DATA SHEET

74LVC125A

Quad buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

Product specification
Supersedes data of 1997 Aug 01
IC24 Data Handbook

1998 Apr 28

Philips
Semiconductors

PHILIPS

Quad buffer/line driver with 5-volt tolerant inputs/outputs (3-state)

74LVC125A

FEATURES

- 5-volt tolerant inputs/outputs, for interfacing with 5-volt logic
- Supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A
- CMOS low power consumption
- Direct interface with TTL levels
- High impedance when V_{CC} = 0V

DESCRIPTION

The 74LVC125A is a high performance, low-power, low-voltage Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3V or 5.0V devices. In 3-state operation, outputs can handle 5V.

The 74LVC125A consists of four non-inverting buffers/line drivers with 3-state outputs. The 3-state outputs (nY) are controlled by the output enable input ($n\overline{OE}$). A HIGH at $n\overline{OE}$ causes the outputs to assume a high impedance OFF-state.

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 nA to nY	C_L = 50 pF; V_{CC} = 3.3 V	3.0	ns
C_I	Input capacitance		5.0	pF
C_{PD}	Power dissipation capacitance per buffer	V_{CC} = 3.3 V Notes 1 and 2	25	pF

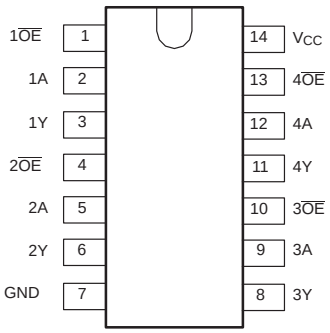
NOTES:

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

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
14-Pin Plastic SO	–40°C to +125°C	74LVC125A D	74LVC125A D	SOT108-1
14-Pin Plastic SSOP Type II	–40°C to +125°C	74LVC125A DB	74LVC125A DB	SOT337-1
14-Pin Plastic TSSOP Type I	–40°C to +125°C	74LVC125A PW	7LVC125APW DH	SOT402-1

PIN CONFIGURATION

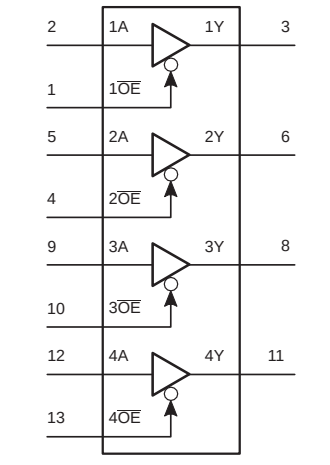


SV00455

PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 4, 10, 13	1$\overline{OE}$ – 4$\overline{OE}$	Data enable inputs (active LOW)
2, 5, 9, 12	1A – 4A	Data inputs
3, 6, 8, 11	1Y – 4Y	Data Outputs
7	GND	Ground (0 V)
14	V_{CC}	Positive supply voltage

LOGIC SYMBOL



SV00456

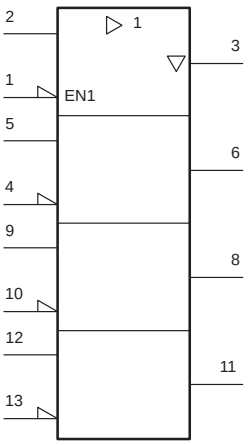
FUNCTION TABLE

INPUTS		OUTPUT
n$\overline{OE}$	nA	nY
L	L	L
L	H	H
H	X	Z

NOTES:

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

LOGIC SYMBOL (IEEE/IEC)



SV00457

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V_{CC}	DC supply voltage (for max. speed performance)		2.7	3.6	V
	DC supply voltage (for low-voltage applications)		1.2	3.6	
V_I	DC input voltage range		0	5.5	V
V_O	DC output voltage range; output HIGH or LOW state		0	V_{CC}	V
	DC output voltage range; output 3-State		0	5.5	
T_{amb}	Operating ambient temperature range in free-air		–40	+85	°C
t_r, t_f	Input rise and fall times	V_{CC} = 1.2 to 2.7V V_{CC} = 2.7 to 3.6V	0 0	20 10	ns/V

ABSOLUTE MAXIMUM RATINGS[1]

