# DATA SHEET



## 74ABT2241

Octal buffer with 30Ω series termination resistors; (3-State)

Product specification

1996 Sep 30

IC23 Data Handbook

Philips
Semiconductors

PHILIPS

# Octal buffer with 30Ω series termination resistors (3-State)

# 74ABT2241

## FEATURES

- Octal bus interface
- 3-State buffers
- Power-up 3-State
- Output capability: +12mA/–32mA
- Latch-up protection exceeds 500mA per Jedec Std 17
- ESD protection exceeds 2000 V per MIL STD 883 Method 3015 and 200 V per Machine Model

## DESCRIPTION

The 74ABT2241 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 74ABT2241 device is an octal buffer that is ideal for driving bus lines. The device features two Output Enables ($1\overline{OE}$, 2OE), each controlling four of the 3-State outputs.

The 74ABT2241 is designed with 30Ω series resistance in both the High and Low states of the output. The design reduces line noise in applications such as memory address drivers, clock drivers, and bus receivers/transceivers.

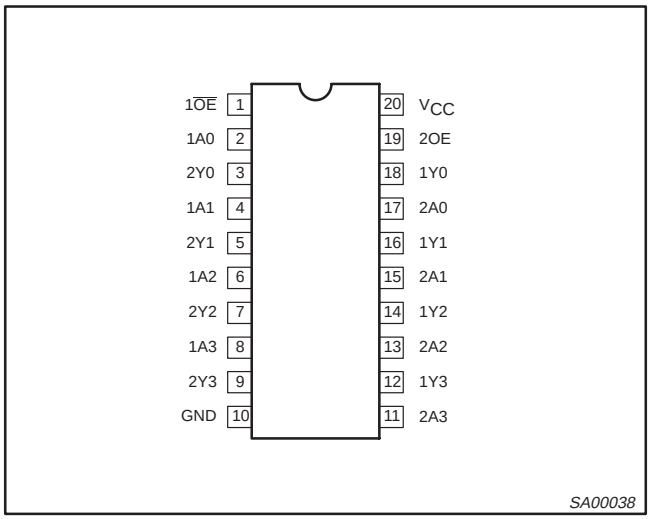
## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS $T_{amb}$ = 25°C; GND = 0V | TYPICAL | UNIT |
|---|---|---|---|---|
| $t_{PLH}$ $t_{PHL}$ | Propagation delay An to Yn | $C_L$ = 50pF; $V_{CC}$ = 5V | 2.9 | ns |
| $C_{IN}$ | Input capacitance | $V_I$ = 0V or $V_{CC}$ | 3 | pF |
| $C_{OUT}$ | Output capacitance | Outputs disabled; $V_O$ = 0V or $V_{CC}$ | 7 | pF |
| $I_{CCZ}$ | Total supply current | Outputs disabled; $V_{CC}$ = 5.5V | 50 | µA |

## ORDERING INFORMATION

| PACKAGES | TEMPERATURE RANGE | OUTSIDE NORTH AMERICA | NORTH AMERICA | DWG NUMBER |
|---|---|---|---|---|
| 20-Pin Plastic DIP | –40°C to +85°C | 74ABT2241 N | 74ABT2241 N | SOT146-1 |
| 20-Pin plastic SO | –40°C to +85°C | 74ABT2241 D | 74ABT2241 D | SOT163-1 |
| 20-Pin Plastic SSOP Type II | –40°C to +85°C | 74ABT2241 DB | 74ABT2241 DB | SOT339-1 |
| 20-Pin Plastic TSSOP Type I | –40°C to +85°C | 74ABT2241 PW | 7ABT2241PW DH | SOT360-1 |

