# DATA SHEET

## 74ALS153
## Dual 4-input multiplexer

Product specification

IC05 Data Handbook

1991 Feb 08

Philips
Semiconductors

PHILIPS

# Dual 4-input multiplexer 74ALS153

## FEATURES

- Non–inverting outputs
- Common select outputs
- Separate enable for each section
- See 74ALS253 for 3–State version

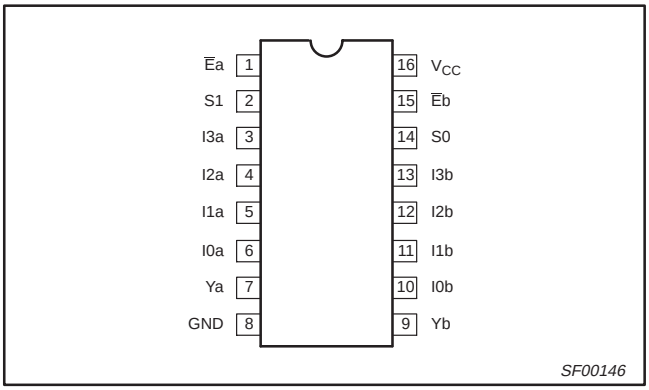
## DESCRIPTION

The 74ALS153 has two identical 4–input multiplexer with 3–State outputs which selects two bits of data from four sources by using common select inputs (S0, S1). The two 4–input multiplexer circuits have individual active–Low enables ($\overline{E}a$, $\overline{E}b$) which can be used to strobe the outputs independently. Outputs (Ya, Yb) are forced Low when the corresponding enable is high.

The 74ALS153 is the logic implementation of a 2–pole, 4–position switch where the position of the switch is determined by the logic levels supplied to the common select inputs.

| TYPE | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|---|---|---|
| 74ALS153 | 7.0ns | 6.5mA |

## PIN CONFIGURATION




## ORDERING INFORMATION

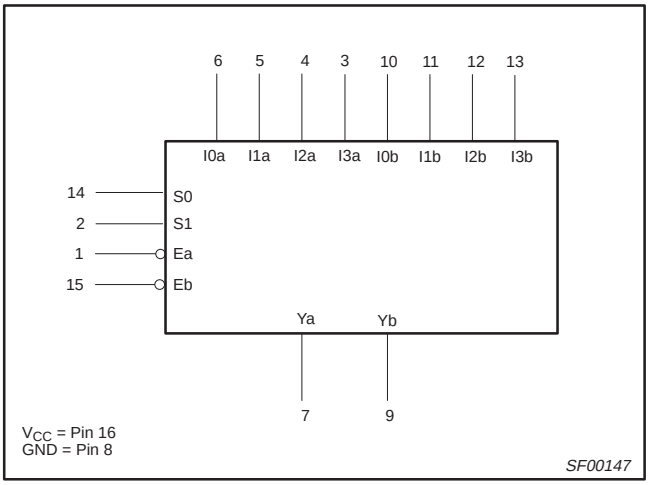
| DESCRIPTION | ORDER CODE: COMMERCIAL RANGE $V_{CC}$ = 5V ±10%, $T_{amb}$ = 0°C to +70°C | DRAWING NUMBER |
|---|---|---|
| 16-pin plastic DIP | 74ALS153N | SOT38-4 |
| 16-pin plastic SO | 74ALS153D | SOT109-1 |
| 16-pin plastic SSOP Type II | 74ALS153DB | SOT338-1 |