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 +6.5	V
I_{IK}	DC input diode current	$V_I < 0$	–50	mA
V_I	DC input voltage	Note 2	–0.5 to +6.5	V
I_{OK}	DC output diode current	$V_O > V_{CC}$ or $V_O < 0$	±50	mA
V_O	DC output voltage; output HIGH or LOW state	Note 2	–0.5 to V_{CC} +0.5	V
	DC output voltage; output 3-State	Note 2	–0.5 to 6.5	
I_{OUT}	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 – plastic mini-pack (SO) – plastic shrink mini-pack (SSOP and TSSOP)	 above +70°C derate linearly with 8 mW/K above +60°C derate linearly with 5.5 mW/K	 500 500	mW

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 input and output voltage ratings may be exceeded if the input and output current ratings are observed.

DC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP[1]	MAX	
V_{IH}	HIGH level Input voltage	V_{CC} = 1.2V	V_{CC}			V
		V_{CC} = 2.7 to 3.6V	2.0			
V_{IL}	LOW level Input voltage	V_{CC} = 1.2V			GND	V
		V_{CC} = 2.7 to 3.6V			0.8	
V_{OH}	HIGH level output voltage	V_{CC} = 2.7V; V_I = V_{IH} or V_{IL}; I_O = –12mA	V_{CC} – 0.5			V
		V_{CC} = 3.0V; V_I = V_{IH} or V_{IL}; I_O = –100µA	V_{CC} – 0.2	V_{CC}		
		V_{CC} = 3.0V; V_I = V_{IH} or $V_{IL;}$ I_O = –18mA	V_{CC} – 0.6			
		V_{CC} = 3.0V; V_I = V_{IH} or $V_{IL;}$ I_O = –24mA	V_{CC} – 0.8			
V_{OL}	LOW level output voltage	V_{CC} = 2.7V; V_I = V_{IH} or V_{IL}; I_O = 12mA			0.40	V
		V_{CC} = 3.0V; V_I = V_{IH} or V_{IL}; I_O = 100µA		GND	0.20	
		V_{CC} = 3.0V; V_I = V_{IH} or $V_{IL;}$ I_O = 24mA			0.55	
I_I	Input leakage current	V_{CC} = 3.6V; V_I = 5.5V or GND		±0.1	±5	µA
I_{OZ}	3-State output OFF-state current[2]	V_{CC} = 3.6V; V_I = V_{IH} or V_{IL}; V_O = 5.5V or GND		0.1	±5	µA
I_{off}	Power off leakage supply	V_{CC} = 0.0V; V_I or V_O = 5.5V		0.1	±10	µA
I_{CC}	Quiescent supply current	V_{CC} = 3.6V; V_I = V_{CC} or GND; I_O = 0		0.1	10	µA
ΔI_{CC}	Additional quiescent supply current per input pin	V_{CC} = 2.7V to 3.6V; V_I = V_{CC} –0.6V; I_O = 0		5	500	µA

NOTE:
1. All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.
2. For I/O ports the parameter I_{OZ} includes the input leakage current.

AC CHARACTERISTICS

GND = 0 V; t_r = t_f = 2.5 ns; C_L = 50 pF; R_L = 500Ω

SYMBOL	PARAMETER	WAVEFORM	LIMITS						UNIT
			V_{CC} = 3.3V ±0.3V			V_{CC} = 2.7V		V_{CC} = 1.2V	
			MIN	TYP[1]	MAX	MIN	MAX	TYP	
t_{PHL} t_{PLH}	Propagation delay nA to nY	Figures 1, 3	1.5	3.0	4.8	1.5	5.5	12.0	ns
t_{PZH} t_{PZL}	3-State output enable time n$\overline{OE}$ to nY	Figures 2, 3	1.5	3.8	5.7	1.5	6.7	13.0	ns
t_{PHZ} t_{PLZ}	3-State output disable time n$\overline{OE}$ to nY	Figures 2, 3	1.5	3.7	5.2	1.5	6.2	8	ns

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

AC WAVEFORMS

V_M = 1.5 V at $V_{CC} \geq$ 2.7 V;
V_M = 0.5 • V_{CC} at V_{CC} < 2.7 V
V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