## PIN CONFIGURATION



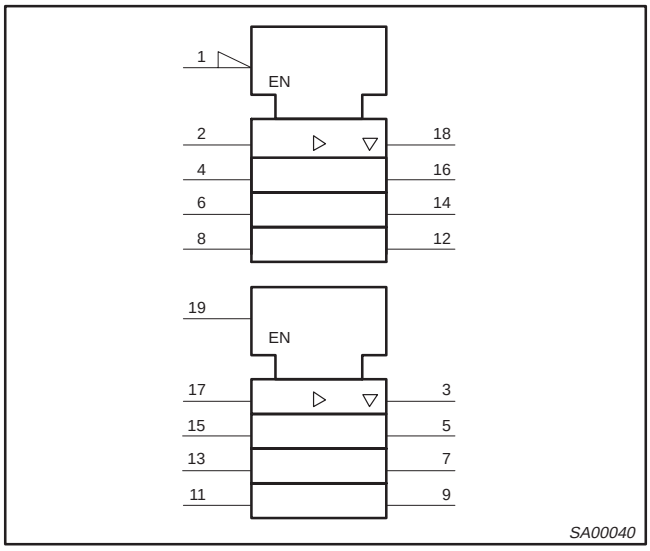

## PIN DESCRIPTION

| PIN NUMBER | SYMBOL | NAME AND FUNCTION |
|---|---|---|
| 2, 4, 6, 8 | 1A0 – 1A3 | Data inputs |
| 17, 15, 13, 11 | 2A0 – 2A3 | Data inputs |
| 18, 16, 14, 12 | 1Y0 – 1Y3 | Data outputs |
| 3, 5, 7, 9 | 2Y0 – 2Y3 | Data outputs |
| 1, 19 | $1\overline{OE}$, 2OE | Output enables |
| 10 | GND | Ground (0V) |
| 20 | $V_{CC}$ | Positive supply voltage |

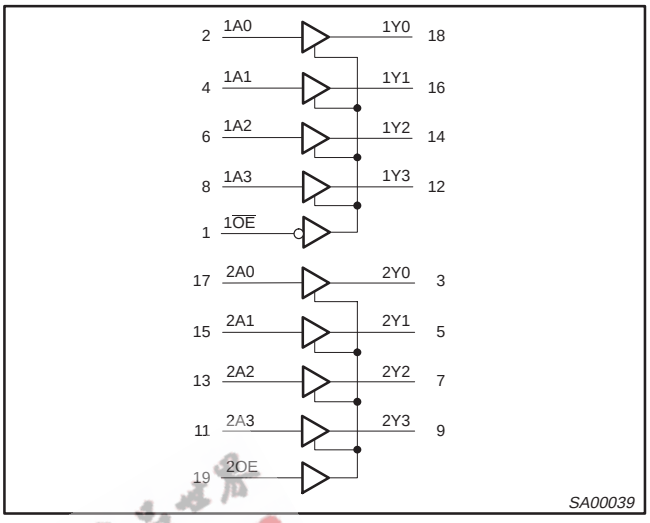
# Octal buffer with 30Ω series termination resistors (3-State)

# 74ABT2241

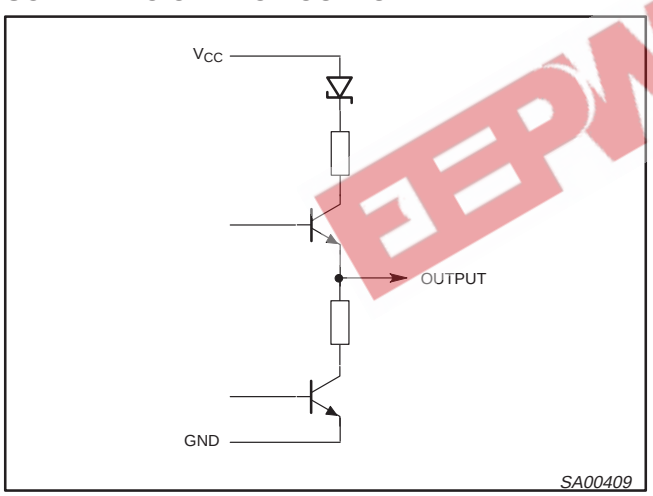
## LOGIC SYMBOL (IEEE/IEC)




## LOGIC SYMBOL




## SCHEMATIC OF EACH OUTPUT




## FUNCTION TABLE

| INPUTS | | | | OUTPUTS | |
|---|---|---|---|---|---|
| $\overline{1OE}$ | 1An | 2OE | 2An | 1Yn | 2Yn |
| L | L | H | L | L | L |
| L | H | H | H | H | H |
| H | X | L | X | Z | Z |

