

MC54/74HC113

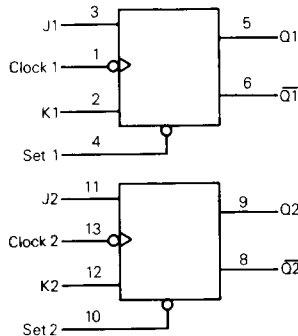
Dual J-K Flip-Flop with Set
High-Performance Silicon-Gate CMOS

The MC54/74HC113 is identical in pinout to the LS113. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

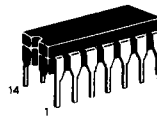
Each flip-flop is negative-edge clocked and has an active-low asynchronous set input.

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V
- Low Input Current: 1 μ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7A
- Chip Complexity: 92 FETs or 23 Equivalent Gates

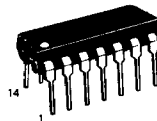
LOGIC DIAGRAM



Pin 14 = V_{CC}
 Pin 7 = GND



J SUFFIX
CERAMIC
CASE 632-08



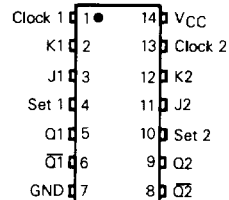
N SUFFIX
PLASTIC
CASE 646-06

ORDERING INFORMATION

MC74HCXXXN Plastic
 MC54HCXXXJ Ceramic

T_A = -55° to 125°C for all packages.
 Dimensions in Chapter 6.

PIN ASSIGNMENT



FUNCTION TABLE

Inputs				Outputs	
Set	Clock	J	K	Q	Q̄
L	X	X	X	H	L
H	~	L	L	No Change	
H	~	L	H	L	H
H	~	H	L	H	L
H	~	H	H	Toggle	
H	H	X	X	No Change	
H	L	X	X	No Change	
H	~	X	X	No Change	

MC5A/74HC113

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V _{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V _{in}	DC Input Voltage (Referenced to GND)	-1.5 to V _{CC} +1.5	V
V _{out}	DC Output Voltage (Referenced to GND)	-0.5 to V _{CC} +0.5	V
I _{in}	DC Input Current, per Pin	±20	mA
I _{out}	DC Output Current, per Pin	±25	mA
I _{CC}	DC Supply Current, V _{CC} and GND Pins	±50	mA
P _D	Power Dissipation in Still Air, Plastic or Ceramic DIP†	750	mW
T _{stg}	Storage Temperature	-65 to +150	°C
T _L	Lead Temperature, 1 mm from Case for 10 Seconds		°C
	Plastic DIP	260	
	Ceramic DIP	300	

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range GND ≤ (V_{in} or V_{out}) ≤ V_{CC}. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

*Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

†Derating — Plastic DIP: -10 mW/°C from 65° to 125°C
Ceramic DIP: -10 mW/°C from 100° to 125°C

For high frequency or heavy load considerations, see Chapter 4.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V _{CC}	DC Supply Voltage (Referenced to GND)	2.0	6.0	V
V _{in} , V _{out}	DC Input Voltage, Output Voltage (Referenced to GND)	0	V _{CC}	V
T _A	Operating Temperature, All Package Types	-55	+125	°C
t _r , t _f	Input Rise and Fall Time (Figure 1)			ns
	V _{CC} = 2.0 V	0	1000	
	V _{CC} = 4.5 V	0	500	
	V _{CC} = 6.0 V	0	400	

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V _{CC} V	Guaranteed Limit			Unit
				25°C to -55°C	≤ 85°C	≤ 125°C	
V _{IH}	Minimum High-Level Input Voltage	V _{out} = 0.1 V or V _{CC} - 0.1 V I _{out} ≤ 20 μA	2.0	1.5	1.5	1.5	V
			4.5	3.15	3.15	3.15	
			6.0	4.2	4.2	4.2	
V _{IL}	Maximum Low-Level Input Voltage	V _{out} = 0.1 V or V _{CC} - 0.1 V I _{out} ≤ 20 μA	2.0	0.3	0.3	0.3	V
			4.5	0.9	0.9	0.9	
			6.0	1.2	1.2	1.2	
V _{OH}	Minimum High-Level Output Voltage	V _{in} = V _{IH} or V _{IL} I _{out} ≤ 20 μA	2.0	1.9	1.9	1.9	V
			4.5	4.4	4.4	4.4	
			6.0	5.9	5.9	5.9	
		V _{in} = V _{IH} or V _{IL} I _{out} ≤ 4.0 mA I _{out} ≤ 5.2 mA	4.5	3.98	3.84	3.70	
			6.0	5.48	5.34	5.20	
V _{OL}	Maximum Low-Level Output Voltage	V _{in} = V _{IH} or V _{IL} I _{out} ≤ 20 μA	2.0	0.1	0.1	0.1	V
			4.5	0.1	0.1	0.1	
			6.0	0.1	0.1	0.1	
		V _{in} = V _{IH} or V _{IL} I _{out} ≤ 4.0 mA I _{out} ≤ 5.2 mA	4.5	0.26	0.33	0.40	
			6.0	0.26	0.33	0.40	
I _{in}	Maximum Input Leakage Current	V _{in} = V _{CC} or GND	6.0	±0.1	±1.0	±1.0	μA
I _{CC}	Maximum Quiescent Supply Current (per Package)	V _{in} = V _{CC} or GND I _{out} = 0 μA	6.0	4	40	80	μA

NOTE: Information on typical parametric values can be found in Chapter 4.

