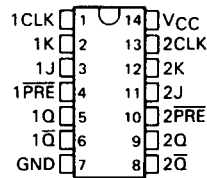


SN54LS113A, SN54S113, SN74LS113A, SN74S113A DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET

D2661, APRIL 1982 - REVISED MARCH 1988

- Fully Buffered to Offer Maximum Isolation from External Disturbance
- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

SN54LS113A, SN54S113 . . . J OR W PACKAGE
SN74LS113A, SN74S113A . . . D OR N PACKAGE
(TOP VIEW)



description

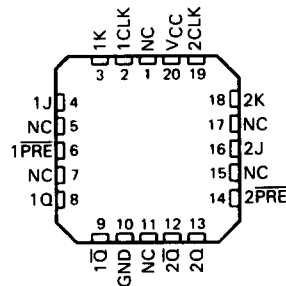
These devices contain two independent J-K negative-edge-triggered flip-flops. A low level at the preset input sets the outputs regardless of the levels of the other inputs. When preset (PRE) is inactive (high), data at the J and K inputs meeting the setup time requirements are transferred to the outputs on the negative-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of the clock pulse. Following the hold time interval, data at the J and K inputs may be changed without affecting the levels at the outputs. These versatile flip-flops can perform as toggle flip-flops by tying J and K high.

The SN54LS113A and SN54S113 are characterized for operation over the full military temperature range of -55°C to 125°C. The SN74LS113A and SN74S113A are characterized for operation from 0°C to 70°C.

FUNCTION TABLE (each flip-flop)

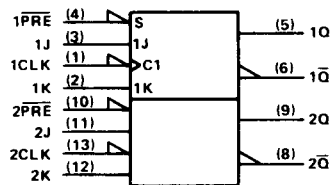
INPUTS				OUTPUTS	
PRE	CLK	J	K	Q	Q-bar
L	X	X	X	H	L
H	↓	L	L	Q ₀	Q ₀ -bar
H	↓	H	L	H	L
H	↓	L	H	L	H
H	↓	H	H	TOGGLE	
H	H	X	X	Q ₀	Q ₀ -bar

SN54LS113A, SN54S113 . . . FK 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.

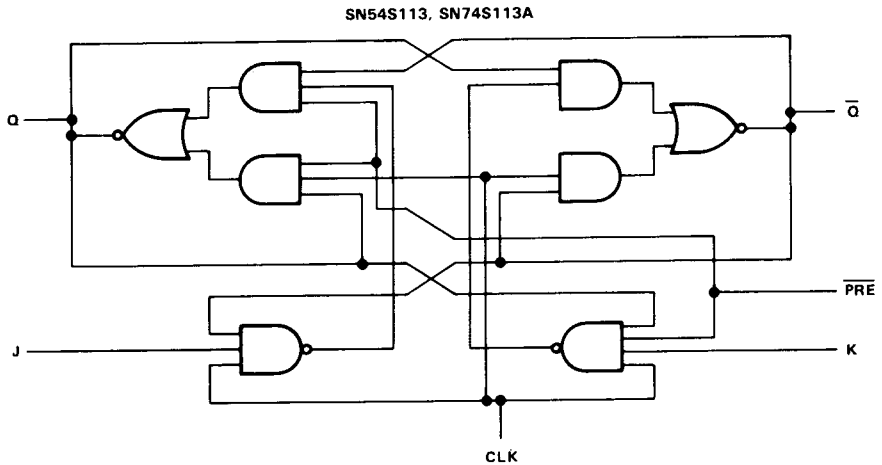
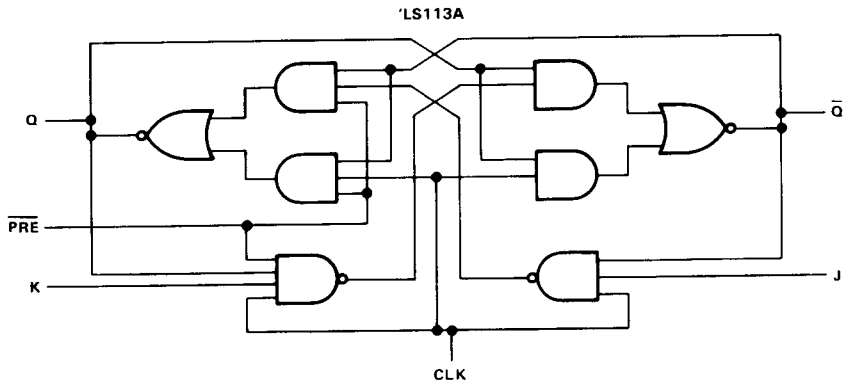
Pin numbers shown are for D, J, N, and W packages.

2

TTL Devices

SN54LS113A, SN54S113, SN74LS113A, SN74S113A
DUAL J-K NEGATIVE-EDGE-TRIGGERED
FLIP-FLOPS WITH PRESET

logic diagrams (positive logic)



