# PHILIPS 74LVT240 buffer datasheet

http://www.manuallib.com/philips/74lvt240-buffer-datasheet.html

The LVT240 is a high-performance BiCMOS product designed for VCC operation at 3.3V.
This device is an octal inverting buffer that is ideal for driving bus lines. The device features two Output Enables (1OE, 2OE), each controlling four of the 3-State outputs.

# DATA SHEET

## 74LVT240
ABT octal inverting buffer (3-State)

Product specification
Supersedes data of 1994 May 16
IC23 Data Handbook

1998 Feb 19

Philips
Semiconductors

PHILIPS

# 3.3V Octal inverting buffer (3-State) 74LVT240

## FEATURES

- Octal bus interface
- 3-State buffers
- Output capability: +64mA/-32mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5V supply
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Power-up 3-State
- Live insertion/extraction permitted
- No bus current loading when output is tied to 5V bus
- 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 LVT240 is a high-performance BiCMOS product designed for $V_{CC}$ operation at 3.3V.

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

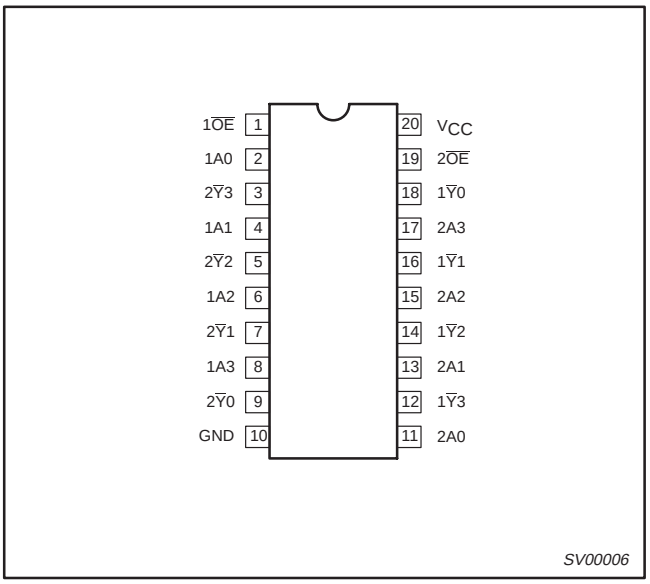
## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS $T_{amb}$ = 25°C; GND = 0V | TYPICAL | UNIT |
|---|---|---|---|---|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>nAx to n$\overline{Y}$x | $C_L$ = 50pF;<br>$V_{CC}$ = 3.3V | 2.5<br>2.6 | ns |
| $C_{IN}$ | Input capacitance | $V_I$ = 0V or 3.0V | 4 | pF |
| $C_{OUT}$ | Output capacitance | Outputs disabled; $V_O$ = 0V or 3.0V | 8 | pF |
| $I_{CCZ}$ | Total supply current | Outputs disabled; $V_{CC}$ = 3.6V | 0.12 | mA |

## ORDERING INFORMATION

| PACKAGES | TEMPERATURE RANGE | OUTSIDE NORTH AMERICA | NORTH AMERICA | DWG NUMBER |
|---|---|---|---|---|
| 20-Pin Plastic SOL | –40°C to +85°C | 74LVT240 D | 74LVT240 D | SOT163-1 |
| 20-Pin Plastic SSOP Type II | –40°C to +85°C | 74LVT240 DB | 74LVT240 DB | SOT339-1 |
| 20-Pin Plastic TSSOP Type I | –40°C to +85°C | 74LVT240 PW | 74LVT240PW DH | SOT360-1 |