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

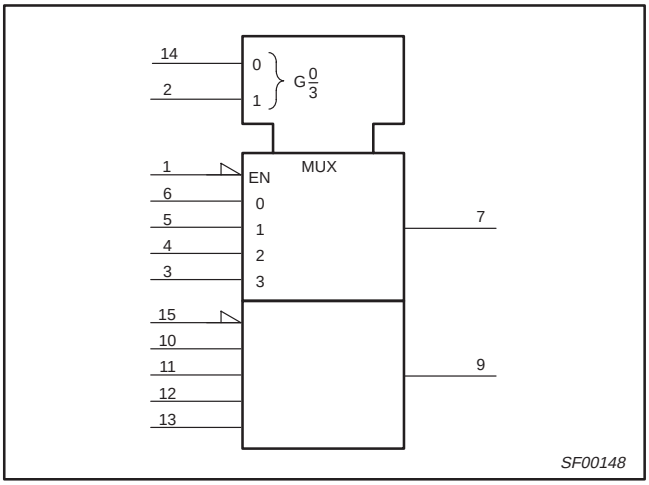
| PINS | DESCRIPTION | 74ALS (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|---|---|---|---|
| Ioa – I3a | Port A data inputs | 1.0/1.0 | 20µA/0.1mA |
| Iob – I3b | Port B data inputs | 1.0/1.0 | 20µA/0.1mA |
| S0, S1 | Common select inputs | 1.0/1.0 | 20µA/0.1mA |
| $\overline{E}a$ | Port A enable input | 1.0/1.0 | 20µA/0.1mA |
| $\overline{E}b$ | Port B enable input | 1.0/1.0 | 20µA/0.1mA |
| Ya, Yb | Data outputs | 130/240 | 2.6mA/24mA |

**NOTE:** One (1.0) ALS unit load is defined as: 20µA in the High state and 0.1mA in the Low state.

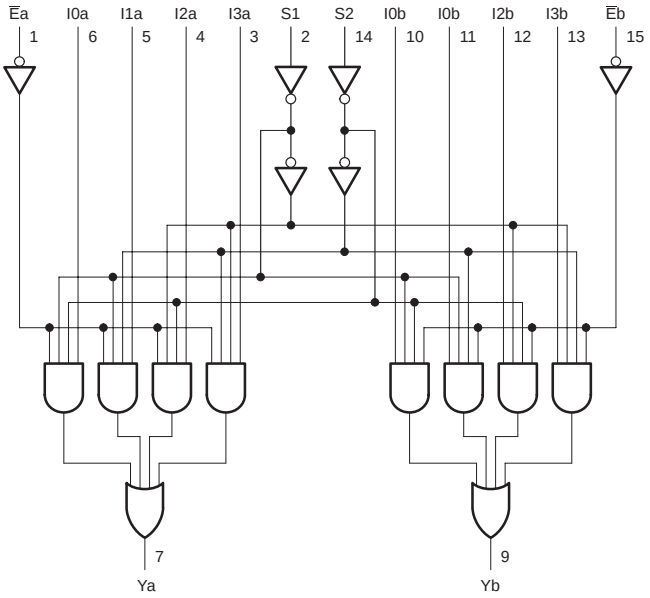
## LOGIC SYMBOL




## IEC/IEEE SYMBOL



## LOGIC DIAGRAM




$V_{CC}$ = Pin 16
GND = Pin 8

*SF00149A*

## FUNCTION TABLE

| INPUTS | | | | | | | OUTPUT |
|---|---|---|---|---|---|---|---|
| **S0** | **S1** | **I0n** | **I1n** | **I2n** | **I3n** | **$\bar{E}$n** | **Yn** |
| L | L | L | X | X | X | L | L |
| L | L | H | X | X | X | L | H |
| H | L | X | L | X | X | L | L |
| H | L | X | H | X | X | L | H |
| L | H | X | X | L | X | L | L |
| L | H | X | X | H | X | L | H |
| H | H | X | X | X | L | L | L |
| H | H | X | X | X | H | L | H |

H = High voltage level
L = Low voltage level
X = Don't care

## ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limit set forth in this table may impair the useful life of the device.
Unless otherwise noted these limits are over the operating free-air temperature range.)

| SYMBOL | PARAMETER | RATING | UNIT |
|---|---|---|---|
| $V_{CC}$ | Supply voltage | –0.5 to +7.0 | V |
| $V_{IN}$ | Input voltage | –0.5 to +7.0 | V |
| $I_{IN}$ | Input current | –30 to +5 | mA |
| $V_{OUT}$ | Voltage applied to output in high output state | –0.5 to $V_{CC}$ | V |
| $I_{OUT}$ | Current applied to output in Low output state | 48 | mA |
| $T_{amb}$ | Operating free-air temperature range | 0 to +70 | °C |
| $T_{stg}$ | Storage temperature range | –65 to +150 | °C |

