

SN5470, SN7470 AND-GATED J-K POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR

SDLS116 - DECEMBER 1983 - REVISED MARCH 1988

- Package Options Include Plastic and Ceramic DIPs and Ceramic Flat Packages
- Dependable Texas Instruments Quality and Reliability

description

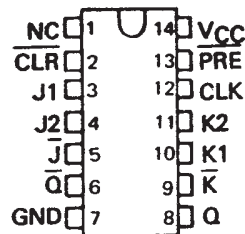
These monolithic, edge-triggered J-K flip-flops feature gated inputs, direct clear and preset inputs, and complementary Q and \bar{Q} outputs. Input information is transferred to the outputs on the positive edge of the clock pulse.

Direct-coupled clock triggering occurs at a specific voltage level of the clock pulse, and after the clock input threshold voltage has been passed, the gated inputs are locked out.

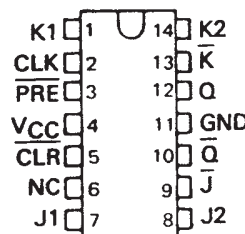
These flip-flops are ideally suited for medium-to-high-speed applications and can result in a significant saving in system power dissipation and package count where input gating is required.

The SN5470 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN7470 is characterized for operation from 0°C to 70°C .

SN5470 ... J PACKAGE
SN7470 ... N PACKAGE
(TOP VIEW)

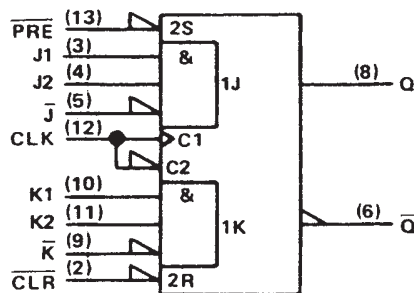


SN5470 ... W PACKAGE
(TOP VIEW)



NC - No internal connection

logic symbol†



†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

Pin numbers shown are for J and N packages only.

FUNCTION TABLE

INPUTS					OUTPUTS	
PRE	CLR	CLK	J	K	Q	\bar{Q}
L	H	L	X	X	H	L
H	L	L	X	X	L	H
L	L	X	X	X	L†	L†
H	H	↑	L	L	Q ₀	Q ₀
H	H	↑	H	L	H	L
H	H	↑	L	H	L	H
H	H	↑	H	H	TOGGLE	
H	H	L	X	X	Q ₀	Q ₀

If inputs J and K are not used, they must be grounded. Preset or clear function can occur only when the clock input is low.

