

# SN5473, SN54LS73A, SN7473, SN74LS73A DUAL J-K FLIP-FLOPS WITH CLEAR

SDLS118 – DECEMBER 1983 – REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

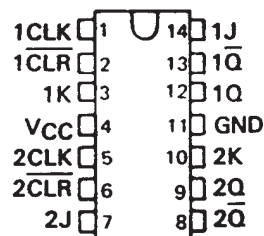
## description

The '73, and 'H73, contain two independent J-K flip-flops with individual J-K, clock, and direct clear inputs. The '73, and 'H73, are positive pulse-triggered flip-flops. J-K input is loaded into the master while the clock is high and transferred to the slave on the high-to-low transition. For these devices the J and K inputs must be stable while the clock is high.

The 'LS73A contains two independent negative-edge-triggered flip-flops. The J and K inputs must be stable one setup time prior to the high-to-low clock transition for predictable operation. When the clear is low, it overrides the clock and data inputs forcing the Q output low and the  $\bar{Q}$  output high.

The SN5473, SN54H73, and the SN54LS73A are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7473, and the SN74LS73A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN5473, SN54LS73A . . . J OR W PACKAGE  
SN7473 . . . N PACKAGE  
SN74LS73A . . . D OR N PACKAGE  
(TOP VIEW)



'73  
FUNCTION TABLE

INPUTS				OUTPUTS	
CLR	CLK	J	K	Q	$\bar{Q}$
L	X	X	X	L	H
H		L	L	$Q_0$	$\bar{Q}_0$
H		H	L	H	L
H		L	H	L	H
H		H	H	TOGGLE	

'LS73A  
FUNCTION TABLE

INPUTS				OUTPUTS	
CLR	CLK	J	K	Q	$\bar{Q}$
L	X	X	X	L	H
H		L	L	$Q_0$	$\bar{Q}_0$
H		H	L	H	L
H		L	H	L	H
H		H	H	TOGGLE	
H	H	X	X	$Q_0$	$\bar{Q}_0$

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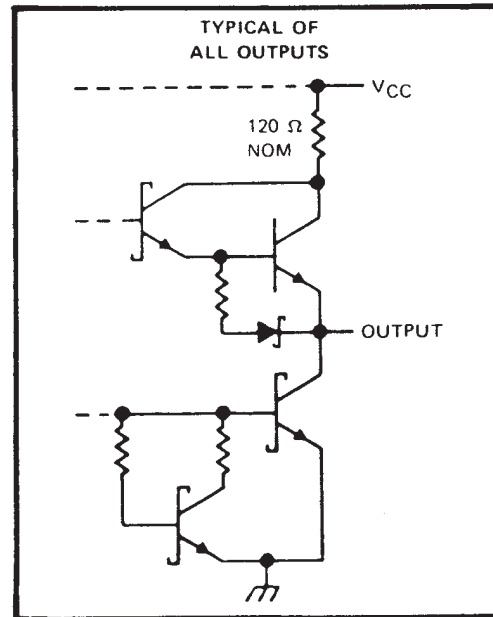
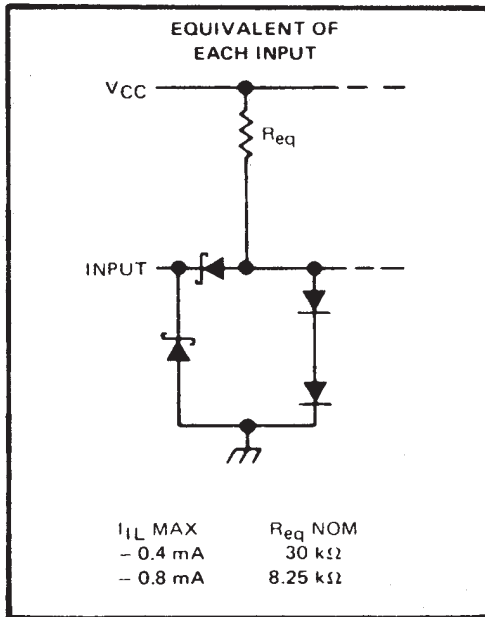
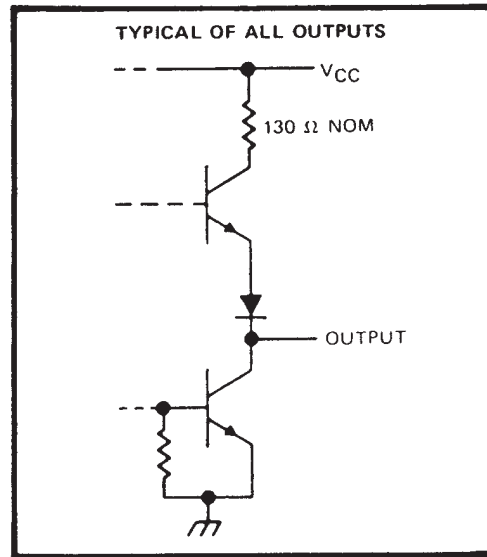
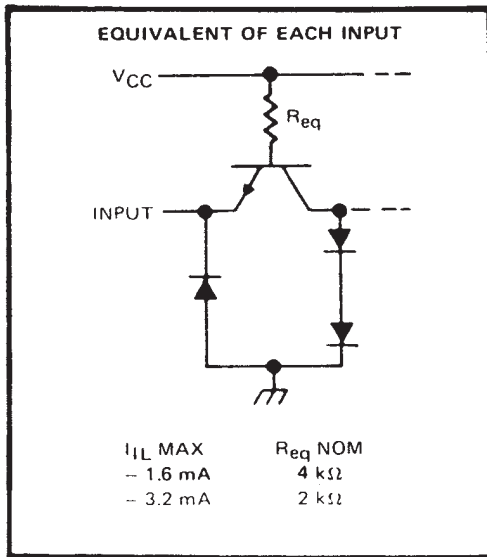
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## logic symbols†