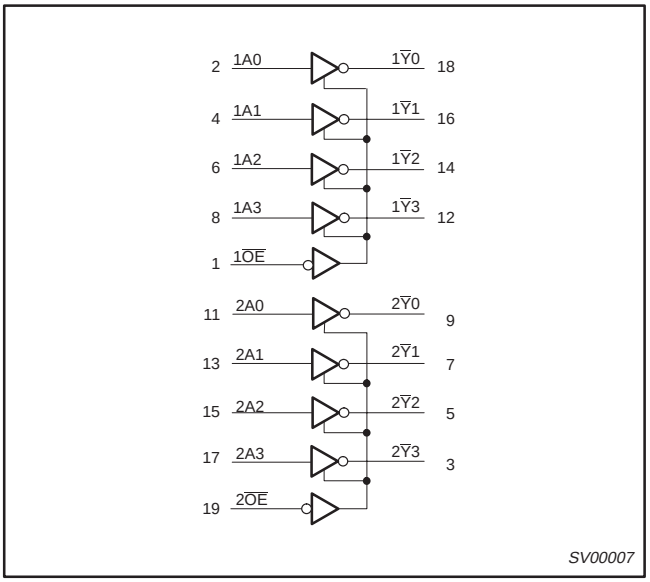
## PIN CONFIGURATION



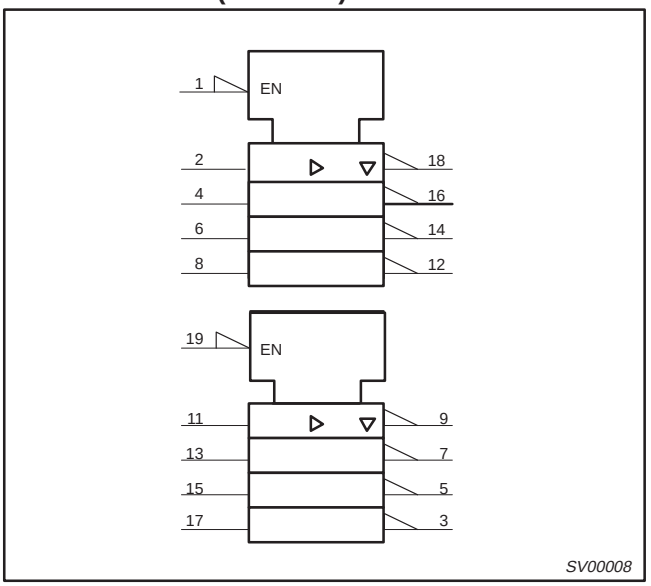

## PIN DESCRIPTION

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

## LOGIC SYMBOL




## LOGIC SYMBOL (IEEE/IEC)




## 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

## ABSOLUTE MAXIMUM RATINGS[1, 2]

| SYMBOL | PARAMETER | CONDITIONS | RATING | UNIT |
|---|---|---|---|---|
| $V_{CC}$ | DC supply voltage | | –0.5 to +4.6 | V |
| $V_I$ | DC input voltage[3] | | –0.5 to +7.0 | V |
| $V_{OUT}$ | DC output voltage[3] | Output in Off or High state | –0.5 to +7.0 | V |
| $I_{OUT}$ | DC output current | Output in Low state | 128 | mA |
| | | Output in High state | –64 | |
| $I_{IK}$ | DC input diode current | $V_I < 0$ | –50 | mA |
| $I_{OK}$ | DC output diode current | $V_O < 0$ | –50 | 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 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 | 2.7 | 3.6 | V |
| $V_I$ | Input voltage | 0 | 5.5 | 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 | | 32 | mA |
| | Low-level output current; current duty cycle ≤ 50%; f ≥ 1kHz | | 64 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate; outputs enabled | | 10 | ns/V |
| $T_{amb}$ | Operating free-air temperature range | –40 | +85 | °C |

