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Kind regards,

Team Nexperia

DATA SHEET

74F74
Dual D-type flip-flop

Product specification
Supercedes data of 1990 Oct 23
IC15 Data Handbook

1996 Mar 12

Philips
Semiconductors

PHILIPS

Dual D-type flip-flop 74F74

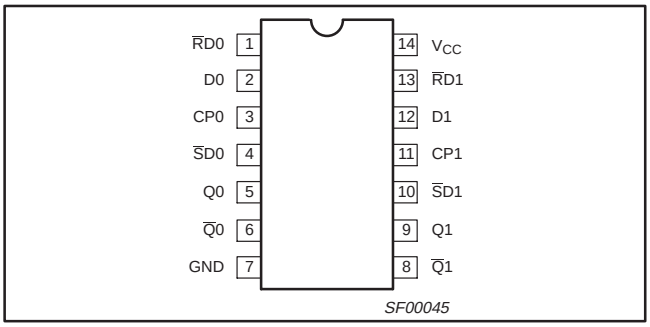
FEATURE

- Industrial temperature range available (–40°C to +85°C)

DESCRIPTION

The 74F74 is a dual positive edge-triggered D-type flip-flop featuring individual data, clock, set, and reset inputs; also true and complementary outputs. Set ($\overline{SD}$) and reset ($\overline{RD}$) are asynchronous active low inputs and operate independently of the clock input. When set and reset are inactive (high), data at the D input is transferred to the Q and $\overline{Q}$ outputs on the low-to-high transition of the clock. Data must be stable just one setup time prior to the low-to-high transition of the clock for predictable operation. Clock triggering occurs at a voltage level and is not directly related to the transition time of the positive-going pulse. Following the hold time interval, data at the D input may be changed without affecting the levels of the output.

PIN CONFIGURATION



TYPE	TYPICAL f_{max}	TYPICAL SUPPLY CURRENT (TOTAL)
74F74	125MHz	11.5mA

ORDERING INFORMATION

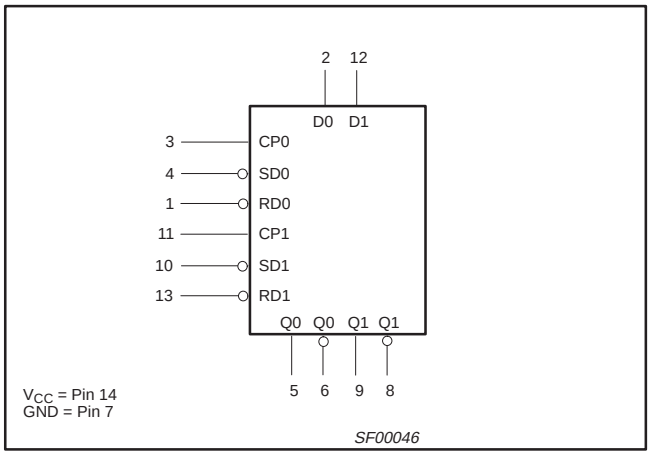
DESCRIPTION	ORDER CODE		PKG. DWG. #
	COMMERCIAL RANGE V_{CC} = 5V ±10%, T_{amb} = 0°C to +70°C	INDUSTRIAL RANGE V_{CC} = 5V ±10%, T_{amb} = –40°C to +85°C	
14-pin plastic DIP	N74F74N	I74F74N	SOT27-1
14-pin plastic SO	N74F74D	I74F74D	SOT108-1

