DATA SHEET

74LV157
Quad 2-input multiplexer

Product specification
Supersedes data of 1997 May 15
IC24 Data Handbook

1998 Apr 30

Philips
Semiconductors

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Quad 2-input multiplexer 74LV157

FEATURES

- Optimized for low voltage applications: 1.0 to 3.6 V
- Accepts TTL input levels between V_{CC} = 2.7 V and V_{CC} = 3.6 V
- Typical V_{OLP} (output ground bounce) < 0.8 V at V_{CC} = 3.3 V, T_{amb} = 25°C
- Typical V_{OHV} (output V_{OH} undershoot) > 2 V at V_{CC} = 3.3 V, T_{amb} = 25°C
- Output capability: standard
- I_{CC} category: MSI

DESCRIPTION

The 74LV157 is a low-voltage CMOS device and is pin and function compatible with 74HC/HCT157.

The 74LV157 is a quad 2-input multiplexer which selects 4 bits of data from two sources under the control of a common data select input (S).

The four outputs present the selected data in the true (non-inverted) form. The enable input ($\overline{E}$) is active LOW. When $\overline{E}$ is HIGH, all of the outputs (1Y to 4Y) are forced LOW regardless of all other input conditions.

Moving the data from two groups of registers to four common output buses is a common use of the 74LV157. The state of the common data select input (S) determines the particular register from which the data comes. It can also be used as function generator.

The device is useful for implementing highly irregular logic by generating any four of the 16 different functions of two variables with one variable common.

The 74LV157 is the logic implementation of a 4-pole, 2-position switch, where the position of the switch is determined by the logic levels applied to S.

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 nI_0, nI_1, to nY $\overline{E}$ to nY S to nY	C_L = 15 pF; V_{CC} = 3.3 V	10 11 12	ns
C_I	Input capacitance		3.5	pF
C_{PD}	Power dissipation capacitance per gate	V_I = GND to V_{CC}[1]	70	pF

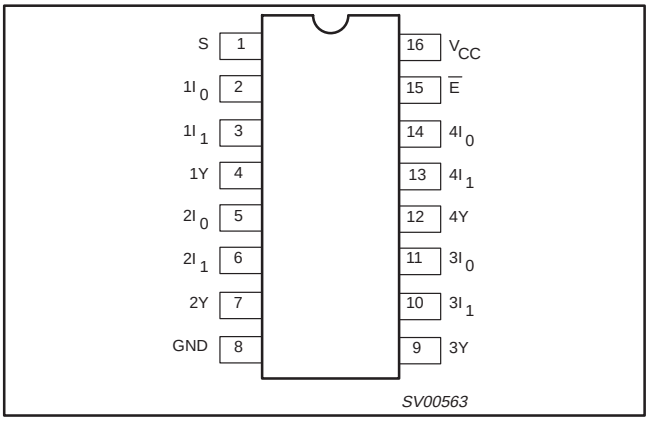
NOTES:

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 capacitance 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.

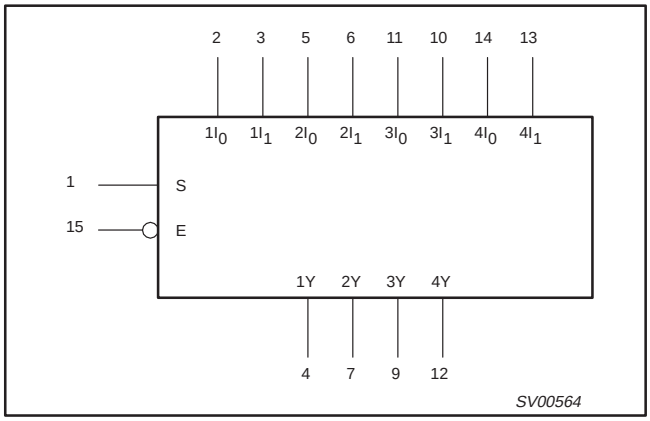
ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
16-Pin Plastic DIL	–40°C to +125°C	74LV157 N	74LV157 N	SOT38-4
16-Pin Plastic SO	–40°C to +125°C	74LV157 D	74LV157 D	SOT109-1
16-Pin Plastic SSOP Type II	–40°C to +125°C	74LV157 DB	74LV157 DB	SOT338-1
16-Pin Plastic TSSOP Type I	–40°C to +125°C	74LV157 PW	74LV157PW DH	SOT403-1