## DC ELECTRICAL CHARACTERISTICS

| SYMBOL | PARAMETER | TEST CONDITIONS | | LIMITS $T_{amb}$ = -40°C to +85°C | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP[1] | MAX | |
| $V_{IK}$ | Input clamp voltage | $V_{CC}$ = 2.7V; $I_I$ = –18mA | | | 0.9 | –1.2 | V |
| $V_{OH}$ | High-level output voltage | $V_{CC}$ = 2.7 to 3.6V; $I_{OH}$ = –100µA | | $V_{CC}$-0.2 | $V_{CC}$-0.1 | | V |
| | | $V_{CC}$ = 2.7V; $I_{OH}$ = –8mA | | 2.4 | 2.5 | | V |
| | | $V_{CC}$ = 3V; $I_{OH}$ = –32mA | | 2 | 2.2 | | V |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = 2.7V; $I_{OL}$ = 100µA | | | 0.1 | 0.2 | V |
| | | $V_{CC}$ = 2.7V; $I_{OL}$ = 24mA | | | 0.3 | 0.5 | |
| | | $V_{CC}$ = 3V; $I_{OL}$ = 16mA | | | 0.25 | 0.4 | |
| | | $V_{CC}$ = 3V; $I_{OL}$ = 32mA | | | 0.3 | 0.5 | |
| | | $V_{CC}$ = 3V; $I_{OL}$ = 64mA | | | 0.4 | 0.55 | |
| $I_I$ | Input leakage current | $V_{CC}$ = 0 or 3.6V; $V_I$ = 5.5V | | | 1 | 10 | µA |
| | | $V_{CC}$ = 3.6V; $V_I$ = $V_{CC}$ or GND | Control pins | | ±0.1 | ±1 | |
| | | $V_{CC}$ = 3.6V; $V_I$ = $V_{CC}$ | Data pins[4] | | 0.1 | 1 | |
| | | $V_{CC}$ = 3.6V; $V_I$ = 0 | | | –1 | -5 | |
| $I_{OFF}$ | Output off current | $V_{CC}$ = 0V; $V_I$ or $V_O$ = 0 to 4.5V | | | 1 | ±100 | µA |
| $I_{HOLD}$ | Bus Hold current A inputs[NO TAG] | $V_{CC}$ = 3V; $V_I$ = 0.8V | | 75 | 150 | | µA |
| | | $V_{CC}$ = 3V; $V_I$ = 2.0V | | –75 | –150 | | |
| | | $V_{CC}$ = 0V to 3.6V; $V_{CC}$ = 3.6V | | ±500 | | | |
| $I_{EX}$ | Current into an output in the High state when $V_O > V_{CC}$ | $V_O$ = 5.5V; $V_{CC}$ = 3.0V | | | 60 | 125 | µA |
| $I_{PU/PD}$ | Power up/down 3-State output current[3] | $V_{CC}$ = ≤ 1.2V; $V_O$ = 0.5V to $V_{CC}$; $V_I$ = GND or $V_{CC}$; $\overline{OE}$/OE = Don't care | | | ±1 | ±100 | µA |
| $I_{OZH}$ | 3-State output High current | $V_{CC}$ = 3.6V; $V_O$ = 3.0V | | | 1 | 5 | µA |
| $I_{OZL}$ | 3-State output Low current | $V_{CC}$ = 3.6V; $V_O$ = 0.5V | | | –1 | –5 | µA |
| $I_{CCH}$ | Quiescent supply current | $V_{CC}$ = 3.6V; Outputs High, $V_I$ = GND or $V_{CC}$, $I_O$ = 0 | | | 0.12 | 0.19 | mA |
| $I_{CCL}$ | | $V_{CC}$ = 3.6V; Outputs Low, $V_I$ = GND or $V_{CC}$, $I_O$ = 0 | | | 3 | 12 | |
| $I_{CCZ}$ | | $V_{CC}$ = 3.6V; Outputs Disabled; $V_I$ = GND or $V_{CC}$, $I_O$ = 0[NO TAG] | | | 0.12 | 0.19 | |
| $\Delta I_{CC}$ | Additional supply current per input pin[2] | $V_{CC}$ = 3.0 to 3.6V; One input at $V_{CC}$ -0.6V; Other inputs at $V_{CC}$ or GND | | | 0.1 | 0.2 | mA |

