

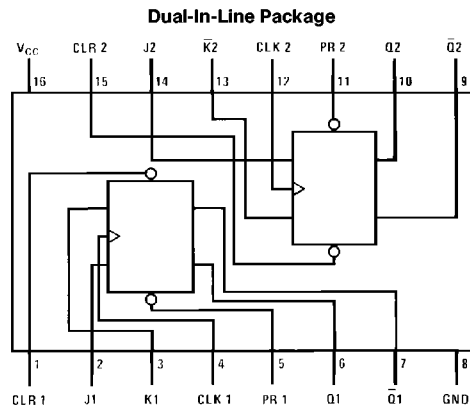
# DM54109 Dual Positive-Edge-Triggered J-K Flip-Flops with Preset, Clear, and Complementary Outputs

## General Description

This device contains two independent positive-edge-triggered J-K flip-flops with complementary outputs. The J and K data is accepted by the flip-flop on the rising edge of the clock pulse. The triggering occurs at a voltage level and is not directly related to the transition time of the rising edge of

the clock. The data on the J and  $\bar{K}$  inputs may be changed while the clock is high or low as long as setup and hold times are not violated. A low logic level on the preset or clear inputs will set or reset the outputs regardless of the logic levels of the other inputs.

## Connection Diagram



TL/F/6537-1

Order Number DM54109J or DM54109W  
See NS Package Number J16A or W16A

## Function Table

Inputs					Outputs	
PR	CLR	CLK	J	$\bar{K}$	Q	$\bar{Q}$
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H*	H*
H	H	↑	L	L	L	H
H	H	↑	H	L	Toggle	
H	H	↑	L	H	Q <sub>0</sub>	$\bar{Q}_0$
H	H	↑	H	H	H	L
H	H	L	X	X	Q <sub>0</sub>	$\bar{Q}_0$

H = High Logic Level

L = Low Logic Level

↑ = Rising Edge of Pulse.

\* = This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (high) level.

Q<sub>0</sub> = The output logic level of Q before the indicated input conditions were established.

Toggle = Each output changes to the complement of its previous level on each active transition of the clock pulse.

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## 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	
DM54	-55°C to +125°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	DM54109			Units
		Min	Nom	Max	
V <sub>CC</sub>	Supply Voltage	4.5	5	5.5	V
V <sub>IH</sub>	High Level Input Voltage	2			V
V <sub>IL</sub>	Low Level Input Voltage			0.8	V
I <sub>OH</sub>	High Level Output Current			-1.2	mA
I <sub>OL</sub>	Low Level Output Current			16	mA
f <sub>CLK</sub>	Clock Frequency (Note 6)	0		30	MHz
t <sub>w</sub>	Pulse Width (Note 6)	Clock High	20		ns
		Clock Low	20		
		Preset Low	20		
		Clear Low	20		
t <sub>SU</sub>	Input Setup Time (Notes 1 & 6)	15 ↑			ns
t <sub>H</sub>	Input Hold Time (Notes 1 & 6)	10 ↓			ns
T <sub>A</sub>	Free Air Operating Temperature	-55		125	°C

## Electrical Characteristics over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = -12 mA			-1.5	V
V <sub>OH</sub>	High Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	2.4	3.4		V
V <sub>OL</sub>	Low Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = Max V <sub>IH</sub> = Min, V <sub>IL</sub> = Max		0.2	0.4	V
I <sub>I</sub>	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max, V <sub>I</sub> = 5.5V			1	mA
I <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max V <sub>I</sub> = 2.4V	J, $\bar{K}$		40	μA
			Preset		80	
			Clock		80	
			Clear		160	
I <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max V <sub>I</sub> = 0.4V (Note 5)	J, $\bar{K}$		-1.6	mA
			Preset		-3.2	
			Clock		-3.2	
			Clear		-4.8	
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 3)	-30		-85	mA
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max (Note 4)		20	30	mA

Note 1: The symbol (↑) indicates the rising edge of the clock pulse is used for reference.

Note 2: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

Note 3: Not more than one output should be shorted at a time.

Note 4: With all outputs open, I<sub>CC</sub> is measured with the Q and  $\bar{Q}$  outputs high in turn. At the time of measurement the clock input grounded.

