DATA SHEET

74F189A

64-bit TTL bipolar RAM, inverting (3-State)

Product specification

1990 Feb 23

IC15 Data Handbook

Philips Semiconductors

PHILIPS

64-bit TTL bipolar RAM, inverting (3-State) 74F189A

FEATURES

- High speed performance
- Replaces 74F189
- Address access time: 8ns max vs 28ns for 74F189
- Power dissipation: 4.3mW/bit
- Schottky clamp TTL
- One chip enable
- Inverting outputs (for non-inverting outputs see 74F219A)
- 3-State outputs
- 74F189A in 150 mil wide SO is preferred options for new designs

DESCRIPTION

The 74F189A is a high speed, 64-bit RAM organized as a 16-word by 4-bit array. Address inputs are buffered to minimize loading and are fully decoded on chip. The outputs are in high impedance state whenever the chip enable ($\overline{CE}$) is high. The outputs are active only in the READ mode ($\overline{WE}$ = high) and the output data is the complement of the stored data.

TYPE	TYPICAL ACCESS TIME	TYPICAL SUPPLY CURRENT (TOTAL)
74F189A	5.0ns	55mA

ORDERING INFORMATION

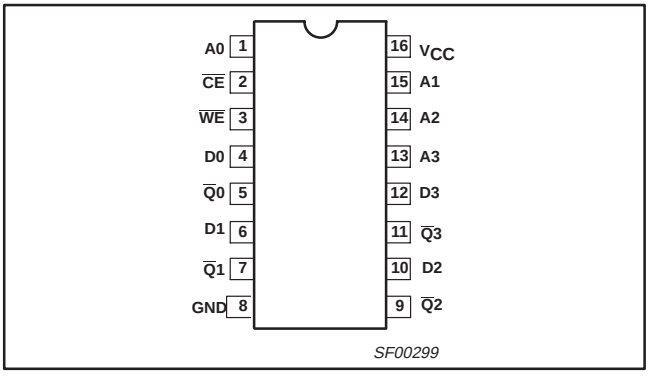
DESCRIPTION	ORDER CODE COMMERCIAL RANGE V_{CC} = 5V ±10%, T_{amb} = 0°C to +70°C	DRAWING NUMBER
16-pin plastic Dual In-line Package	N74F189AN	SOT38-4
16-pin plastic Small Outline (150mil)	N74F189AD	SOT109-1

INPUT AND OUTPUT LOADING AND FAN OUT TABLE

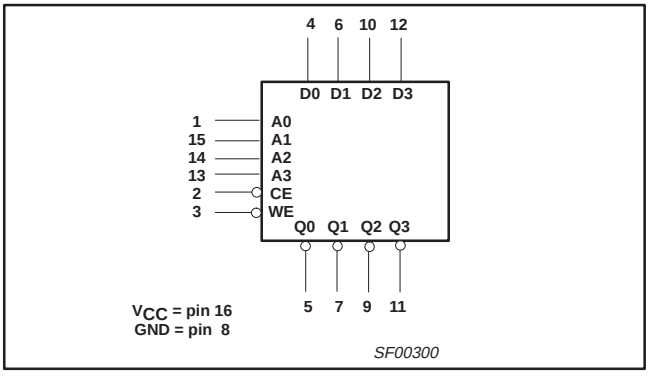
PINS	DESCRIPTION	74F (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
D0 – D3	Data inputs	1.0/1.0	20µA/0.6mA
A0 – A3	Address inputs	1.0/1.0	20µA/0.6mA
$\overline{CE}$	Chip enable input (active low)	1.0/2.0	20µA/1.2mA
$\overline{WE}$	Write enable input (active low)	1.0/2.0	20µA/1.2mA
$\overline{Q}0$ – $\overline{Q}3$	Data outputs	150/40	3mA/24mA