**NOTES:**
1. All typical values are at $T_{amb}$ = 25°C.
2. This is the increase in supply current for each input at $V_{CC}$ –0.6V.
3. This parameter is valid for any $V_{CC}$ between 0V and 1.2V with a transition time of up to 10msec. From $V_{CC}$ = 1.2V to $V_{CC}$ = 3.3V ± 10% a transition time of 100µsec is permitted. This parameter is valid for $T_{amb}$ = 25°C, only.
4. Unused pins at $V_{CC}$ or GND
5. $I_{CCZ}$ is measured with outputs pulled to $V_{CC}$ or GND.
6. This is the bus hold overdrive current required to force the input to the opposite logic state.

## AC CHARACTERISTICS

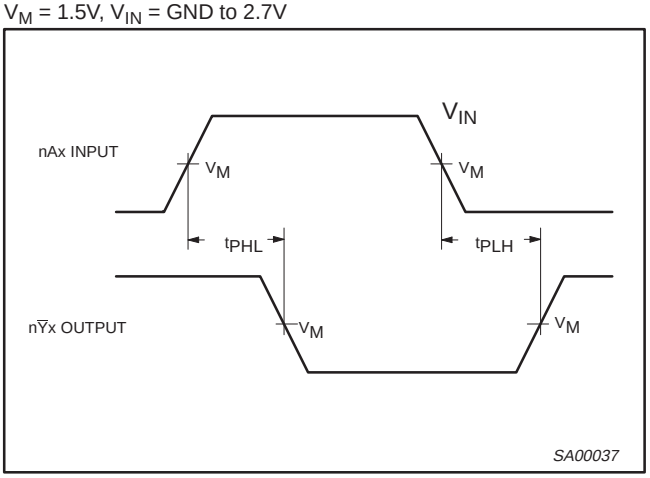
GND = 0V; $t_R = t_F$ = 2.5ns; $C_L$ = 50pF; $R_L$ = 500Ω;$T_{amb}$ = –40°C to +85°C.

| SYMBOL | PARAMETER | WAVEFORM | LIMITS | | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | $T_{amb}$ = –40°C to +85°C<br>$V_{CC}$ = +3.3V ±0.3V | | | $V_{CC}$ = 2.7V | |
| | | | MIN | TYP[1] | MAX | MAX | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>nAx to n$\overline{Y}$x | 1 | 1<br>1 | 2.5<br>2.5 | 4.3<br>4.3 | 5.2<br>5.0 | ns |
| $t_{PZH}$<br>$t_{PZL}$ | Output enable time<br>to High and Low level | 2 | 1<br>1 | 3.7<br>3.1 | 5.2<br>5.2 | 6.3<br>6.7 | ns |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output disable time<br>from High and Low level | 2 | 2<br>1.6 | 3.4<br>3.2 | 5.6<br>5.1 | 6.3<br>5.6 | ns |

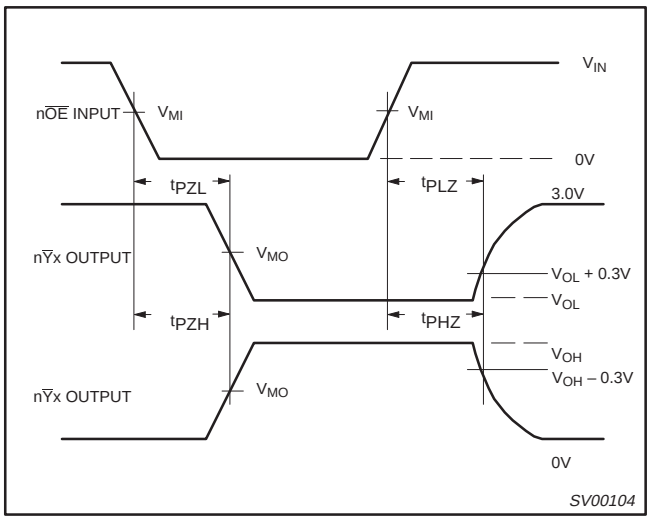
**NOTE:**
1. All typical values are at $V_{CC}$ = 3.3V and $T_{amb}$ = 25°C.