PIN CONFIGURATION



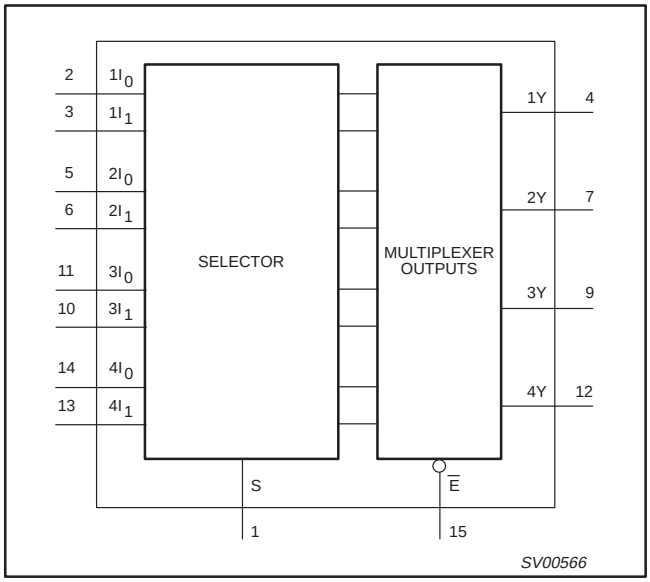
LOGIC SYMBOL



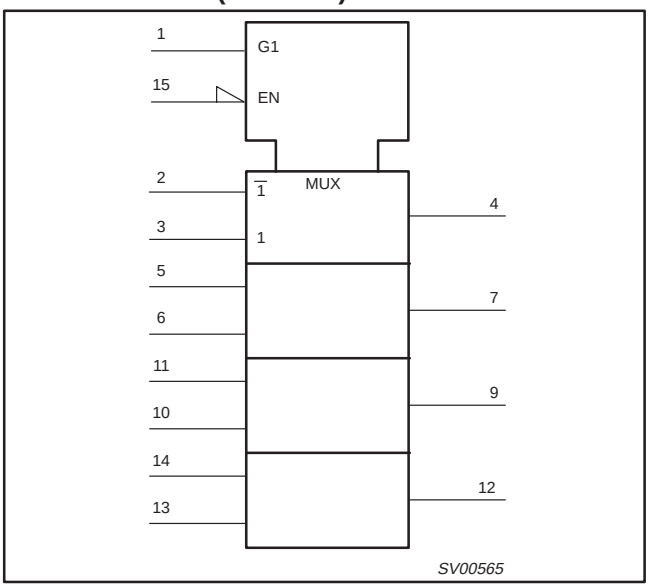
PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1	S	Common data select input
2, 5, 11, 14	$1I_0$ to $4I_0$	Data inputs from source 0
3, 6, 10, 13	$1I_1$ to $4I_1$	Data inputs from source 1
4, 7, 9, 12	1Y to 4Y	Multiplexer outputs
8	GND	Ground (0 V)
15	$\overline{E}$	Enable inputs (active LOW)
16	V_{CC}	Positive supply voltage

FUNCTIONAL DIAGRAM



LOGIC SYMBOL (IEEE/IEC)



RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
V_{CC}	DC supply voltage	See Note 1	1.0	3.3	3.6	V
V_I	Input voltage		0	–	V_{CC}	V
V_O	Output voltage		0	–	V_{CC}	V
T_{amb}	Operating ambient temperature range in free air	See DC and AC characteristics See DC and AC characteristics	–40 –40		+85 +125	°C
t_r, t_f	Input rise and fall times	V_{CC} = 1.0V to 2.0V V_{CC} = 2.0V to 2.7V V_{CC} = 2.7V to 3.6V	– – –	– – –	500 200 100	ns/V

NOTE:
1. The LV is guaranteed to function down to V_{CC} = 1.0V (input levels GND or V_{CC}); DC characteristics are guaranteed from V_{CC} = 1.2V to V_{CC} = 3.6V.