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

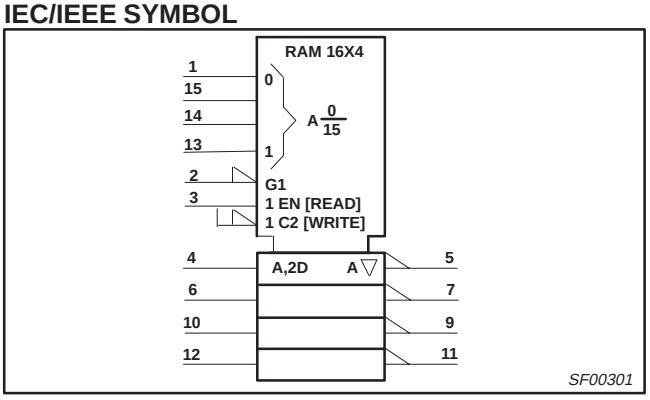
PIN CONFIGURATION



LOGIC SYMBOL



IEC/IEEE SYMBOL

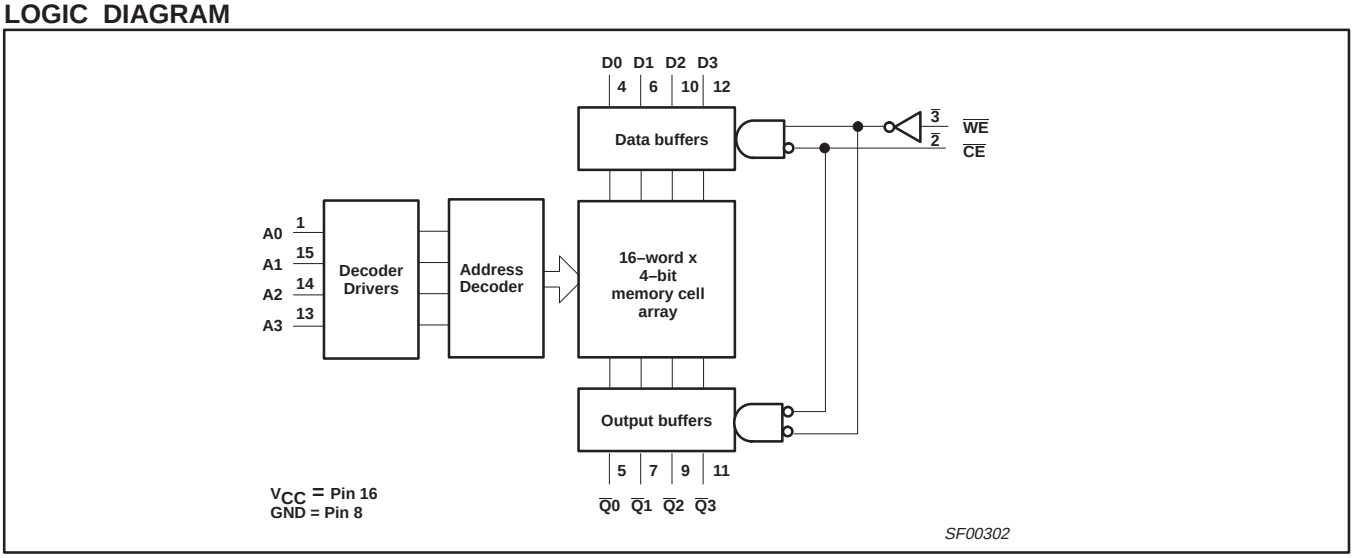


FUNCTION TABLE

INPUTS			OUTPUT	OPERATING MODE
$\overline{CE}$	$\overline{WE}$	Dn	$\overline{Q}_n$	
L	H	X	Complement of stored data	Read
L	L	L	High impedance	Write “0”
H	L	H	High impedance	Write “1”
H	X	X	High impedance	Disable input

NOTES:
H = High voltage level
L = Low voltage level
X = Don’t care

LOGIC DIAGRAM



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	T_A = –40 to +85°C
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			–3	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} = MIN, V_{IL} = MAX	±10%V_{CC}	2.4			V
			V_{IH} = MIN, I_{OH} = MAX	±5%V_{CC}	2.7	3.4		V
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IL} = MAX	±10%V_{CC}		0.35	0.50	V
			V_{IH} = MIN, I_{OL} = MAX	±5%V_{CC}		0.35	0.50	V
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	others	V_{CC} = MAX, V_I = 0.5V				-0.6	mA
		$\overline{CE}$, $\overline{WE}$					-1.2	mA
I_{OZH}	Offset output current, high–level voltage applied		V_{CC} = MAX, V_I = 2.7V				50	µA
I_{OZL}	Offset output current, low–level voltage applied		V_{CC} = MAX, V_I = 0.5V				–50	µA
I_{OS}	Short-circuit output current[3]		V_{CC} = MAX		-60		-150	mA
I_{CC}	Supply current (total)		V_{CC} = MAX, $\overline{CE}$ = $\overline{WE}$ = GND			55	80	mA
C_{IN}	Input capacitance		V_{CC} = 5V, V_{IN} = 2.0V			4		pF
C_{OUT}	Output capacitance		V_{CC} = 5V, V_{OUT} = 2.0V			7		pF

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.