## AC WAVEFORMS

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

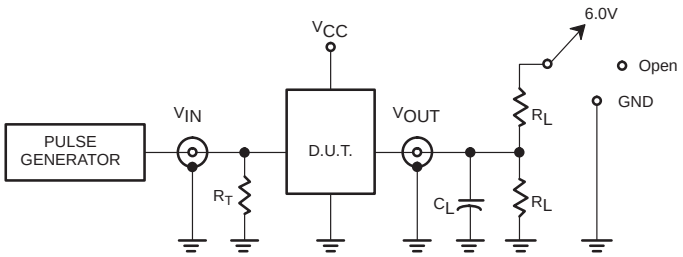



**Waveform 1. Input (nAx) to Output (n$\overline{Y}$x) Propagation Delays**

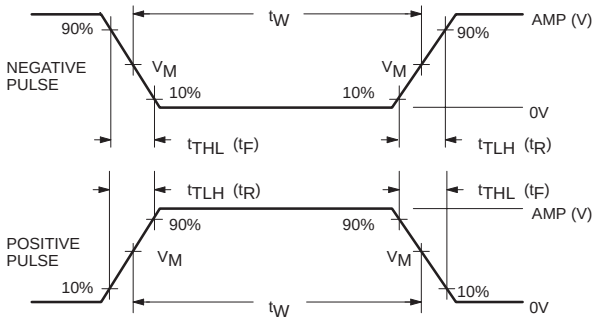



**Waveform 2. 3-State Output Enable and Disable Times**

## TEST CIRCUIT AND WAVEFORMS




Test Circuit for 3-State Outputs




$V_M$ = 1.5V
Input Pulse Definition

### SWITCH POSITION

| TEST | SWITCH |
|---|---|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 6V |
| $t_{PHZ}/t_{PZH}$ | GND |

### DEFINITIONS

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

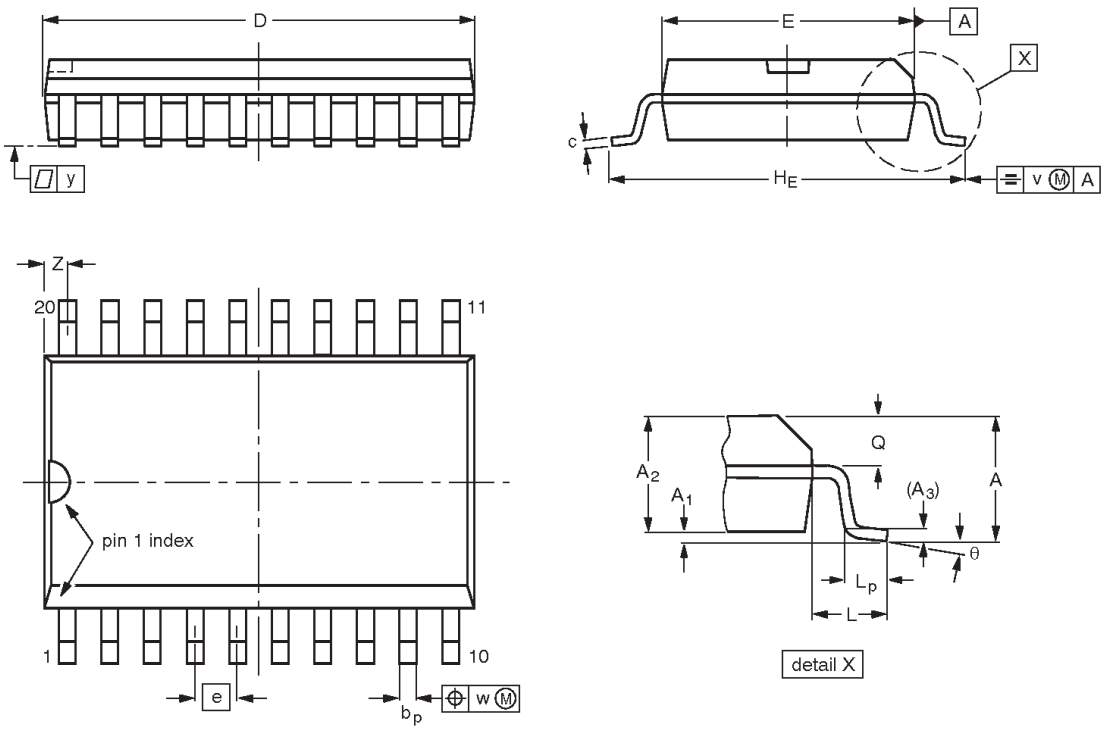
$C_L$ = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

