DATA SHEET

~~74F157~~*, 74F157A, ~~74F158~~*, 74F158A
Data selectors/multiplexers

** Discontinued part. Please see the Discontinued Product List in Section 1, page 21.*

Product specification

IC15 Data Handbook

1996 Mar 12

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Data selectors/multiplexers 74F157A, 74F158A

74F157A: Quad 2-input data selector/multiplexer, non-inverting
74F158A: Quad 2-input data selector/multiplexer, inverting

DESCRIPTION

The 74F157A is a high speed Quad 2-Input Multiplexer which selects 4 bits of data from one of two sources under the control of a common Select input (S). The Enable input ($\overline{E}$) is active when Low. When $\overline{E}$ is High, all of the outputs (Yn) are forced Low regardless of all other input conditions.

Moving data from two registers to a common output bus is a common use of the 74F157A. The state of the Select input determines the particular register from which the data comes.

The device is the logic implementation of a 4-pole, 2-position switch where the position of the switch is determined by the logic levels supplied to the Select input.

The 74F158A is similar, but has inverting outputs ($\overline{Y}$n).

- Industrial temperature range (–10°C to +85°C) available for 74F157A

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F157	4.6ns	15mA
74F157A	4.6ns	15mA
74F158	3.7ns	10mA
74F158A	3.7ns	10mA

ORDERING INFORMATION

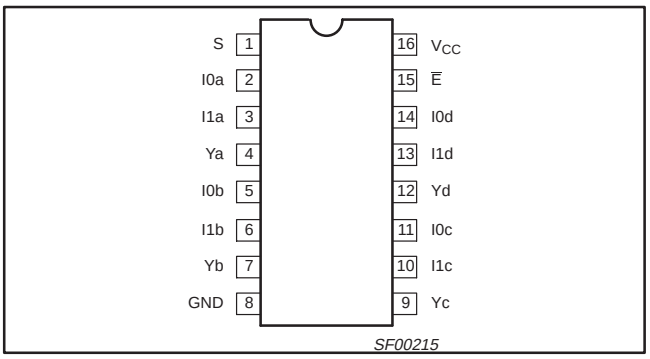
DESCRIPTION	ORDER CODE		PKG. DWG. #
	COMMERCIAL RANGE V_{CC} = 5V ±10%, T_{amb} = 0°C to +70°C	INDUSTRIAL RANGE V_{CC} = 5V ±10%, T_{amb} = –40°C to +85°C	
16-pin plastic DIP	N74F157AN, N174F158AN	I74F157AN	SOT38-4
16-pin plastic SO	N74F157AD, N74F158AD	I74F157AD	SOT109-1

INPUT AND OUTPUT LOADING AND FAN OUT TABLE

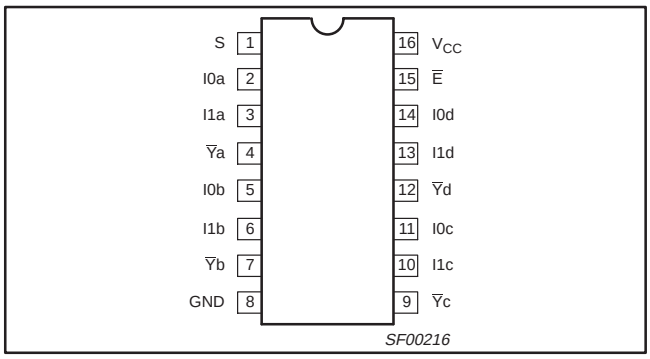
PINS	DESCRIPTION	74F (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
Ina, Inb, Inc, Ind	Data inputs	1.0/1.0	20µA/0.6mA
S	Select input	1.0/1.0	20µA/0.6mA
$\overline{E}$	Enable input	1.0/1.0	20µA/0.6mA
Ya–Yd	Data outputs (74F157/74F157A)	50/33	1.0mA/20mA
$\overline{Y}$a–$\overline{Y}$d	Data outputs (74F158/74F158A)	50/33	1.0mA/20mA

NOTE: One (1.0) FAST unit load is defined as: 20µA in the High state and 0.6mA in the Low state.

