# DATA SHEET

## 74ABT162240
## 74ABTH162240

16-bit inverting buffer/driver with 30Ω series termination resistors

Product specification
Supersedes data of 1998 Jan 16
IC23 Data Handbook

1998 Feb 25

Philips
Semiconductors

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# 16-bit inverting buffer/driver with 30Ω series termination resistors (3-State)

# 74ABT162240
# 74ABTH162240

## FEATURES

- 16-bit bus interface
- 3-State buffers
- Output capability: +12mA/-32mA
- TTL input and output switching levels
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion/extraction permitted
- Power-up 3-State
- 74ABTH162240 incorporates bus hold data inputs which eliminate the need for external pull up resistors to hold unused inputs
- Latch-up protection exceeds 500mA per JEDEC Std 17
- ESD protection exceeds 2000V per MIL STD 883 Method 3015 and 200V per Machine Model

## DESCRIPTION

The 74ABT162240 is a high-performance BiCMOS device which combines low static and dynamic power dissipation with high speed.

This device is an inverting 16-bit buffer that is ideal for driving bus lines. The device features four Output Enables ($1\overline{OE}$, $2\overline{OE}$, $3\overline{OE}$, $4\overline{OE}$), each controlling four of the 3-State outputs.

Two options are available, 74ABT162240 which does not have the bus hold feature and 74ABTH162240 which incorporates the bus hold feature.

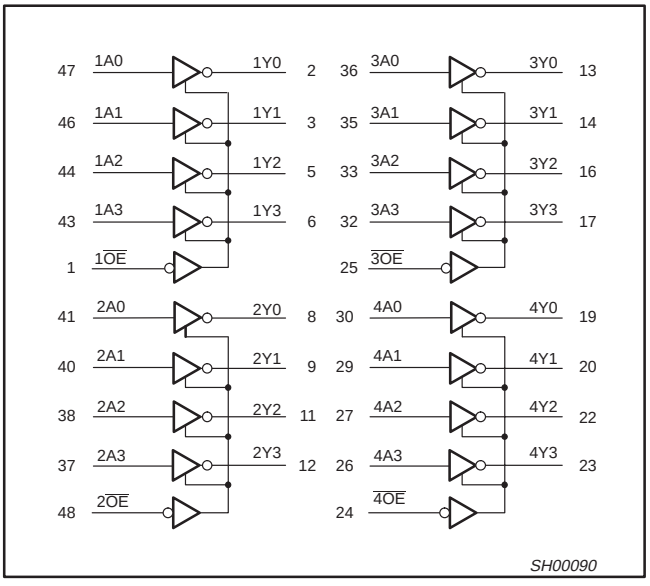
## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS $T_{amb}$ = 25°C | TYPICAL | UNIT |
|---|---|---|---|---|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>nAx to n$\overline{Y}$x | $C_L$ = 50pF;<br>$V_{CC}$ = | 2.7<br>2.6 | ns |
| $C_{IN}$ | Input capacitance n$\overline{OE}$ | $V_I$ = 0V or 3.0V | 4 | pF |
| $C_{OUT}$ | Output capacitance | Outputs disabled; $V_O$ = 0V or | 6 | pF |
| $I_{CCZ}$ | Quiescent supply current | Outputs disabled; $V_{CC}$ = | 500 | µA |
| $I_{CCL}$ | | Outputs low; $V_{CC}$ = 5.5V | 8 | mA |

