

DATA SHEET

74F174 Hex D flip-flops

Product specification

1988 Oct 07

IC15 Data Handbook

Hex D flip-flop

74F174

FEATURES

- Six edge-triggered D-type flip-flops
- Buffered common Clock
- Buffered, asynchronous Master Reset

DESCRIPTION

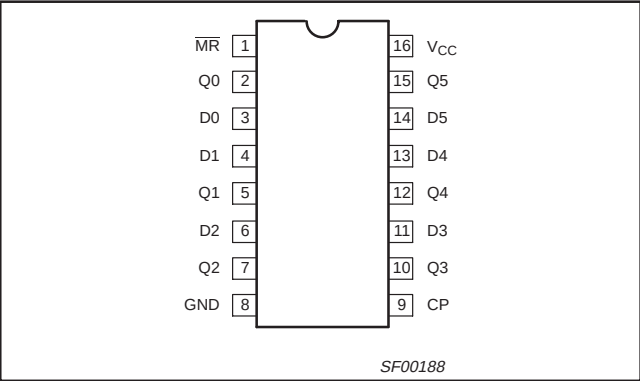
The 74F174 has six edge-triggered D-type flip-flops with individual D inputs and Q outputs. The common buffered Clock (CP) and Master Reset ($\overline{MR}$) inputs load and reset (clear) all flip-flops simultaneously.

The register is fully edge-triggered. The state of each D input, one setup time before the Low-to-High clock transition is transferred to the corresponding flip-flop's Q output.

All Q outputs will be forced Low independent of Clock or Data inputs by a Low voltage level on the $\overline{MR}$ input. The device is useful for applications where true outputs only are required, and the Clock and Master Reset are common to all storage elements.

TYPE	TYPICAL f_{MAX}	TYPICAL SUPPLY CURRENT (TOTAL)
74F174	100MHz	35mA

PIN CONFIGURATION



ORDERING INFORMATION

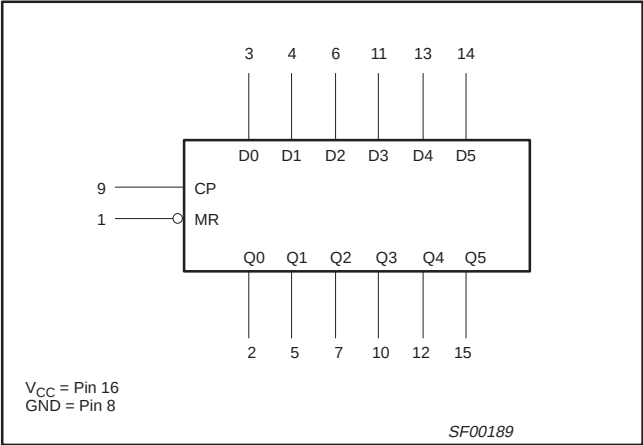
DESCRIPTION	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$, $T_{amb} = 0^{\circ}C \text{ to } +70^{\circ}C$	PKG DWG #
16-pin plastic DIP	N74F174N	SOT38-4
16-pin plastic SO	N74F174D	SOT109-1

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

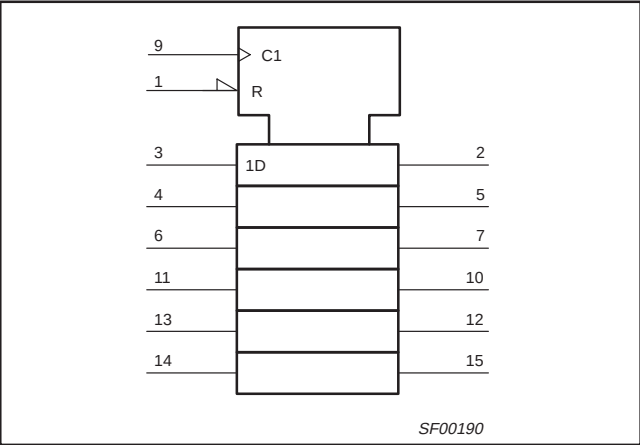
PINS	DESCRIPTION	74F (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
D0–D5	Data inputs	1.0/1.0	20 μ A/0.6mA
CP	Clock Pulse input (active rising edge)	1.0/1.0	20 μ A/0.6mA
$\overline{MR}$	Master Reset input (active-Low)	1.0/1.0	20 μ A/0.6mA
Q0–Q5	Outputs	50/33	1.0mA/20mA