INPUT AND OUTPUT LOADING AND FAN OUT TABLE

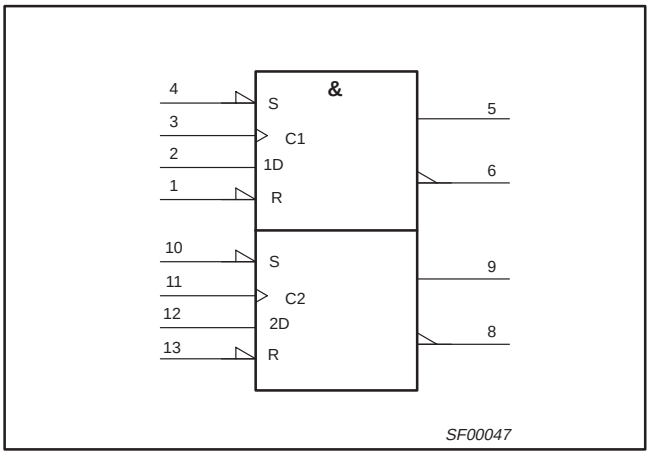
PINS	DESCRIPTION	74F (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
D0, D1	Data inputs	1.0/1.0	20µA/0.6mA
CP0, CP1	Clock inputs (active rising edge)	1.0/1.0	20µA/0.6mA
$\overline{SD}$0, $\overline{SD}$1	Set inputs (active low)	1.0/3.0	20µA/1.8mA
$\overline{RD}$0, $\overline{RD}$1	Reset inputs (active low)	1.0/3.0	20µA/1.8mA
Q0, Q1, $\overline{Q}$0, $\overline{Q}$1	Data outputs	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.

LOGIC SYMBOL

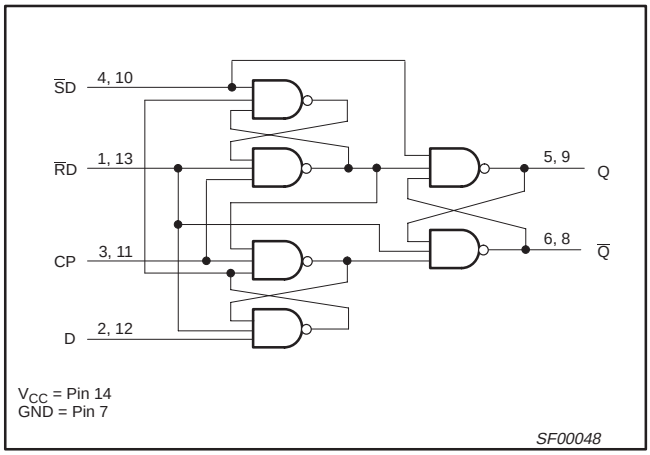


IEC/IEEE SYMBOL



Dual D-type flip-flop 74F74

LOGIC DIAGRAM



FUNCTION TABLE

INPUTS				OUTPUTS		OPERATING MODE
$\overline{SD}$	$\overline{RD}$	CP	D	Q	$\overline{Q}$	
L	H	X	X	H	L	Asynchronous set
H	L	X	X	L	H	Asynchronous reset
L	L	X	X	H	H	Undetermined*
H	H	↑	h	H	L	Load "1"
H	H	↑	l	L	H	Load "0"
H	H	↥	X	NC	NC	Hold

NOTES:
H = High voltage level
h = High voltage level one setup time prior to low-to-high clock transition
L = Low voltage level
l = Low voltage level one setup time prior to low-to-high clock transition
NC = No change from the previous setup
X = Don't care
↑ = Low-to-high clock transition
↥ = Not low-to-high clock transition
* = This setup is unstable and will change when either set or reset return to the high level.

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	–40 to +85	°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				–1	mA
I_{OL}	Low-level output current				20	mA
T_{amb}	Operating free air temperature range	Commercial range	0		+70	°C
		Industrial range	–40		+85	°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, V_{IH} = MIN	I_{OH} = MAX	±10%V_{CC}	2.5			V
					±5%V_{CC}	2.7	3.4		V
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IL} = MAX, V_{IH} = MIN	I_{OL} = MAX	±10%V_{CC}		0.30	0.50	V
					±5%V_{CC}		0.30	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	Dn, CPn	V_{CC} = MAX, V_I = 0.5V					-0.6	mA
		$\overline{S}$Dn, $\overline{R}$Dn	V_{CC} = MAX, V_I = 0.5V					-1.8	mA
I_{OS}	Short-circuit output current[3]		V_{CC} = MAX			-60		-150	mA
I_{CC}	Supply current (total) [4]		V_{CC} = MAX				11.5	16	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 Measure I_{CC} with the clock input grounded and all outputs open, then with Q and $\overline{Q}$ outputs high in turn.