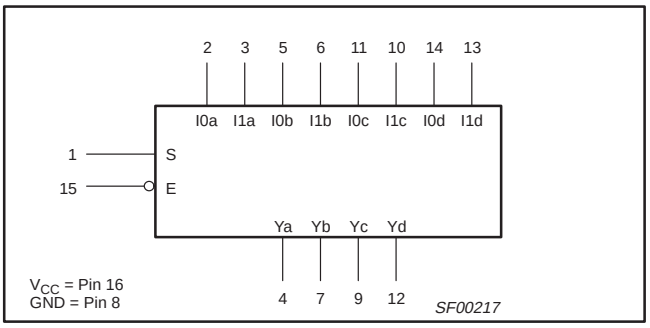
PIN CONFIGURATIONS, 74F157A



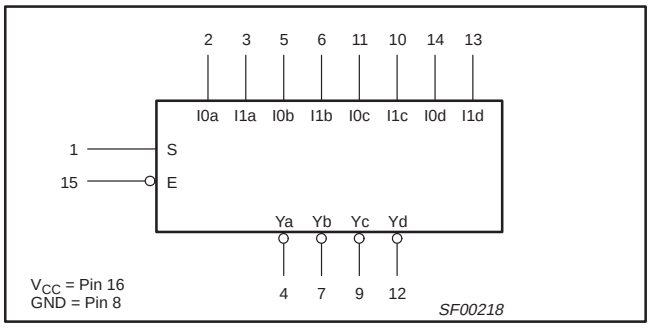
74F158A



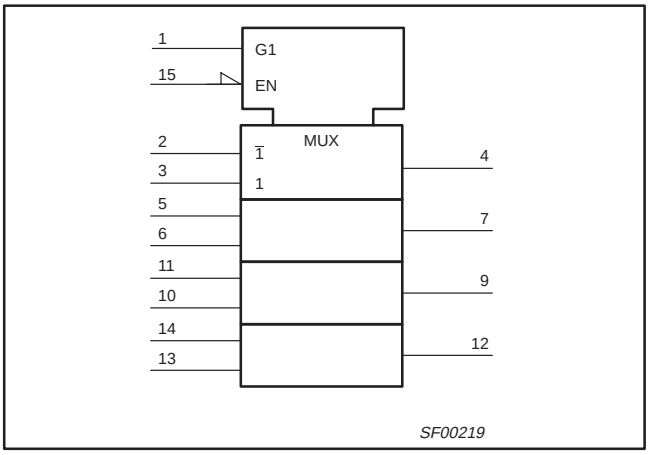
LOGIC SYMBOLS, 74F157A



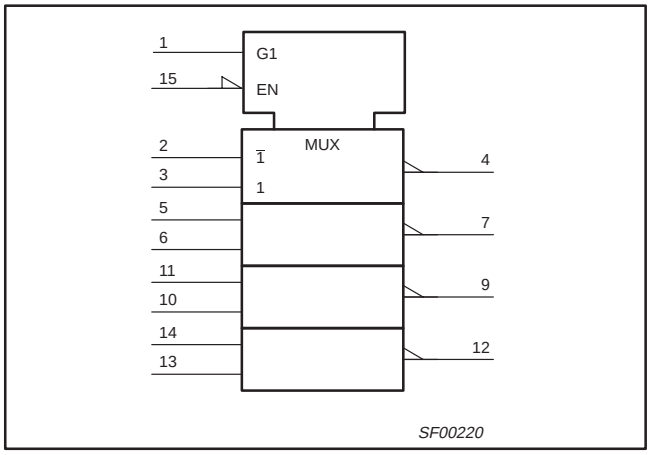
74F158A



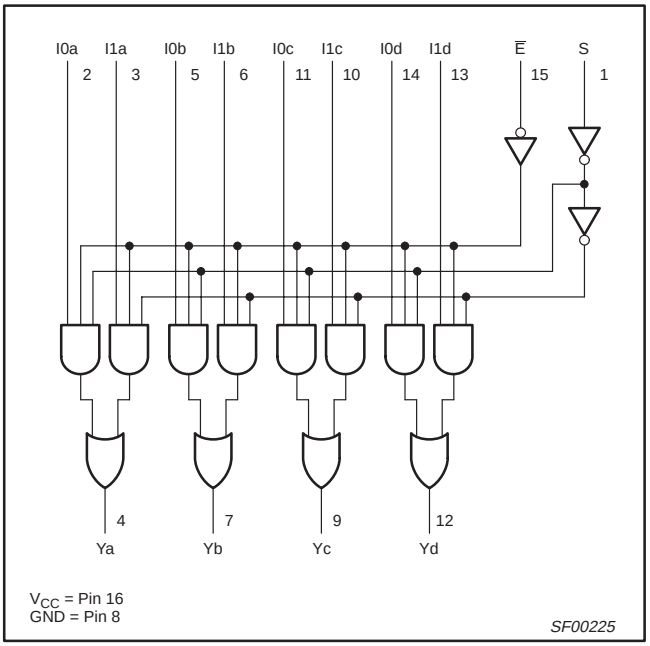
IEEE/IEC SYMBOLS, 74F157A



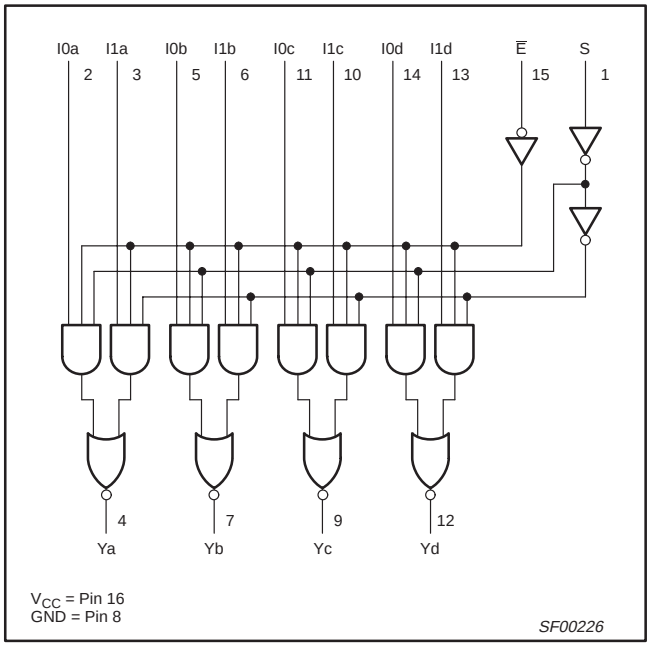
74F158A



LOGIC DIAGRAM, 74F157A



74F158A



FUNCTION TABLE, 74F157A

INPUTS				OUTPUT
$\overline{E}$	S	I0n	I1n	Yn
H	X	X	X	L
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

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

74F158A

INPUTS				OUTPUT
$\overline{E}$	S	I0n	I1n	$\overline{Y}$n
H	X	X	X	H
L	L	L	X	H
L	L	H	X	L
L	H	X	L	H
L	H	X	H	L

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		40	mA
T_{amb}	Operating free-air temperature range	Commercial Range	0 to +70	°C
		Industrial Range 74F157A only	–40 to +85	
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				–1	mA
I_{OL}	Low-level output current				20	mA
T_{amb}	Operating free air temperature range	Commercial Range	0		70	°C
