

# 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

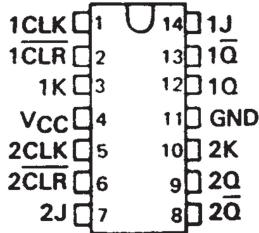
The '73, and 'H73, contain two independent J-K flip-flops with individual J-K, clock, and direct clear inputs. The '73, and 'H73, are positive pulse-triggered flip-flops. J-K input is loaded into the master while the clock is high and transferred to the slave on the high-to-low transition. For these 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	$Q_0$	$\bar{Q}_0$

FOR CHIP CARRIER INFORMATION,  
CONTACT THE FACTORY

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

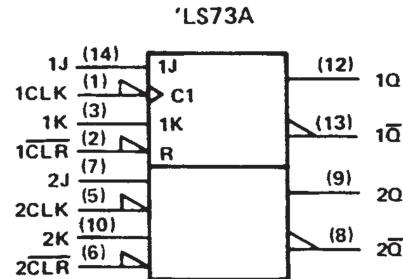
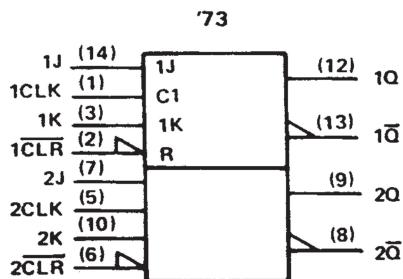


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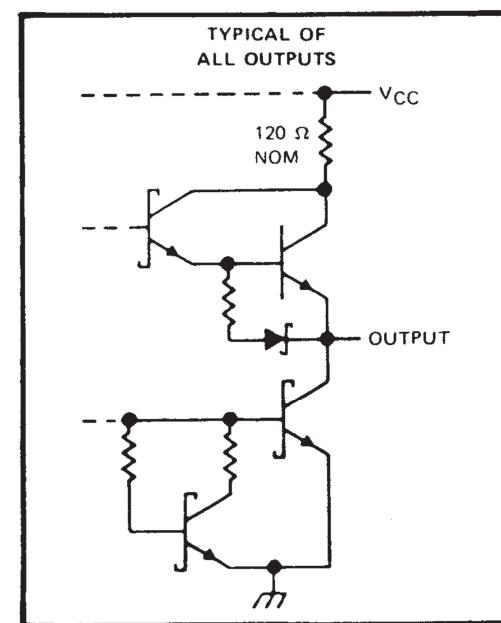
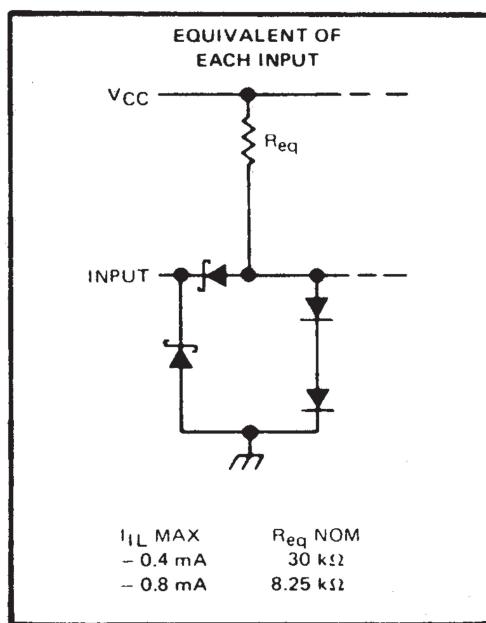
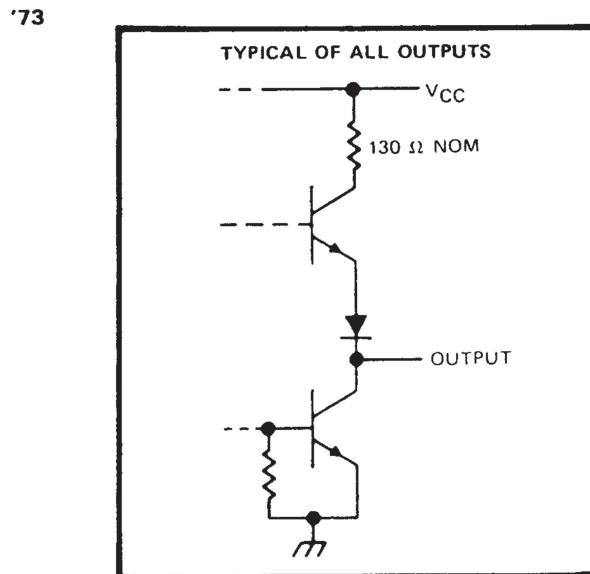
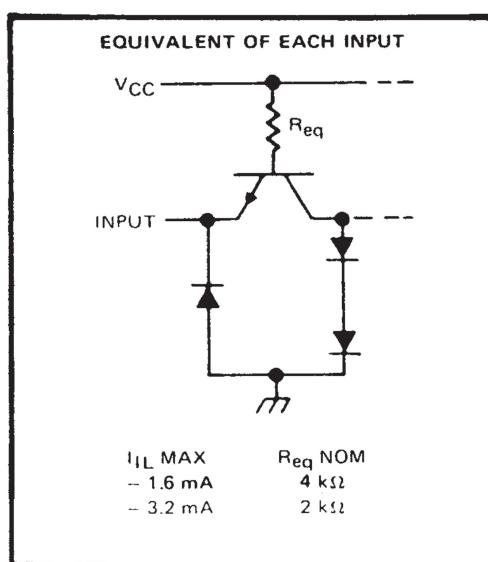
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## logic symbols†