AC ELECTRICAL CHARACTERISTICS

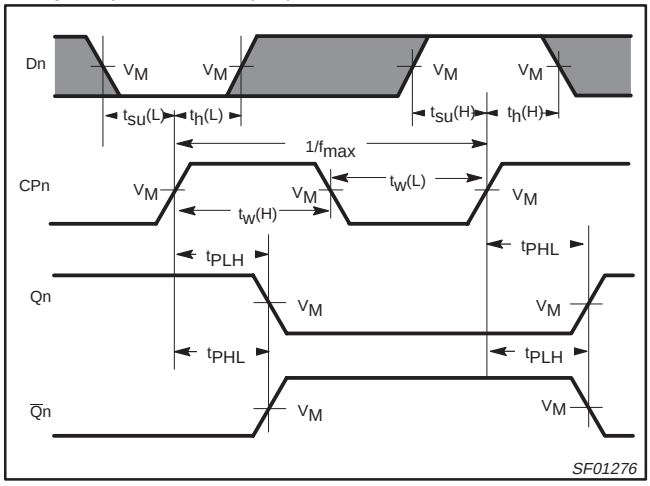
SYMBOL	PARAMETER	TEST CONDITION	LIMITS							UNIT
			V_{CC} = +5.0V T_{amb} = +25°C C_L = 50pF, R_L = 500Ω			V_{CC} = +5.0V ± 10% T_{amb} = 0°C to +70°C C_L = 50pF, R_L = 500Ω		V_{CC} = +5.0V ± 10% T_{amb} = –40°C to +85°C C_L = 50pF, R_L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}	Maximum clock frequency	Waveform 1	100	125		100		90		MHz
t_{PLH} t_{PHL}	Propagation delay CPn to Qn or $\overline{Q}$n	Waveform 1	3.8 4.4	5.3 6.2	6.8 8.0	3.8 4.4	7.8 9.2	3.8 4.4	8.5 9.2	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{S}$Dn, $\overline{R}$Dn to Qn or $\overline{Q}$n	Waveform 2	3.2 3.5	4.6 7.0	6.1 9.0	3.2 3.5	7.1 10.5	3.2 2.5	7.5 10.5	ns

AC SETUP REQUIREMENTS

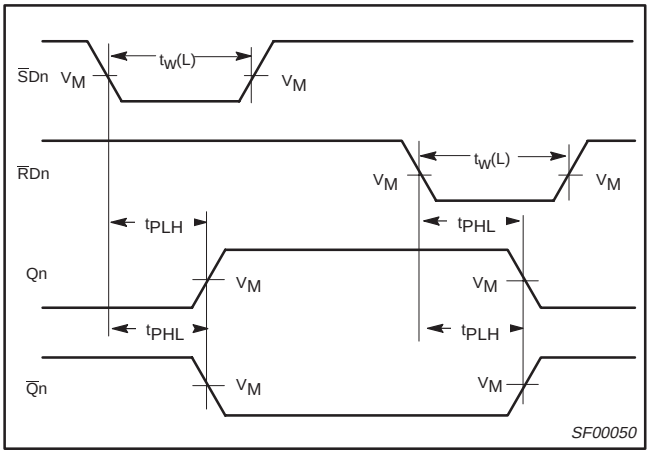
SYMBOL	PARAMETER	TEST CONDITION	LIMITS							UNIT
			V_{CC} = +5.0V T_{amb} = +25°C C_L = 50pF, R_L = 500Ω			V_{CC} = +5.0V ± 10% T_{amb} = 0°C to +70°C C_L = 50pF, R_L = 500Ω		V_{CC} = +5.0V ± 10% T_{amb} = –40°C to +85°C C_L = 50pF, R_L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{su} (H) t_{su} (L)	Setup time, high or low Dn to CPn	Waveform 1	2.0 3.0			2.0 3.0		2.0 3.0		ns
t_h (H) t_h (L)	Hold time, high or low Dn to CPn	Waveform 1	1.0 1.0			1.0 1.0		1.0 1.0		ns
t_w (H) t_w (L)	CPn pulse width, high or low	Waveform 1	4.0 5.0			4.0 5.0		4.0 5.0		ns
t_w (L)	$\overline{S}$Dn, $\overline{R}$Dn pulse width, low	Waveform 2	4.0			4.0		4.0		ns
t_{rec}	Recovery time $\overline{S}$Dn, $\overline{R}$Dn to CPn	Waveform 3	2.0			2.0		2.0		ns