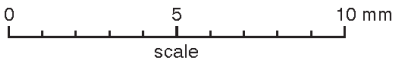
$R_T$ = Termination resistance should be equal to $Z_{OUT}$ of pulse generators.

| FAMILY | INPUT PULSE REQUIREMENTS | | | | |
|---|---|---|---|---|---|
| | Amplitude | Rep. Rate | $t_W$ | $t_R$ | $t_F$ |
| 74LVT | 2.7V | ≤10MHz | 500ns | ≤2.5ns | ≤2.5ns |

SV00092

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




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

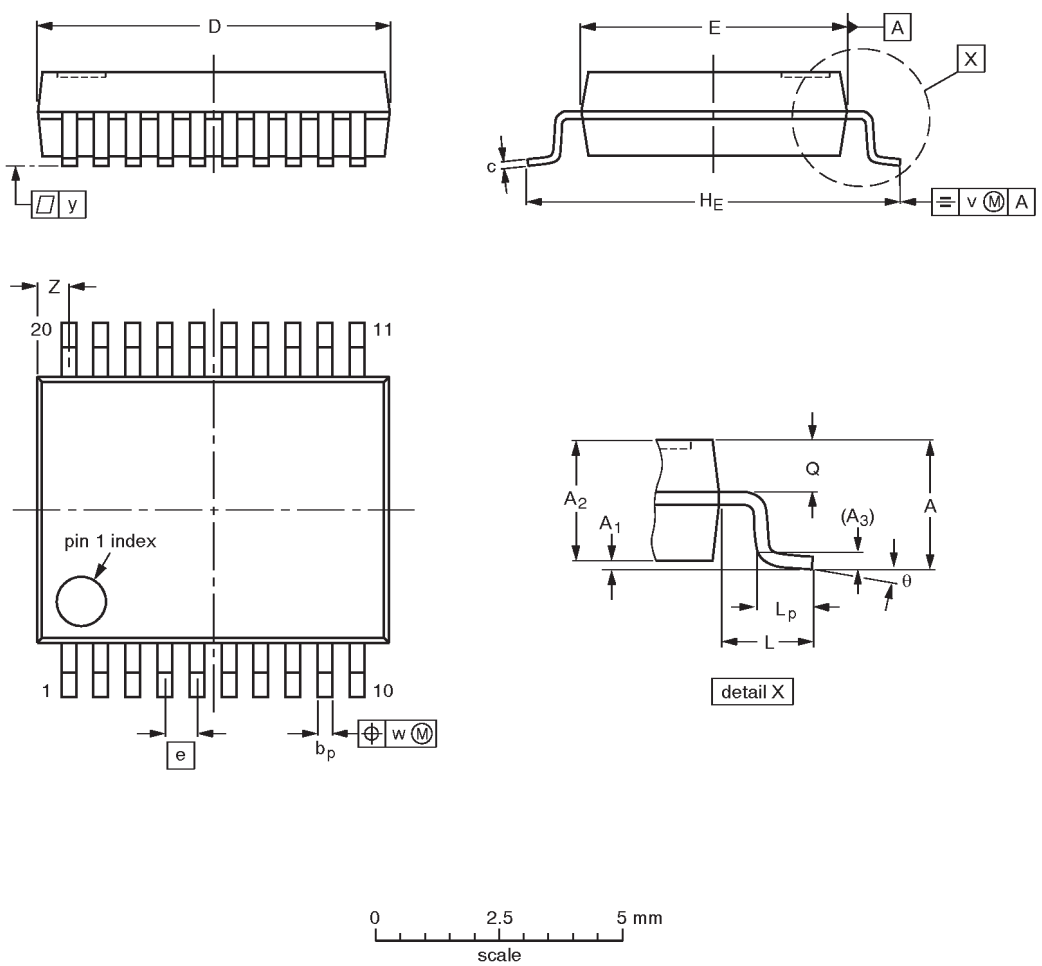
| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (1) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.65 | 0.30<br>0.10 | 2.45<br>2.25 | 0.25 | 0.49<br>0.36 | 0.32<br>0.23 | 13.0<br>12.6 | 7.6<br>7.4 | 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°<br>0° |
| 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)**