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

LOGIC SYMBOL



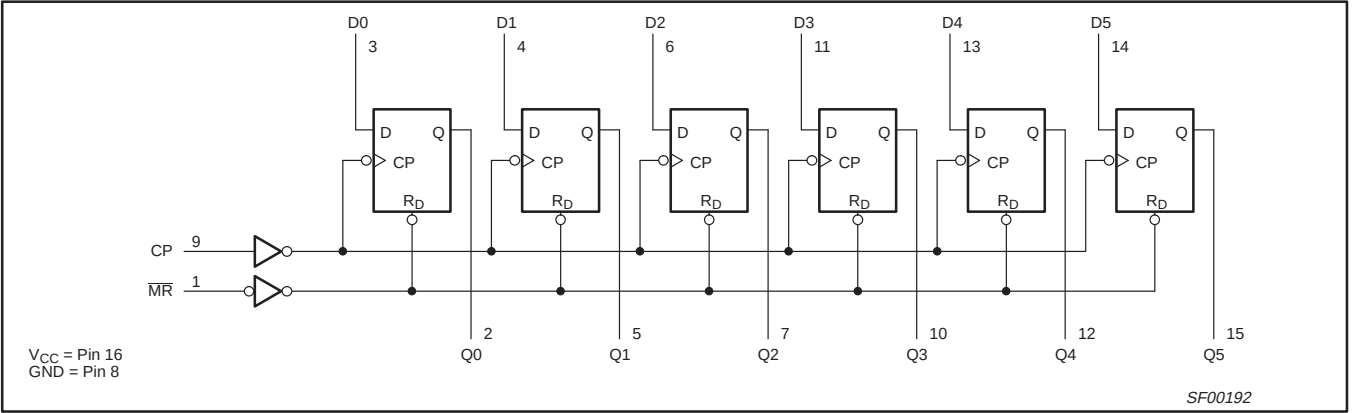
IEC/IEEE SYMBOL



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LOGIC DIAGRAM



FUNCTION TABLE

INPUTS			OUTPUTS	OPERATING MODE
MR	CP	D	Qn	
L	X	X	L	Reset (clear)
H	↑	h	H	Load "1"
H	↑	l	L	Load "0"

H = High voltage level
L = Low voltage level
X = Don't care
↑ = Low-to-High Clock transition
h = High voltage level one set-up time prior to the Low-to-High Clock transition.
l = Low voltage level one set-up time prior to the Low-to-High Clock transition.

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limits 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	0 to +70	°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	0		+70	°C

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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	V
		V _{IH} = MIN, I _{OL} = MAX	±5%V _{CC}		0.30	
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)	V _{CC} = MAX, D _n = $\overline{MR}$ = 4.5V, CP = ↑		35	45	mA

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V_{CC} = 5V, T_{amb} = 25°C.
- 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
			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		
			MIN	TYP	MAX	MIN	MAX	
f _{MAX}	Maximum clock frequency	Waveform 1	80	100		80		MHz
t _{PLH} t _{PHL}	Propagation delay CP to Qn	Waveform 1	3.5 4.5	5.5 6.0	8.0 10.0	3.5 4.5	9.0 11.0	ns
t _{PHL}	Propagation delay $\overline{MR}$ to Qn	Waveform 2	5.0	8.5	14.0	5.0	15.0	ns