ABSOLUTE MAXIMUM RATINGS[1, 2]

In accordance with the Absolute Maximum Rating System (IEC 134).
Voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		–0.5 to +4.6	V
$\pm I_{IK}$	DC input diode current	$V_I < –0.5$ or $V_I > V_{CC} + 0.5V$	20	mA
$\pm I_{OK}$	DC output diode current	$V_O < –0.5$ or $V_O > V_{CC} + 0.5V$	50	mA
$\pm I_O$	DC output source or sink current – standard outputs	$–0.5V < V_O < V_{CC} + 0.5V$	25	mA
$\pm I_{GND}$, $\pm I_{CC}$	DC V_{CC} or GND current for types with – standard outputs		50	mA
T_{stg}	Storage temperature range		–65 to +150	°C
P_{TOT}	Power dissipation per package – plastic DIL – plastic mini-pack (SO) – plastic shrink mini-pack (SSOP and TSSOP)	for temperature range: –40 to +125°C above +70°C derate linearly with 12 mW/K above +70°C derate linearly with 8 mW/K above +60°C derate linearly with 5.5 mW/K	 750 500 400	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 = 0 V).

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			-40°C to +85°C			-40°C to +125°C		
			MIN	TYP[1]	MAX	MIN	MAX	
V_{IH}	HIGH level Input voltage	V_{CC} = 1.2 V	0.9			0.9		V
		V_{CC} = 2.0 V	1.4			1.4		
		V_{CC} = 2.7 to 3.6 V	2.0			2.0		
V_{IL}	LOW level Input voltage	V_{CC} = 1.2 V			0.3		0.3	V
		V_{CC} = 2.0 V			0.6		0.6	
		V_{CC} = 2.7 to 3.6 V			0.8		0.8	
V_{OH}	HIGH level output voltage; all outputs	V_{CC} = 1.2 V; V_I = V_{IH} or V_{IL}; $-I_O$ = 100µA		1.2				V
		V_{CC} = 2.0 V; V_I = V_{IH} or V_{IL}; $-I_O$ = 100µA	1.8	2.0		1.8		
		V_{CC} = 2.7 V; V_I = V_{IH} or V_{IL}; $-I_O$ = 100µA	2.5	2.7		2.5		
		V_{CC} = 3.0 V; V_I = V_{IH} or V_{IL}; $-I_O$ = 100µA	2.8	3.0		2.8		
V_{OH}	HIGH level output voltage; STANDARD outputs	V_{CC} = 3.0 V; V_I = V_{IH} or V_{IL}; $-I_O$ = 6mA	2.40	2.82		2.20		V
V_{OL}	LOW level output voltage; all outputs	V_{CC} = 1.2 V; V_I = V_{IH} or V_{IL}; I_O = 100µA		0				V
		V_{CC} = 2.0 V; V_I = V_{IH} or V_{IL}; I_O = 100µA		0	0.2		0.2	
		V_{CC} = 2.7 V; V_I = V_{IH} or V_{IL}; I_O = 100µA		0	0.2		0.2	
		V_{CC} = 3.0 V; V_I = V_{IH} or V_{IL}; I_O = 100µA		0	0.2		0.2	
V_{OL}	LOW level output voltage; STANDARD outputs	V_{CC} = 3.0 V; V_I = V_{IH} or V_{IL}; I_O = 6mA		0.25	0.40		0.50	V
I_I	Input leakage current	V_{CC} = 3.6 V; V_I = V_{CC} or GND			1.0		1.0	µA
I_{CC}	Quiescent supply current; MSI	V_{CC} = 3.6 V; V_I = V_{CC} or GND; I_O = 0			20.0		160	µA
ΔI_{CC}	Additional quiescent supply current per input	V_{CC} = 2.7 V to 3.6 V; V_I = V_{CC} – 0.6 V			500		850	µA

NOTE:

