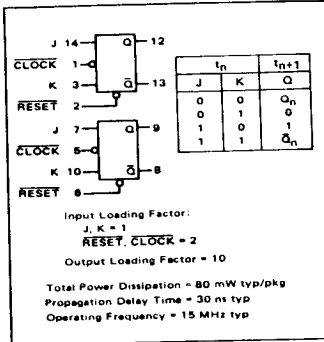


DUAL J-K FLIP-FLOP

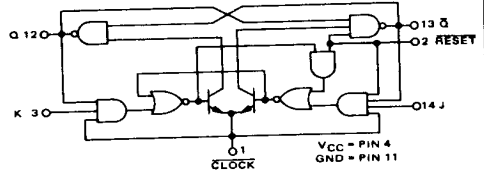
MTTL MC7400P series
MTTL MC5400L/7400L series

MC5473L*
MC7473P,L*

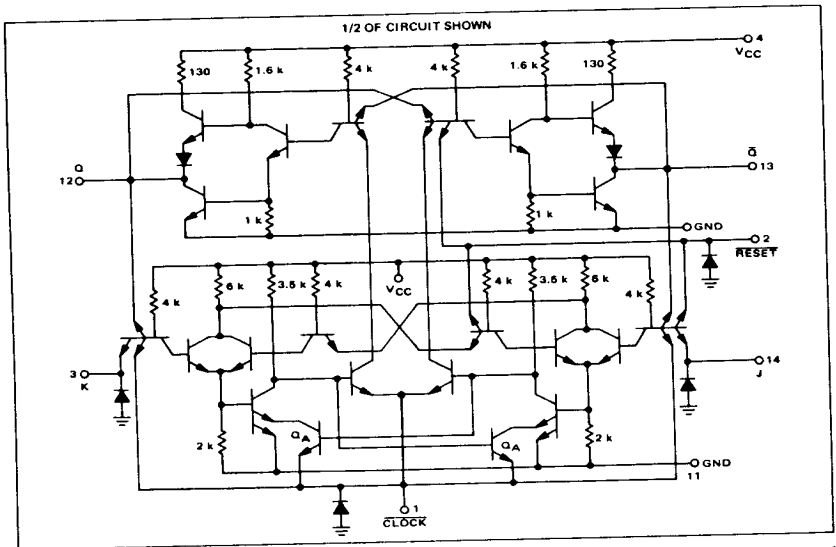


This negative-edge-triggered dual J-K flip-flop operates on the master-slave principle. The device is quite useful for simple registers and counters where multiple J and K inputs are not required.

LOGIC DIAGRAM
(1/2 OF DEVICE SHOWN)

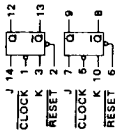


*L suffix = TO-116 ceramic package (Case 632)
P suffix = TO-116 plastic package (Case 605)
See General Information section for package outline dimensions.



ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one flip-flop. The other flip-flop is tested in the same manner.



TEST CURRENT/VOLTAGE VALUES (All Temperatures)																							
		Volts																					
		mA																					
		Symbol	Pin Under Test	Characteristic	Input	Forward Current J K Reset Clock	TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:																**
							I _{OL}	I _{OH}	V _{IL}	V _{IH}	V _{MLH}	V _{MH}	V _{SL}	V _{SH}	V _{OL}	V _{OH}	V _{CC1}	V _{CC2}	V _{CC3}	V _{COH}			
MC5473	MC7473	MC5473 Test Limits -55 to +125 °C	MC7473 Test Limits 0 to +75 °C	I _{OL}	I _{OH}	V _{IL}	V _{IH}	V _{MLH}	V _{MH}	V _{SL}	V _{SH}	V _{OL}	V _{OH}	V _{CC1}	V _{CC2}	V _{CC3}	V _{COH}						
		Min	Max	Unit	Min	Max	Unit	Min	Max	Unit	Min	Max	Unit	Min	Max	Unit	Min	Max	Unit				
		-	-1.6	mAdc	-	-1.6	mAdc	-	-1.6	mAdc	-	-1.6	mAdc	-	-1.6	mAdc	-	-1.6	mAdc				
		-	-3.2	μAdc	-	-3.2	μAdc	-	-3.2	μAdc	-	-3.2	μAdc	-	-3.2	μAdc	-	-3.2	μAdc				
		-	40	μAdc	-	40	μAdc	-	40	μAdc	-	40	μAdc	-	40	μAdc	-	40	μAdc				
		-	80	mAdc	-	80	mAdc	-	80	mAdc	-	80	mAdc	-	80	mAdc	-	80	mAdc				
		-	1.0	mAdc	-	1.0	mAdc	-	1.0	mAdc	-	1.0	mAdc	-	1.0	mAdc	-	1.0	mAdc				
		-	0.4	Vdc	-	0.4	Vdc	-	0.4	Vdc	-	0.4	Vdc	-	0.4	Vdc	-	0.4	Vdc				
		-	2.4	Vdc	-	2.4	Vdc	-	2.4	Vdc	-	2.4	Vdc	-	2.4	Vdc	-	2.4	Vdc				
		-	57	mAdc	-	57	mAdc	-	57	mAdc	-	57	mAdc	-	57	mAdc	-	57	mAdc				
		-	32	mAdc	-	32	mAdc	-	32	mAdc	-	32	mAdc	-	32	mAdc	-	32	mAdc				
		-	1.1,1.14*		-	1.1,1.14*		-	1.1,1.14*		-	1.1,1.14*		-	1.1,1.14*		-	1.1,1.14*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*					
		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*		-	2.3,11.14*					
		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*		-	1.2,1.1*					
		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*		-	1.11*,1.14*</											

**Ground inputs to flip-flop not under test.

††Momentarily ground pin prior to taking measurement to set flip-flop in the desired state. (If pin is also in another column, the pin must be returned to that voltage or current for measurement.)

