

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 .

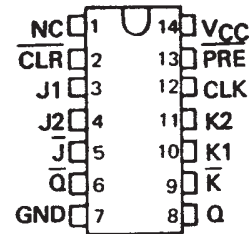
FUNCTION TABLE

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

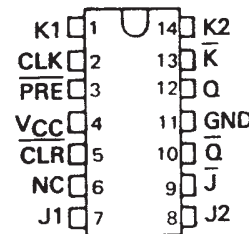
If inputs J and K are not used, they must be grounded. Preset or clear function can occur only when the clock input is low.

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

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

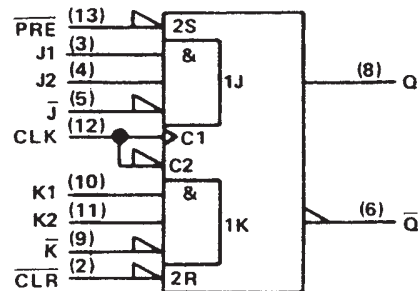


SN5470 ... W PACKAGE
(TOP VIEW)



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

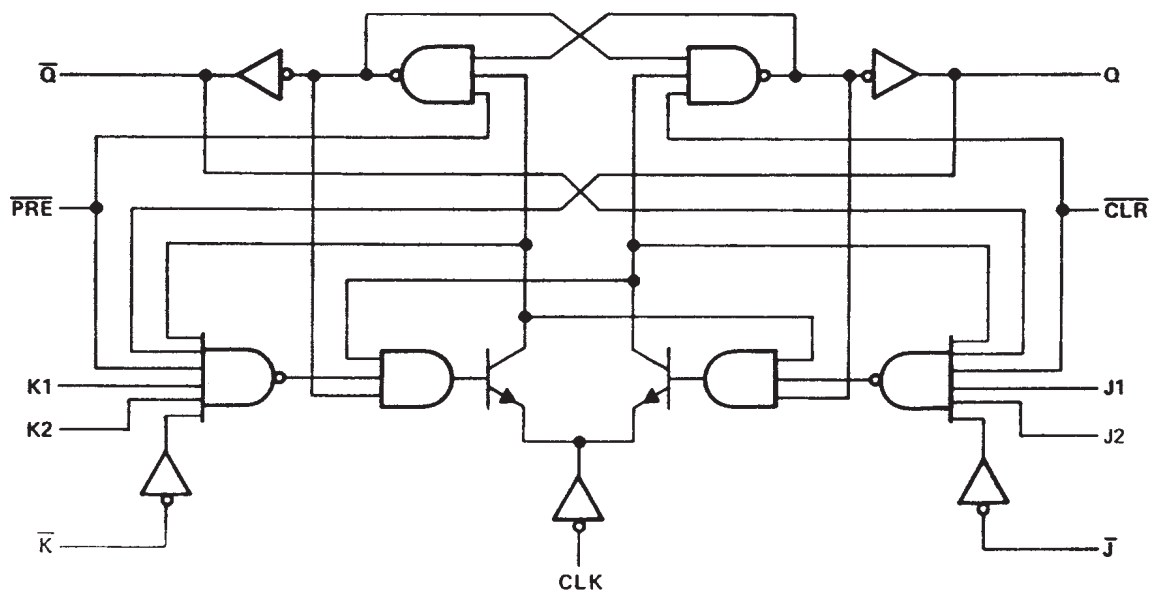
$$J = J1 \cdot J2 \cdot \bar{J}$$

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

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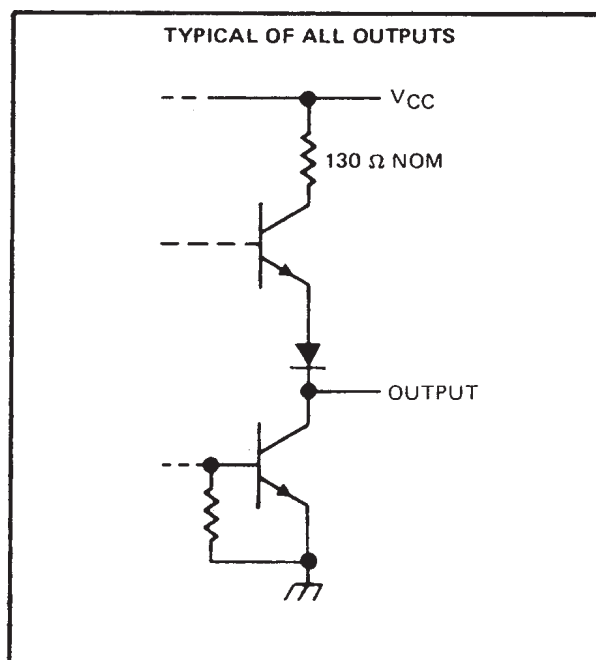
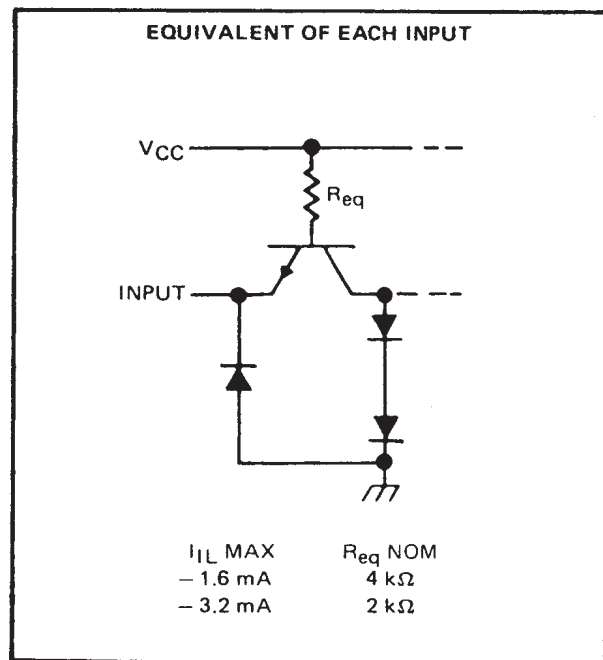
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logic diagram (positive logic)



'70-GATED J-K WITH CLEAR AND PRESET

schematics of input and outputs



SN5470, SN7470

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

SDLS116 – DECEMBER 1983 – REVISED MARCH 1988

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			
		PRE or 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			°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}	$\overline{PRE}$ or $\overline{CLR}$	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$				80			80	μA
	All other					40			40	
I_{IL}	$\overline{PRE}$ or $\overline{CLR}^\dagger$	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$				– 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 $\overline{Q}$ 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 Ω, C _L = 15 pF	20	35		MHz
t _{PLH}	PRE or CLR	Q or Q̄				50	ns
t _{PHL}						50	ns
t _{PLH}	CLK	Q or Q̄			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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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
SN5470J	OBSOLETE	CDIP	J	14		TBD	Call TI	Call TI	-55 to 125		
SN7470N	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI	0 to 70		
SN7470N	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI	0 to 70		
SNJ5470J	OBSOLETE	CDIP	J	14		TBD	Call TI	Call TI	-55 to 125		
SNJ5470J	OBSOLETE	CDIP	J	14		TBD	Call TI	Call TI	-55 to 125		
SNJ5470W	OBSOLETE	CFP	W	14		TBD	Call TI	Call TI	-55 to 125		
SNJ5470W	OBSOLETE	CFP	W	14		TBD	Call TI	Call TI	-55 to 125		

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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OTHER QUALIFIED VERSIONS OF SN5470, SN7470 :

- Catalog: [SN7470](#)
- Military: [SN5470](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