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | LIMITS | | | UNIT |
|---|---|---|---|---|---|
| | | MIN | NOM | MAX | |
| $V_{CC}$ | Supply voltage | 4.5 | 5.0 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | 2.0 | | | V |
| $V_{IL}$ | Low-level input voltage | | | 0.8 | V |
| $I_{Ik}$ | Input clamp current | | | –18 | mA |
| $I_{OH}$ | High-level output current | | | –2.6 | mA |
| $I_{OL}$ | Low-level output current | | | 24 | mA |
| $T_{amb}$ | Operating free-air temperature range | 0 | | +70 | °C |

## DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

| SYMBOL | PARAMETER | TEST CONDITIONS[1] | | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP[2] | MAX | |
| $V_{OH}$ | High-level output voltage | $V_{CC}$ = ±10%, $V_{IL}$ = MAX, $V_{IH}$ = MIN | $I_{OH}$ = –0.4mA | $V_{CC}$ – 2 | | | V |
| | | | $I_{OH}$ = MAX | 2.4 | 3.2 | | V |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = MIN, $V_{IL}$ = MAX, $V_{IH}$ = MIN | $I_{OL}$ = 12mA | | 0.25 | 0.40 | V |
| | | | $I_{OL}$ = 24mA | | 0.35 | 0.50 | V |
| $V_{IK}$ | Input clamp voltage | $V_{CC}$ = MIN, $I_I$ = $I_{IK}$ | | | –0.73 | –1.5 | V |
| $I_I$ | Input current at minimum input voltage | $V_{CC}$ = MAX, $V_I$ = 7.0V | | | | 0.1 | mA |
| $I_{IH}$ | High-level input current | $V_{CC}$ = MAX, $V_I$ = 2.7V | | | | 20 | µA |
| $I_{IL}$ | Low-level input current | $V_{CC}$ = MAX, $V_I$ = 0.4V | | | | –0.1 | mA |
| $I_O$ | Output current[3] | $V_{CC}$ = MAX, $V_O$ = 2.25V | | –30 | | –112 | mA |
| $I_{CC}$ | Supply current (total) | $V_{CC}$ = MAX | | | 6.5 | 12 | mA |

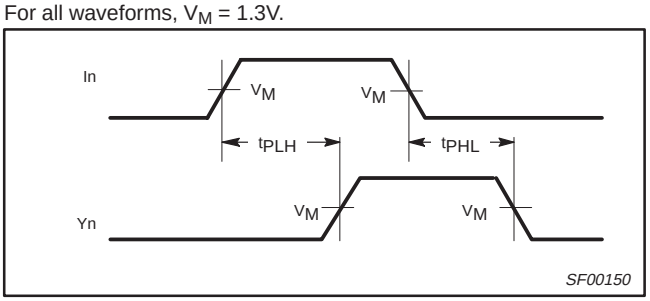
**NOTES:**
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at $V_{CC}$ = 5V, $T_{amb}$ = 25°C.
3. The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, $I_{OS}$.

## AC ELECTRICAL CHARACTERISTICS

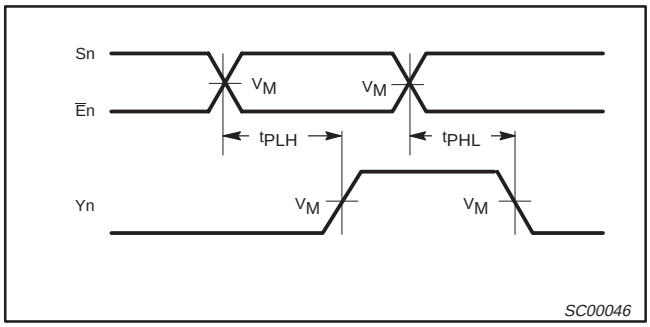
| SYMBOL | PARAMETER | TEST CONDITION | LIMITS | | UNIT |
|---|---|---|---|---|---|
| | | | $T_{amb}$ = 0°C to +70°C<br>$V_{CC}$ = +5.0V ± 10%<br>$C_L$ = 50pF, $R_L$ = 500Ω | | |
| | | | MIN | MAX | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>In to Yn | Waveform 1 | 4.0<br>4.0 | 12.0<br>12.0 | ns |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>Sn to Yn | Waveform 2 | 5.0<br>7.0 | 15.0<br>16.0 | ns |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>$\overline{E}$n to Yn | Waveform 2 | 3.0<br>5.0 | 10.0<br>12.0 | ns |

## AC WAVEFORMS

For all waveforms, $V_M$ = 1.3V.