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

## 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 |
| $T_{stg}$ | 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 voltage ratings may be exceeded if the input and output 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 |
| $V_{IL}$ | Low-level Input voltage | | 0.8 | V |
| $I_{OH}$ | High-level output current | | –32 | mA |
| $I_{OL}$ | Low-level output current | | 12 | mA |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | 0 | 5 | 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; $I_{OL}$ = 5mA; $V_I$ = $V_{IL}$ or $V_{IH}$ | | 0.32 | 0.55 | | 0.55 | V |
| | | $V_{CC}$ = 4.5V; $I_{OL}$ = 12mA; $V_I$ = $V_{IL}$ or $V_{IH}$ | | | 0.8 | | 0.8 | V |
| $I_I$ | Input leakage current | $V_{CC}$ = 5.5V; $V_I$ = GND or 5.5V | | ±0.01 | ±1.0 | | ±1.0 | µA |
| $I_{OFF}$ | Power-off leakage current | $V_{CC}$ = 0.0V; $V_I$ or $V_O \leq$ 4.5V | | ±5.0 | ±100 | | ±100 | µA |
| $I_{PU}/I_{PD}$ | Power-up/down 3-State output current[3] | $V_{CC}$ = 2.0V; $V_O$ = 0.5V; $V_I$ = GND or $V_{CC}$; $V_{\overline{OE}}$ = $V_{CC}$; $V_{OE}$ = GND | | ±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 $V_{IH}$ | | 5.0 | 50 | | 50 | µA |
| $I_{OZL}$ | 3-State output Low current | $V_{CC}$ = 5.5V; $V_O$ = 0.5V; $V_I$ = $V_{IL}$ or $V_{IH}$ | | –5.0 | –50 | | –50 | µA |
| $I_{CEX}$ | Output High leakage current | $V_{CC}$ = 5.5V; $V_O$ = 5.5V; $V_I$ = GND or $V_{CC}$ | | 5.0 | 50 | | 50 | µA |
| $I_O$ | Output current[1] | $V_{CC}$ = 5.5V; $V_O$ = 2.5V | –50 | –100 | –180 | –50 | –180 | mA |
| $I_{CCH}$ | Quiescent supply current | $V_{CC}$ = 5.5V; Outputs High, $V_I$ = GND or $V_{CC}$ | | 50 | 250 | | 250 | µA |
| $I_{CCL}$ | | $V_{CC}$ = 5.5V; Outputs Low, $V_I$ = GND or $V_{CC}$ | | 24 | 30 | | 30 | mA |
| $I_{CCZ}$ | | $V_{CC}$ = 5.5V; Outputs 3–State; $V_I$ = GND or $V_{CC}$ | | 50 | 250 | | 250 | µA |
| $\Delta I_{CC}$ | Additional supply current per input pin[2] | Outputs enabled, one input at 3.4V, other inputs at $V_{CC}$ or GND; $V_{CC}$ = 5.5V | | 0.5 | 1.5 | | 1.5 | mA |
| | | Outputs 3-State, one data input at 3.4V, other inputs at $V_{CC}$ or GND; $V_{CC}$ = 5.5V | | 50 | 250 | | 250 | µA |
| | | Outputs 3-State, one enable input at 3.4V, other inputs at $V_{CC}$ or GND; $V_{CC}$ = 5.5V | | 0.5 | 1.5 | | 1.5 | 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 parameter is valid for any $V_{CC}$ between 0V and 2.1V with a transition time of up to 10msec. For $V_{CC}$ = 2.1V to $V_{CC}$ = 5V ± 10%, a transition time of up to 100 µsec is permitted.