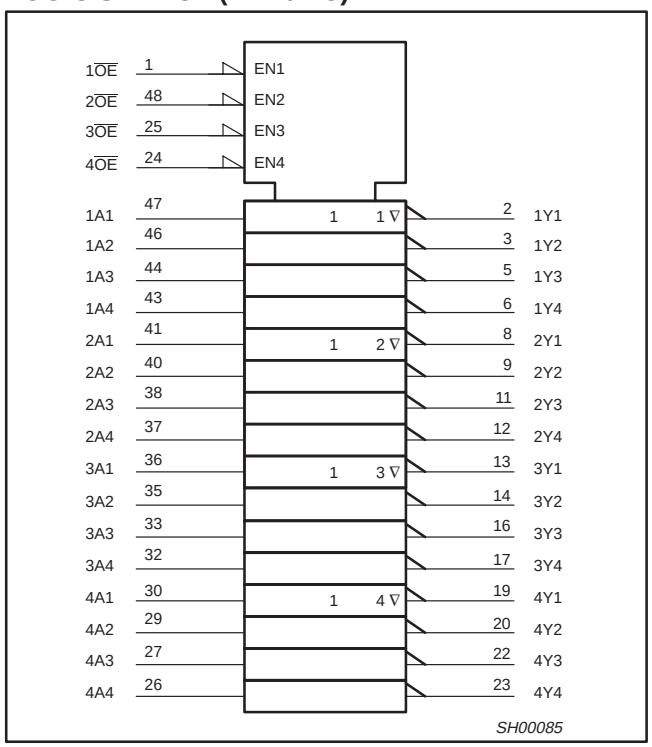
## ORDERING INFORMATION

| PACKAGES | TEMPERATURE RANGE | OUTSIDE NORTH AMERICA | NORTH AMERICA | DWG NUMBER |
|---|---|---|---|---|
| 48-Pin Plastic SSOP Type III | –40°C to +85°C | 74ABT162240 DL | BT162240 DL | SOT370-1 |
| 48-Pin Plastic TSSOP Type II | –40°C to +85°C | 74ABT162240 DGG | BT162240 DGG | SOT362-1 |
| 48-Pin Plastic SSOP Type III | –40°C to +85°C | 74ABTH162240 DL | BH162240 DL | SOT370-1 |
| 48-Pin Plastic TSSOP Type II | –40°C to +85°C | 74ABTH162240 DGG | BH162240 DGG | SOT362-1 |

