DATA SHEET

74F175A

Quad D flip-flop

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Quad D flip-flop   74F175A

FEATURES

- Four edge-triggered D-type flip-flops
- Buffered common clock
- Buffered asynchronous Master Reset
- True and complementary outputs
- Industrial temperature range available (–40°C to +85°C)
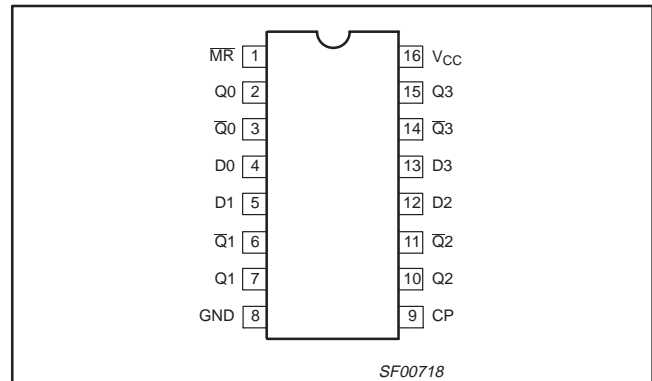- PNP light loading inputs

DESCRIPTION

The 74F175A is a quad, edge-triggered D-type flip-flop with individual D inputs and both Q and $\overline{Q}$ 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 independently of clock or data inputs by a Low voltage level on the $\overline{MR}$ input. The device is useful for applications where both true and complementary outputs are required, and the CP and $\overline{MR}$ are common to all storage elements.

PIN CONFIGURATION

Pin	Signal	Pin	Signal
1	$\overline{MR}$	16	V_{CC}
2	Q0	15	Q3
3	$\overline{Q}0$	14	$\overline{Q}3$
4	D0	13	D3
5	D1	12	D2
6	$\overline{Q}1$	11	$\overline{Q}2$
7	Q1	10	Q2
8	GND	9	CP

SF00718

TYPE	TYPICAL f_{max}	TYPICAL SUPPLY CURRENT (TOTAL)
74F175A	160MHz	22mA

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	74F175AN	I74F175AN	SOT38-4
16-pin plastic SO	74F175AD	I74F175AD	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	74F175A	1.0/0.033	20μA/20μA
$\overline{MR}$	Master reset input (active–Low)	74F175A	1.0/0.033	20μA/20μA
CP	Clock input (active rising edge)	74F175A	1.0/0.033	20μA/20μA
Q0–Q3	True outputs		50/33	1.0mA/20mA
$\overline{Q}0$–$\overline{Q}3$	Complementary outputs		50/33	1.0mA/20mA

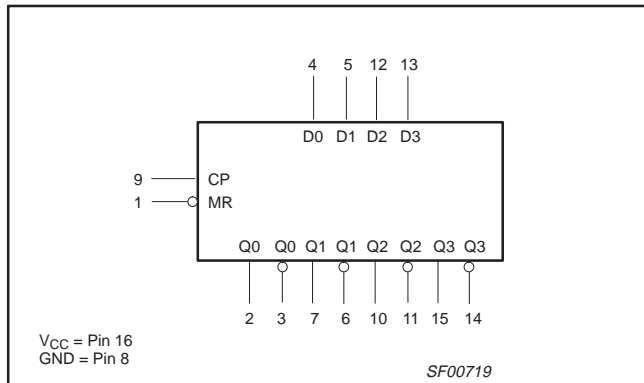**NOTE:**
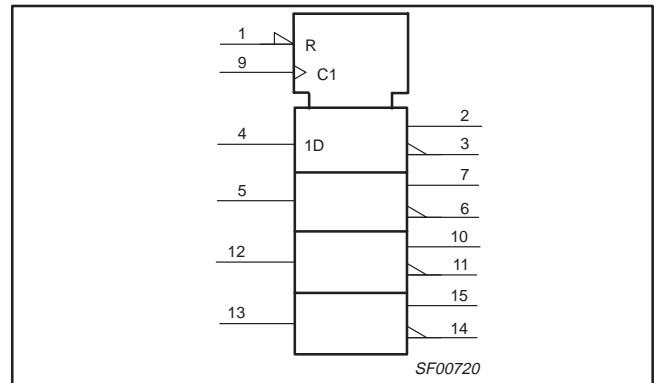One (1.0) FAST unit load is defined as: 20μA in the High state and 0.6mA in the Low state.
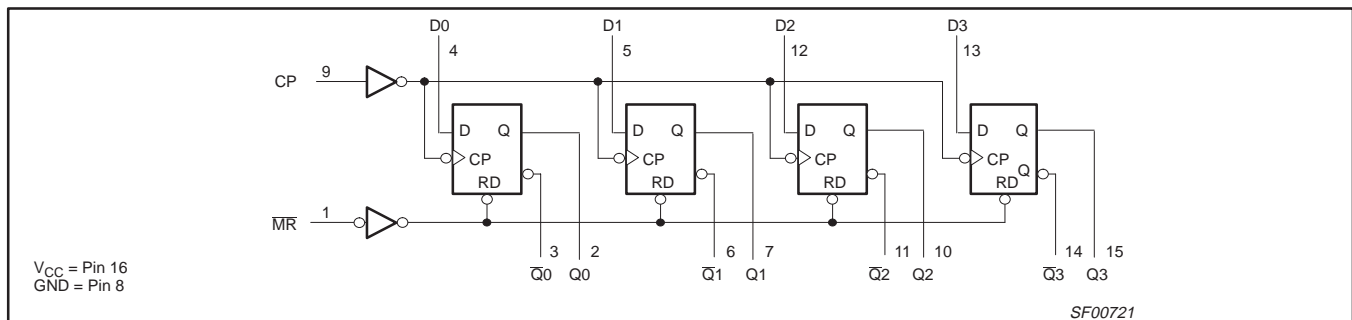
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LOGIC SYMBOL