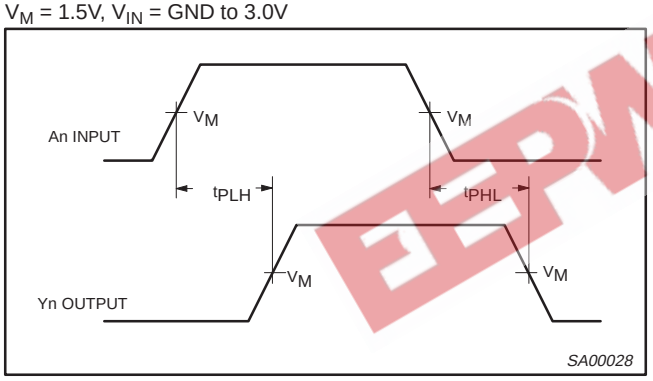
## AC CHARACTERISTICS

GND = 0V; $t_R = t_F$ = 2.5ns; $C_L$ = 50pF, $R_L$ = 500Ω

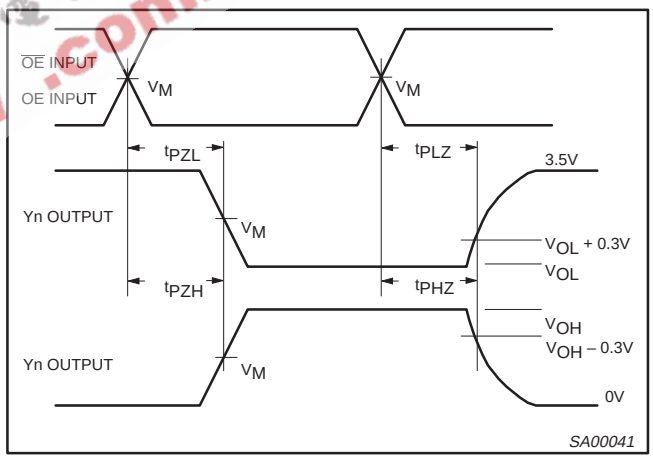
| SYMBOL | PARAMETER | WAVEFORM | LIMITS | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | $T_{amb}$ = +25°C, $V_{CC}$ = +5.0V | | | $T_{amb}$ = –40°C to +85°C, $V_{CC}$ = +5.0V ±0.5V | | |
| | | | Min | Typ | Max | Min | Max | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>An to Yn | 1 | 1.0<br>1.0 | 2.7<br>3.9 | 4.3<br>5.3 | 1.0<br>1.0 | 4.7<br>5.6 | ns |
| $t_{PZH}$<br>$t_{PZL}$ | Output enable time<br>to High and Low level | 2 | 1.1<br>2.1 | 3.3<br>5.4 | 4.8<br>7.6 | 1.1<br>2.1 | 5.8<br>8.4 | ns |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output disable time<br>from High and Low level | 2 | 1.7<br>1.7 | 3.8<br>3.4 | 5.6<br>5.8 | 1.7<br>1.7 | 6.6<br>6.4 | ns |