‡Test duration : 100 ns.

Under normal operating conditions this current is negative. This test guarantees that positive leakage current will not exceed the limit shown.

OPERATING CHARACTERISTICS

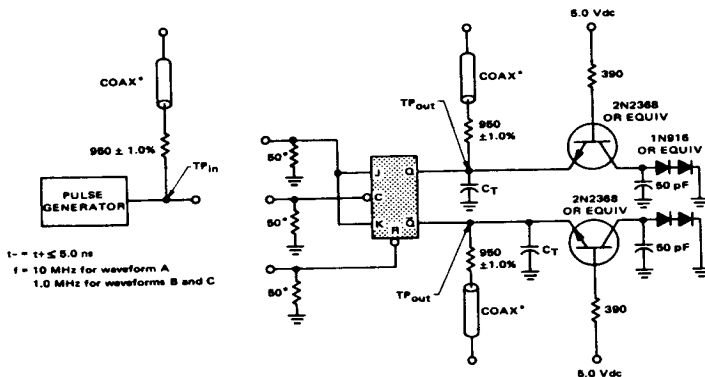
Data must be applied to the J-K inputs while the clock is low. When the clock input goes to the positive logic "1" state, the data at the J and K inputs is transferred to the master section, where it is stored until the clock changes to the positive logic "0" state. Data at the J and K inputs must not be changed while the clock is high. When the clock returns to the positive logic "0" state, information in the master section is transferred to the slave section.

Application of a logic "0" to the RESET input will force the Q output to the logic "1" state. The RESET input overrides the clock.

Since no charge storage is involved in this flip-flop, rise and fall times are not important to its operation. Clock fall times as long as $1.0 \mu s$ will not adversely affect the operation of the flip-flop. The clock pulse need only be wide enough to allow the data to settle in the master section. This time, which is the setup time for a logic "1", is 20 ns minimum.

Transistors Q_A have been added to the standard flip-flop circuit to protect the device against negative clock transients. This addition prevents both outputs from changing to the logic "1" state when transients in excess of $-2.0 V$ appear at the clock.

SWITCHING TIME TEST CIRCUIT



$t_r = t_f \leq 5.0\text{ ns}$
 $f = 10\text{ MHz}$ for waveform A
 1.0 MHz for waveforms B and C

Two pulse generators are required and must be slewed together for t_{sd} tests.

* The coax delays from input to scope and output to scope must be matched. The scope must be terminated in $50\text{-}\Omega$ impedance. The $950\text{-}\Omega$ resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

$C_T = 15\text{ pF}$ = total parasitic capacitance, which includes probe, wiring, and load capacitances.

4-77

MC5473L, MC7473P, L (continued)

OPERATING CHARACTERISTICS (continued)

TEST PROCEDURES

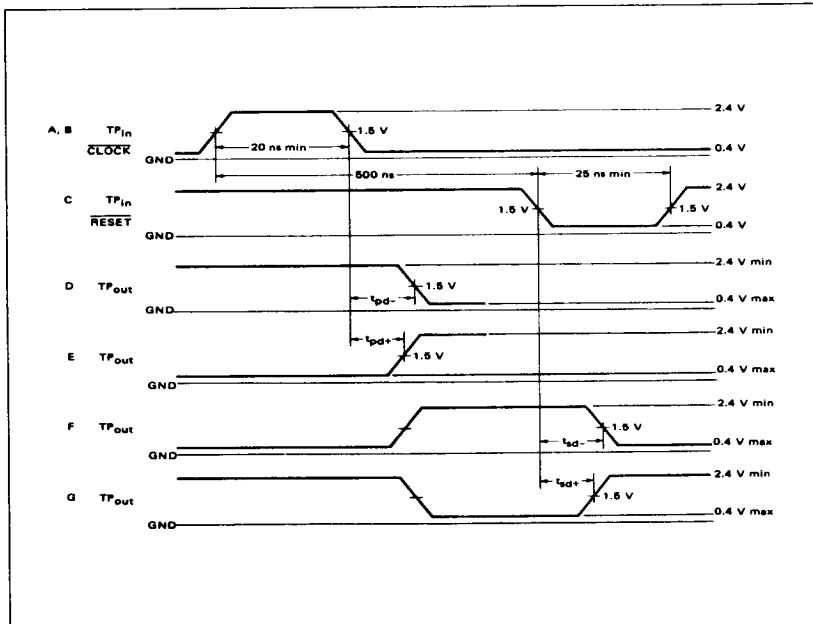
(Letters shown in test columns refer to waveforms.)

TEST	SYMBOL	INPUT			Q	$\bar{Q}$	LIMITS		
		C	J, K	$\bar{R}$			Min	Max	Unit
Toggle Frequency	f_{Tog}	A	A	2.4 V	T	T	10	—	MHz
Turn-On Delay	t_{pd-}	B	B	2.4 V	D	D	10	50	ns
Turn-Off Delay	t_{pd+}	B	B	2.4 V	E	E	10	50	ns
Turn-On Delay	t_{sd-}	B	B	C	F	F	—	50	ns
Turn-Off Delay	t_{sd+}	B	B	C	G	G	—	50	ns
Enable Voltage	V_{EN}	B	2.0 V	2.4 V	T	T	T	—	—
Inhibit Voltage	V_{INH}	B	0.8 V	2.4 V	‡	‡	‡	—	—

[†]Output shall toggle with each input pulse.

[‡]Output shall NOT toggle.

VOLTAGE WAVEFORMS AND DEFINITIONS



402

402