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

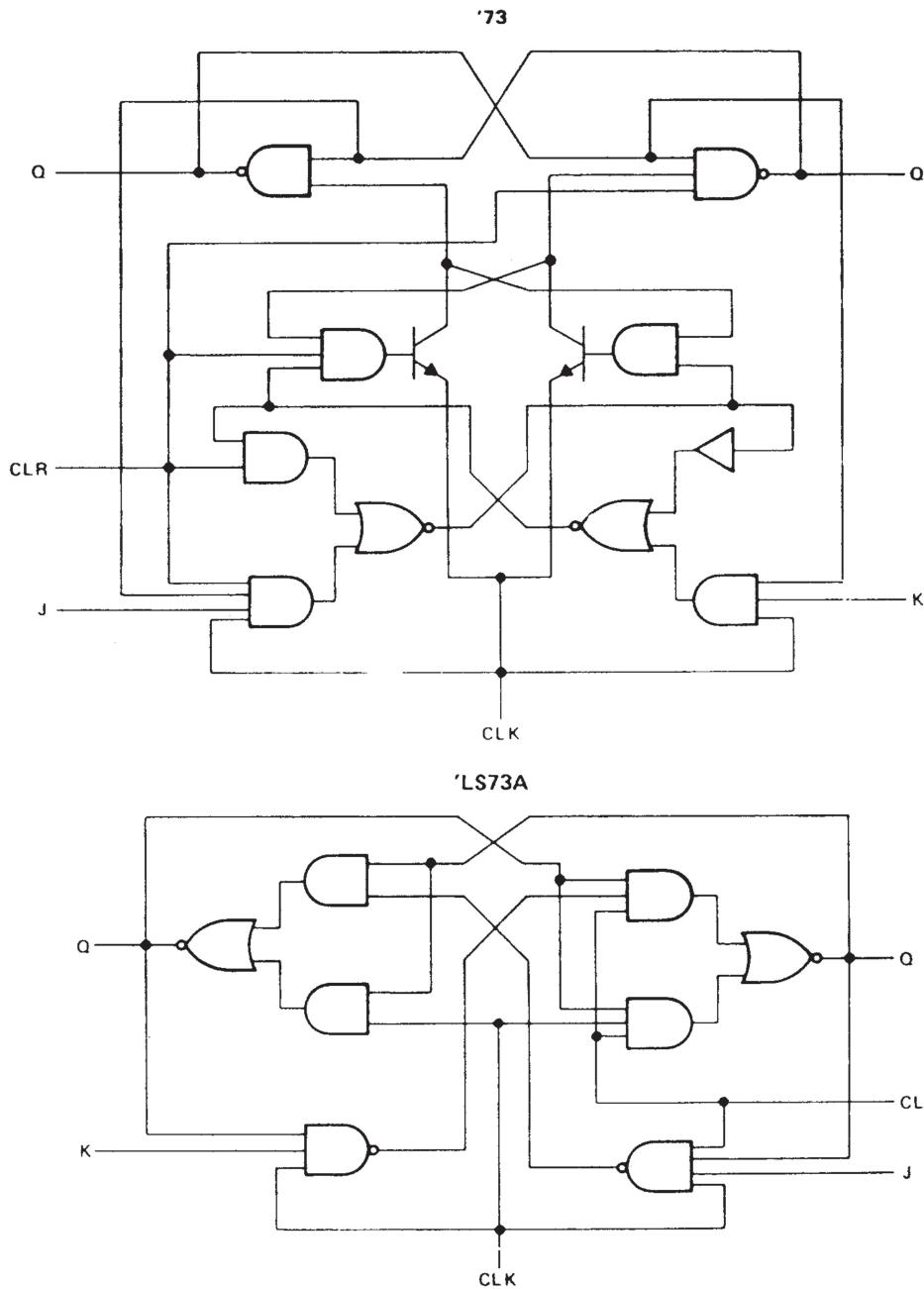
## schematics of inputs and outputs



# 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 <sub>CC</sub> (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.