		Industrial Range 74F157A only	–40		85	

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} = MIN, V_{IL} = MAX	±10%V_{CC}	2.5			V
			V_{IH} = MIN, I_{OH} = MAX	±5%V_{CC}	2.7	3.4		
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IL} = MAX	±10%V_{CC}		0.30	0.50	V
			V_{IH} = MIN, I_{OL} = MAX	±5%V_{CC}		0.30	0.50	
V_{IK}	Input clamp voltage		V_{CC} = MIN, I_I = I_{IK}			–0.73	–1.2	V
I_I	Input current at maximum input voltage		V_{CC} = MAX, V_I = 7.0V				100	µA
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 = 0.5V				–0.6	mA
I_{OS}	Short-circuit output current[3]		V_{CC} = MAX		–60		–150	mA
I_{CC}	Supply current (total)[4]	74F157A	V_{CC} = MAX			15.0	23.0	mA
		74F158A				14.0	19.0	mA

NOTES:

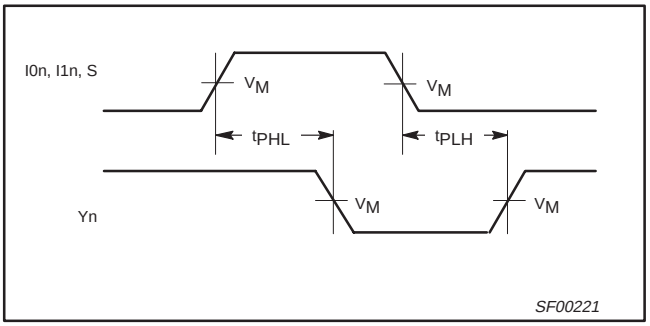
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V_{CC} = 5V, T_{amb} = 25°C.
3. Not more than one output should be shorted at a time. For testing I_{OS}, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} tests should be performed last.
4. I_{CC} is measured with 4.5V applied to all inputs and all outputs open.