AC WAVEFORMS

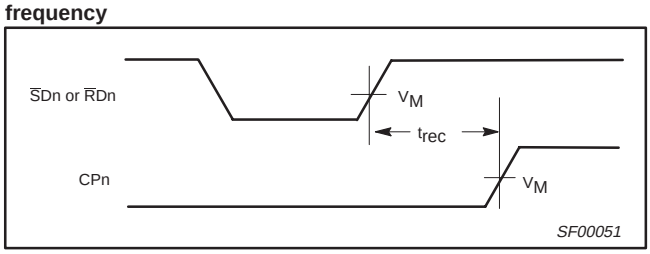
For all waveforms, V_M = 1.5V.
The shaded areas indicate when the input is permitted to change for predictable output performance.



Waveform 1. Propagation delay for data to output, data setup time and hold times, and clock width, and maximum clock frequency

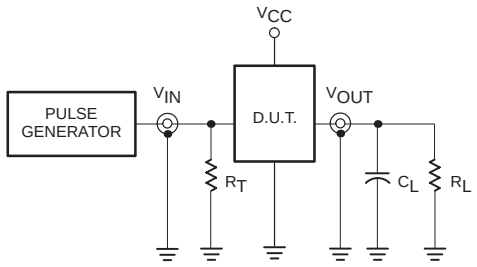


Waveform 2. Propagation delay for set and reset to output, set and reset pulse width

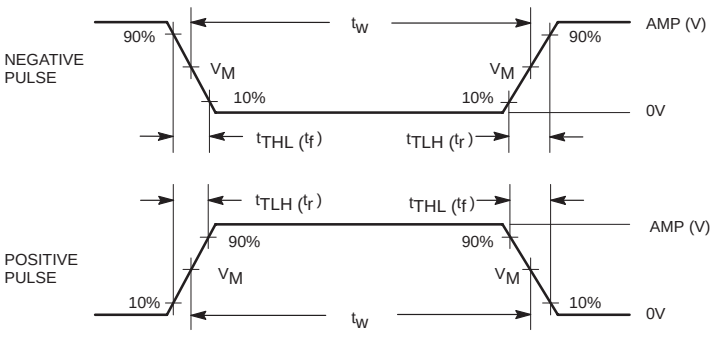


Waveform 3. Recovery time for set or reset to clock

TEST CIRCUIT AND WAVEFORMS



Test Circuit for Totem-Pole Outputs



Input Pulse Definition

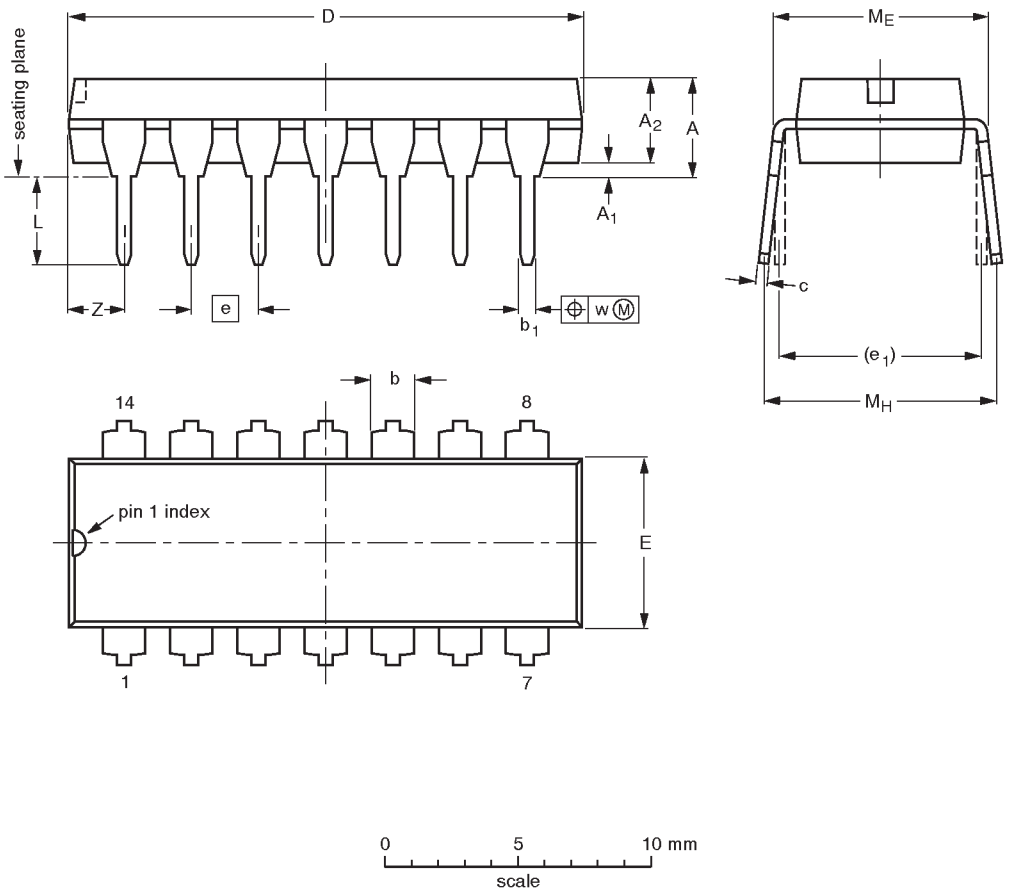
family	INPUT PULSE REQUIREMENTS					
	amplitude	V_M	rep. rate	t_w	t_{TLH}	t_{THL}
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