1. All typical values are measured at T_{amb} = 25°C.

AC CHARACTERISTICS

GND = 0V; $t_r = t_f$ = 2.5ns; C_L = 50pF; R_L = KΩ

SYMBOL	PARAMETER	WAVEFORM	CONDITION	LIMITS					UNIT
				–40 to +85 °C			–40 to +125 °C		
			V_{CC}(V)	MIN	TYP[1]	MAX	MIN	MAX	
t_{PHL}/t_{PLH}	Propagation delay nI_0 to nY; nI_1 to nY	Figures 1, 2	1.2		65				ns
			2.0		22	43		51	
			2.7		16	31		38	
			3.0 to 3.6		12[2]	25		30	
t_{PHL}/t_{PLH}	Propagation delay $\overline{E}$ to nY	Figures 1, 2	1.2		70				ns
			2.0		24	44		54	
			2.7		18	33		40	
			3.0 to 3.6		13[2]	26		32	
t_{PHL}/t_{PLH}	Propagation delay S to nY	Figures 1, 2	1.2		75				ns
			2.0		26	49		60	
			2.7		19	36		44	
			3.0 to 3.6		14[2]	29		35	

NOTES:
1. Unless otherwise stated, all typical values are measured at T_{amb} = 25°C
2. Typical values are measured at V_{CC} = 3.3 V.

AC WAVEFORMS

V_M = 1.5 V at $V_{CC} \geq$ 2.7 V;
V_M = 0.5 V × 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.

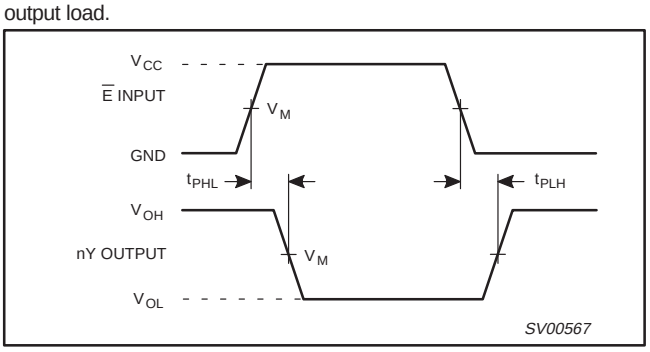


Figure 1. Enable input ($\overline{E}$) to output (nY) propagation delays and output transition times.

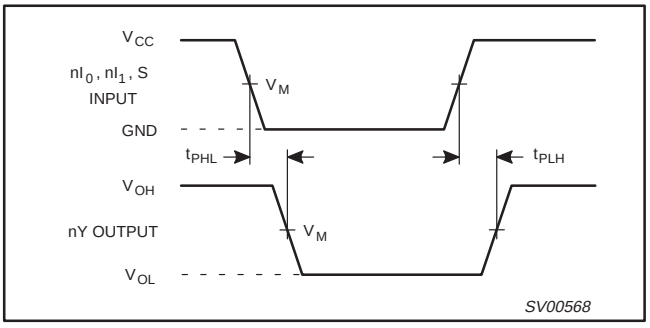
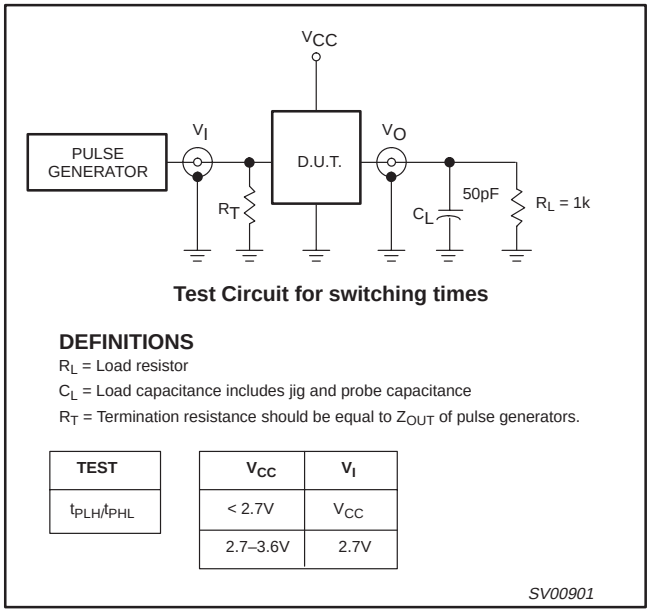


Figure 2. Data inputs (nI_n) and common data select input (S) to output (nY) propagation delays.

