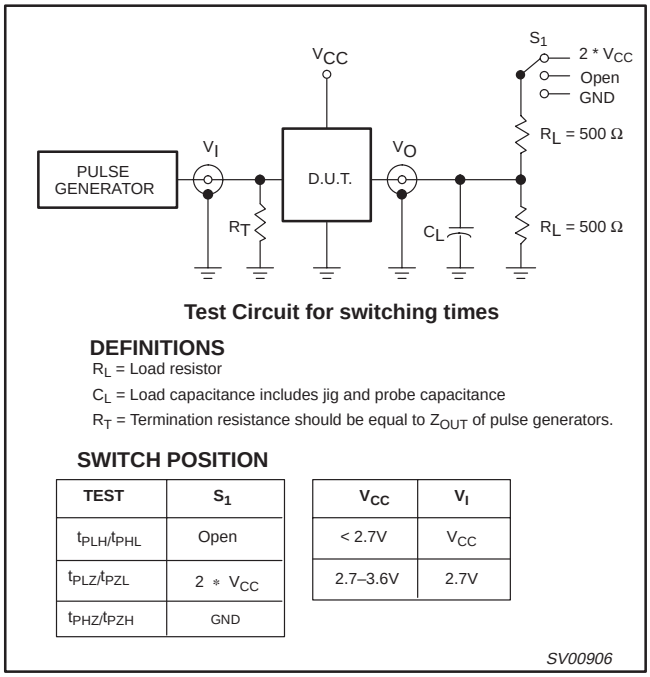



**Waveform 1. Input (An) to output (Yn) propagation delay times**




**Waveform 2. 3-State enable and disable times**

## TEST CIRCUIT




**Test Circuit for switching times**

**DEFINITIONS**

$R_L$ = Load resistor

$C_L$ = Load capacitance includes jig and probe capacitance

$R_T$ = Termination resistance should be equal to $Z_{OUT}$ of pulse generators.

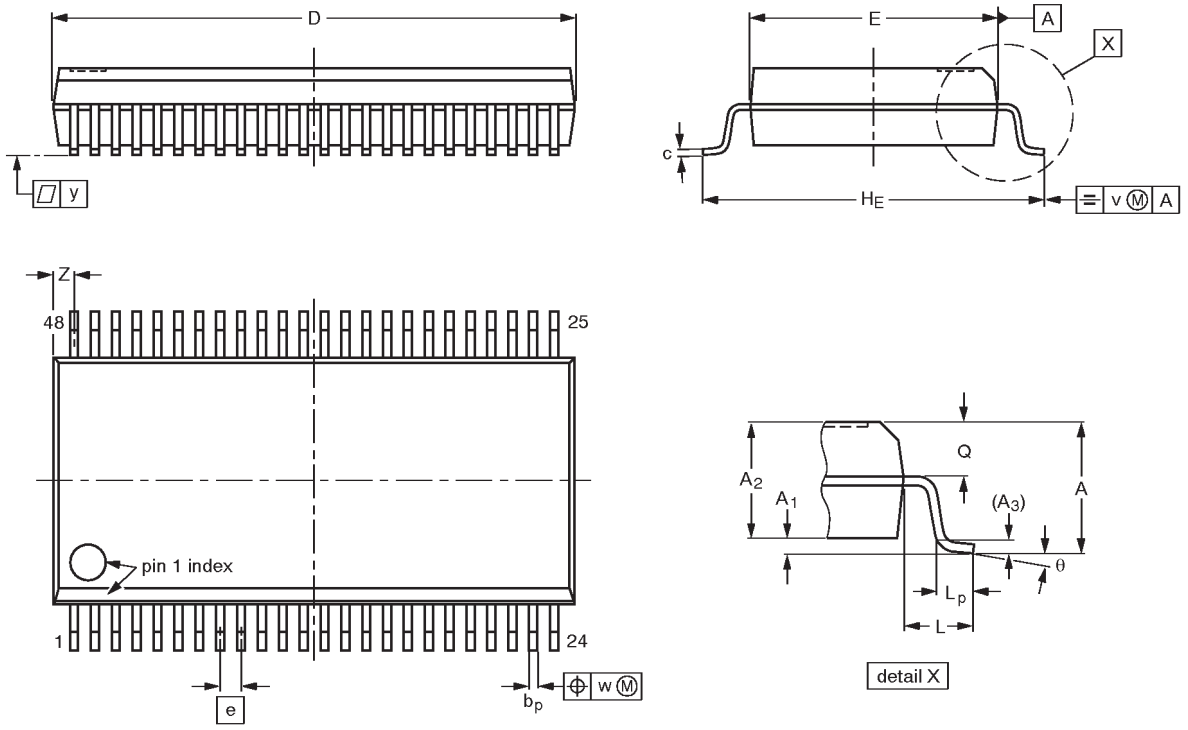
**SWITCH POSITION**

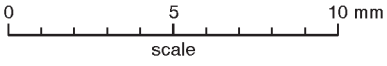
| TEST | $S_1$ |
|---|---|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 2 * $V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | GND |