## AC WAVEFORMS

$V_M$ = 1.5V, $V_{IN}$ = GND to 3.0V

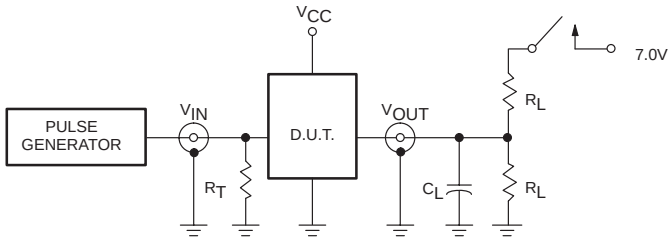



**Waveform 1. Waveforms Showing the Input (An) to Output (Yn) Propagation Delays**

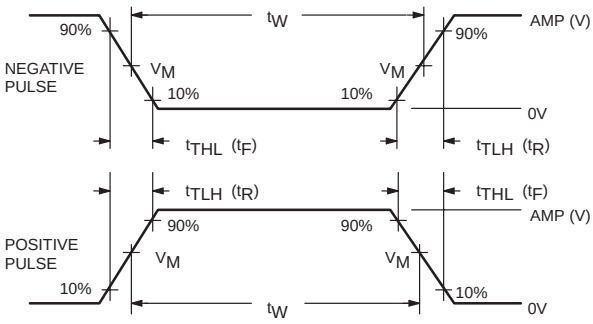



**Waveform 2. Waveforms Showing the 3–State Output Enable and Disable Times**

## TEST CIRCUIT AND WAVEFORMS




**Test Circuit for 3-State Outputs**




$V_M$ = 1.5V

**Input Pulse Definition**

### SWITCH POSITION

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

### DEFINITIONS

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

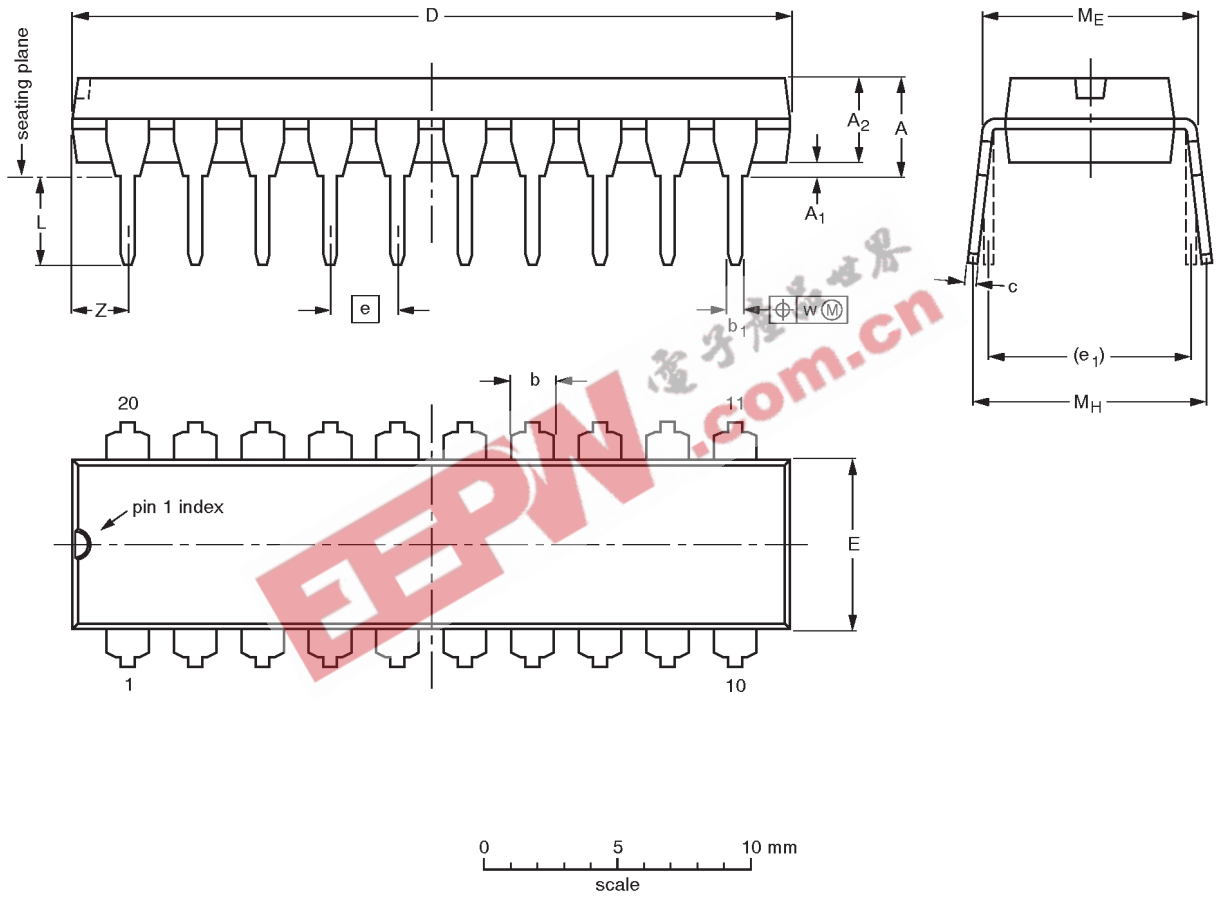
$C_L$ = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