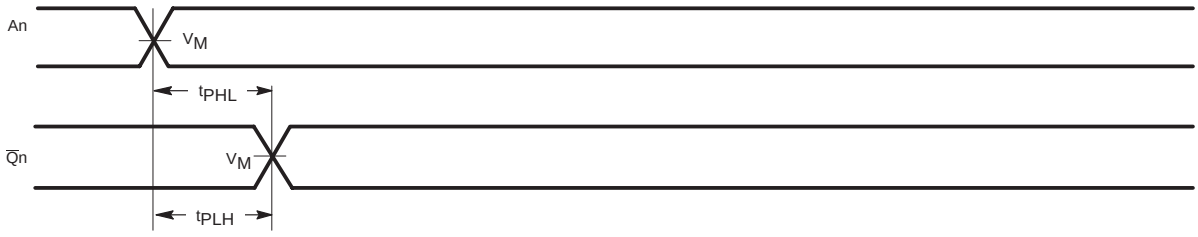
AC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER		TEST CONDITION	LIMITS					UNIT
				T_{amb} = +25°C V_{CC} = +5.0V C_L = 50pF, R_L = 500Ω			T_{amb} = 0°C to +70°C V_{CC} = +5.0V ± 10% C_L = 50pF, R_L = 500Ω		
				MIN	TYP	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Access time	Propagation delay An to $\overline{Q}$n	Waveform 1	2.5 2.0	5.0 4.5	8.0 8.0	2.5 2.0	8.0 8.0	ns
t_{PZH} t_{PZL}		Enable time $\overline{CE}$ to $\overline{Q}$n	Waveform 2	2.0 2.0	3.5 4.0	6.0 7.0	1.5 2.0	7.0 7.5	ns
t_{PHZ} t_{PLZ}	Disable time $\overline{CE}$ to $\overline{Q}$n		Waveform 3	2.5 1.5	4.5 3.0	7.0 5.5	2.0 1.5	8.0 6.0	ns
t_{PZH} t_{PZL}	Write recovery time	Enable time $\overline{WE}$ to $\overline{Q}$n	Waveform 4	2.0 2.5	4.0 4.5	6.5 7.5	2.0 2.5	7.0 8.0	ns
t_{PHZ} t_{PLZ}	Disable time $\overline{WE}$ to $\overline{Q}$n		Waveform 4	3.5 1.5	5.5 3.5	8.5 6.5	3.0 1.5	9.0 7.0	ns

AC SETUP REQUIREMENT

SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			T_{amb} = +25°C V_{CC} = +5.0V C_L = 50pF, R_L = 500Ω			T_{amb} = 0°C to +70°C V_{CC} = +5.0V ± 10% C_L = 50pF, R_L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	
t_{su}(H) t_{su}(L)	Setup time, high or low An to $\overline{WE}$	Waveform 4	4.5 4.5			5.0 5.0		ns
t_h(H) t_h(L)	Hold time, high or low An to $\overline{WE}$	Waveform 4	0 0			0 0		ns
t_{su}(H) t_{su}(L)	Setup time, high or low Dn to $\overline{WE}$	Waveform 4	7.5 6.5			9.0 8.0		ns
t_h(H) t_h(L)	Hold time, high or low Dn to $\overline{WE}$	Waveform 4	0 0			0 0		ns
t_{su}(L)	Setup time, low $\overline{CE}$ (falling edge) to $\overline{WE}$ (falling edge)	Waveform 4	0			0		ns
t_h(L)	Hold time, low $\overline{WE}$ (falling edge) to $\overline{WE}$ (rising edge)	Waveform 4	6.5			7.5		ns
t_w(L)	Pulse width, low $\overline{WE}$	Waveform 4	7.0			8.0		ns