TEST CIRCUIT



Test Circuit for switching times

DEFINITIONS

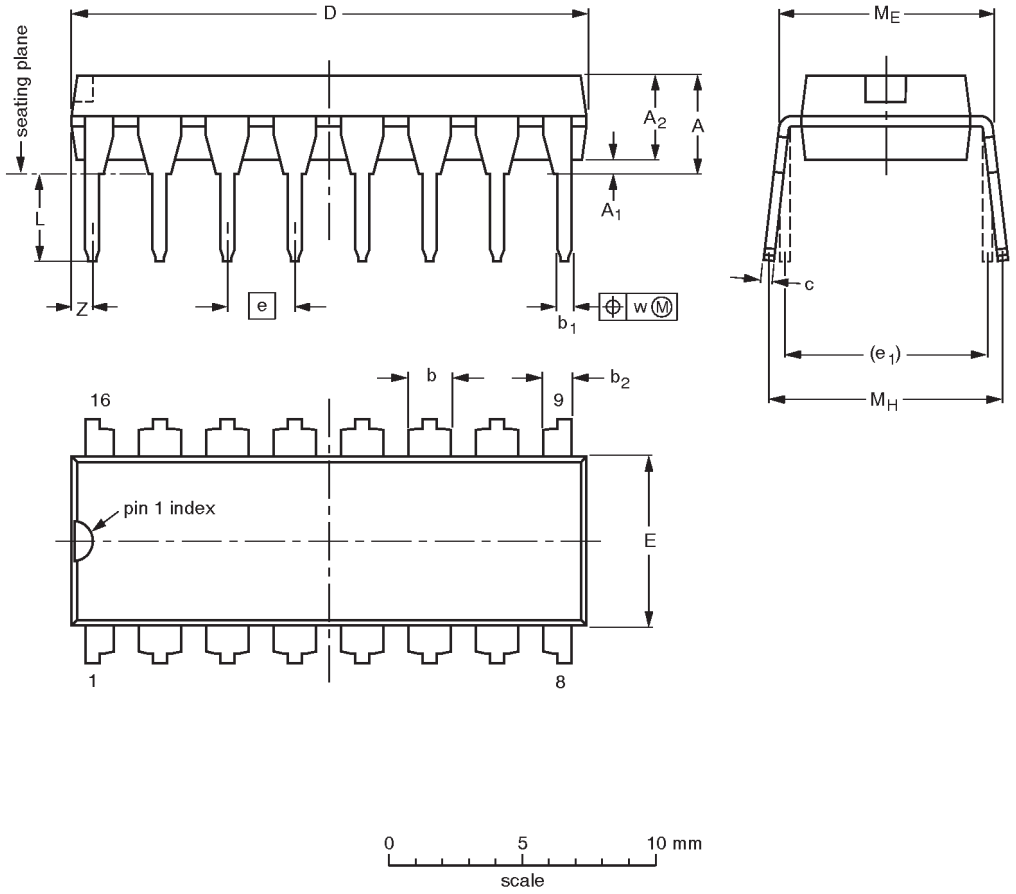
R_L = Load resistor
C_L = Load capacitance includes jig and probe capacitance
R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

TEST
t_{PLH}/t_{PHL}

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

Figure 3. Load circuitry for switching times.