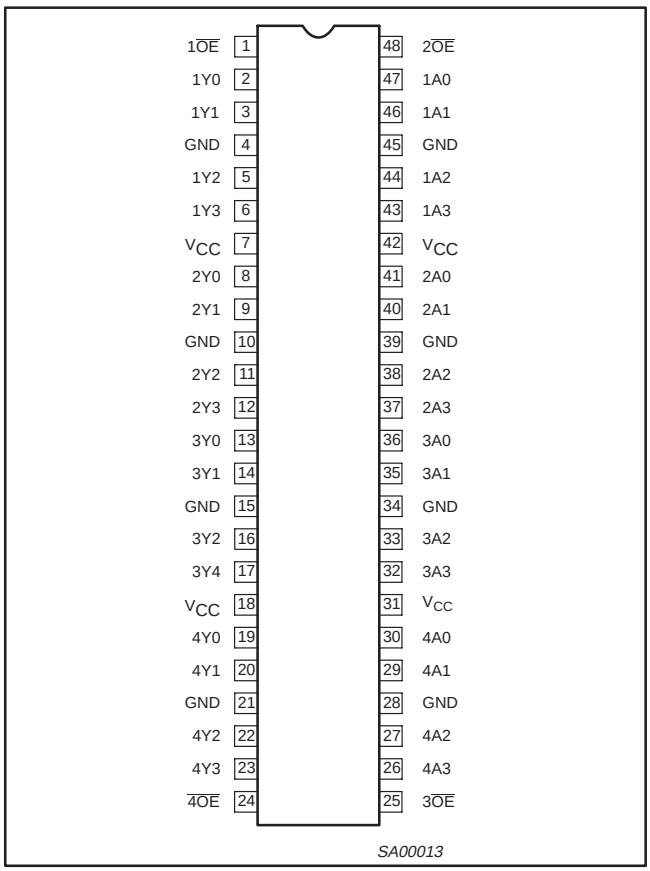
## LOGIC SYMBOL



## LOGIC SYMBOL (IEEE/IEC)




## PIN CONFIGURATION

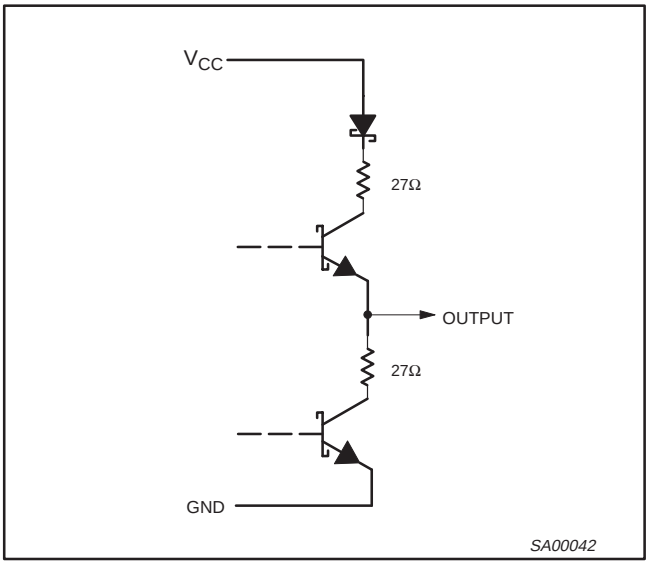



## FUNCTION TABLE

| Inputs | | Outputs |
|---|---|---|
| $n\overline{OE}$ | nAx | $n\overline{Y}x$ |
| L | L | H |
| L | H | L |
| H | X | Z |

H = High voltage level
L = Low voltage level
X = Don't care
Z = High Impedance "off" state

## SCHEMATIC OF Y OUTPUTS




## PIN DESCRIPTION

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

## ABSOLUTE MAXIMUM RATINGS[1, 2]

| SYMBOL | PARAMETER | CONDITIONS | RATING | UNIT |
|---|---|---|---|---|
| $V_{CC}$ | DC supply voltage | | -0.5 to +7.0 | V |
| $I_{IK}$ | DC input diode current | $V_I < 0$ | –18 | mA |
| $V_I$ | DC input voltage[3] | | –1.2 to +7.0 | V |
| $I_{OK}$ | DC output diode current | $V_O < 0$ | –50 | mA |
| $V_{OUT}$ | DC output voltage[3] | Output in Off or High state | –0.5 to +5.5 | V |
| $I_{OUT}$ | DC output current | Output in Low state | 128 | mA |
| | | Output in High state | -64 | |
| $T_{stg}$ | Storage temperature range | | -65 to +150 | °C |

**NOTES:**
1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
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. The maximum junction temperature of this integrated circuit should not exceed 150°C.
3. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | LIMITS | | UNIT |
|---|---|---|---|---|
| | | MIN | MAX | |
| $V_{CC}$ | DC supply voltage | 4.5 | 5.5 | V |
| $V_I$ | Input voltage | 0 | $V_{CC}$ | V |
| $V_{IH}$ | High-level input voltage | 2.0 | | V |
| $V_{IL}$ | Input voltage | | 0.8 | V |
| $I_{OH}$ | High-level output current | | –32 | mA |
| $I_{OL}$ | Low-level output current | | 32 | mA |
| | Low-level output current; current duty cycle ≤ 50%; f ≥ 1kHz | | 12 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate; Outputs enabled | 0 | 10 | ns/V |
| $T_{amb}$ | Operating free-air temperature range | –40 | +85 | °C |