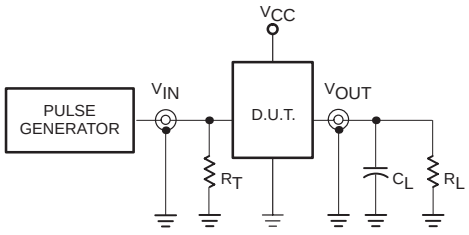



**Waveform 1. Propagation Delay for Data to Output**

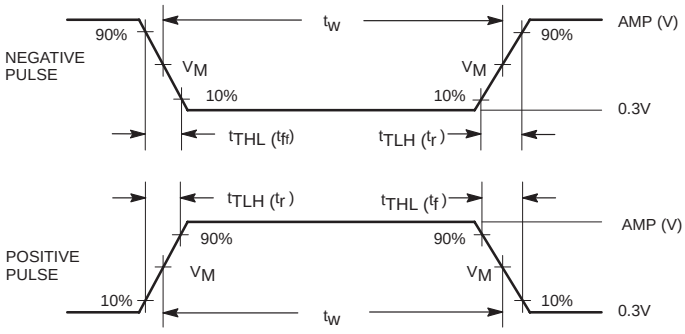



**Waveform 2. Propagation Delay for Select or Enable to Output**

## TEST CIRCUIT AND WAVEFORMS




**Test Circuit for Totem-pole Outputs**




**Input Pulse Definition**

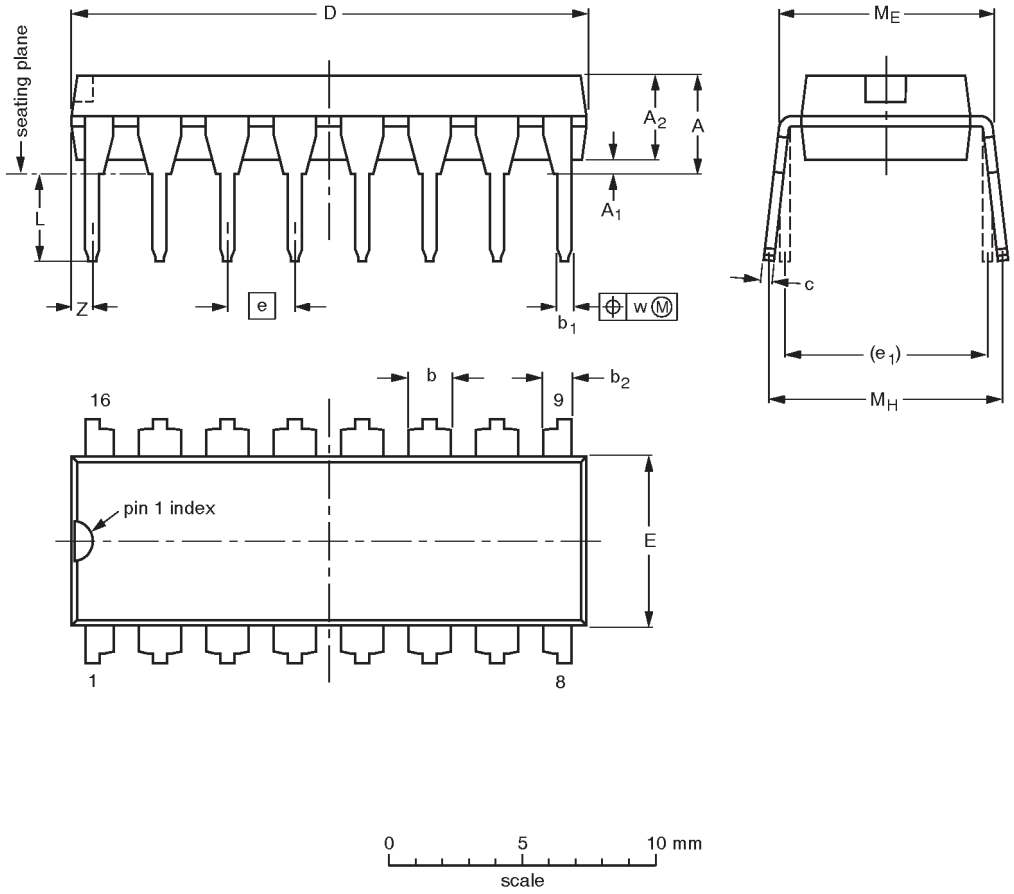
| Family | INPUT PULSE REQUIREMENTS | | | | | |
|---|---|---|---|---|---|---|
| | Amplitude | $V_M$ | Rep.Rate | $t_w$ | $t_{TLH}$ | $t_{THL}$ |
| 74ALS | 3.5V | 1.3V | 1MHz | 500ns | 2.0ns | 2.0ns |