SF00719

V$_{CC}$ = Pin 16
GND = Pin 8

IEC/IEEE SYMBOL

SF00720

LOGIC DIAGRAM

V$_{CC}$ = Pin 16
GND = Pin 8

SF00721

FUNCTION TABLE

INPUTS			OUTPUTS		OPERATING MODE
$\overline{MR}$	CP	Dn	Q$_n$	$\overline{Q}_n$	
L	X	X	L	H	Reset (clear)
H	↑	h	H	L	Load "1"
H	↑	l	L	H	Load "0"

H = High voltage level
h = High state must be present one setup time before the Low-to-High clock transition
L = Low voltage level
l = Low state must be present one setup time before the Low-to-High clock transition
X = Don't care
↑ = Low-to-High clock transition

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

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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_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IL} = MAX, V_{IH} = MIN, I_{OL} = MAX	±10%V_{CC}		0.30	0.5	V
			±5%V_{CC}		0.30	0.5	
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} = 0.0V, 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				−20	µA
I_{OS}	Short-circuit output current[3]	V_{CC} = MAX		−60		−150	mA
I_{CC}	Supply current (total)	V_{CC} = MAX			22	31	mA

Notes to DC electrical characteristics
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} = +5V C_L = 50pF, R_L = 500Ω			T_{amb} = 0°C to +70°C V_{CC} = +5.0V ± 10% C_L = 50pF, R_L = 500Ω		T_{amb} = −40°C to +85°C V_{CC} = +5.0V ± 10% C_L = 50pF, R_L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}	Maximum clock frequency	Waveform 1	140	160		125		110		MHz
t_{PLH} t_{PHL}	Propagation delay CP to Qn or $\overline{Q}$n	Waveform 1	3.0 4.5	4.0 6.0	6.5 8.5	2.5 4.0	7.5 9.0	2.5 4.0	8.0 10.0	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{MR}$ to Qn	Waveform 3	4.5	6.5	9.0	4.5	10.0	4.5	11.0	ns
t_{PHL} t_{PHL}	Propagation delay $\overline{MR}$ to Qn	Waveform 3	4.5	6.0	8.0	4.0	9.0	4.0	10.0	ns

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AC SETUP REQUIREMENTS

| SYMBOL	PARAMETER	TEST CONDITION	LIMITS							UNIT
			T_{amb} = 25°C V_{CC} = +5V C_L = 50pF, R_L = 500Ω			T_{amb} = 0°C to +70°C V_{CC} = +5.0V $\pm$ 10% C_L = 50pF, R_L = 500Ω		T_{amb} = $-$40°C to +85°C V_{CC} = +5.0V $\pm$ 10% C_L = 50pF, R_L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_s(H) t_s(L)	Setup time, High or Low Dn to CP	Waveform 2	3.0 3.0			3.5 3.5		4.0 4.0		ns
t_h(H) t_h(L)	Hold time, High or Low Dn to CP	Waveform 2	0.0 0.0			0.0 0.0		0.0 0.0		ns
t_w(H) t_w(L)	CP Pulse width High or Low	Waveform 1	3.0 4.0			3.5 5.0		4.0 5.5		ns
t_w(L)	$\overline{MR}$ Pulse width Low	Waveform 3	3.5			3.5		4.0		ns
t_{REC}	Recovery time $\overline{MR}$ to CP	Waveform 3	4.0			4.5		5.0		ns