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

positive logic

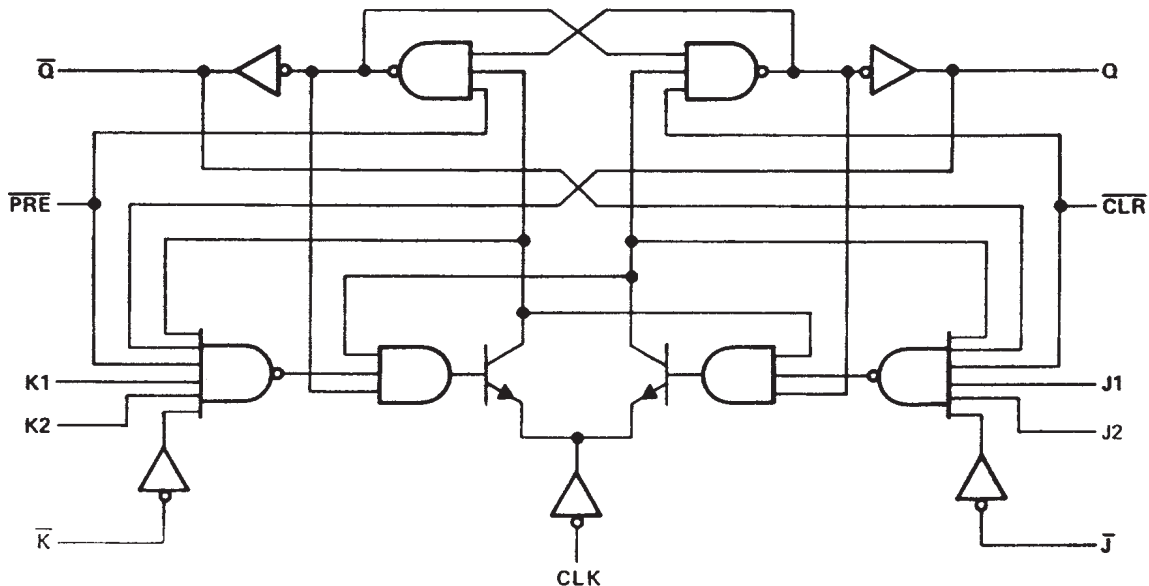
$$J = J1 \cdot J2 \cdot \bar{J}$$

$$K = K1 \cdot K2 \cdot \bar{K}$$

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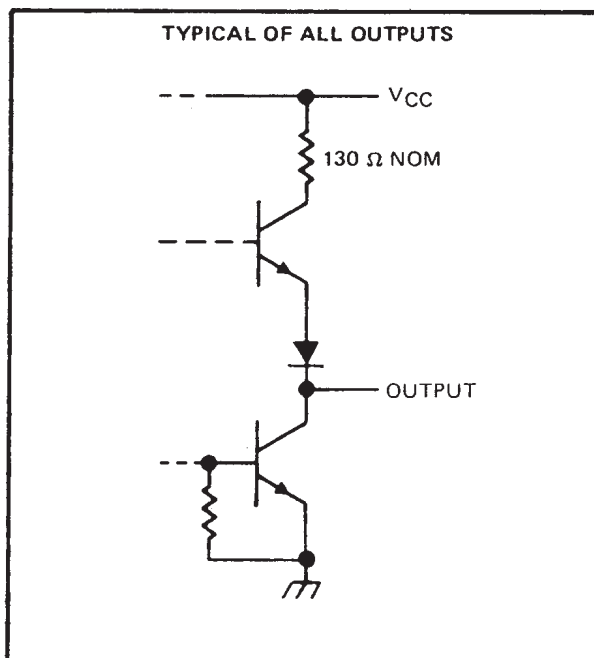
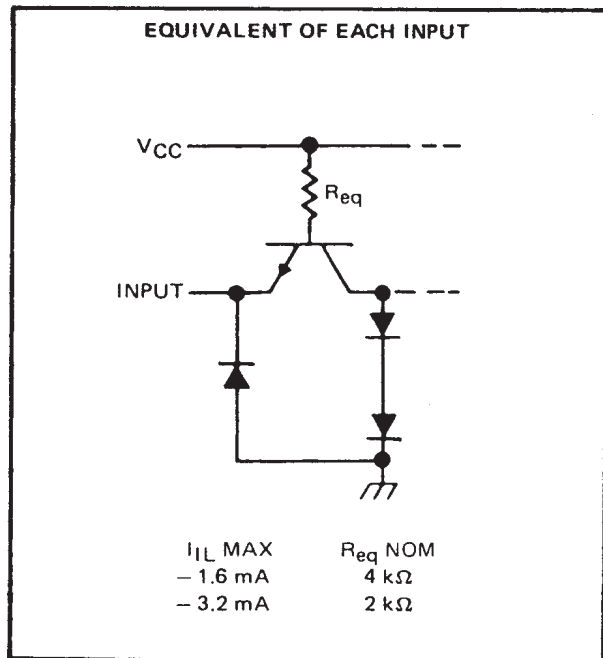
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logic diagram (positive logic)



'70-GATED J-K WITH CLEAR AND PRESET

schematics of input and outputs



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

Supply voltage, V_{CC} (see Note 1)7 V
Input voltage	5.5 V
Operating free-air temperature: SN5470	– 55°C to 125°C
SN74700°C to 70°C
Storage temperature range	– 65°C to 150°C

NOTE 1: All voltage values are with respect to network ground terminal.

recommended operating conditions

	SN5470			SN7470			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC} Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH} High-level input voltage	2			2			V
V_{IL} Low-level input voltage	0.8			0.8			V
I_{OH} High-level output current	– 0.4			– 0.4			mA
I_{OL} Low-level output current	16			16			mA
t_w Pulse duration	CLK high	20		20		ns	
	CLK low	30		30			
	PRE or CLR low	25		25			
t_{su} Setup time before CLK \uparrow	20			20			ns
t_h Hold time-Data after CLK \uparrow	5			5			ns
T_A Operating free-air temperature	– 55	125		0	70		°C

†‡ The arrow indicates the edge of the clock pulse used for reference: \uparrow for the rising edge, \downarrow for the falling edge.

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

PARAMETER	TEST CONDITIONS†	SN5470			SN7470			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}	$V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$	– 1.5			– 1.5			V
V_{OH}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -0.4 \text{ mA}$	2.4	3.4		2.4	3.4		V
V_{OL}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 16 \text{ mA}$		0.2	0.4		0.2	0.4	V
I_I	$V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$		1			1		mA
I_{IH}	PRE or CLR	80			80			μA
	All other	40			40			
I_{IL}	PRE or CLR†	– 3.2			– 3.2			mA
	All other	– 1.6			– 1.6			
$I_{OS}\S$	$V_{CC} = \text{MAX}$	– 20	– 57		– 18	– 57		mA
I_{CC}	$V_{CC} = \text{MAX}$, See Note 2		13	26		13	26	mA

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

§Not more than one output should be shorted at a time.

†Clear is tested with preset high and preset is tested with clear high.

NOTE 2: With all outputs open, I_{CC} is measured with the Q and \bar{Q} outputs high in turn. At the time of measurement, the clock input is at 4.5 V.

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switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (see note 3)

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{\max}			$R_L = 400\ \Omega$, $C_L = 15\ \text{pF}$	20	35		MHz
t_{PLH}	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or $\overline{\text{Q}}$				50	ns
t_{PHL}						50	ns
t_{PLH}	CLK	Q or $\overline{\text{Q}}$			27	50	ns
t_{PHL}					18	50	ns

† f_{\max} = maximum clock frequency; t_{PLH} = propagation delay time, low-to-high level output;

t_{PHL} = propagation delay time, high-to-low level output.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



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