AC SETUP REQUIREMENTS

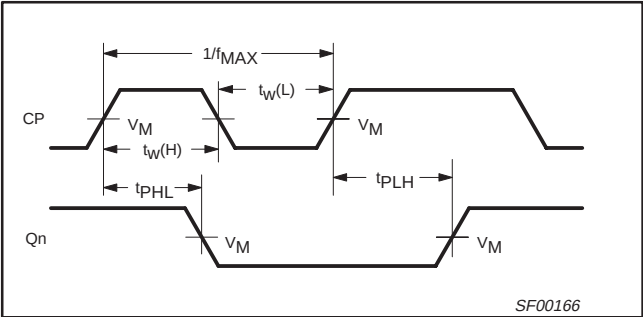
SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			V _{CC} = +5.0V T _{amb} = +25°C C _L = 50pF, R _L = 500Ω			V _{CC} = +5.0V ± 10% T _{amb} = 0°C to +70°C C _L = 50pF, R _L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	
t _S (H) t _S (L)	Setup time, High or Low Dn to CP	Waveform 3	4.0 4.0			4.0 4.0		ns
t _h (H) t _h (L)	Hold time, High or Low Dn to CP	Waveform 3	0.0 0.0			0.0 0.0		ns
t _w (H) t _w (L)	CP Pulse width, High or Low	Waveform 1	4.0 6.0			4.0 6.0		ns
t _w (L)	$\overline{MR}$ Pulse width, Low	Waveform 2	5.0			5.0		ns
t _{REC}	Recovery time, $\overline{MR}$ to CP	Waveform 2	5.0			5.0		ns

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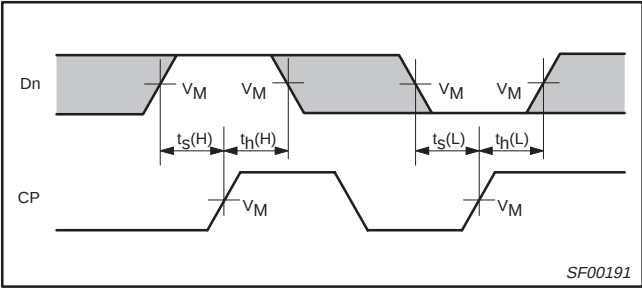
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AC WAVEFORMS

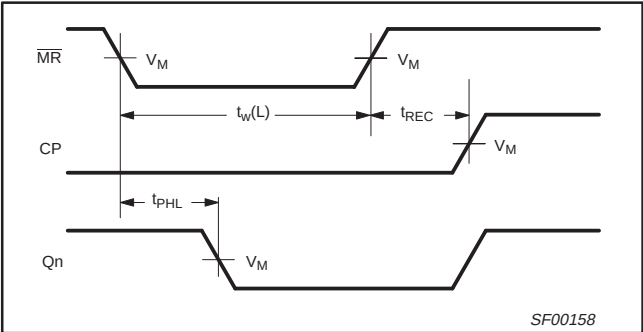
For all waveforms, $V_M = 1.5V$.
The shaded areas indicate when the input is permitted to change for predictable output performance.



Waveform 1. Propagation Delay, Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency