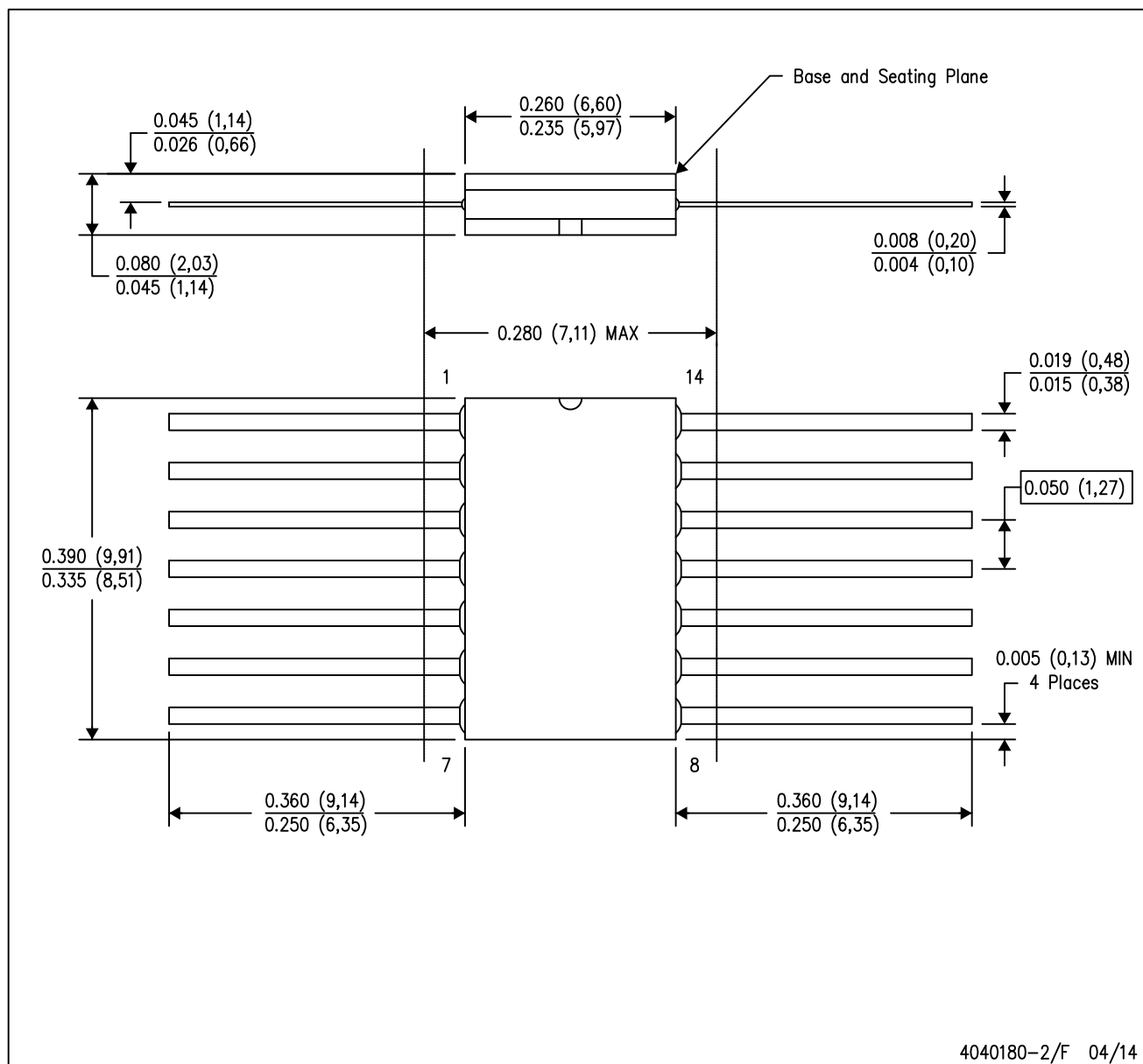


4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



14/18 Pin Only
20 Pin vendor option

4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

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