AC WAVEFORMS

For all waveforms, V_M = 1.3V.
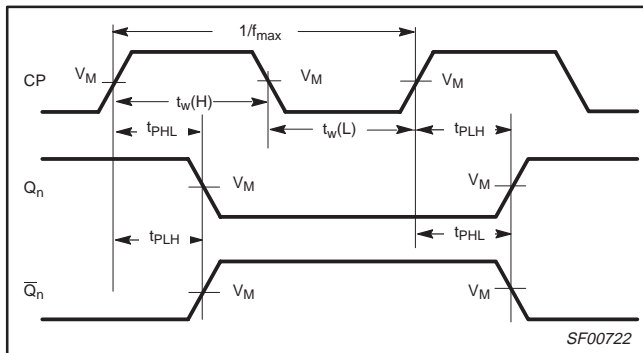
Waveform 1. Propagation delay for clock input to output, clock pulse width, and maximum clock frequency
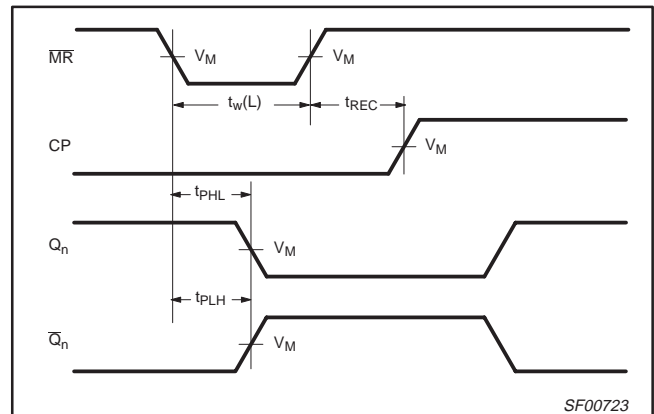
Waveform 3. Master Reset pulse width, Master Reset to output delay and Master Reset to Clock recovery time
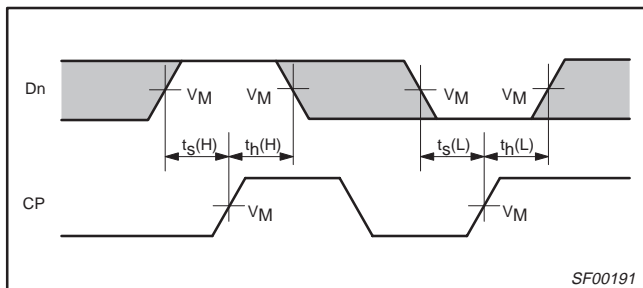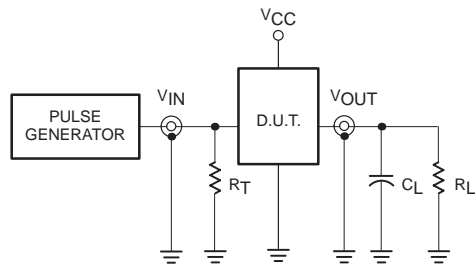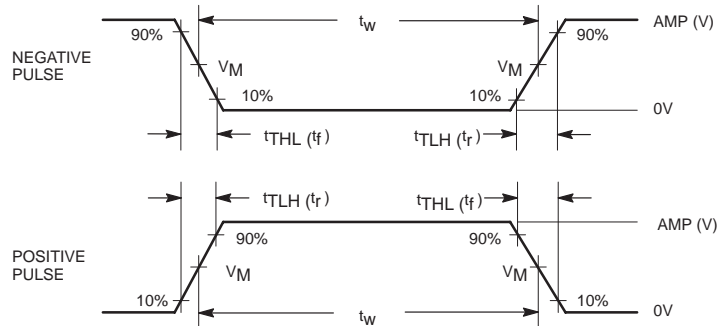

Waveform 2. Data setup time and hold times

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TEST CIRCUIT AND WAVEFORMS

Test Circuit for Totem-Pole Outputs

Input Pulse Definition

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.

