National Semiconductor

MM54C73/MM74C73/MM54C76/MM74C76/MM54C107 MM74C107 Dual J-K Flip-Flops with Clear and Preset

General Description

These dual J-K flip-flops are monolithic complementary MOS (CMOS) integrated circuits constructed with N-and P-channel enhancement transistors. Each flip-flop has independent J, K, clock and clear inputs and Q and Q outputs. The MM54C76/MM74C76 flip flops also include preset inputs and are supplied in 16 pin packages. These flip-flops are edge sensitive to the clock input and change state on the negative going transition of the clock pulses. Clear or preset is independent of the clock and is accomplished by a low level on the respective input.

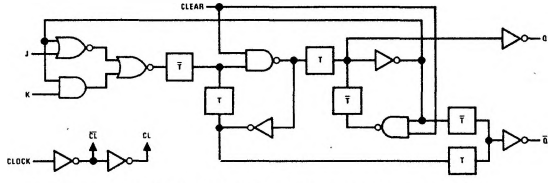
Features

- Supply voltage range — 3V to 15V
- Tenth power TTL compatible — drive 2 LPTTL loads
- High noise immunity — 0.45 V_{CC} (typ.)
- Low power — 50 nW (typ.)
- Medium speed operation — 10 MHz (typ.) with 10V supply

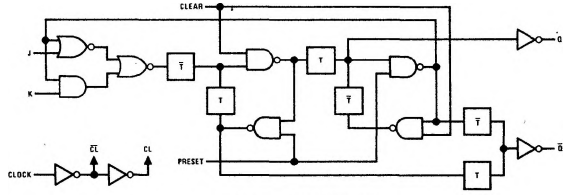
Applications

- Automotive
- Data terminals
- Instrumentation
- Medical electronics
- Alarm systems
- Industrial electronics
- Remote metering
- Computers

Logic and Connection Diagrams

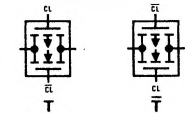


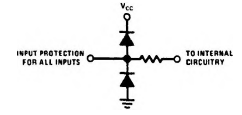
MM54C73/MM74C73 and MM54C107/MM74C107

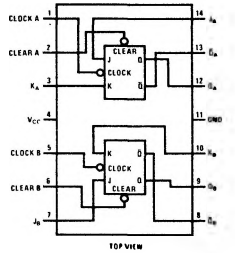


MM54C76/MM74C76

Transmission Gate

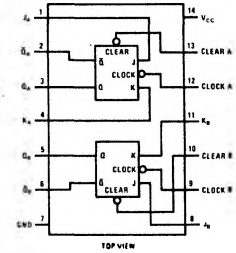






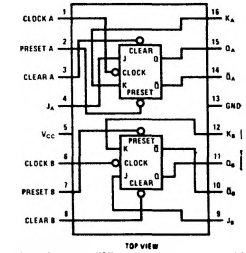
Note: A logic "0" on clear sets Q to logic "0."

MM54C73/MM74C73



Note: A logic "0" on clear sets Q to logic "0."

MM54C107/MM74C107



Note 1: A logic "0" on clear sets Q to a logic "0."
Note 2: A logic "0" on preset sets Q to a logic "1."

MM54C76/MM74C76

Absolute Maximum Ratings

Voltage at Any Pin (Note 1)	$-0.3V$ to $V_{CC} + 0.3V$
Operating Temperature Range	
MM54CXX	$-55°C$ to $125°C$
MM74CXX	$-40°C$ to $+85°C$
Storage Temperature	$-65°C$ to $150°C$
Package Dissipation	500 mW
Lead Temperature (Soldering, 10 seconds)	300°C
Operating V_{CC} Range	$+3V$ to $15V$

DC Electrical Characteristics

Min/max limits apply across temperature range unless otherwise noted.