AC ELECTRICAL CHARACTERISTICS FOR 74F157A AND 74F158A

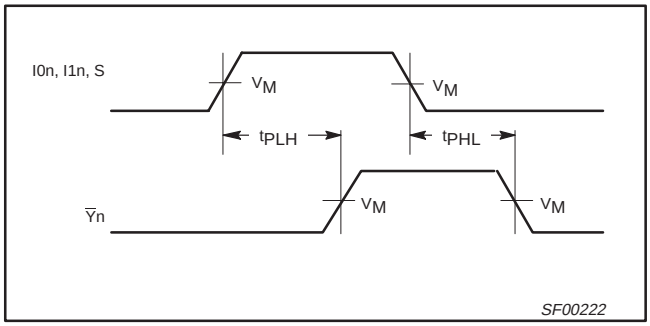
SYMBOL	PARAMETER		TEST CONDITION	LIMITS							UNIT
				V_{CC} = +5.0V T_{amb} = +25°C C_L = 50pF R_L = 500Ω			V_{CC} = +5.0V ± 10% T_{amb} = 0°C to +70°C C_L = 50pF R_L = 500Ω		V_{CC} = +5.0V ± 10% T_{amb} = −40°C to +85°C C_L = 50pF R_L = 500Ω		
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay I0n, I1n to Yn	74F157A	Waveform 1	3.5 2.5	4.5 3.5	6.5 5.0	3.0 1.5	7.0 6.0	3.0 1.5	7.5 6.5	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{E}$ to Yn		Waveform 3	6.0 4.0	7.5 5.0	9.0 6.5	5.5 4.0	10.5 7.0	5.5 4.0	11.0 7.5	ns
t_{PLH} t_{PHL}	Propagation delay S to Yn		Waveform 1	5.5 4.5	7.5 6.0	10.0 7.5	5.0 4.0	11.0 8.5	5.0 4.0	11.5 9.0	ns
t_{PLH} t_{PHL}	Propagation delay I0n, I1n to $\overline{Y}$n	74F158A	Waveform 2	3.0 1.5	4.0 2.5	6.0 4.0	2.5 1.0	7.0 4.5	—	—	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{E}$ to $\overline{Y}$n		Waveform 4	4.5 5.0	5.5 6.0	7.0 7.5	4.0 5.0	7.5 8.0	—	—	ns
t_{PLH} t_{PHL}	Propagation delay S to $\overline{Y}$n		Waveform 2	4.5 4.0	6.5 5.5	8.5 7.5	4.0 3.5	9.5 8.0	—	—	ns

AC WAVEFORMS

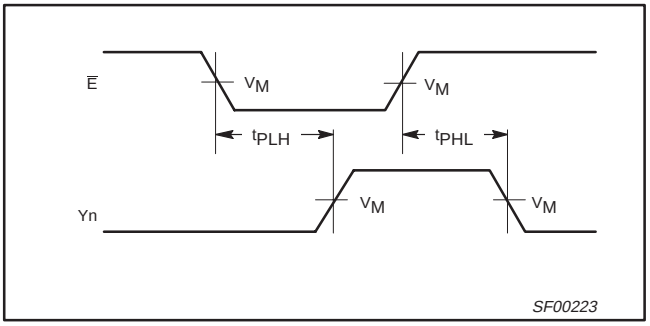
For all waveforms, V_M = 1.5V



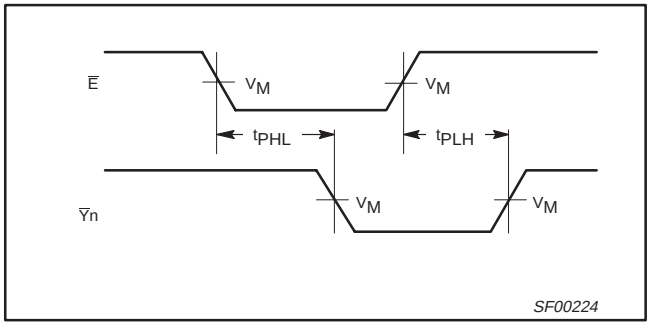
Waveform 1. Propagation Delay for Data and Select to Output