†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

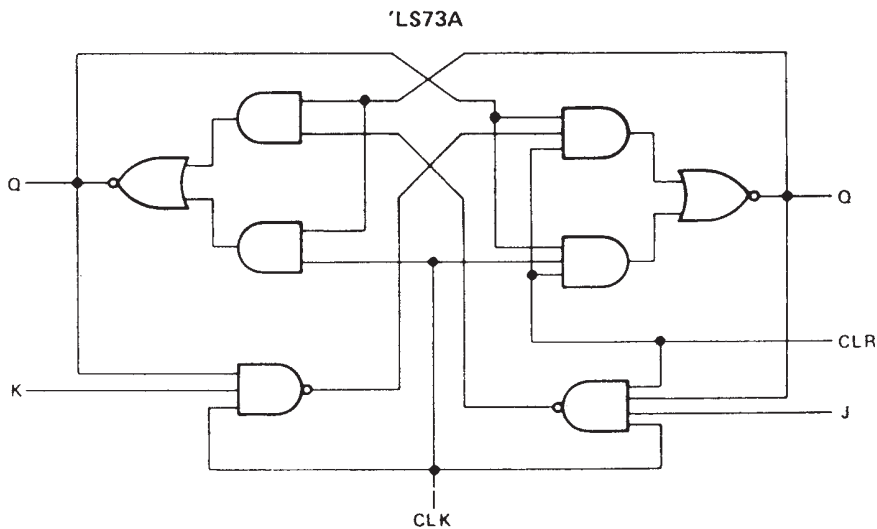
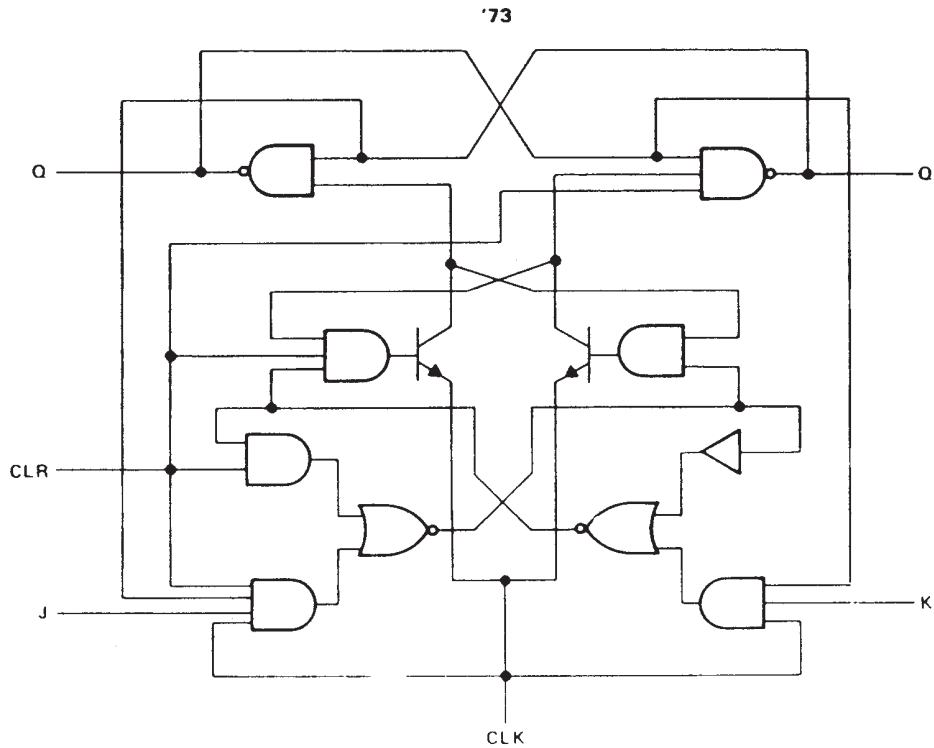
## schematics of inputs and outputs