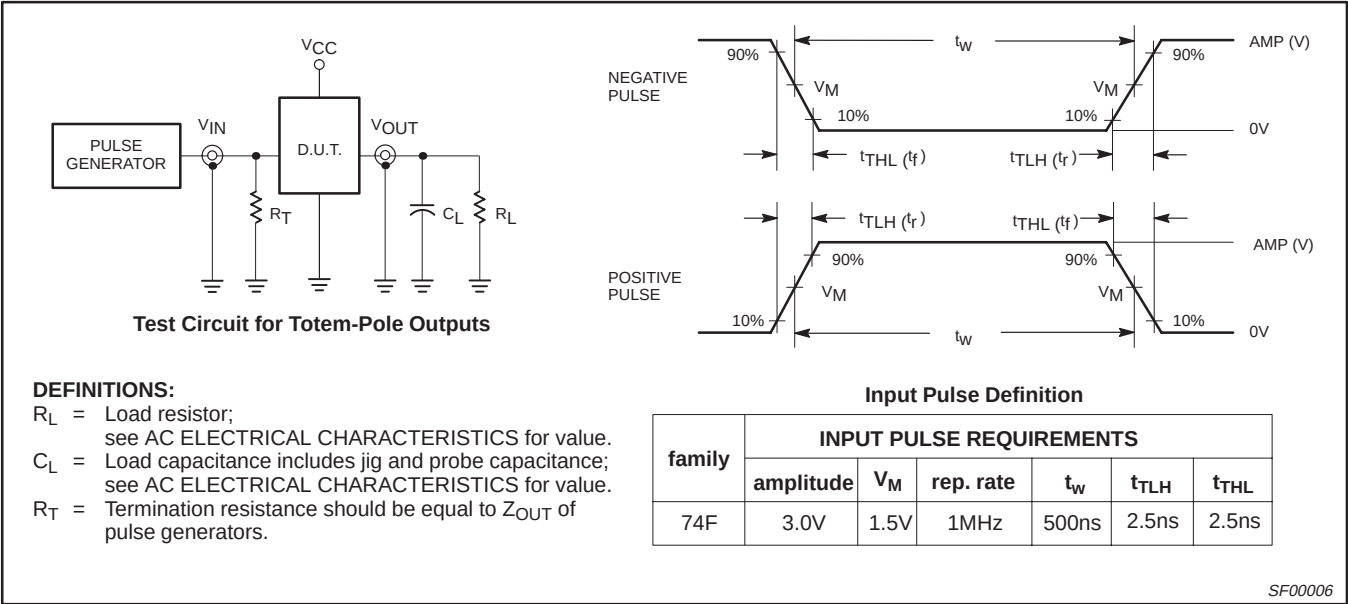


Waveform 3. Data Setup and Hold Times



Waveform 2. Master Reset Pulse Width, Master Reset to Output Delay and Master Reset to Clock recovery Time

