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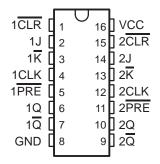
 Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

^ldescription

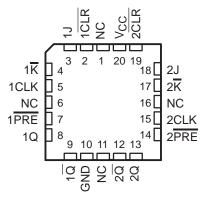
These devices contain two independent J- \overline{K} positive-edge-triggered flip-flops. A low level at the preset (PRE) or clear (CLR) inputs sets or resets the outputs regardless of the levels of the other inputs. When PRE and CLR are inactive (high), data at the J and \overline{K} input meeting the setup-time requirements are transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of the clock pulse. Following the hold time interval, data at the J and K inputs may be changed without affecting the levels at the outputs. These versatile flip-flops can perform as toggle flip-flops by grounding \overline{K} and trying J high. They also can perform as D-type flip-flops if J and \overline{K} are tied together.

The SN54F109 is characterized for operation over the full military temperature range of -55° C to 125°C. The SN74F109 is characterized for operation from 0°C to 70°C.

SN54F109 . . . J PACKAGE SN74F109 . . . D OR N PACKAGE (TOP VIEW)



SN54F109 . . . FK PACKAGE (TOP VIEW)



NC - No internal connection

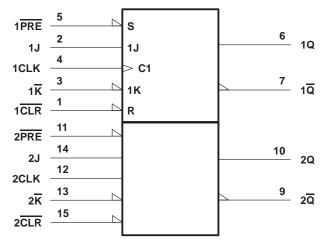
FUNCTION TABLE

		OUTI	PUTS			
PRE	CLR	CLK	J	K	Q	Q
L	Н	Х	Χ	Х	Н	L
Н	L	X	Χ	X	L	Н
L	L	X	Χ	X	H [†]	H [†]
Н	Н	\uparrow	L	L	L	Н
Н	Н	\uparrow	Н	L	Toggle	
Н	Н	\uparrow	L	Н	Q_0	\overline{Q}_0
Н	Н	\uparrow	Н	Н	Н	L
Н	Н	L	Χ	Χ	Q ₀	\overline{Q}_0

[†] The output levels are not guaranteed to meet the minimum levels for V_{OH}. Furthermore, this configuration is nonstable; that is, it will not persist when $\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ returns to its inactive (high) level.

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logic symbol[†]



[†] This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the D, J, and N packages.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage range, V _{CC}	$-0.5\;V$ to 7 V
Input voltage range, V _I (see Note 1)	-1.2 V to 7 V
Input current range	-30 mA to $5 mA$
Voltage range applied to any output in the high state	. -0.5 V to V_{CC}
Current into any output in the low state	40 mA
Operating free-air temperature range: SN54F109	−55°C to 125°C
SN74F109	0°C to 70°C
Storage temperature range	-65°C to 150°C

[‡] Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The input voltage ratings may be exceeded provided the input current ratings are observed.

recommended operating conditions

		SN54F109			SN74F109			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	UNIT
Vcc	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
\vee_{IH}	High-level input voltage	2			2			V
V _{IL}	Low-level input voltage			0.8			0.8	V
ΙΙΚ	Input clamp current			-18			-18	mA
IOH	High-level output current			- 1			- 1	mA
loL	Low-level output current			20			20	mA
TA	Operating free-air temperature	-55		125	0		70	°C



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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS			SN54F109			SN74F109		
				MIN	TYP†	MAX	MIN	TYP	MAX	UNIT
VIK		$V_{CC} = 4.5 \text{ V},$	$I_{I} = -18 \text{ mA}$			-1.2			-1.2	V
Voi		$V_{CC} = 4.5 \text{ V},$	$I_{OH} = -1 \text{ mA}$	2.5	3.4		2.5	3.4		V
VOH		$V_{CC} = 4.75 \text{ V},$	$I_{OH} = -1 \text{ mA}$				2.7			
V _{OL}		$V_{CC} = 4.5 \text{ V},$	$I_{OL} = 20 \text{ mA}$		0.3	0.5		0.3	0.5	V
II		$V_{CC} = 5.5 \text{ V},$	V _I = 7 V			0.1			0.1	mA
Iн		$V_{CC} = 5.5 \text{ V},$	V _I = 2.7 V			20			20	μΑ
J, K	, CLK	V 55V V: 05	V _I = 0.5 V			- 0.6			- 0.6	mA
I _{IL} PRE	or CLR	V _{CC} = 5.5 V,	v = 0.5 v			- 1.8			- 1.8	IIIA
los [‡]		$V_{CC} = 5.5 \text{ V},$	V _O = 0	-60		-150	-60		-150	mA
Icc		$V_{CC} = 5.5 \text{ V},$	See Note 2		11.7	17		11.7	17	mA

[†] All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}\text{C}$.

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

			V _{CC} = 5 V, T _A = 25°C		SN54F109		SN74F109		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f _{clock}	ck Clock frequency			100	0	70	0	90	MHz
	Pulse duration	CLK high, PRE or CLR low	4		4		4		ns
t _W	Pulse duration	CLK low	5		5		5		
		High	3		3		3		
t _{su}	Setup time, data before CLK↑	Low	3		3		3		ns
	Setup time, inactive-state before CLK↑§	PRE or CLR to CLK	2		2		2		
th	Hold time, data after CLK↑	High	1		1		1		20
	noid time, data after CLK1	Low	1		1		1		ns

[§] Inactive-state setup time is also referred to as recovery time.

switching characteristics (see Note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5 \text{ V},$ $C_{L} = 50 \text{ pF},$ $R_{L} = 500 \Omega,$ $T_{A} = 25^{\circ}\text{C}$			V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R_L = 500 Ω, T_A = MIN to MAX \P SN54F109 SN74F109				UNIT	
			MIN	TYP	MAX	MIN	MAX	MIN	MAX		
f _{max}			100	150		70		90		MHz	
tPLH	CLK	0.57 0	3	4.9	7	3	9	3	8	no	
^t PHL		Q or $\overline{\mathbb{Q}}$	3.6	5.8	8	3.6	10.5	3.6	9.2	ns	
^t PLH	PRE or CLR	DDE OLD	Q or $\overline{\mathbb{Q}}$	2.4	4.8	7	2.4	9	2.4	8	no
^t PHL		Q 01 Q	2.7	6.6	9	2.7	11.5	2.7	10.5	ns	

[¶] For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions. NOTE 3: Load circuits and waveforms are shown in Section 1.



[‡] Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second. NOTE 2: ICC is measured with J, K, CLK, and PRE grounded then with J, K, CLK, and CLR grounded.

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