## DC ELECTRICAL CHARACTERISTICS

| SYMBOL | PARAMETER | TEST CONDITIONS | | LIMITS | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | $T_{amb}$ = +25°C | | | $T_{amb}$ = –40°C to +85°C | | |
| | | | | Min | Typ | Max | Min | Max | |
| $V_{IK}$ | Input clamp voltage | $V_{CC}$ = 4.5V; $I_{IK}$ = –18mA | | | –0.9 | –1.2 | | –1.2 | V |
| $V_{OH}$ | High-level output voltage | $V_{CC}$ = 4.5V; $I_{OH}$ = –3mA; $V_I$ = $V_{IL}$ or $V_{IH}$ | | 2.5 | 2.9 | | 2.5 | | V |
| | | $V_{CC}$ = 5.0V; $I_{OH}$ = –3mA; $V_I$ = $V_{IL}$ or $V_{IH}$ | | 3.0 | 3.4 | | 3.0 | | V |
| | | $V_{CC}$ = 4.5V; $I_{OH}$ = –32mA; $V_I$ = $V_{IL}$ or $V_{IH}$ | | 2.0 | 2.4 | | 2.0 | | V |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = 4.5V; $I_{OL}$ = 8mA; $V_I$ = $V_{IL}$ or $V_{IH}$ | | | | 0.65 | | 0.65 | V |
| | | $V_{CC}$ = 4.5V; $I_{OL}$ = 12mA; $V_I$ = $V_{IL}$ or $V_{IH}$ | | | | 0.80 | | 0.80 | V |
| $I_I$ | Input leakage current | $V_{CC}$ = 5.5V; $V_I$ = GND or 5.5V | | | ±0.01 | ±1.0 | | ±1.0 | µA |
| $I_I$ | Input leakage current 74ABTH162240 | $V_{CC}$ = 5.5V; $V_I$ = $V_{CC}$ or GND | Control pins | | ±0.01 | ±1 | | ±1 | µA |
| | | $V_{CC}$ = 5.5V; $V_I$ = $V_{CC}$ | Data pins | | 0.01 | 1 | | 1 | µA |
| | | $V_{CC}$ = 5.5V; $V_I$ = 0 | | | –2 | –3 | | –5 | µA |
| $I_{HOLD}$ | Bus Hold current A inputs[3] 74ABTH162240 | $V_{CC}$ = 4.5V; $V_I$ = 0.8V | | 50 | | | 50 | | µA |
| | | $V_{CC}$ = 4.5V; $V_I$ = 2.0V | | –75 | | | –75 | | |
| | | $V_{CC}$ = 5.5V; $V_I$ = 0 to 5.5V | | ±500 | | | | | |
| $I_{OFF}$ | Power-off leakage current | $V_{CC}$ = 0.0V; $V_O$ or $V_I \leq$ 4.5V | | | ±5.0 | ±100 | | ±100 | µA |
| $I_{PU}/I_{PD}$ | Power-up/down 3-State output current | $V_{CC}$ = 2.0V; $V_O$ = 0.5V; $V_I$ = GND or $V_{CC}$; $V_{\overline{OE}}$ = $V_{CC}$ | | | ±5.0 | ±50 | | ±50 | µA |
| $I_{OZH}$ | 3-State output High current | $V_{CC}$ = 5.5V; $V_O$ = 2.7V; $V_I$ = $V_{IL}$ or $V_{IH}$ | | | 1.0 | 10 | | 10 | µA |
| $I_{OZL}$ | 3-State output Low current | $V_{CC}$ = 5.5V; $V_O$ = 0.5V; $V_I$ = $V_{IL}$ or $V_{IH}$ | | | –1.0 | –10 | | –10 | µA |
| $I_{CEX}$ | Output high leakage current | $V_{CC}$ = 5.5V; $V_O$ = 5.5V; $V_I$ = GND or $V_{CC}$ | | | 1.0 | 50 | | 50 | µA |
| $I_O$ | Output current[1] | $V_{CC}$ = 5.5V; $V_O$ = 2.5V | | –50 | –70 | –180 | –50 | –180 | mA |
| $I_{CCH}$ | Quiescent supply current | $V_{CC}$ = 5.5V; Outputs High, $V_I$ = GND or $V_{CC}$ | | | 0.5 | 1.0 | | 1.0 | mA |
| $I_{CCL}$ | | $V_{CC}$ = 5.5V; Outputs Low, $V_I$ = GND or $V_{CC}$ | | | 8 | 19 | | 19 | mA |
| $I_{CCZ}$ | | $V_{CC}$ = 5.5V; Outputs 3-State; $V_I$ = GND or $V_{CC}$ | | | 0.5 | 1.0 | | 1.0 | mA |
| $\Delta I_{CC}$ | Additional supply current per input pin[2] 74ABT162240 | Outputs enabled, one input at 3.4V, other inputs at $V_{CC}$ or GND; $V_{CC}$ = 5.5V | | | 10 | 200 | | 200 | µA |
| $\Delta I_{CC}$ | Additional supply current per input pin[2] 74ABTH162240 | Outputs enabled, one input at 3.4V, other inputs at $V_{CC}$ or GND; $V_{CC}$ = 5.5V | | | 0.2 | 1.0 | | 1.0 | mA |

**NOTES:**
1. Not more than one output should be tested at a time, and the duration of the test should not exceed one second.
2. This is the increase in supply current for each input at 3.4V.
3. This is the bus hold overdrive current required to force the input to the opposite logic state.