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

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

*SA00012*

**DIP20: plastic dual in-line package; 20 leads (300 mil)** **SOT146-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

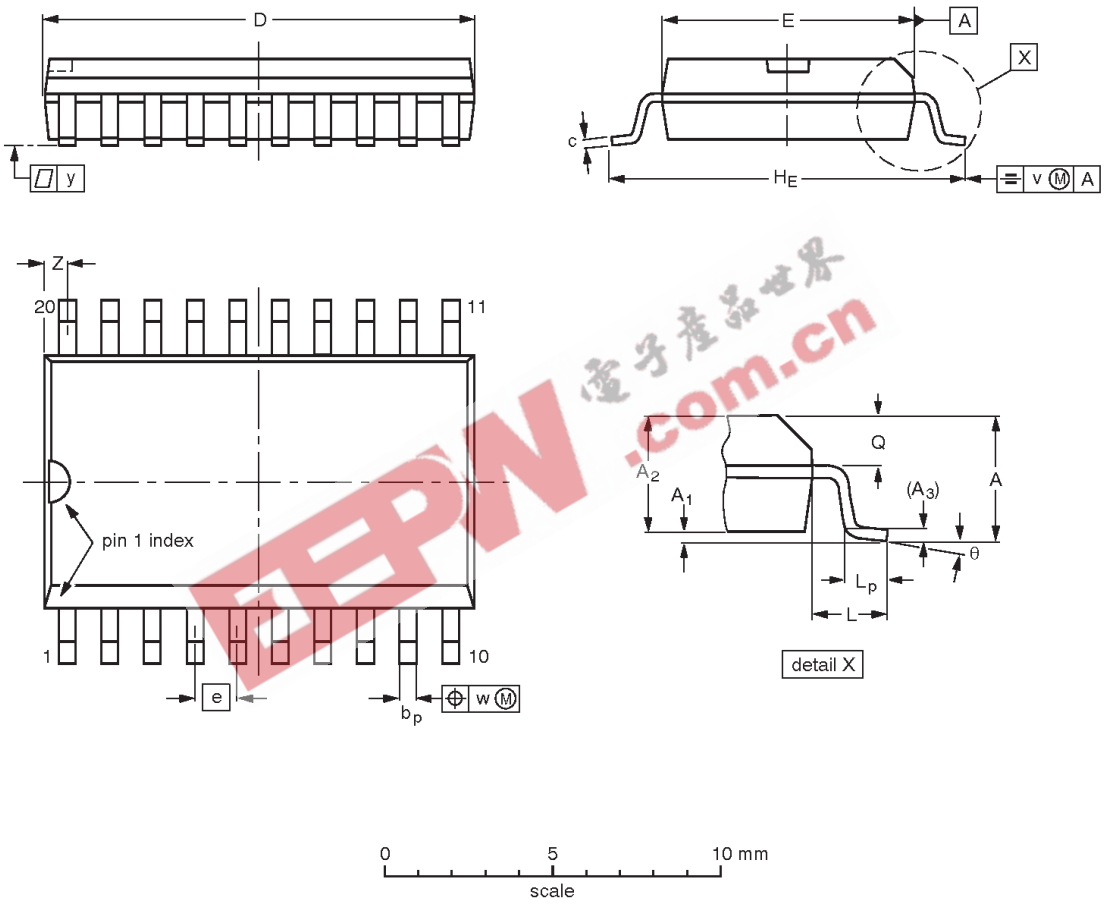
| UNIT | A max. | $A_1$ min. | $A_2$ max. | b | $b_1$ | c | D (1) | E (1) | e | $e_1$ | L | $M_E$ | $M_H$ | w | Z (1) max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.2 | 0.51 | 3.2 | 1.73<br>1.30 | 0.53<br>0.38 | 0.36<br>0.23 | 26.92<br>26.54 | 6.40<br>6.22 | 2.54 | 7.62 | 3.60<br>3.05 | 8.25<br>7.80 | 10.0<br>8.3 | 0.254 | 2.0 |
| inches | 0.17 | 0.020 | 0.13 | 0.068<br>0.051 | 0.021<br>0.015 | 0.014<br>0.009 | 1.060<br>1.045 | 0.25<br>0.24 | 0.10 | 0.30 | 0.14<br>0.12 | 0.32<br>0.31 | 0.39<br>0.33 | 0.01 | 0.078 |

