National Semiconductor

June 1989

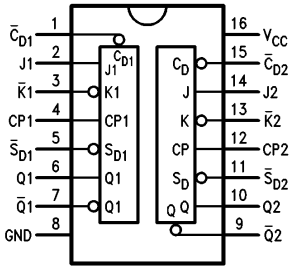
DM74S109 Dual $J\overline{K}$ Positive Edge-Triggered Flip-Flop

General Description

This device consists of two high speed, completely independent transition clocked $J\overline{K}$ flip-flops. The clocking operation is independent of rise and fall times of the clock waveform. The $J\overline{K}$ design allows operation as a D flip-flop (refer to 'S74 data sheet) by connecting the J and $\overline{K}$ inputs together.

Connection Diagram

Dual-In-Line Package



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Order Number DM74S109N
See NS Package Number N16E

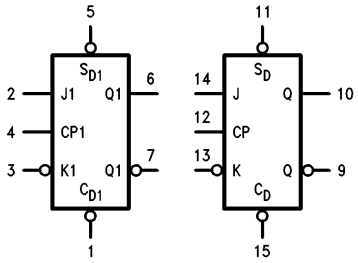
Truth Table

Inputs		Outputs	
@ t_n		@ t_n + 1	
J	**K**	**Q**	**Q**
L	H	No Change	
L	L	L	H
H	H	H	L
H	L	Toggles	

t_n = Bit time before clock pulse
t_{n+1} = Bit time after clock pulse
H = HIGH Voltage Level
L = LOW Voltage Level

Asynchronous Inputs:
LOW input to $\overline{S}_D$ sets Q to HIGH level
LOW input to $\overline{C}_D$ sets Q to LOW level
Clear and Set are independent of clock
Simultaneous LOW on $\overline{C}_D$ and $\overline{S}_D$ makes both Q and $\overline{Q}$ HIGH

Logic Symbol



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V_{CC} = Pin 16
GND = Pin 8

RRD-B30M115/Printed in U. S. A.

Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	5.5V
Operating Free Air Temperature Range	
DM74S	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: *The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation*

Recommended Operating Conditions

Symbol	Parameter	DM74S109			Units
		Min	Nom	Max	
V_{CC}	Supply Voltage	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			V
V_{IL}	Low Level Input Voltage			0.8	V
I_{OH}	High Level Output Current			−1	mA
I_{OL}	Low Level Output Current			20	mA
T_A	Free Air Operating Temperature	0		70	°C
t_s (H) t_s (L)	Setup Time J_n or $\overline{K}_n$ to CP_n	6.0 6.0			ns
t_h (H) t_h (L)	Hold Time J_n or $\overline{K}_n$ to CP_n	0 0			ns
t_w (H) t_w (L)	CP_n Pulse Width	7.0 6.5			ns
t_w (L)	$\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ Pulse Width LOW	6.0			ns

Electrical Characteristics

Over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA			−1.2	V
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max V_{IL} = Max	2.7	3.4		V
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max V_{IH} = Min		0.35	0.5	V
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 5.5V			1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V			50	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.5V			−2.0	mA
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 2)	−40		−100	mA
I_{CC}	Supply Current	V_{CC} = Max V_{CP} = 0V			52	mA

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Switching Characteristics

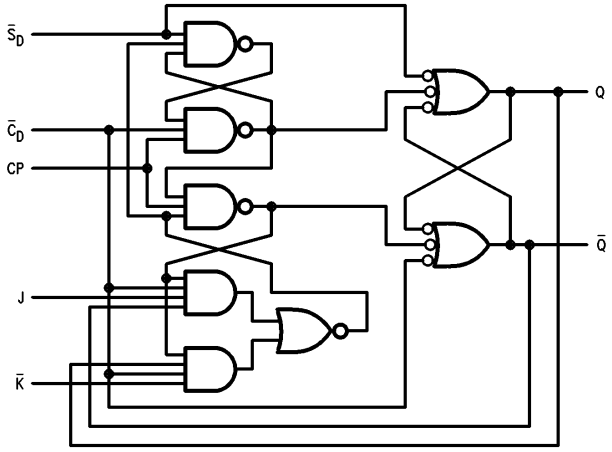
$V_{CC} = +5.0V$, $T_A = +25°C$ (See Section 1 for waveforms and load configurations)

Symbol	Parameter	$C_L = 15$ pF, $R_L = 280\Omega$		Units
		Min	Max	
f_{max}	Maximum Clock Frequency	75		MHz
t_{PLH} t_{PHL}	Propagation Delay CP_n to Q_n or $\overline{Q}_n$		9.0 11	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q_n or $\overline{Q}_n$		6.0 11	ns

Note 1: All typicals are at $V_{CC} = 5V$, $T_A = 25°C$.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Logic Diagram (one half shown)



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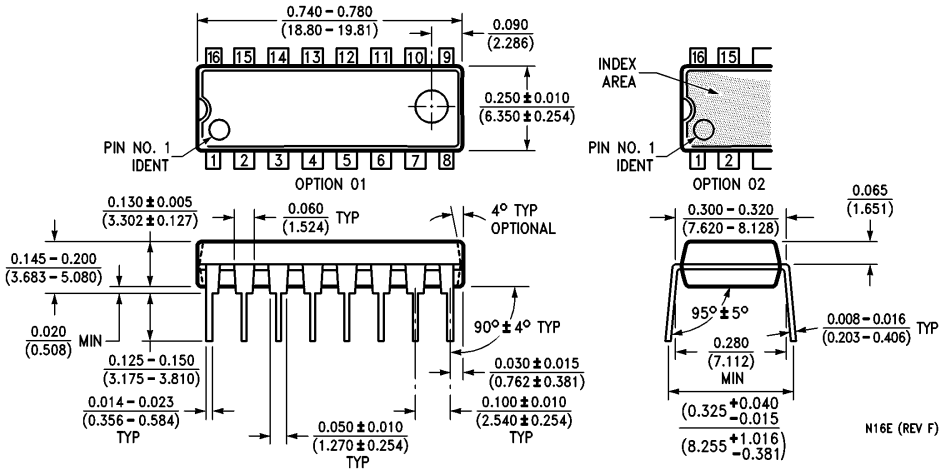
Physical Dimensions inches (millimeters)



16-Lead Molded Dual-In-Line Package (N)
Order Number DM74S109N
NS Package Number N16E

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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