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

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 $\overline{Q}$ 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.

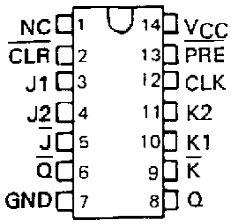
The SN5470 is characterized for operation over the full military temperature range of −55°C to 125°C. The SN7470 is characterized for operation from 0°C to 70°C.

FUNCTION TABLE

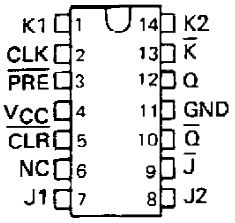
INPUTS					OUTPUTS	
$\overline{PRE}$	$\overline{CLR}$	CLK	J	K	Q	$\overline{Q}$
L	H	L	X	X	H	L
H	L	L	X	X	L	H
L	L	X	X	X	L†	L†
H	H	↑	L	L	Q_0	Q_0
H	H	↑	H	L	H	L
H	H	↑	L	H	L	H
H	H	↑	H	H	TOGGLE	
H	H	L	X	X	Q_0	Q_0

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.

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

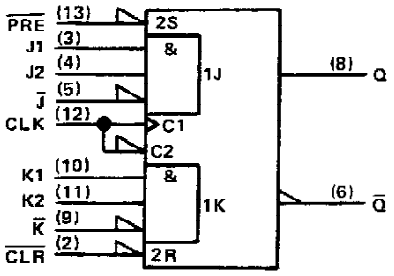


SN5470 . . . W PACKAGE
(TOP VIEW)



NC – No internal connection

logic symbol†

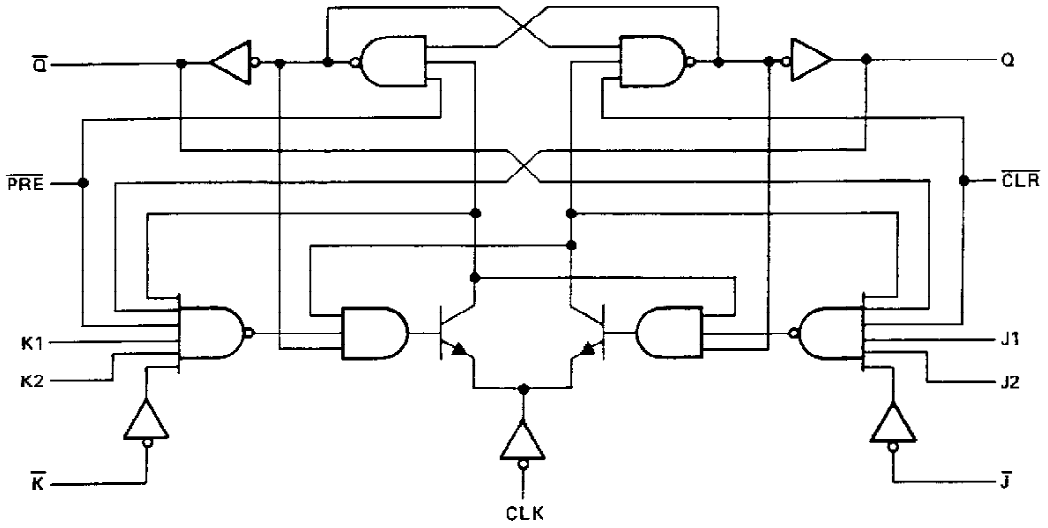


†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.
Pin numbers shown are for J and N packages only.

positive logic

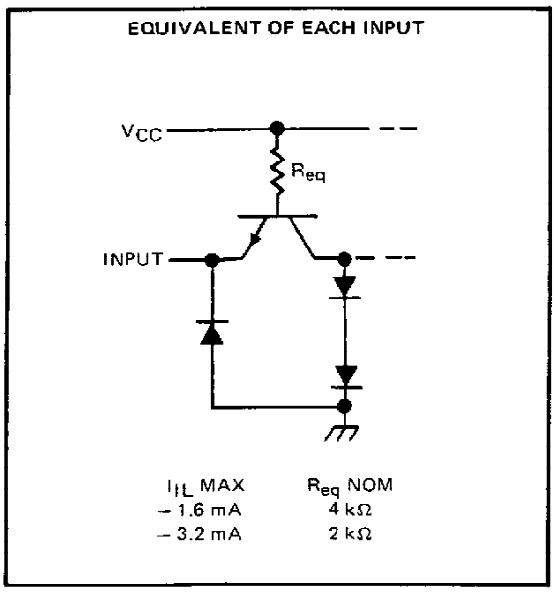
$$J = J1 \cdot J2 \cdot \overline{J}$$
$$K = K1 \cdot K2 \cdot \overline{K}$$

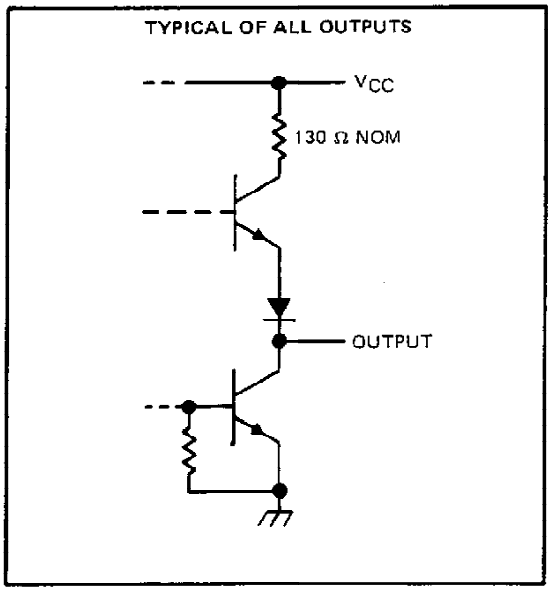
logic diagram (positive logic)



'70-GATED J-K WITH CLEAR AND PRESET

schematics of input and outputs





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
SN7470 . . . . . 0°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			
		$\overline{PRE}$ or $\overline{CLR}$ low	25			25			
t_{su}	Setup time before CLK ↑		20			20			ns
t_h	Hold time-Data after CLK↑		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: ↑ for the rising edge, ↓ 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} = MIN,	I_I = −12 mA			−1.5			−1.5	V
V_{OH}		V_{CC} = MIN, V_{IL} = 0.8 V,	V_{IH} = 2 V, I_{OH} = −0.4 mA	2.4	3.4		2.4	3.4		V
V_{OL}		V_{CC} = MIN, V_{IL} = 0.8 V,	V_{IH} = 2 V, I_{OL} = 16 mA		0.2	0.4		0.2	0.4	V
I_I		V_{CC} = MAX,	V_I = 5.5 V			1			1	mA
I_{IH}	$\overline{PRE}$ or $\overline{CLR}$	V_{CC} = MAX,	V_I = 2.4 V			80			80	μA
	All other					40			40	
I_{IL}	$\overline{PRE}$ or $\overline{CLR}$¶	V_{CC} = MAX,	V_I = 0.4 V			−3.2			−3.2	mA
	All other					−1.6			−1.6	
I_{OS}§		V_{CC} = MAX		−20		−57	−18		−57	mA
I_{CC}		V_{CC} = 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 V, T_A = 25°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 $\overline{Q}$ outputs high in turn. At the time of measurement, the clock input is at 4.5 V.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 3)

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