**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 | | | |
| SOT146-1 | | | SC603 | | | ~~92-11-17~~<br>95-05-24 |

**SO20: plastic small outline package; 20 leads; body width 7.5 mm** **SOT163-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

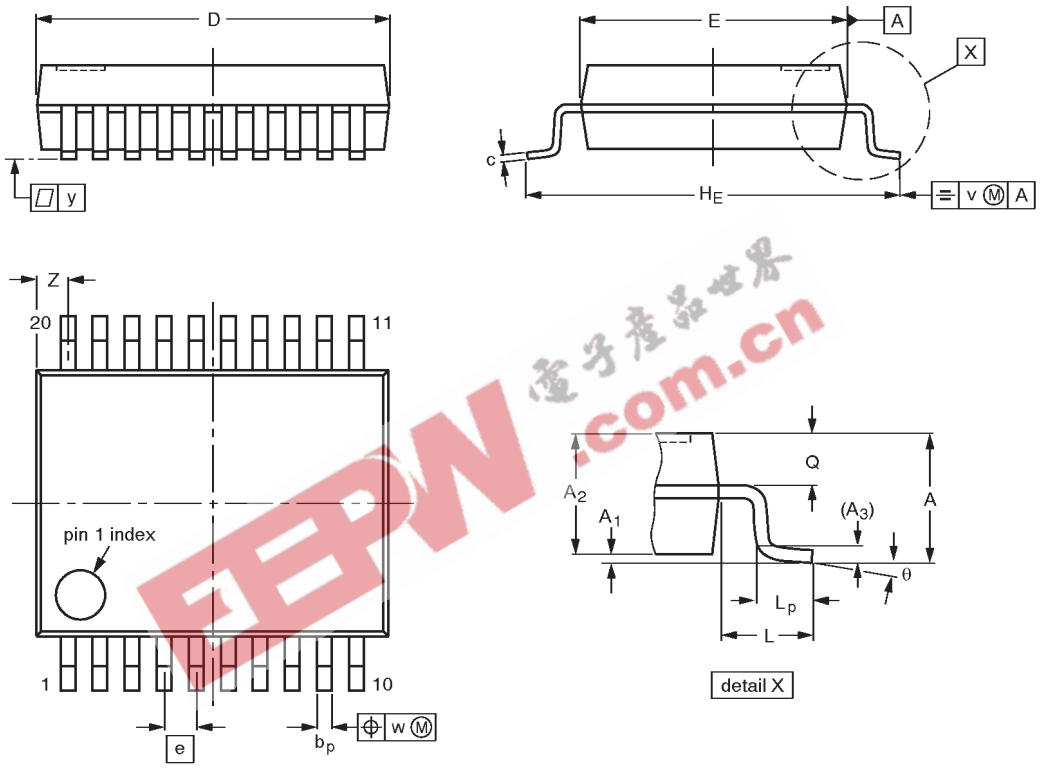
| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (1) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.65 | 0.30<br>0.10 | 2.45<br>2.25 | 0.25 | 0.49<br>0.36 | 0.32<br>0.23 | 13.0<br>12.6 | 7.6<br>7.4 | 1.27 | 10.65<br>10.00 | 1.4 | 1.1<br>0.4 | 1.1<br>1.0 | 0.25 | 0.25 | 0.1 | 0.9<br>0.4 | $8^o$<br>$0^o$ |
| inches | 0.10 | 0.012<br>0.004 | 0.096<br>0.089 | 0.01 | 0.019<br>0.014 | 0.013<br>0.009 | 0.51<br>0.49 | 0.30<br>0.29 | 0.050 | 0.42<br>0.39 | 0.055 | 0.043<br>0.016 | 0.043<br>0.039 | 0.01 | 0.01 | 0.004 | 0.035<br>0.016 | |