| $V_{CC}$ | $V_I$ |
|---|---|
| < 2.7V | $V_{CC}$ |
| 2.7–3.6V | 2.7V |

**Waveform 3. Load circuitry for switching times**

**SSOP48: plastic shrink small outline package; 48 leads; body width 7.5 mm** **SOT370-1**




**DIMENSIONS (mm are the original dimensions)**

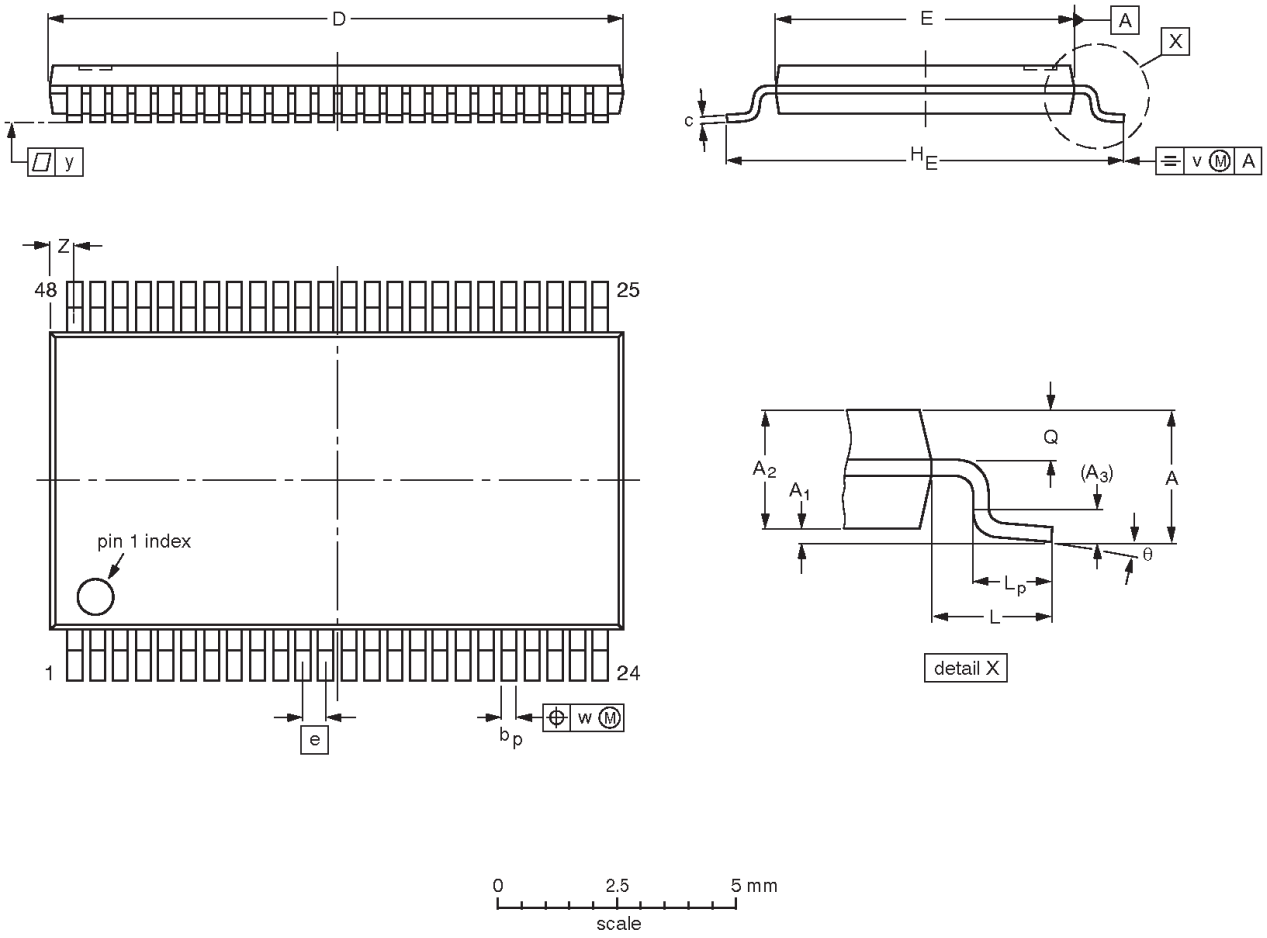
| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (1) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.8 | 0.4<br>0.2 | 2.35<br>2.20 | 0.25 | 0.3<br>0.2 | 0.22<br>0.13 | 16.00<br>15.75 | 7.6<br>7.4 | 0.635 | 10.4<br>10.1 | 1.4 | 1.0<br>0.6 | 1.2<br>1.0 | 0.25 | 0.18 | 0.1 | 0.85<br>0.40 | 8°<br>0° |

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT370-1 | | MO-118AA | | | | ~~93-11-02~~<br>95-02-04 |

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




**DIMENSIONS (mm are the original dimensions).**

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

**Notes**

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.

| OUTLINE VERSION | REFERENCES | | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | | |
| SOT362-1 | | MO-153ED | | | | | ~~93-02-03~~<br>95-02-10 |

**NOTES**

# 16-bit buffer/line driver with 30Ω termination resistor (3-State)

74ALVCH162244

## Data sheet status

| Data sheet status | Product status | Definition [1] |
|---|---|---|
| Objective specification | Development | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice. |
| Preliminary specification | Qualification | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make chages at any time without notice in order to improve design and supply the best possible product. |
| Product specification | Production | This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |

[1] Please consult the most recently issued datasheet before initiating or completing a design.

## Definitions

**Short-form specification —** The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition —** Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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