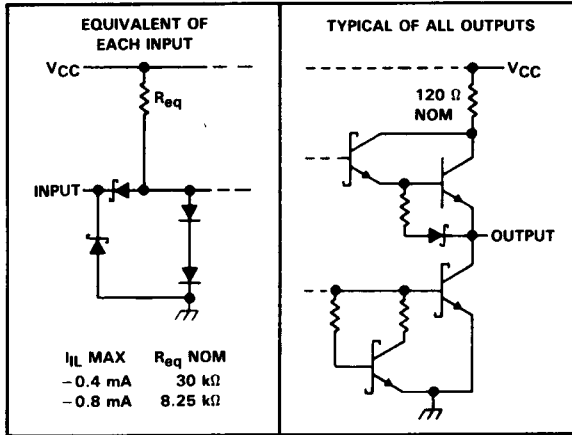
2

TTL Devices

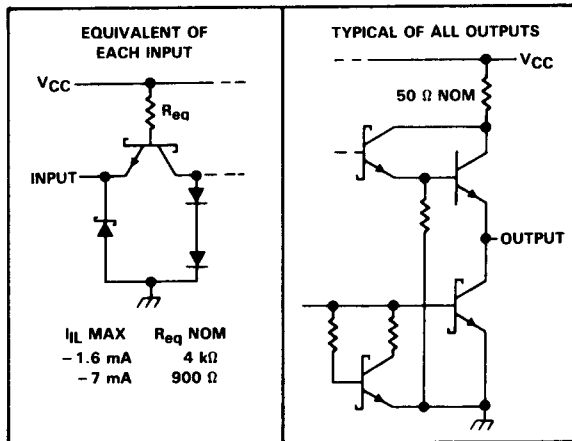
**SN54LS113A, SN74LS113A, SN54S113, SN74S113A
DUAL J-K NEGATIVE-EDGE-TRIGGERED
FLIP-FLOPS WITH PRESET**

schematics of inputs and outputs

'LS113A



SN54S113, SN74S113A



2
TTL Devices

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage: 'LS113A	7 V
SN54S113, SN74S113A	5.5 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 terminals.

SN54LS113A, SN74LS113A
DUAL J-K NEGATIVE-EDGE-TRIGGERED
FLIP-FLOPS WITH PRESET

recommended operating conditions

		SN54LS113A			SN74LS113A			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
		PRE or CLR low		25	25			
t _{su}	Set up time-before CLK↓	Data high or low		20	20			ns
		PRE inactive		20	20			
t _h	Hold time-data after CLK↓			0	0			ns
T _A	Operating free-air temperature	-55		125	0		70	°C

2

TTL Devices

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

PARAMETER		TEST CONDITIONS†		SN54LS113A			SN74LS113A			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IK}		V _{CC} = MIN, I _I = -18 mA		-1.5			-1.5			V
V _{OH}		V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = MAX, I _{OH} = -0.4 mA		2.5	3.4		2.7	3.4		V
V _{OL}		V _{CC} = MIN, V _{IL} = MAX, V _{IH} = 2 V, I _{OL} = 4 mA		0.25	0.4		0.25	0.4		V
		V _{CC} = MIN, V _{IL} = MAX, V _{IH} = 2 V, I _{OL} = 8 mA					0.35	0.5		
I _I	J or K	V _{CC} = MAX, V _I = 7 V		0.1			0.1			mA
	PRE			0.3			0.3			
	CLK			0.4			0.4			
I _{IH}	J or K	V _{CC} = MAX, V _I = 2.7 V		20			20			μA
	PRE			60			60			
	CLK			80			80			
I _{IL}	J or K	V _{CC} = MAX, V _I = 0.4 V		-0.4			-0.4			mA
	PRE or CLK			-0.8			-0.8			
I _{OS} §		V _{CC} = MAX, see Note 2		-20	-100		-20	-100		mA
I _{CC} (Total)		V _{CC} = MAX, see Note 3		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 V, T_A = 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.

NOTES: 2. 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 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.

3. 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.

SN54LS113A, SN74LS113A
DUAL J-K NEGATIVE-EDGE-TRIGGERED
FLIP-FLOPS WITH PRESET

switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (see Note 4)

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}	PRE or CLK	Q or \bar{Q}			15	20	ns
t_{PHL}					15	20	ns

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

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TTL Devices

SN54S113, SN74S113A DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET

recommended operating conditions

		SN54S113			SN74S113A			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			V	
I _{OH}	High-level output current				-1			mA	
I _{OL}	Low-level output current				20			mA	
t _w	Pulse duration	CLK high	6		6		ns		
		CLK low	6.5		6.5				
		PRE low	8		8				
t _{su}	Set up time-before CLK↓	Data high or low		7		7		ns	
t _h	Hold time-data after CLK↓	0		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)

2
TTL Devices

PARAMETER		TEST CONDITIONS†		SN54S113			SN74S113A			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IK}		V _{CC} = MIN,	I _I = -18 mA	-1.2			-1.2			V
V _{OH}		V _{CC} = MIN,	V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = -1 mA	2.5	3.4		2.7	3.4		V
V _{OL}		V _{CC} = MIN,	V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OL} = 20 mA	0.5			0.5			V
I _I		V _{CC} = MAX,	V _I = 5.5 V	1			1			mA
I _{IH}	J or K	V _{CC} = MAX,	V _I = 2.7 V	50			50			μA
	PRE or CLK			100			100			
I _{IL}	J or K	V _{CC} = MAX,	V _I = 0.5 V	-1.6			-1.6			mA
	PRE‡			-7			-7			
	CLK‡			-4			-4			
I _{OS} ‡		V _{CC} = MAX		-40	-100		-40	-100		mA
I _{CC} ‡		V _{CC} = MAX,	see Note 3	15	25		15	25		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.

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

¶ Not more than one output should be shorted at a time, and the duration of the short-circuit should not exceed one second.

Values are average per flip-flop.

NOTE 3: 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.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see Note 4)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f _{max}				80	125		MHz
t _{PLH}	PRE	Q or \bar{Q}	R _L = 280 Ω, C _L = 15 pF		4	7	ns
t _{PHL}	PRE (CLK high)	\bar{Q} or Q			5	7	ns
	PRE (CLK low)				5	7	ns
t _{PLH}	CLK	Q or \bar{Q}			4	7	ns
t _{PHL}					5	7	ns

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.