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



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

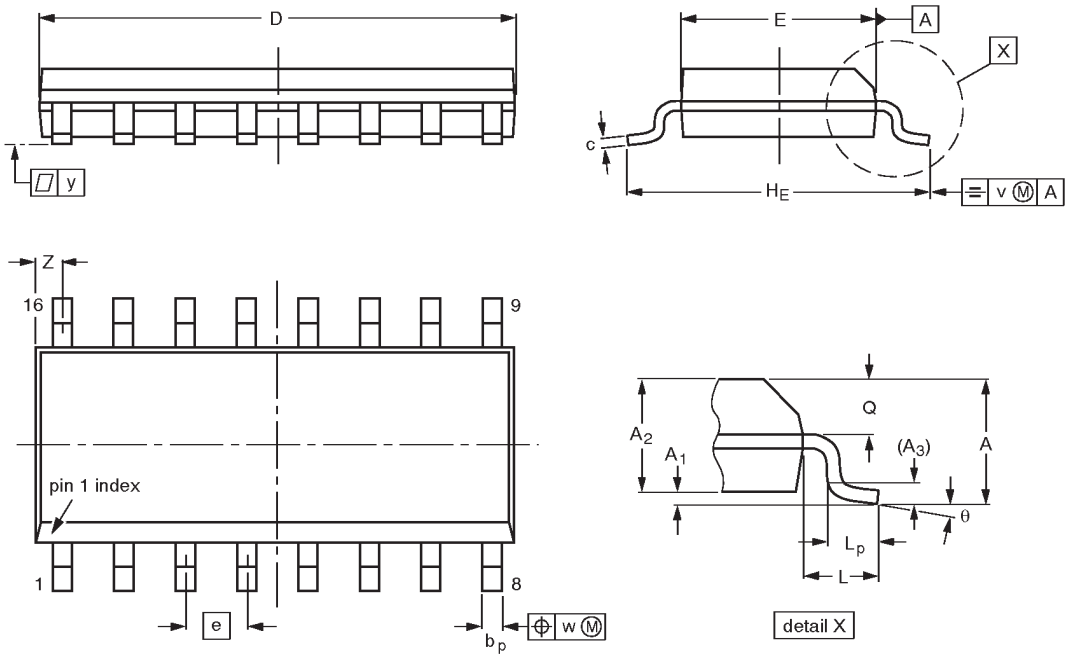
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	b_2	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24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

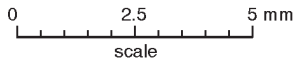
Note

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~~ 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)

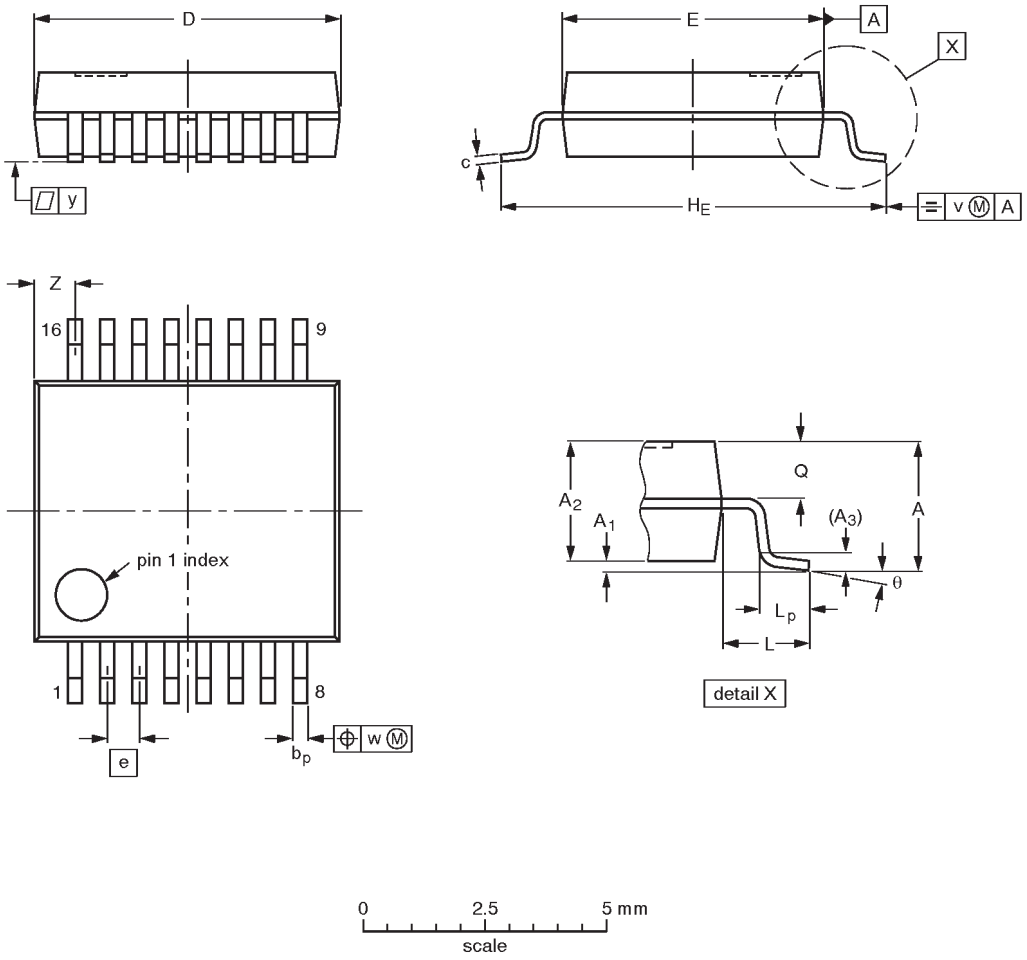
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.39 0.38	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.020	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			
SOT109-1	076E07S	MS-012AC				~~91-08-13~~ 95-01-23