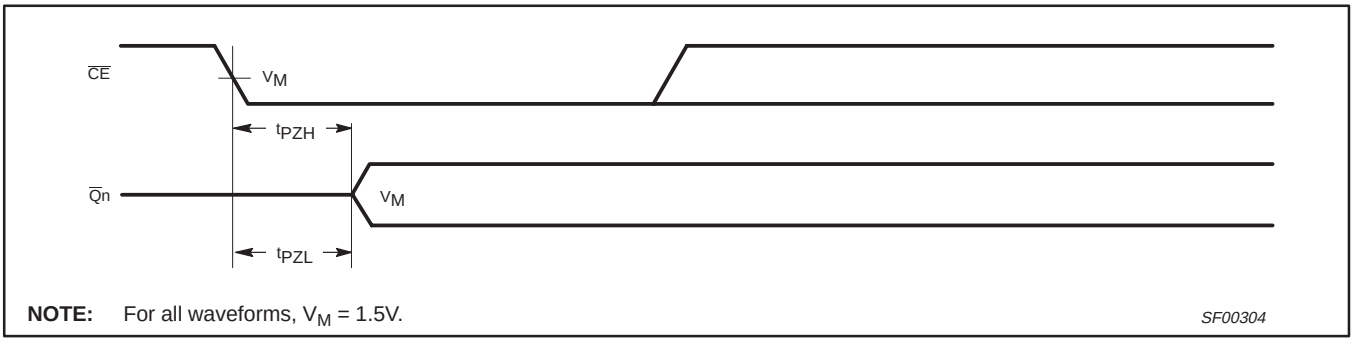
AC WAVEFORMS FOR READ CYCLES



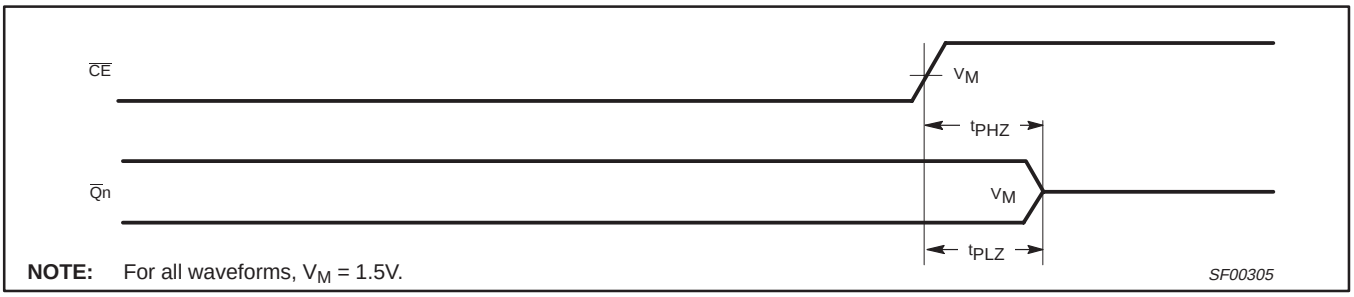
NOTE: For all waveforms, V_M = 1.5V.