$V_X = V_{OL}$ + 0.3 V at $V_{CC} \geq$ 2.7 V
$V_X = V_{OL}$ + 0.1 V at V_{CC} > 2.7 V
$V_Y = V_{OH}$ – 0.3 V at $V_{CC} \geq$ 2.7 V
$V_Y = V_{OH}$ – 0.1 V at V_{CC} < 2.7 V

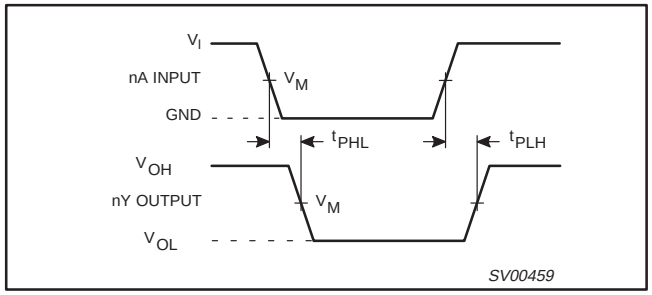


Figure 1. Input (nA) to output (nY) propagation delays.

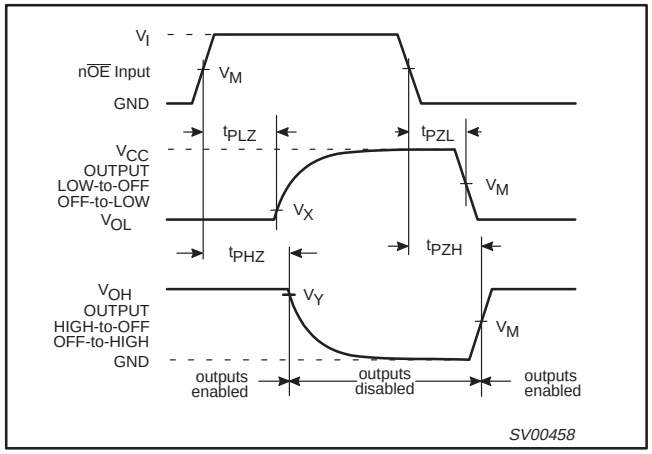
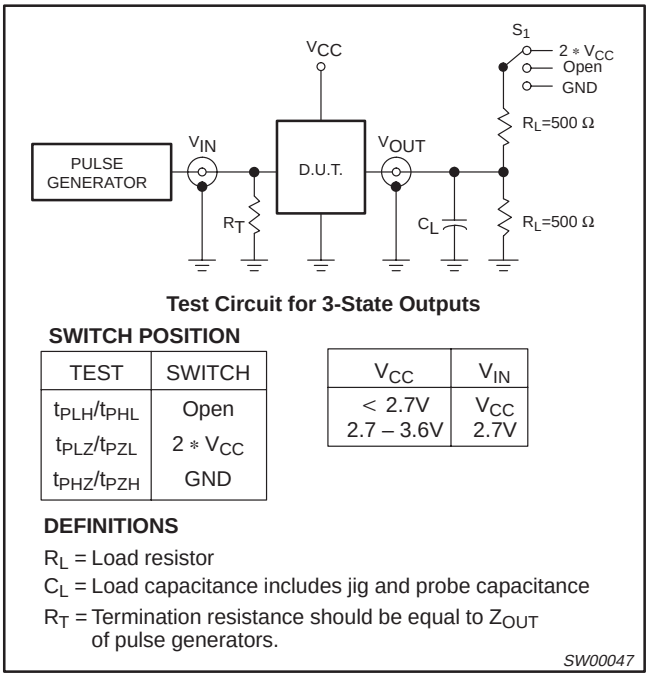


Figure 2. 3-state enable and disable times.