# SN5473, SN54LS73A, SN7473, SN74LS73A DUAL J-K FLIP-FLOPS WITH CLEAR

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## logic diagrams (positive logic)



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

Supply voltage, $V_{CC}$ (See Note 1) .....	7 V
Input voltage: '73 .....	5.5 V
'LS73A .....	7 V
Operating free-air temperature range: SN54' .....	-55°C to 125°C
SN74' .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

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



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# SN5473, SN54LS73A, SN7473, SN74LS73A DUAL J-K FLIP-FLOPS WITH CLEAR

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## recommended operating conditions

		SN5473			SN7473			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		47			47		
		$\overline{CLR}$ low		25			25		
$t_{su}$	Input setup time before CLK $\uparrow$			0			0	ns	
$t_h$	Input hold time data after CLK $\downarrow$			0			0	ns	
$T_A$	Operating free-air temperature			-55		125	0	70	$^{\circ}C$

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

PARAMETER	TEST CONDITIONS <sup>†</sup>	SN5473			SN7473			UNIT
		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	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
$I_{IH}$	J or K			40			40	$\mu\text{A}$
	$\overline{CLR}$ or CLK			80			80	
$I_{IL}$	J or K			-1.6			-1.6	mA
	$\overline{CLR}$			-3.2			-3.2	
	CLK			-3.2			-3.2	
$I_{OS}$ <sup>§</sup>	$V_{CC} = \text{MAX}$	-20		-57	-18		-57	mA
$I_{CC}$ <sup>¶</sup>	$V_{CC} = \text{MAX}$ , See Note 2		10	20		10	20	mA

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

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

<sup>§</sup> Not more than one output should be shorted at a time.

<sup>¶</sup> Average per flip-flop.

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 grounded.

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

PARAMETER <sup>#</sup>	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_{max}$			$R_L = 400 \Omega$ , $C_L = 15 \text{ pF}$	15	20		MHz
$t_{PLH}$	$\overline{CLR}$	$\overline{Q}$			16	25	ns
$t_{PHL}$		Q			25	40	ns
$t_{PLH}$	CLK	Q or $\overline{Q}$			16	25	ns
$t_{PHL}$						25	40

<sup>#</sup> $f_{max}$  = 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.



# SN5473, SN54LS73A, SN7473, SN74LS73A DUAL J-K FLIP-FLOPS WITH CLEAR

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## recommended operating conditions

	SN54LS73A			SN74LS73A			UNIT	
	MIN	NOM	MAX	MIN	NOM	MAX		
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V	
V <sub>IH</sub> High-level input voltage	2			2			V	
V <sub>IL</sub> Low-level input voltage			0.7			0.8	V	
I <sub>OH</sub> High-level output current			-0.4			-0.4	mA	
I <sub>OL</sub> Low-level output current			4			8	mA	
f <sub>clock</sub> Clock frequency	0		30	0		30	MHz	
t <sub>w</sub> Pulse duration	CLK high		20	20		ns		
	CLR low		25	20				
t <sub>su</sub> Set up time-before CLK ↓	data high or low		20	20		ns		
	CLR inactive		20	20				
t <sub>h</sub> Hold time-data after CLK ↓			0	0		ns		
T <sub>A</sub> Operating free-air temperature			-55	125		0	70	°C

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

PARAMETER	TEST CONDITIONS†	SN54LS73A			SN74LS73A			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.5			-1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OH</sub> = -0.4 mA	2.5	3.4		2.7	3.4		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 4 mA		0.25	0.4		0.25	0.4	V
	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 8 mA					0.35	0.5	
I <sub>I</sub>	J or K			0.1			0.1	mA
	CLR	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V		0.3			0.3	
	CLK			0.4			0.4	
I <sub>IH</sub>	J or K			20			20	μA
	CLR	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V		60			60	
	CLK			80			80	
I <sub>IL</sub>	J or K	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V		-0.4			-0.4	mA
	CLR or CLK			-0.8			-0.8	
I <sub>OS</sub> §	V <sub>CC</sub> = MAX, See Note 4	-20		-100	-20		-100	mA
I <sub>CC</sub> (Total)	V <sub>CC</sub> = MAX, See Note 2		4	6		4	6	mA

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

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

§ 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: With all outputs open, I<sub>CC</sub> is measured with the Q and Q̄ outputs high in turn. At the time of measurement, the clock input is grounded.

NOTE 4: For certain devices where state commutation can be caused by shorting an output to ground, an equivalent test may be performed with V<sub>O</sub> = 2.25 V and 2.125 V for the 54 family and the 74 family, respectively, with the minimum and maximum limits reduced to one half of their stated values.

## switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f <sub>max</sub>				30	45		MHz
t <sub>PLH</sub>	CLR or CLK	Q or Q̄	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF		15	20	ns
t <sub>PHL</sub>					15	20	ns

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



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