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.

SF00006

DIP14: plastic dual in-line package; 14 leads (300 mil) **SOT27-1**



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

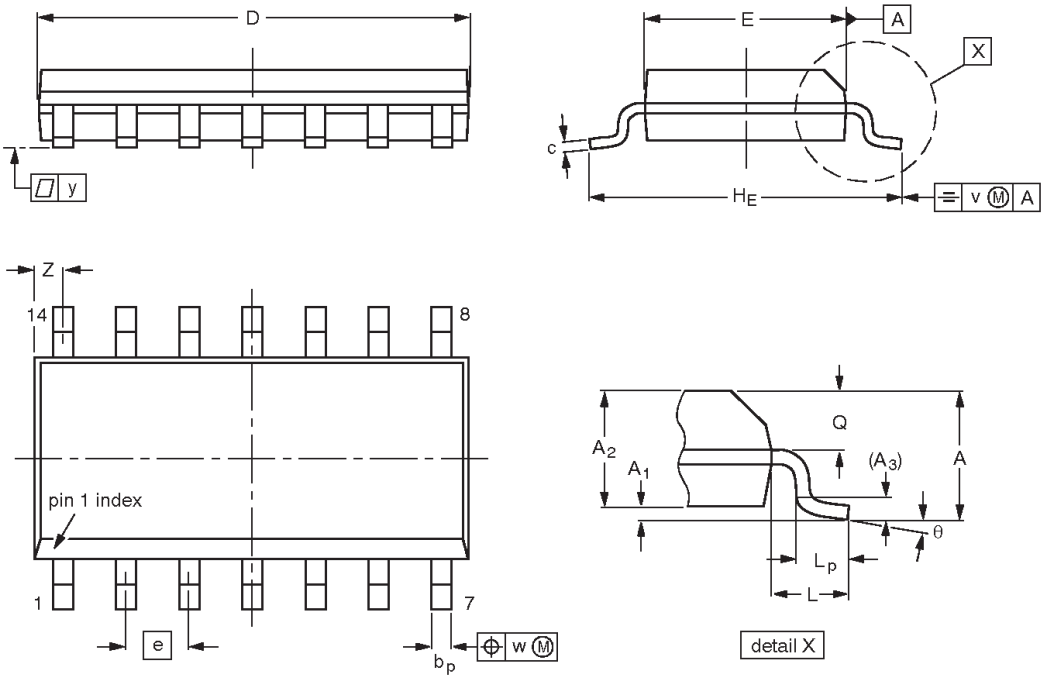
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.13	0.53 0.38	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.2
inches	0.17	0.020	0.13	0.068 0.044	0.021 0.015	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.087

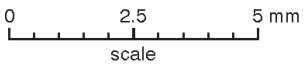
Note

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			
SOT27-1	050G04	MO-001AA				~~92-11-17~~ 95-03-11

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^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.35 0.34	0.16 0.15	0.050	0.244 0.228	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				~~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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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.

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Philips Semiconductors
811 East Arques Avenue
P.O. Box 3409
Sunnyvale, California 94088–3409
Telephone 800-234-7381

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