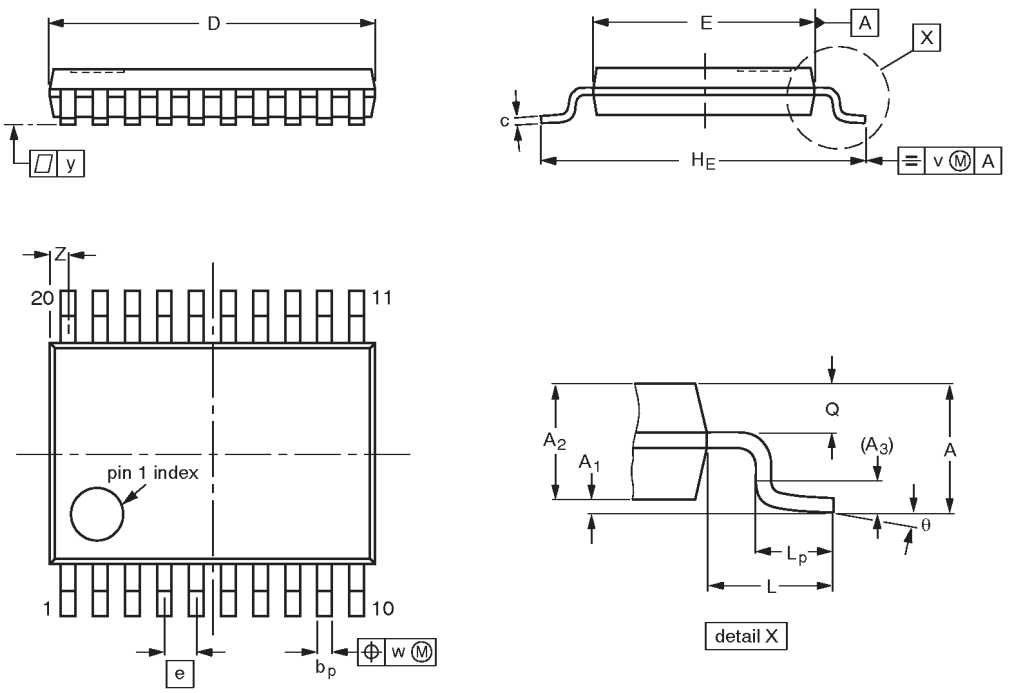
| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.0 | 0.21<br>0.05 | 1.80<br>1.65 | 0.25 | 0.38<br>0.25 | 0.20<br>0.09 | 7.4<br>7.0 | 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° |

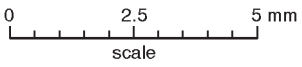
**Note**

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 |

## 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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