



T-46-07-07

DM74AS109 Dual J-K Positive-Edge-Triggered Flip-Flop with Preset and Clear

General Description

The 'AS109 is a dual edge-triggered flip-flop. Each flip-flop has individual J, K, clock, clear and preset inputs, and also complementary Q and \bar{Q} outputs.

Information at inputs J and K meeting the setup time requirements are transferred to the Q output on the positive going edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive going pulse. When the clock input is at either the high or low level, the J, K input signal has no effect.

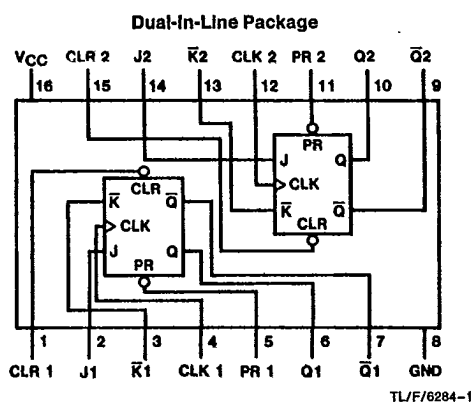
Asynchronous preset and clear inputs will set or reset Q output respectively upon the application of low level signal.

The J-K design allows operation as a D flip-flop by tying the J and \bar{K} inputs together.

Features

- Switching specifications at 50 pF
- Switching specifications guaranteed over full temperature and V_{CC} range
- Advanced oxide-isolated, ion-implanted Schottky TTL process
- Functionally and pin for pin compatible with Schottky and LS TTL counterpart
- Improved AC performance over S109 at approximately half the power

Connection Diagram



Function Table

Inputs					Outputs	
PR	CLR	CK	J	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_0	\bar{Q}_0
H	H	↑	H	H	H	L
H	H	L	X	X	Q_0	\bar{Q}_0

L = Low State, H = High State, X = Don't Care

↑ = Positive Edge Transition, Q_0 = Previous Condition of Q

*This condition is nonstable; it will not persist when preset and clear inputs return to their inactive (high) level. The output levels in this condition are not guaranteed to meet the V_{OH} specification.

*Contact your local NSC representative about surface mount (M) package availability.

Absolute Maximum Ratings

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +150°C
Typical θ_{JA} N Package	72.0°C/W

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		Min	Nom	Max	Units
V_{CC}	Supply Voltage		4.5	5	5.5	V
V_{IH}	High Level Input Voltage		2			V
V_{IL}	Low Level Input Voltage				0.8	V
I_{OH}	High Level Output Current				-2	mA
I_{OL}	Low Level Output Current				20	mA
f_{CLK}	Clock Frequency		0		105	MHz
t_{WCLK}	Pulse Width	Clock High	4			ns
		Clock Low	5.5			ns
t_W	Pulse Width	Preset & Clear	4			ns
t_{SU}	Data Setup Time	J or \bar{K}	5.5 \uparrow			ns
		PRE or CLR Inactive	2 \uparrow			
t_H	Data Hold Time		0 \uparrow			ns
T_A	Free Air Operating Temperature		0		70	°C

The (\uparrow) indicates the positive edge of the Clock is used for reference.

Electrical Characteristics

over recommended operating free-air temperature range. All typical values are measured at $V_{CC} = 5V$, $T_A = 25^\circ C$.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IK}	Input Clamp Voltage	$V_{CC} = 4.5V$, $I_I = -18\text{ mA}$			-1.2	V
V_{OH}	High Level Output Voltage	$I_{OH} = -2\text{ mA}$ $V_{CC} = 4.5V$ to $5.5V$	$V_{CC} - 2$			V
V_{OL}	Low Level Output Voltage	$V_{CC} = 4.5V$, $V_{IH} = 2V$ $I_{OL} = 20\text{ mA}$		0.35	0.5	V
I_I	Input Current at Max Input Voltage	$V_{CC} = 5.5V$, $V_{IH} = 7V$			0.1	mA
I_{IH}	High Level Input Current	$V_{CC} = 5.5V$, $V_{IH} = 2.7V$			20	μA
		Clock, J, \bar{K} Preset, Clear			40	
I_{IL}	Low Level Input Current	$V_{CC} = 5.5V$, $V_{IL} = 0.4V$			-0.5	mA
		Clock, J, \bar{K} Preset, Clear			-1.8	
I_O	Output Drive Current	$V_O = 2.25V$, $V_{CC} = 5.5V$	-30		-112	mA
I_{CC}	Supply Current	$V_{CC} = 5.5V$ (Note 1)		11.5	17	mA

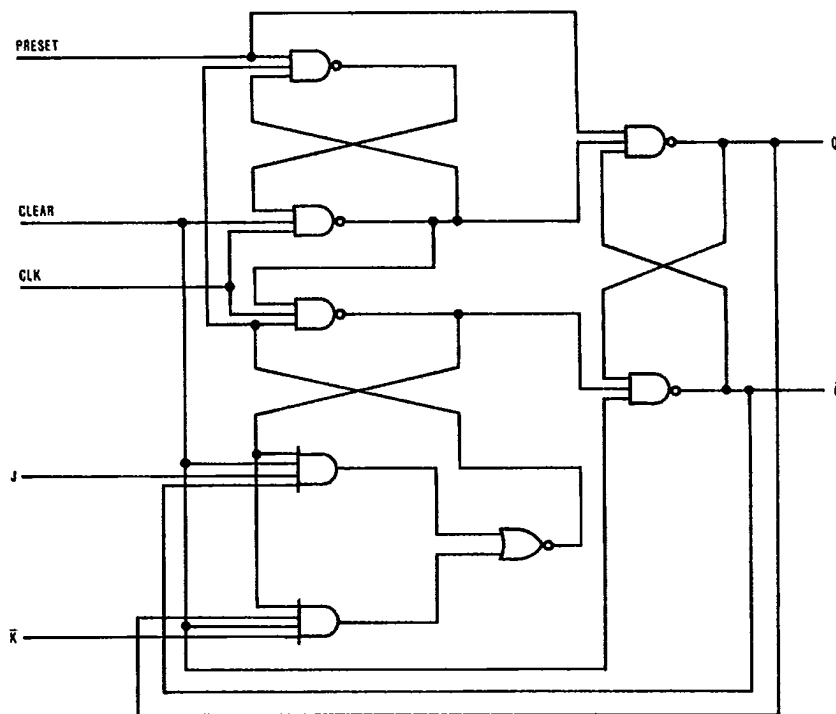
Note 1: I_{CC} is measured with J, \bar{K} , CLK and PR grounded, then with J, \bar{K} , CLK and CLR grounded.

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Switching Characteristics over recommended operating free air temperature range (Note 1)

Symbol	Parameter	Conditions	From	To	Min	Max	Units
f_{MAX}	Maximum Clock Frequency	$V_{CC} = 4.5V$ to $5.5V$ $R_L = 500\Omega$ $C_L = 50 pF$			105		MHz
t_{PLH}	Propagation Delay Time Low to High Level Output		Preset or Clear	Q or \bar{Q}	3	8	ns
t_{PHL}	Propagation Delay Time High to Low Level Output		Preset or Clear	Q or \bar{Q}	3.5	10.5	ns
t_{PLH}	Propagation Delay Time Low to High Level Output		Clock	Q or \bar{Q}	3.5	9	ns
t_{PHL}	Propagation Delay Time High to Low Level Output		Clock	Q or \bar{Q}	4.5	9	ns

Note 1: See Section 1 for test waveforms and output load.**Logic Diagram**

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