TEST CIRCUIT



Test Circuit for 3-State Outputs

SWITCH POSITION

TEST	SWITCH
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	2 * V_{CC}
t_{PHZ}/t_{PZH}	GND

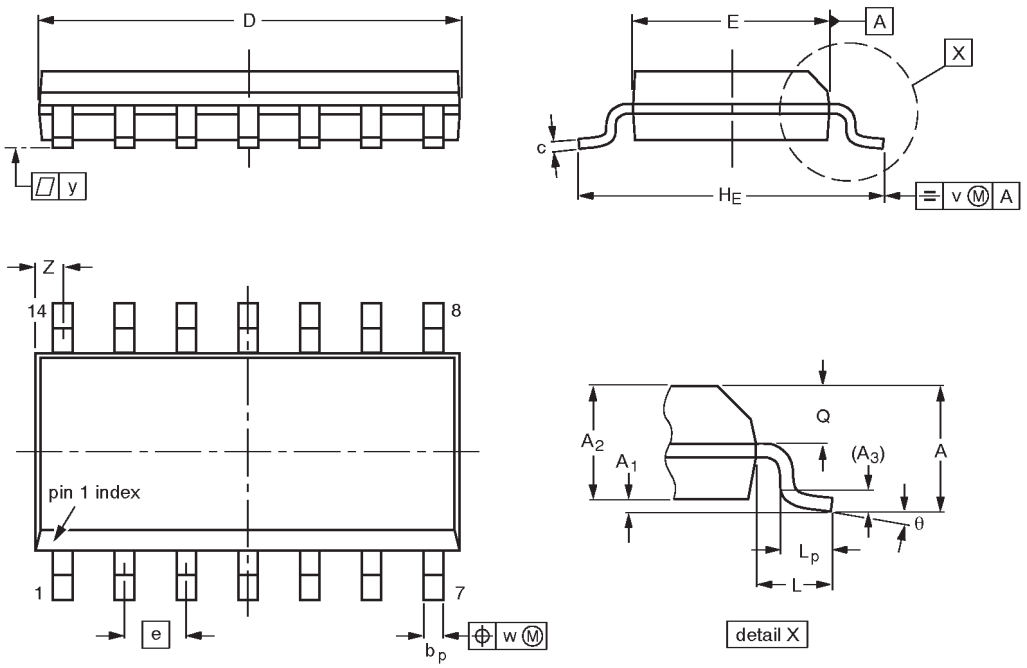
V_{CC}	V_{IN}
< 2.7V	V_{CC}
2.7 – 3.6V	2.7V

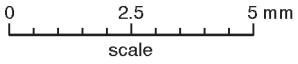
DEFINITIONS

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.

Figure 3. Load circuitry for switching times.

SO14: plastic small outline package; 14 leads; body width 3.9 mm **SOT108-1**





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

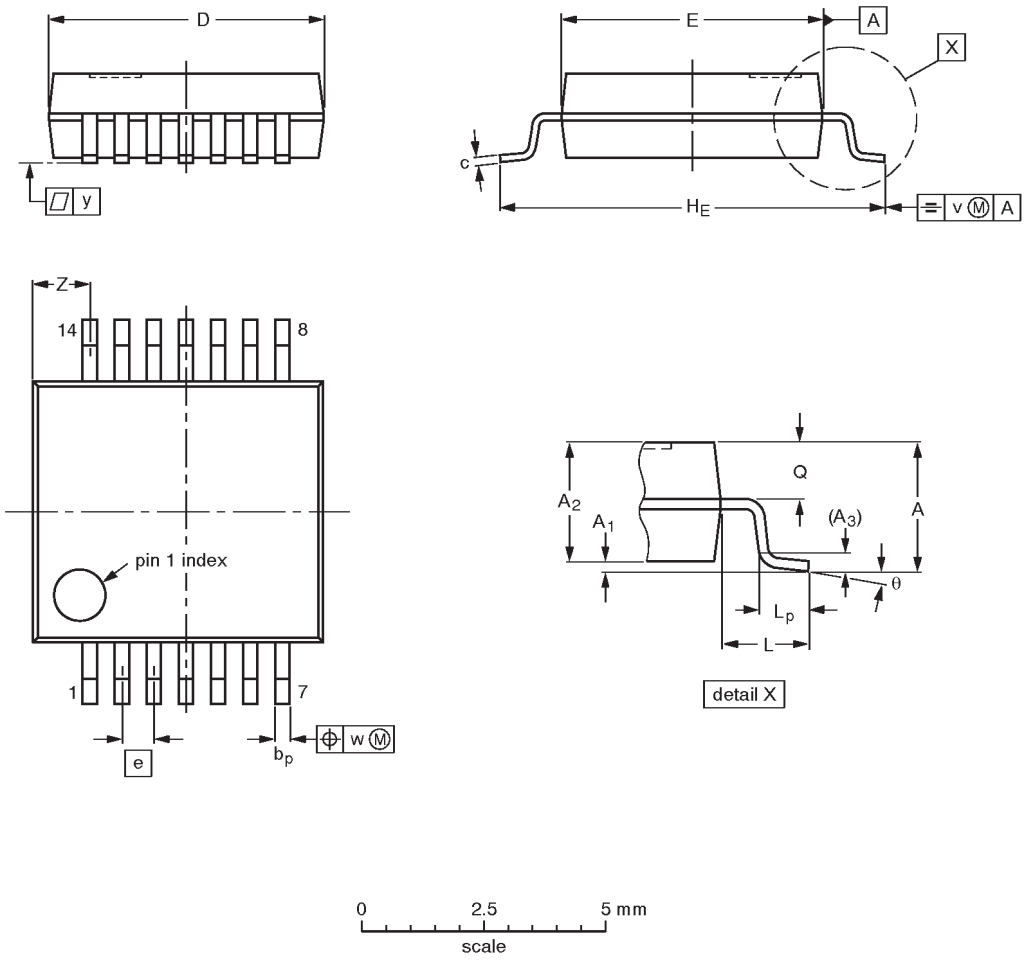
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.35 0.34	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 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			
SOT108-1	076E06S	MS-012AB				~~91-08-13~~ 95-01-23