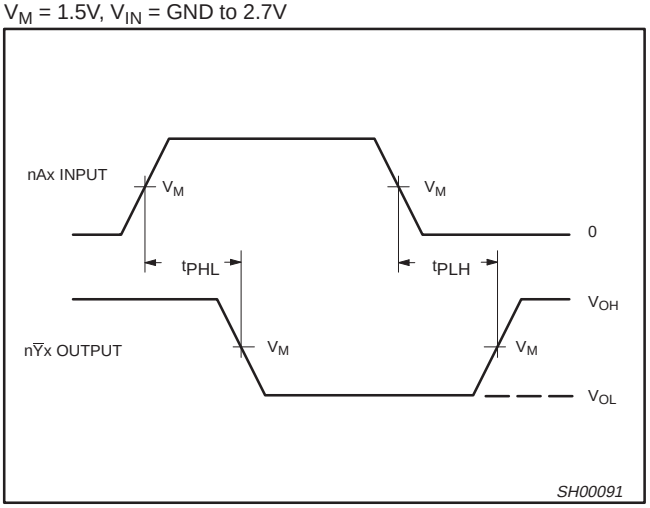
## AC CHARACTERISTICS

GND = 0V; $t_R = t_F$ = 2.5ns; $C_L$ = 50pF; $R_L$ = 500Ω; $T_{amb}$ = -40°C to +85°C.

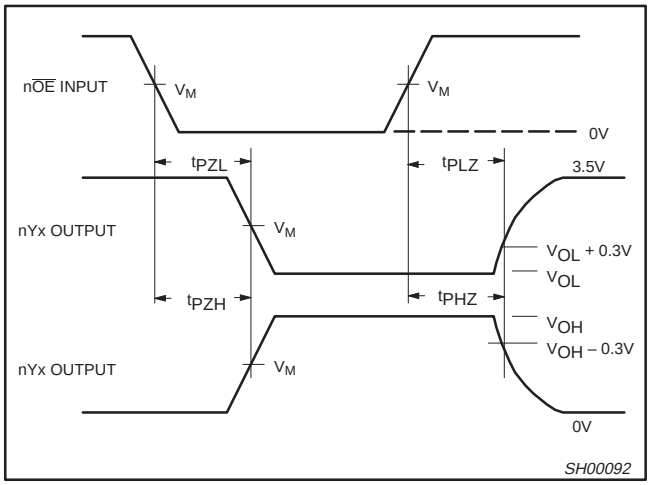
| SYMBOL | PARAMETER | WAVEFORM | LIMITS | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | $T_{amb}$ = +25°C $V_{CC}$ = +5.0V | | | $T_{amb}$ = –40°C to +85°C $V_{CC}$ = +5.0V ±0.5V | | |
| | | | Min | Typ | Max | Min | Max | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>nAx to nȲx | 1 | 1.0<br>1.0 | 2.7<br>2.6 | 3.8<br>3.2 | 1.0<br>1.0 | 4.2<br>3.7 | ns |
| $t_{PZH}$<br>$t_{PZL}$ | Output enable time<br>to High and Low level | 2 | 1.2<br>1.0 | 2.3<br>2.9 | 3.2<br>3.8 | 1.2<br>1.0 | 4.0<br>4.7 | ns |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output disable time<br>from High and Low level | 2 | 1.6<br>1.4 | 3.0<br>2.8 | 4.1<br>3.8 | 1.6<br>1.4 | 4.7<br>4.0 | ns |