**DEFINITIONS:**

$R_L$ = Load resistor; see AC electrical characteristics for value.
$C_L$ = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
$R_T$ = Termination resistance should be equal to $Z_{OUT}$ of pulse generators.

SC00005

**DIP16: plastic dual in-line package; 16 leads (300 mil)** **SOT38-4**




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

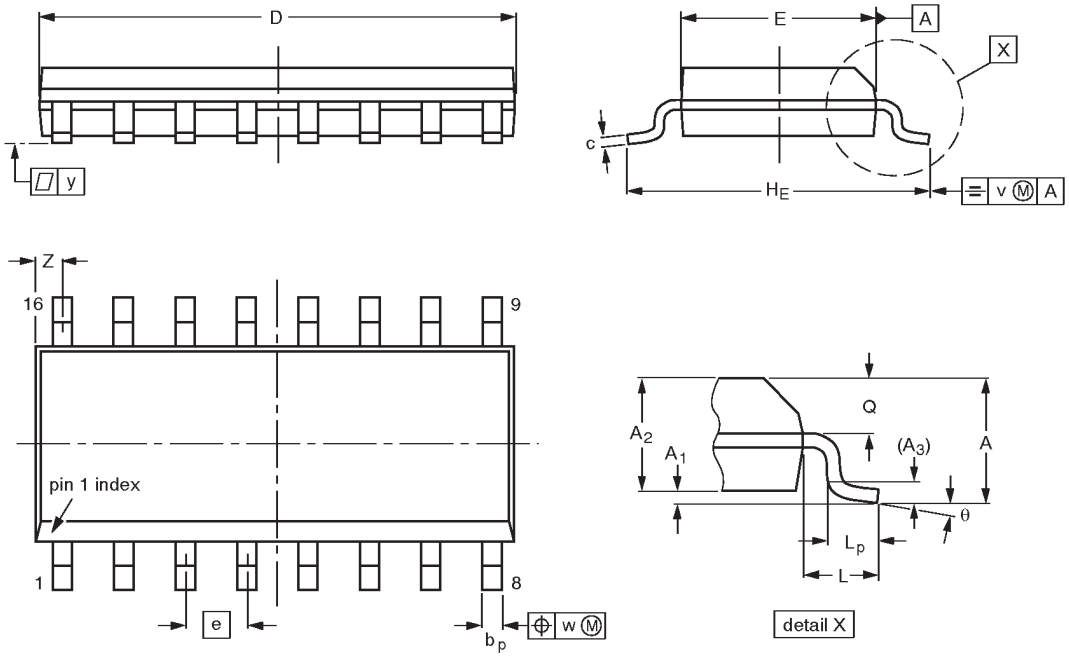
| UNIT | A max. | $A_1$ min. | $A_2$ max. | b | $b_1$ | $b_2$ | c | D (1) | E (1) | e | $e_1$ | L | $M_E$ | $M_H$ | w | Z (1) max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.2 | 0.51 | 3.2 | 1.73<br>1.30 | 0.53<br>0.38 | 1.25<br>0.85 | 0.36<br>0.23 | 19.50<br>18.55 | 6.48<br>6.20 | 2.54 | 7.62 | 3.60<br>3.05 | 8.25<br>7.80 | 10.0<br>8.3 | 0.254 | 0.76 |
| inches | 0.17 | 0.020 | 0.13 | 0.068<br>0.051 | 0.021<br>0.015 | 0.049<br>0.033 | 0.014<br>0.009 | 0.77<br>0.73 | 0.26<br>0.24 | 0.10 | 0.30 | 0.14<br>0.12 | 0.32<br>0.31 | 0.39<br>0.33 | 0.01 | 0.030 |