# 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 <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			0.8			0.8	V
I <sub>OH</sub>	High-level output current			-0.4			-0.4	mA
I <sub>OL</sub>	Low-level output current			16			16	mA
t <sub>w</sub>	Pulse duration	CLK high	20		20			ns
		CLK low	47		47			
		CLR low	25		25			
t <sub>su</sub>	Input setup time before CLK↑	0			0			ns
t <sub>h</sub>	Input 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 <sup>†</sup>			SN5473		SN7473		UNIT
				MIN	TYP <sup>‡</sup>	MAX	MIN	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 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> = 0.8 V, I <sub>OH</sub> = -0.4 mA			2.4	3.4		2.4	V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 16 mA			0.2	0.4		0.2	V
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V				1		1	mA
I <sub>IH</sub>	J or K	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V			40		40	μA
					80		80	
I <sub>IL</sub>	J or K	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			-1.6		-1.6	mA
	CLR				-3.2		-3.2	
	CLK				-3.2		-3.2	
I <sub>OS</sub> <sup>§</sup>	V <sub>CC</sub> = MAX			-20	-57	-18	-57	mA
I <sub>CC</sub> <sup>¶</sup>	V <sub>CC</sub> = 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<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°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<sub>CC</sub> is measured with the Q and  $\bar{Q}$  outputs high in turn. At the time of measurement, the clock input is grounded.

## 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>			R <sub>L</sub> = 400 Ω, C <sub>L</sub> = 15 pF					15	20	MHz
t <sub>PLH</sub>	CLR	$\bar{Q}$						16	25	ns
t <sub>PHL</sub>		Q						25	40	ns
t <sub>PLH</sub>	CLK	Q or $\bar{Q}$						16	25	ns
t <sub>PHL</sub>								25	40	ns

#f<sub>max</sub> = maximum clock frequency; t<sub>PLH</sub> = propagation delay time, low-to-high-level output; t<sub>PHL</sub> = propagation delay time, high-to-low-level output.

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



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# 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	
$V_{CC}$	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			0.7			0.8	V
$I_{OH}$	High-level output current			-0.4			-0.4	mA
$I_{OL}$	Low-level output current			4			8	mA
$f_{clock}$	Clock frequency	0		30	0		30	MHz
$t_w$	Pulse duration	CLK high	20		20			ns
		CLR low	25		20			
$t_{su}$	Set up time-before CLK↓	data high or low	20		20			ns
		CLR inactive	20		20			
$t_h$	Hold time-data after CLK↓	0			0			ns
$T_A$	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	
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -18 \text{ mA}$			-1.5			-1.5	V
$V_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = \text{MAX}$ , $I_{OH} = -0.4 \text{ mA}$	2.5	3.4		2.7	3.4		V
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IL} = \text{MAX}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 4 \text{ mA}$		0.25	0.4	0.25	0.4		V
	$V_{CC} = \text{MIN}$ , $V_{IL} = \text{MAX}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 8 \text{ mA}$				0.35	0.5		
$I_I$	J or K			0.1			0.1	mA
	CLR			0.3			0.3	
	CLK			0.4			0.4	
$I_{IH}$	J or K			20			20	μA
	CLR			60			60	
	CLK			80			80	
$I_{IL}$	J or K			-0.4			-0.4	mA
	CLR or CLK			-0.8			-0.8	
$I_{OS\$}$		$V_{CC} = \text{MAX}$ , See Note 4	-20	-100	-20	-100		mA
$I_{CC}$ (Total)		$V_{CC} = \text{MAX}$ , 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  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

§ 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,  $I_{CC}$  is measured with the Q and  $\bar{Q}$  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  $V_O = 2.25 \text{ V}$  and  $2.125 \text{ V}$  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, $V_{CC} = 5 \text{ V}$ , $T_A = 25^\circ\text{C}$ (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_{max}$			$R_L = 2 \text{ k}\Omega$ , $C_L = 15 \text{ pF}$	30	45		MHz
$t_{PLH}$	CLR or CLK	Q or $\bar{Q}$			15	20	ns
$t_{PHL}$					15	20	ns

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