## AC WAVEFORMS

$V_M$ = 1.5V, $V_{IN}$ = GND to 2.7V

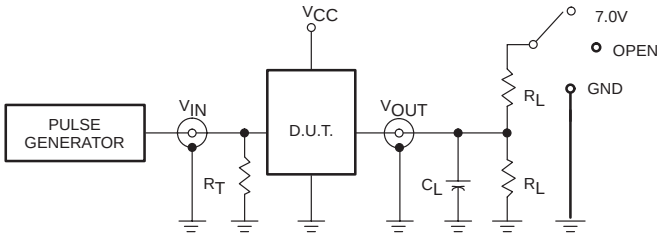



**Waveform 1. Input (nAx) to Output (nYx) Propagation Delays**

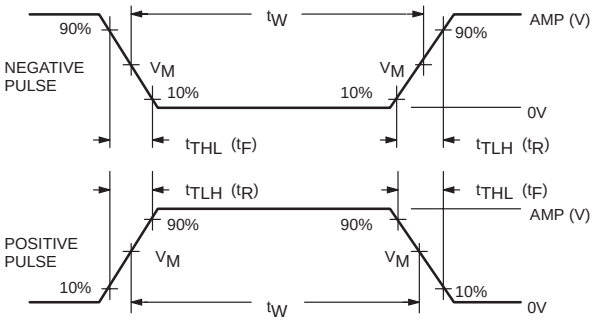



**Waveform 2. 3-State Output Enable and Disable Times**

## TEST CIRCUIT AND WAVEFORMS




**Test Circuit for 3-State Outputs**




**$V_M$ = 1.5V**
**Input Pulse Definition**

### SWITCH POSITION

| TEST | SWITCH |
|---|---|
| $t_{PLZ}$ | closed |
| $t_{PZL}$ | 7V |
| All other | open |

### DEFINITIONS

$R_L$ = Load resistor; see AC CHARACTERISTICS for value.

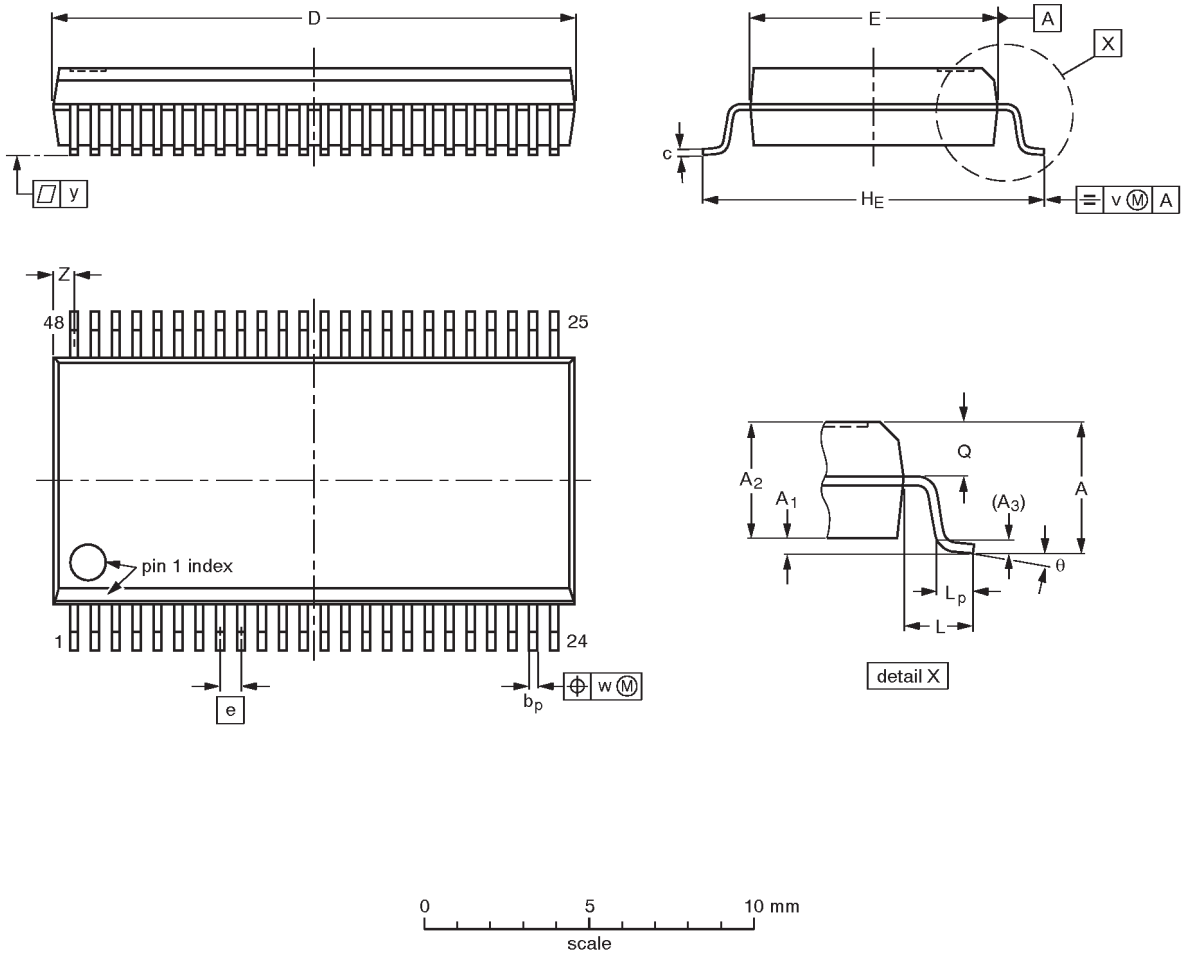
$C_L$ = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