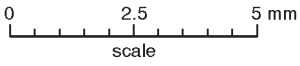
**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT163-1 | 075E04 | MS-013AC | | | | ~~92-11-17~~<br>95-01-24 |

**SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm** **SOT339-1**




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

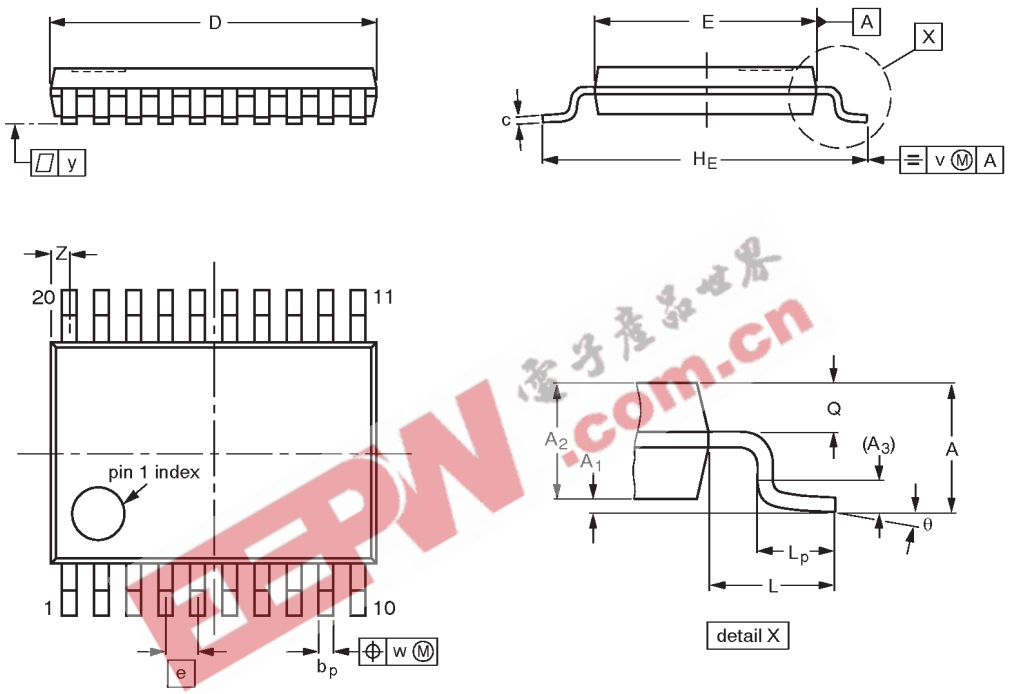
| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.0 | 0.21<br>0.05 | 1.80<br>1.65 | 0.25 | 0.38<br>0.25 | 0.20<br>0.09 | 7.4<br>7.0 | 5.4<br>5.2 | 0.65 | 7.9<br>7.6 | 1.25 | 1.03<br>0.63 | 0.9<br>0.7 | 0.2 | 0.13 | 0.1 | 0.9<br>0.5 | 8°<br>0° |

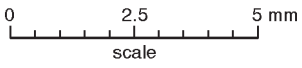
**Note**

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT339-1 | | MO-150AE | | | | ~~93-09-08~~<br>95-02-04 |

**TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm** **SOT360-1**




**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 (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.10 | 0.15<br>0.05 | 0.95<br>0.80 | 0.25 | 0.30<br>0.19 | 0.2<br>0.1 | 6.6<br>6.4 | 4.5<br>4.3 | 0.65 | 6.6<br>6.2 | 1.0 | 0.75<br>0.50 | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.5<br>0.2 | 8°<br>0° |

**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 | | | |
| SOT360-1 | | MO-153AC | | | | ~~93-06-16~~<br>95-02-04 |

**NOTES**

# Octal buffer with 30Ω series termination resistors (3-State)

# 74ABT2241



## DEFINITIONS

| Data Sheet Identification | Product Status | Definition |
|---|---|---|
| *Objective Specification* | Formative or in Design | This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice. |
| *Preliminary Specification* | Preproduction Product | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
| *Product Specification* | Full 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. |



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