Waveform 2. Propagation Delay for Data and Select to Output

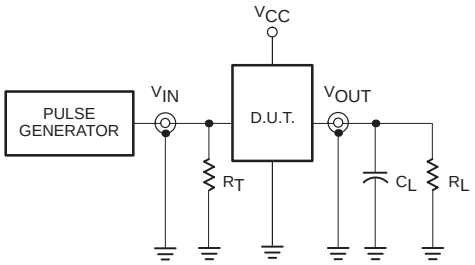


Waveform 3. Propagation Delay for Enable to Output

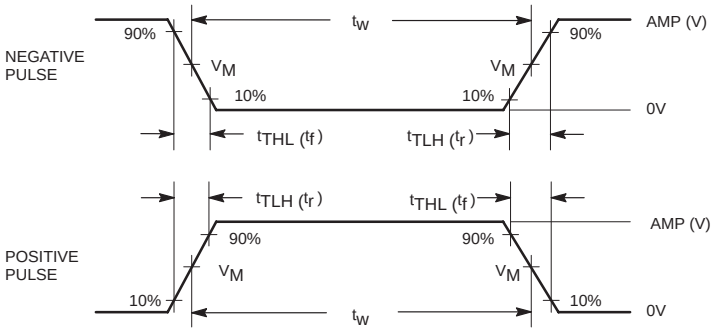


Waveform 4. Propagation Delay for Enable to Output

TEST CIRCUIT AND WAVEFORMS



Test Circuit for Totem-Pole Outputs



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.

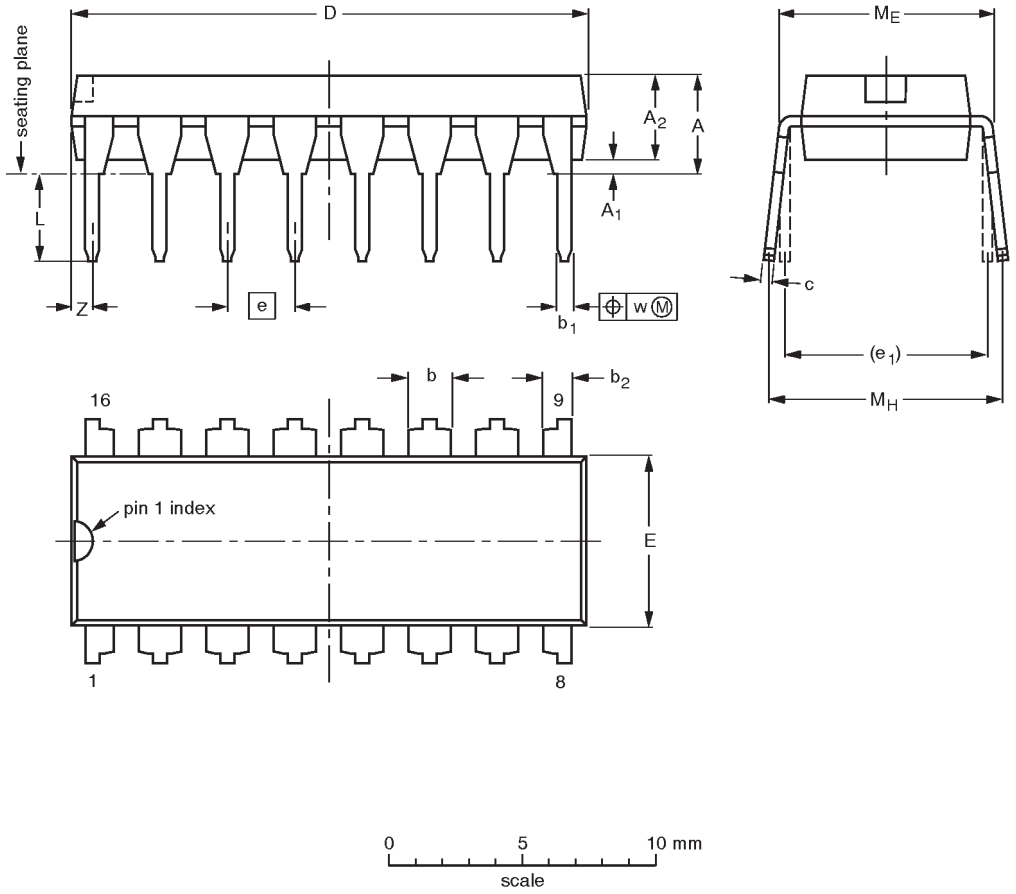
R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