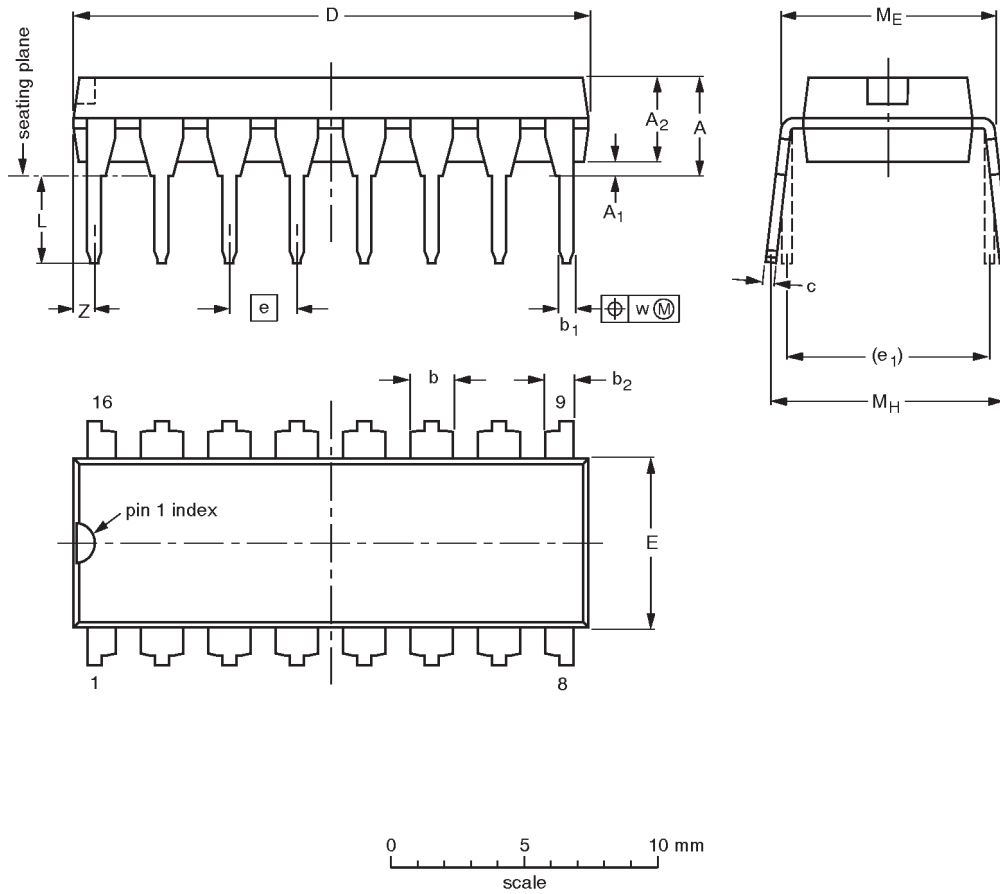| family	INPUT PULSE REQUIREMENTS					
	amplitude	V_M	rep. rate	t_w	t_{TLH}	t_{THL}
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

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

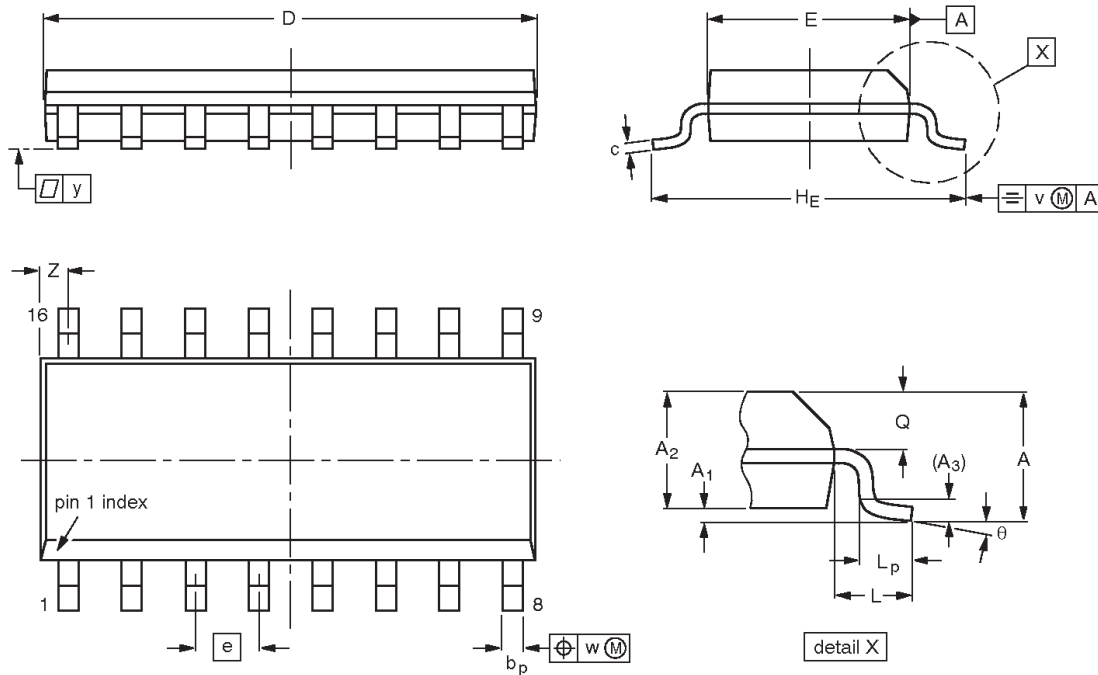1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

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


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0        2.5       5 mm
|_____|_____|
      scale
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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

NOTES

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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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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