TEST CIRCUIT AND WAVEFORMS

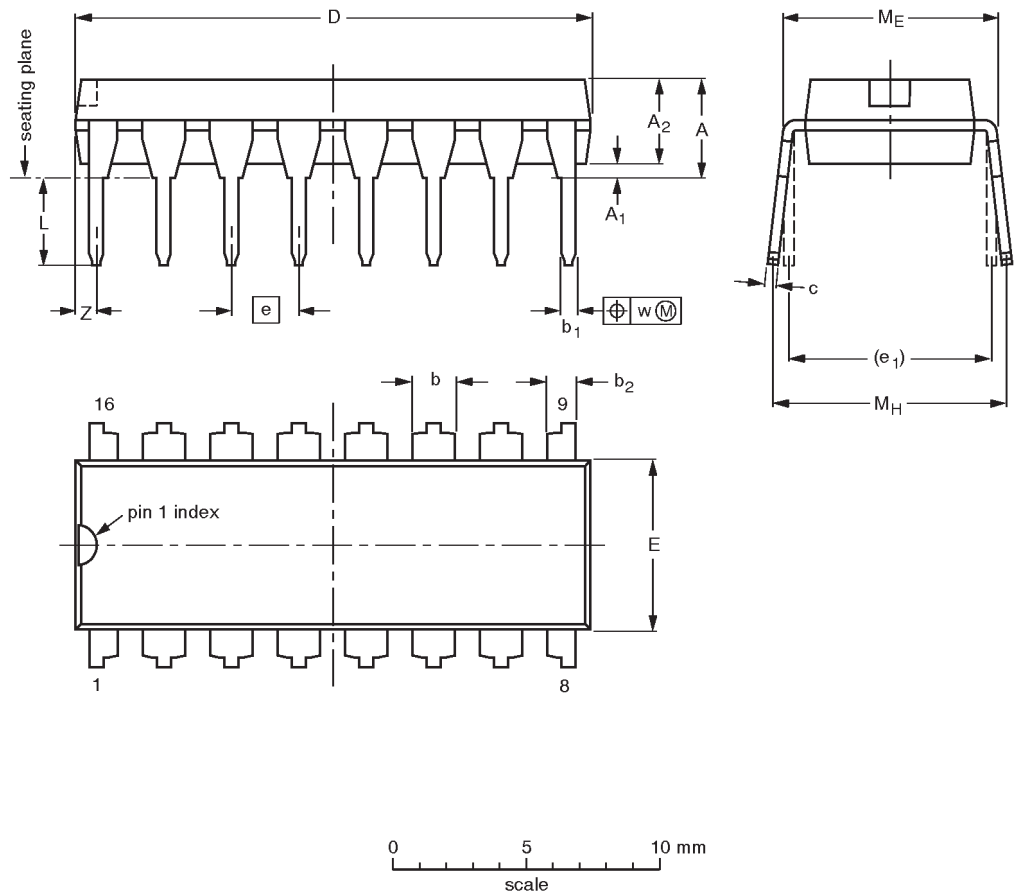


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DIP16: plastic dual in-line package; 16 leads (300 mil)

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.

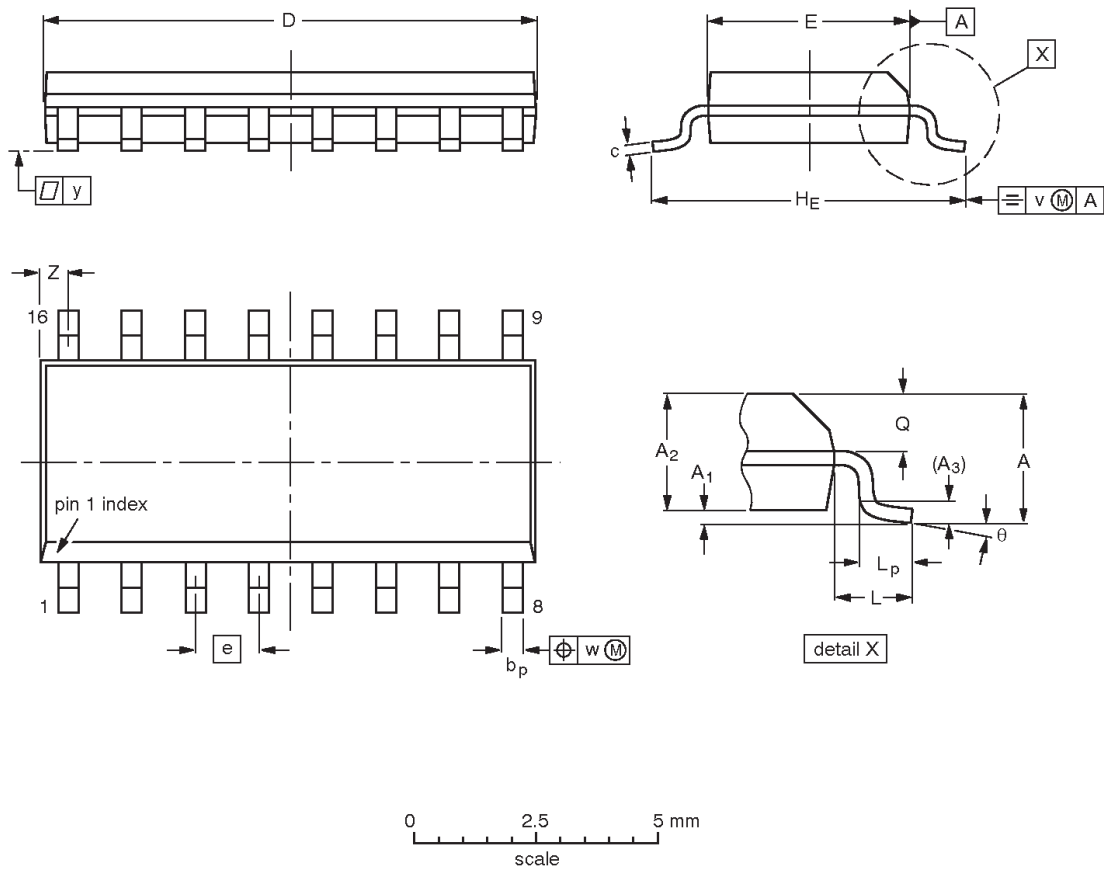
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-4						92-11-17 95-01-14

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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	0.010 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

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

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