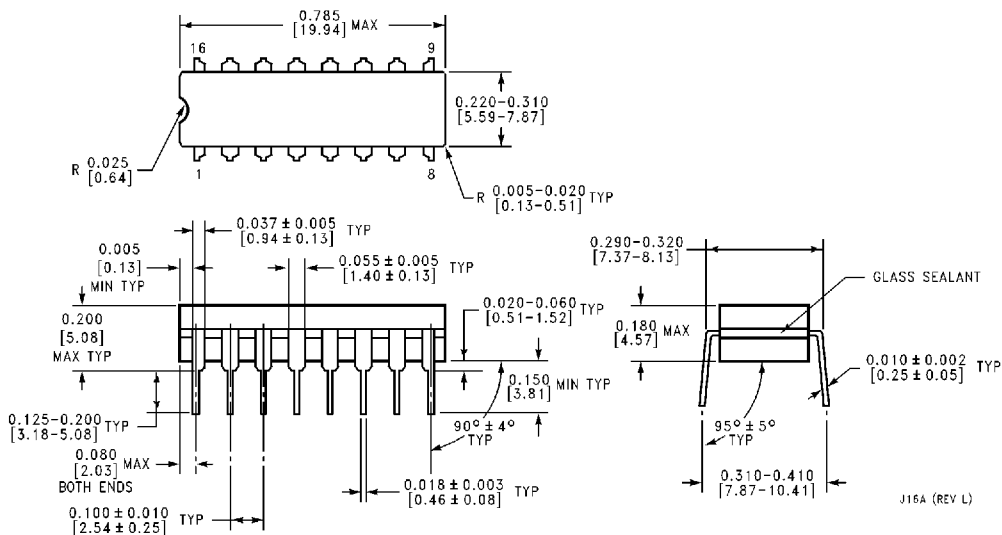
Note 5: Clear is tested with preset high and preset is tested with clear high.

Note 6: T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.

**Switching Characteristics** at  $V_{CC} = 5V$  and  $T_A = 25^\circ C$  (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	From (Input) To (Output)	$R_L = 400\Omega$ $C_L = 15\text{ pF}$		Units
			Min	Max	
$f_{MAX}$	Maximum Clock Frequency		30		MHz
$t_{PLH}$	Propagation Delay Time Low to High Level Output	Preset to Q		14	ns
$t_{PHL}$	Propagation Delay Time High to Low Level Output	Preset to $\bar{Q}$		29	ns
$t_{PLH}$	Propagation Delay Time Low to High Level Output	Clear to $\bar{Q}$		14	ns
$t_{PHL}$	Propagation Delay Time High to Low Level Output	Clear to Q		25	ns
$t_{PLH}$	Propagation Delay Time Low to High Level Output	Clock to Q or $\bar{Q}$		18	ns
$t_{PHL}$	Propagation Delay Time High to Low Level Output	Clock to Q or $\bar{Q}$		28	ns

**Physical Dimensions** inches (millimeters)

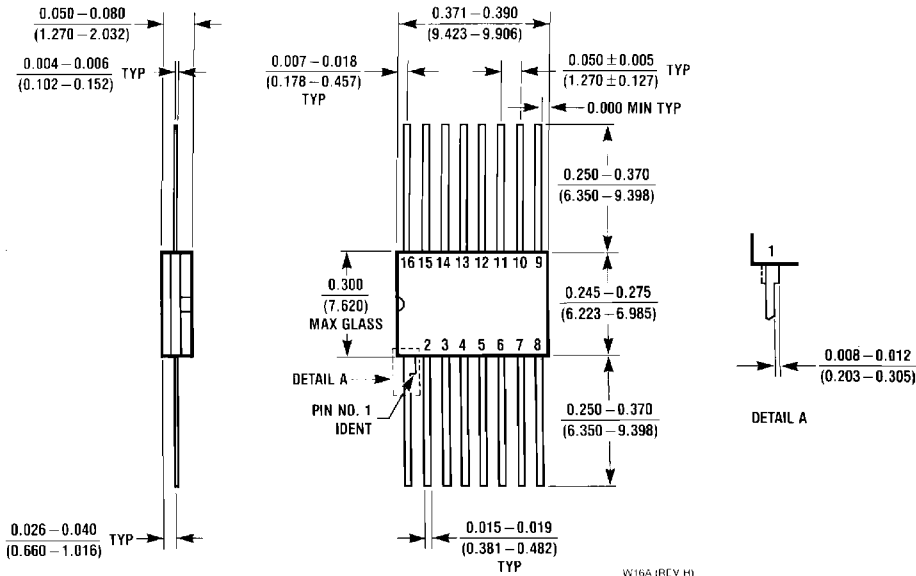


**16-Lead Ceramic Dual-In-Line Package (J)**  
Order Number DM54109J  
NS Package Number J16A

J16A (REV L)

**DM54109 Dual Positive-Edge-Triggered J-K Flip-Flops with Preset, Clear, and Complementary Outputs**

**Physical Dimensions** inches (millimeters) (Continued)



**16-Lead Ceramic Flat Package (W)**  
**Order Number DM54109W**  
**NS Package Number W16A**

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