SF00303

Waveform 1. Read cycle, address access time

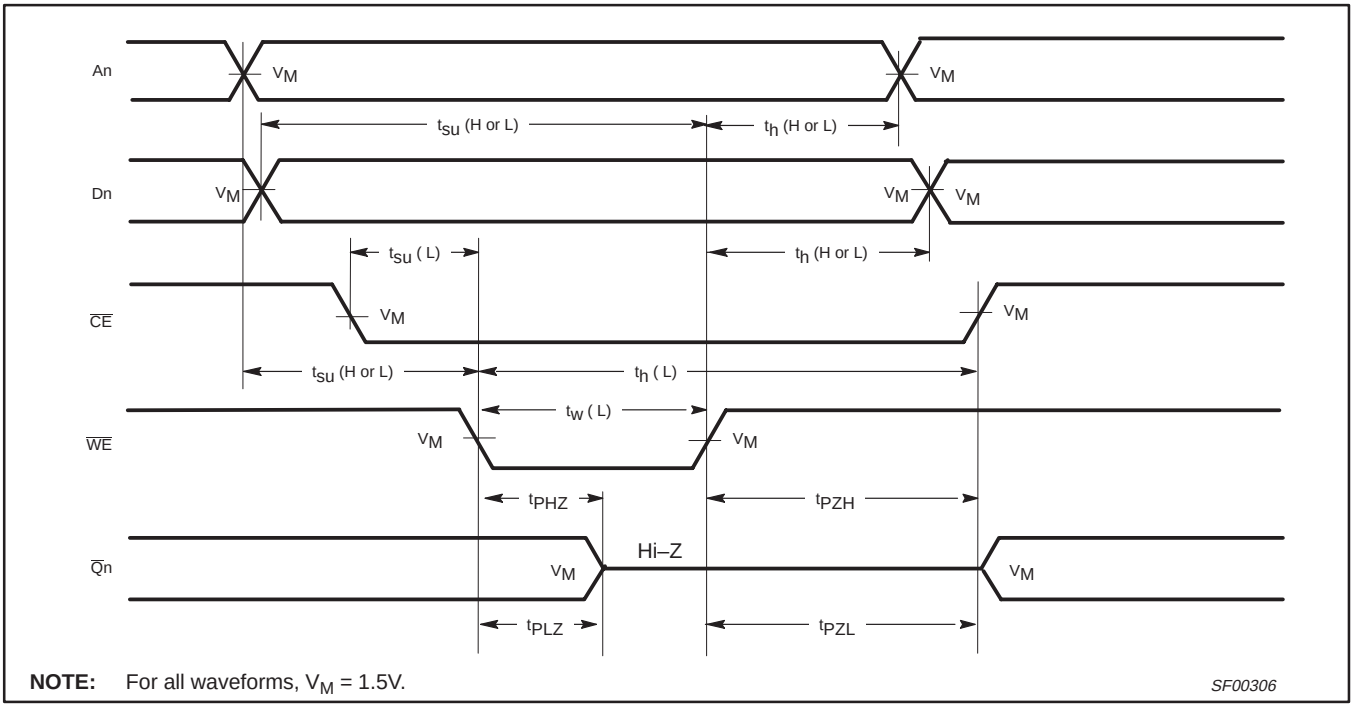


Waveform 2. Read cycle, chip enable access time



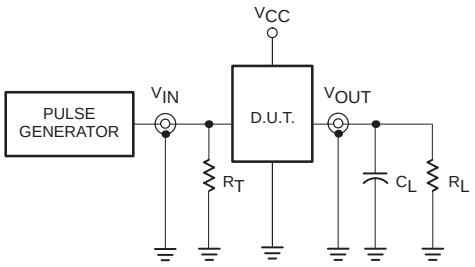
Waveform 3. Read cycle, chip disable time

AC WAVEFORMS FOR WRITE CYCLE

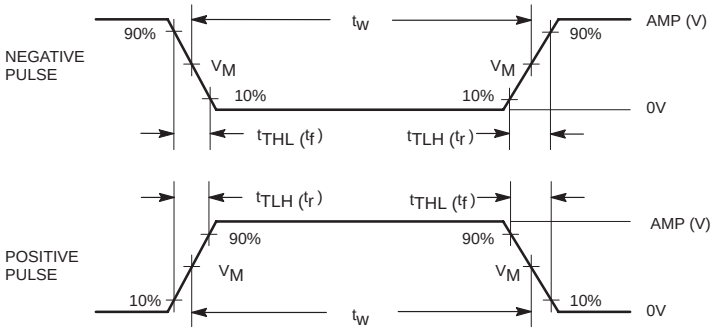


Waveform 4. Write cycle

TEST CIRCUIT AND WAVEFORM



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.