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm **SOT337-1**



DIMENSIONS (mm are the original dimensions)

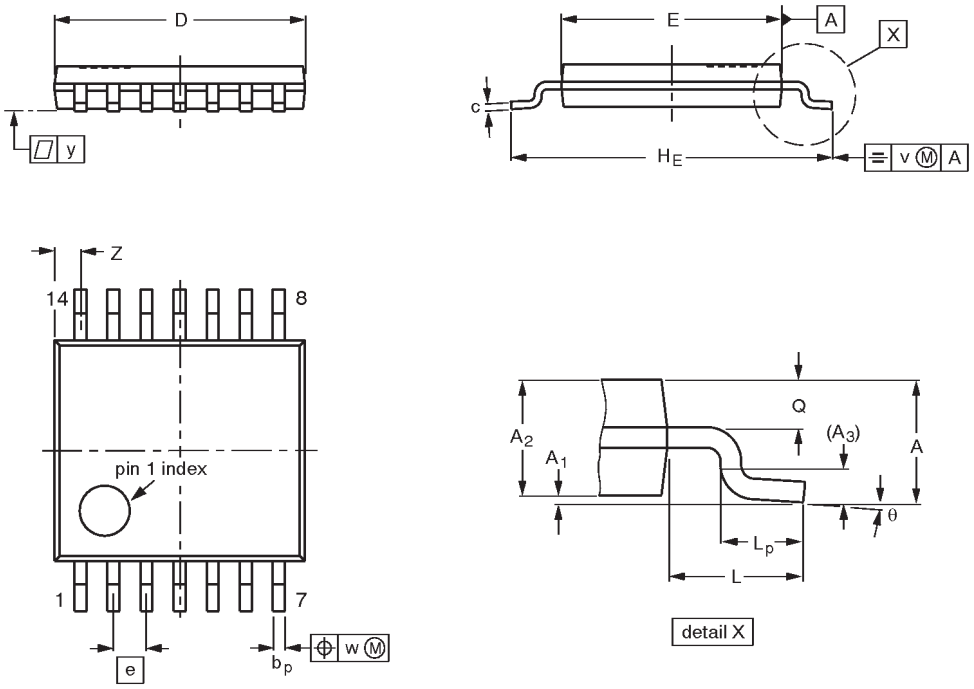
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

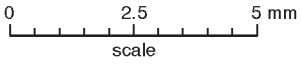
Note

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			
SOT337-1		MO-150AB				~~95-02-04~~ 96-01-18

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm SOT402-1





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 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8° 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			
SOT402-1		MO-153				~~94-07-12~~ 95-04-04

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

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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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