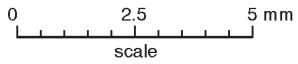
**Note**

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 | | | |
| SOT38-4 | | | | | | ~~92-11-17~~<br>95-01-14 |

**SO16: plastic small outline package; 16 leads; body width 3.9 mm** **SOT109-1**




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

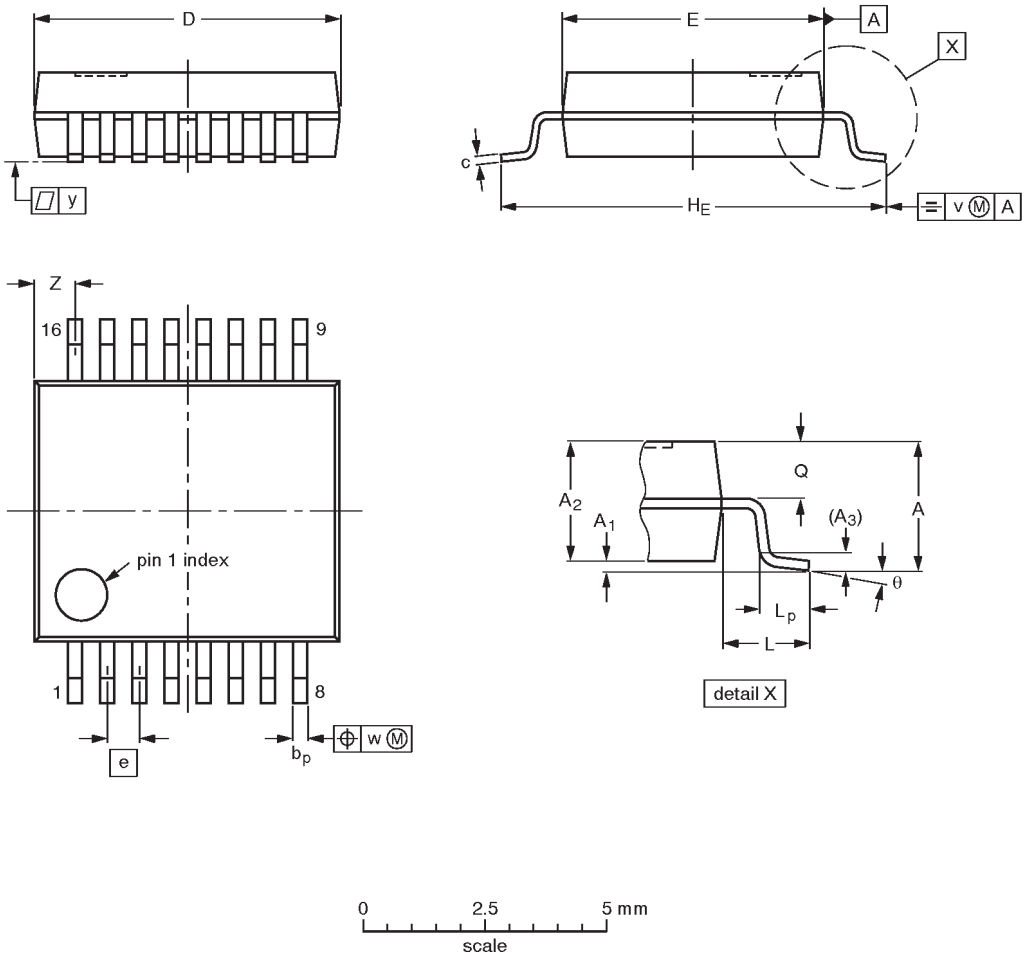
| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 10.0<br>9.8 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | 8°<br>0° |
| inches | 0.069 | 0.0098<br>0.0039 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0098<br>0.0075 | 0.39<br>0.38 | 0.16<br>0.15 | 0.050 | 0.24<br>0.23 | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

**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 | | | |
| SOT109-1 | 076E07S | MS-012AC | | | | ~~91-08-13~~<br>95-01-23 |

**SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm** **SOT338-1**




**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 | 6.4<br>6.0 | 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 | 1.00<br>0.55 | 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 | | | |
| SOT338-1 | | MO-150AC | | | | ~~94-01-14~~<br>95-02-04 |

## 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. |
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