Input Pulse Definition

family	INPUT PULSE REQUIREMENTS					
	amplitude	V_M	rep. rate	t_w	t_{TLH}	t_{THL}
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

SF00006

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

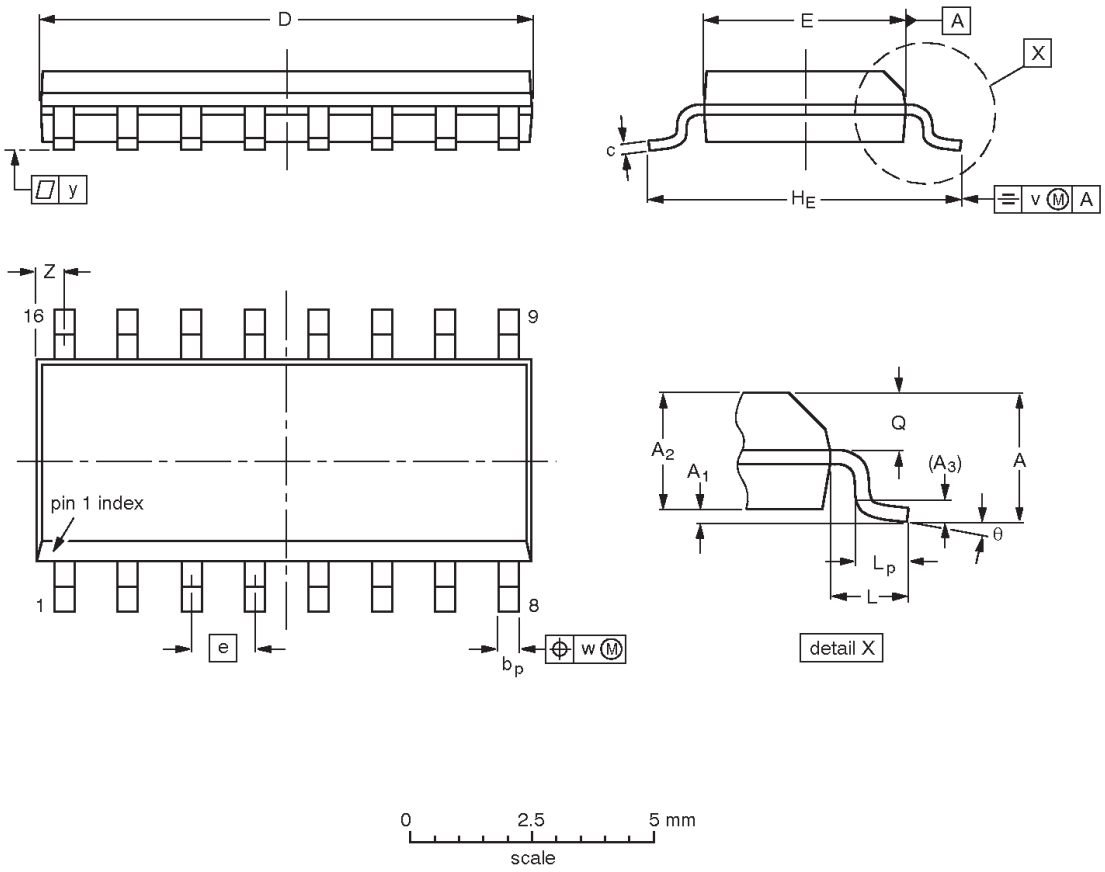
Note

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

** Discontinued part. Please see the Discontinued Product List in Section 1, page 21.*

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^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.050	0.244 0.228	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				~~95-01-23~~ 97-05-22

** Discontinued part. Please see the Discontinued Product List in Section 1, page 21.*

NOTES

** Discontinued part. Please see the Discontinued Product List in Section 1, page 21.*

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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