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



DIMENSIONS (mm are the original dimensions)

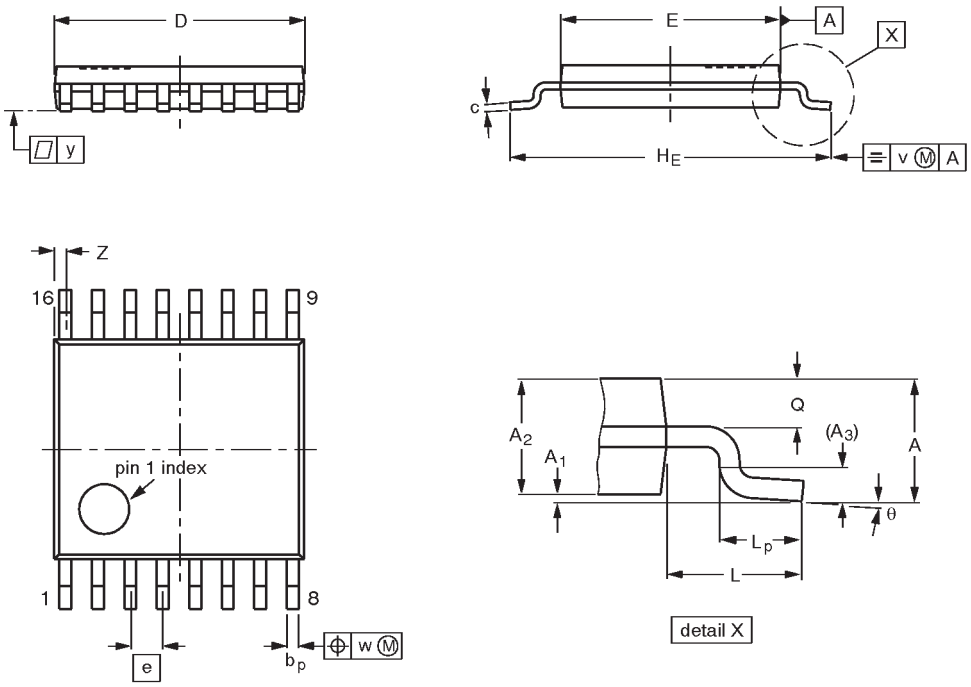
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.00 0.55	8° 0°

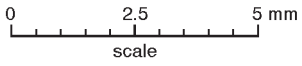
Note

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			
SOT338-1		MO-150AC				~~94-01-14~~ 95-02-04

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm **SOT403-1**





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	0.40 0.06	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			
SOT403-1		MO-153				~~94-07-12~~ 95-04-04

NOTES

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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