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AC ELECTRICAL CHARACTERISTICS ($C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			25°C to -55°C	≤85°C	≤125°C	
f _{max}	Maximum Clock Frequency (50% Duty Cycle) (Figures 1 and 4)	2.0	6.0	4.8	4.0	MHz
		4.5	30	24	20	
		6.0	35	28	24	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, Clock to Q or \bar{Q} (Figures 1 and 4)	2.0	125	155	190	ns
		4.5	25	31	38	
		6.0	21	26	32	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, Set to Q or \bar{Q} (Figures 2 and 4)	2.0	165	205	250	ns
		4.5	33	41	50	
		6.0	28	35	43	
t _{TLH} , t _{THL}	Maximum Output Transition Time, Any Output (Figures 1 and 4)	2.0	75	95	110	ns
		4.5	15	19	22	
		6.0	13	16	19	
C _{in}	Maximum Input Capacitance	—	10	10	10	pF

NOTES:

1. For propagation delays with loads other than 50 pF, see Chapter 4.
2. Information on typical parametric values can be found in Chapter 4.

CPD	Power Dissipation Capacitance (Per Flip-Flop) Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ For load considerations, see Chapter 4.	Typical @ 25°C, V _{CC} = 5.0 V	pF
		35	

TIMING REQUIREMENTS (Input $t_r = t_f = 6$ ns)

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			25°C to -55°C	≤85°C	≤125°C	
t _{su}	Minimum Setup Time, J or K to Clock (Figure 3)	2.0	100	125	150	ns
		4.5	20	25	30	
		6.0	17	21	26	
t _h	Minimum Hold Time, Clock to J or K (Figure 3)	2.0	3	3	3	ns
		4.5	3	3	3	
		6.0	3	3	3	
t _{rec}	Minimum Recovery Time, Set Inactive to Clock (Figure 2)	2.0	100	125	150	ns
		4.5	20	25	30	
		6.0	17	21	26	
t _w	Minimum Pulse Width, Clock (Figure 1)	2.0	80	100	120	ns
		4.5	16	20	24	
		6.0	14	17	20	
t _w	Minimum Pulse Width, Set (Figure 2)	2.0	80	100	120	ns
		4.5	16	20	24	
		6.0	14	17	20	
t _r , t _f	Maximum Input Rise and Fall Times (Figure 1)	2.0	1000	1000	1000	ns
		4.5	500	500	500	
		6.0	400	400	400	

NOTE: Information on typical parametric values can be found in Chapter 4.

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SWITCHING WAVEFORMS

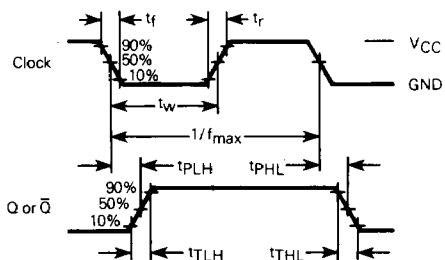


Figure 1.

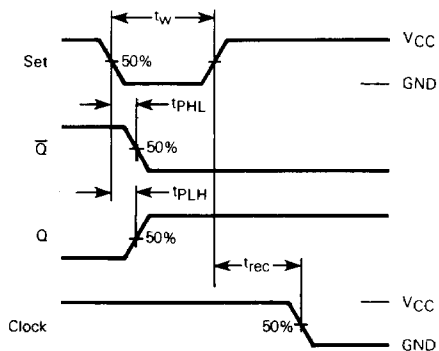


Figure 2.

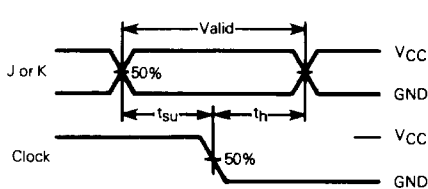
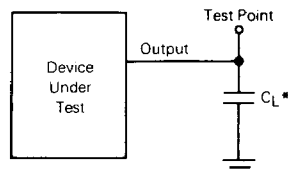


Figure 3.



* Includes all probe and jig capacitance.

Figure 4. Test Circuit

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EXPANDED LOGIC DIAGRAM