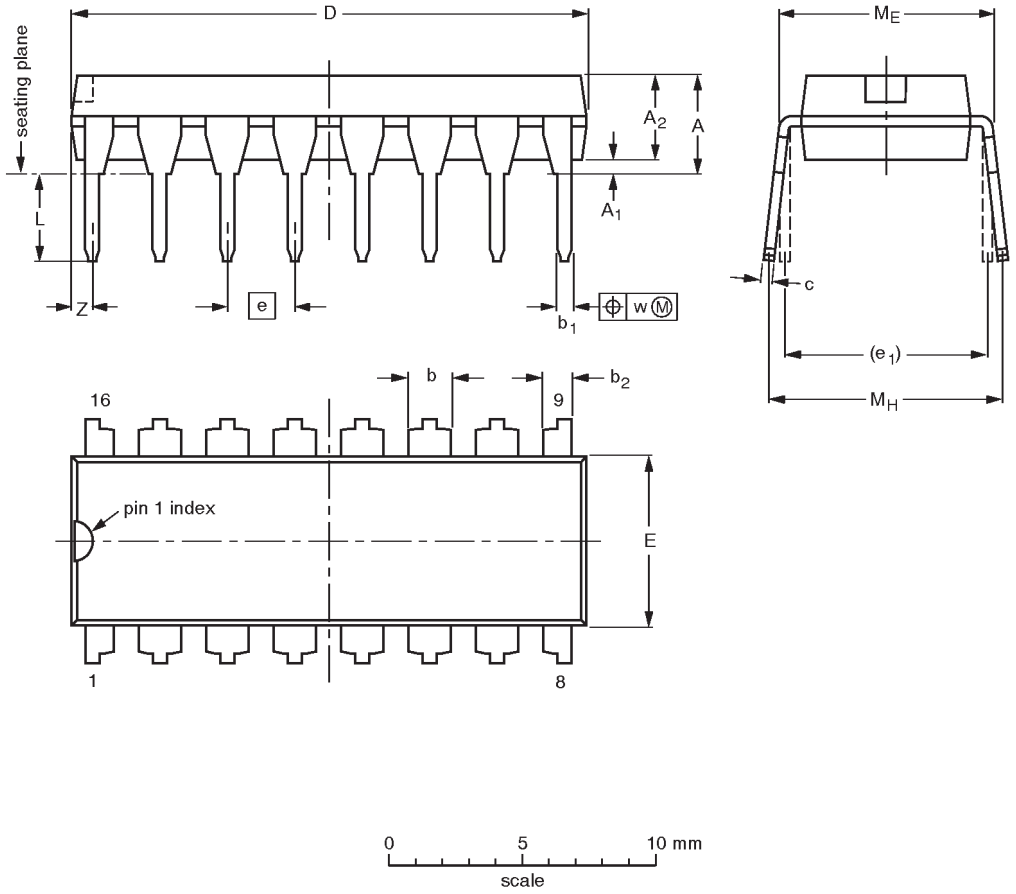
R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

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)

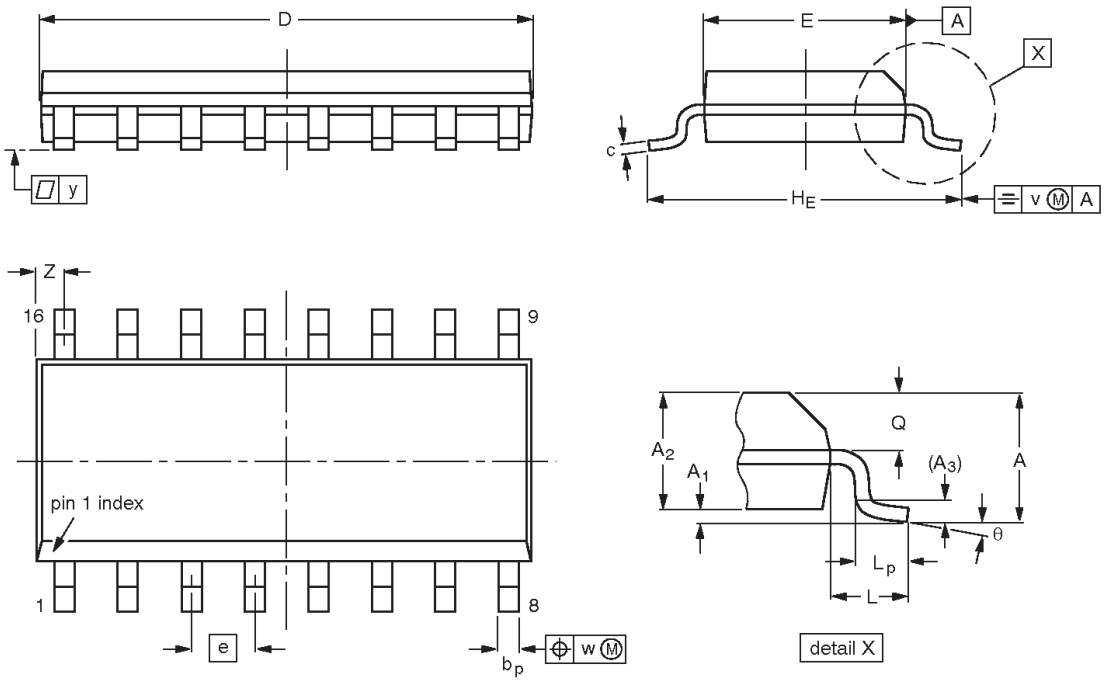
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	b_2	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24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

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

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.

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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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