

SN54HC113, SN74HC113 DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET

D2684, DECEMBER 1982—REVISED SEPTEMBER 1987

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Dependable Texas Instruments Quality and Reliability

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 outputs. These versatile flip-flops can perform as toggle flip-flops by tying J and K high.

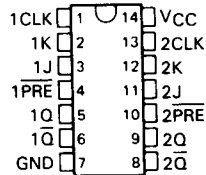
The SN54HC113 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74HC113 is characterized for operation from -40°C to 85°C .

FUNCTION TABLE

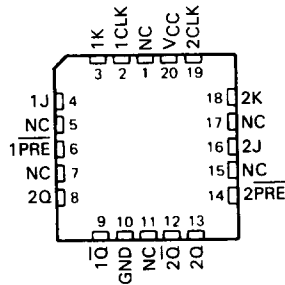
PRE	INPUTS			OUTPUTS	
	CLK	J	K	Q_0	\bar{Q}_0
L	X	X	X	H	L
H	I	L	L	Q_0	\bar{Q}_0
H	I	H	L	H	L
H	I	L	H	L	H
H	I	H	H	TOGGLE	
H	H	X	X	Q_0	\bar{Q}_0

SN54HC113 . . . J PACKAGE
SN74HC113 . . . D OR N PACKAGE

(TOP VIEW)

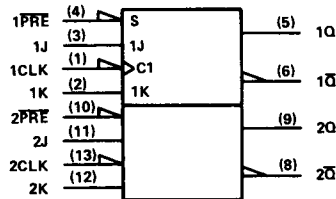


SN54HC113 . . . FK PACKAGE
(TOP VIEW)



NC—No internal connection

logic symbol†



†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

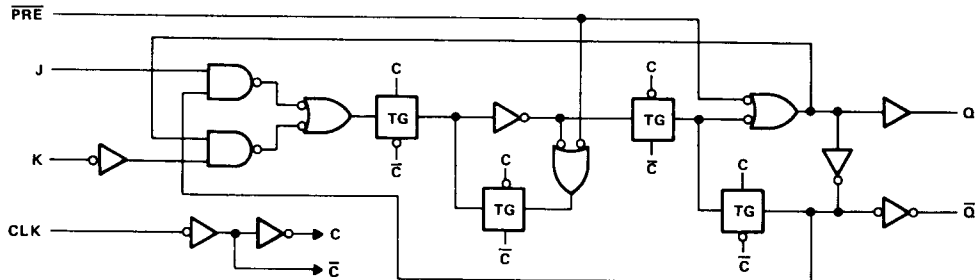
Pin numbers shown are for D, J, and N packages.

2

HCMOS Devices

SN54HC113, SN74HC113 DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET

logic diagram, each flip-flop (positive logic)



absolute maximum ratings over operating free-air temperature†

Supply voltage, V_{CC}	-0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$)	± 20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	± 20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	± 25 mA
Continuous current through V_{CC} or GND pins	± 50 mA
Lead temperature 1,6 mm (1/16 in) from case for 60 s: FK or J package	300°C
Lead temperature 1,6 mm (1/16 in) from case for 10 s: D or N package	260°C
Storage temperature range	-65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

		SN54HC113			SN74HC113			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	2	5	6	2	5	6	V
V_{IH}	High-level input voltage	$V_{CC} = 2$ V	1.5		1.5			V
		$V_{CC} = 4.5$ V	3.15		3.15			
		$V_{CC} = 6$ V	4.2		4.2			
V_{IL}	Low-level input voltage	$V_{CC} = 2$ V	0	0.3	0	0.3	V	
		$V_{CC} = 4.5$ V	0	0.9	0	0.9		
		$V_{CC} = 6$ V	0	1.2	0	1.2		
V_I	Input voltage	0		V_{CC}	0		V_{CC}	V
V_O	Output voltage	0		V_{CC}	0		V_{CC}	V
t_t	Input transition (rise and fall) times	$V_{CC} = 2$ V	0	1000	0	1000	ns	
		$V_{CC} = 4.5$ V	0	500	0	500		
		$V_{CC} = 6$ V	0	400	0	400		
T_A	Operating free-air temperature	-55		125	-40		85	°C

SN54HC113, SN74HC113
DUAL J-K NEGATIVE-EDGE-TRIGGERED
FLIP-FLOPS WITH PRESET

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			SN54HC113		SN74HC113		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	V _I = V _{IH} or V _{IL} . I _{OH} = -20 μA	2 V	1.9	1.998		1.9		1.9	V	
		4.5 V	4.4	4.499		4.4		4.4		
		6 V	5.9	5.999		5.9		5.9		
	4.5 V	3.98	4.30		3.7		3.84			
V _{OL}	V _I = V _{IH} or V _{IL} . I _{OL} = 20 μA	2 V		0.002	0.1		0.1	0.1	V	
		4.5 V		0.001	0.1		0.1	0.1		
		6 V		0.001	0.1		0.1	0.1		
	4.5 V		0.17	0.26		0.4	0.33			
V _I = V _{IH} or V _{IL} . I _{OH} = -5.2 mA	6 V	5.48	5.80		5.2		5.34			
	6 V		0.15	0.26		0.4	0.33			
I _I	V _I = V _{CC} or 0	6 V		±0.1	±100		±1000	±1000	nA	
I _{CC}	V _I = V _{CC} or 0, I _O = 0	6 V			4		80	40	μA	
C _i		2 to 6 V		3	10		10	10	pF	

2

HCMOS Devices

timing requirements over recommended operating free-air temperature range (unless otherwise noted)

		V _{CC}	T _A = 25°C		SN54HC113		SN74HC113		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency	2 V		6		4.2		5	MHz
		4.5 V		31		21		25	
		6 V		36		25		29	
t _w	Pulse duration	PRE low	2 V	100		150		125	ns
			4.5 V	20		30		25	
			6 V	17		25		21	
	CLK high or low	2 V	80		120		100		
		4.5 V	16		24		20		
		6 V	14		20		17		
t _{su}	Setup time before CLK↓	Data (J, K)	2 V	100		150		125	ns
			4.5 V	20		30		25	
			6 V	17		25		21	
	PRE inactive	2 V	25		40		30		
		4.5 V	5		8		6		
		6 V	4		7		5		
t _h	Hold time, data after CLK↓	2 V	0		0		0	ns	
		4.5 V	0		0		0		
		6 V	0		0		0		

SN54HC113, SN74HC113
DUAL J-K NEGATIVE-EDGE-TRIGGERED
FLIP-FLOPS WITH PRESET

switching characteristics over recommended operating free-air temperature range (unless otherwise noted), $C_L = 50$ pF (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	VCC	T _A = 25°C			SN54HC113		SN74HC113		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f _{max}			2 V	6	10		4.2		5	MHz	
			4.5 V	31	50		21		25		
			6 V	36	60		25		29		
t _{pd}	PRE	Q or \bar{Q}	2 V		60	165		250		205	ns
			4.5 V		18	33		50		41	
			6 V		15	28		43		35	
t _{pd}	CLK	Q or \bar{Q}	2 V		85	140		211		175	ns
			4.5 V		19	28		42		35	
			6 V		16	24		36		30	
t _t		Q or \bar{Q}	2 V		28	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	13		19		16	

C _{pd}	Power dissipation capacitance per flip-flop	No load, T _A = 25°C	35 pF typ
-----------------	---	--------------------------------	-----------

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