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

| FAMILY | INPUT PULSE REQUIREMENTS | | | | |
|---|---|---|---|---|---|
| | Amplitude | Rep. Rate | $t_W$ | $t_R$ | $t_F$ |
| 74ABT16 | 3.0V | 1MHz | 500ns | 2.5ns | 2.5ns |

*SH00093*

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







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

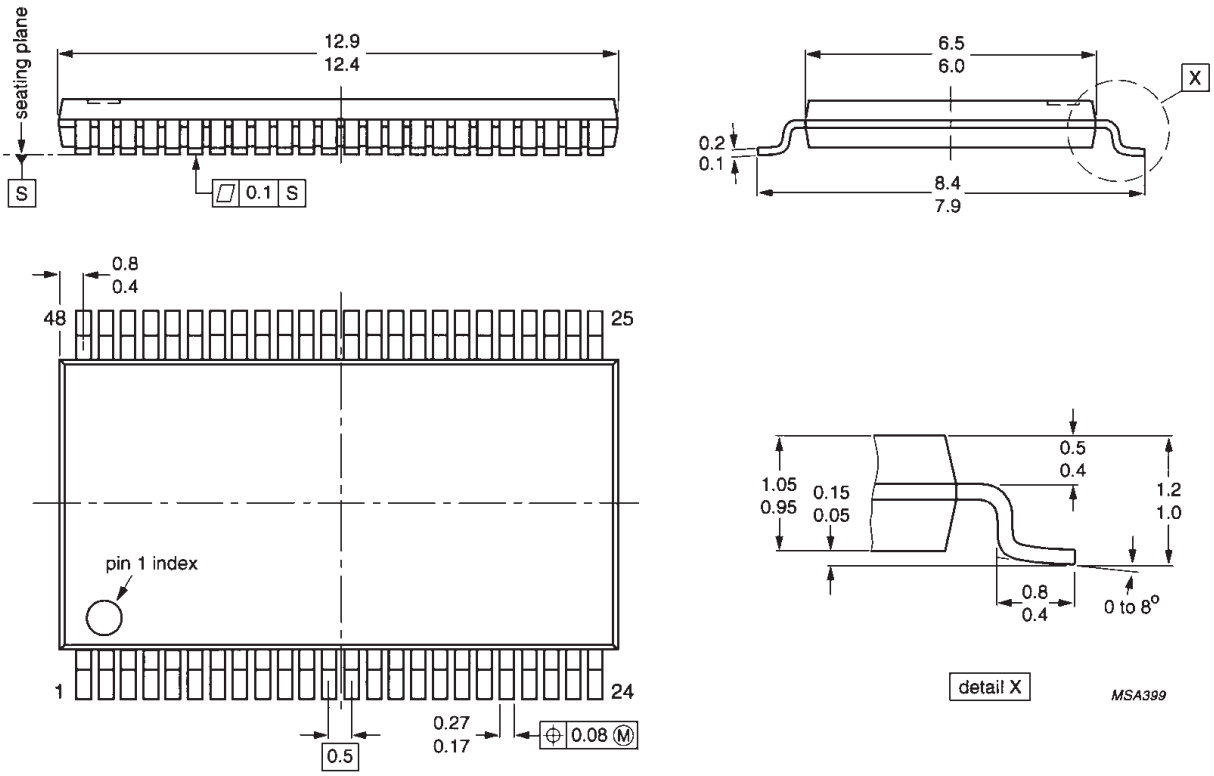
| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (1) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.8 | 0.4<br>0.2 | 2.35<br>2.20 | 0.25 | 0.3<br>0.2 | 0.22<br>0.13 | 16.00<br>15.75 | 7.6<br>7.4 | 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 in mm.

**NOTES**

# 16-bit inverting buffer/driver with 30 Ω series termination resistors (3-State)

74ABT162240
74ABTH162240

## 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. |
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[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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