	Parameter	Conditions	Min.	Typ.	Max.	Units
	CMOS to CMOS					
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5.0V$ $V_{CC} = 10V$	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5.0V$ $V_{CC} = 10V$			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5.0V$ $V_{CC} = 10V$	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5.0V$ $V_{CC} = 10V$			0.5 1.0	V V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15.0V$			1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15.0V$	-1.0			μA
I_{CC}	Supply Current	$V_{CC} = 15.0V$		0.050	60	μA
	Low Power TTL to CMOS Interface					
$V_{IN(1)}$	Logical "1" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.75V$	$V_{CC} - 1.5$			V
$V_{IN(0)}$	Logical "0" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.75V$			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C, $V_{CC} = 4.5V$, $I_O = -360\mu A$ 74C, $V_{CC} = 4.75V$, $I_O = -360\mu A$	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C, $V_{CC} = 4.5V$, $I_O = 360\mu A$ 74C, $V_{CC} = 4.75V$, $I_O = 360\mu A$			0.4	V
	Output Drive (See 54C/74C Family Characteristics Data Sheet) (short circuit current)					
I_{SOURCE}	Output Source Current	$V_{CC} = 5.0V$, $V_{IN(0)} = 0V$ $T_A = 25°C$, $V_{OUT} = 0V$	-1.75			mA
I_{SOURCE}	Output Source Current	$V_{CC} = 10V$, $V_{IN(0)} = 0V$ $T_A = 25°C$, $V_{OUT} = 0V$	-8.0			mA
I_{SINK}	Output Sink Current	$V_{CC} = 5.0V$, $V_{IN(1)} = 5.0V$ $T_A = 25°C$, $V_{OUT} = V_{CC}$	1.75			mA
I_{SINK}	Output Sink Current	$V_{CC} = 10V$, $V_{IN(1)} = 10V$ $T_A = 25°C$, $V_{OUT} = V_{CC}$	8.0			mA

AC Electrical Characteristics $T_A = 25°C$, $C_L = 50pF$, unless otherwise noted.

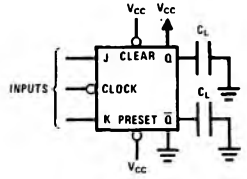
Parameter		Conditions	Min.	Typ.	Max.	Units
C_{IN}	Input Capacitance	Any Input		5		pF
t_{pd0}, t_{pd1}	Propagation Delay Time to a Logical "0" or Logical "1" from Clock to Q or Q	$V_{CC} = 5.0V$ $V_{CC} = 10V$		180 70	300 110	ns ns
t_{pd0}	Propagation Delay Time to a Logical "0" from Preset or Clear	$V_{CC} = 5.0V$ $V_{CC} = 10V$		200 80	300 130	ns ns
t_{pd}	Propagation Delay Time to a Logical "1" from Preset or Clear	$V_{CC} = 5.0V$ $V_{CC} = 10V$		200 80	300 130	ns ns
t_S	Time Prior to Clock Pulse that Data must be Present	$V_{CC} = 5.0V$ $V_{CC} = 10V$		110 45	175 70	ns ns
t_H	Time after Clock Pulse that J and K must be Held	$V_{CC} = 5.0V$ $V_{CC} = 10V$		−40 −20	0 0	ns ns
t_{PW}	Minimum Clock Pulse Width $t_{WL} = t_{WH}$	$V_{CC} = 5.0V$ $V_{CC} = 10V$		120 50	190 80	ns ns
t_{PW}	Minimum Preset and Clear Pulse Width	$V_{CC} = 5.0V$ $V_{CC} = 10V$		90 40	130 60	ns ns
f_{MAX}	Maximum Toggle Frequency	$V_{CC} = 5.0V$ $V_{CC} = 10V$	2.5 7.0	4.0 11.0		MHz MHz
t_r, t_f	Clock Pulse Rise and Fall Time	$V_{CC} = 5.0V$ $V_{CC} = 10V$			15 5	μs μs

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: Capacitance is guaranteed by periodic testing.

Note 3: C_{PD} determines the no load ac power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics application note — AN-90.

AC Test Circuit



Truth Table

t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

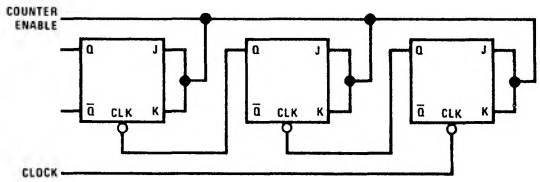
t_n = bit time before clock pulse.
t_{n+1} = bit time after clock pulse.

Preset	Clear	Q_n	$\overline{Q}_n$
0	0	0	0
0	1	1	0
1	0	0	1
1	1	*Q_n	*$\overline{Q}_n$

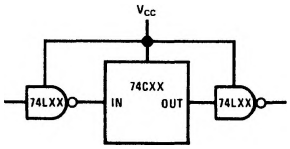
*No change in output from previous state.

Typical Applications

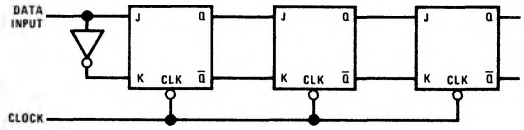
Ripple Binary Counters



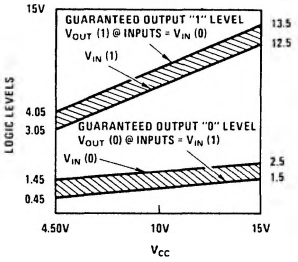
74C Compatibility



Shift Registers

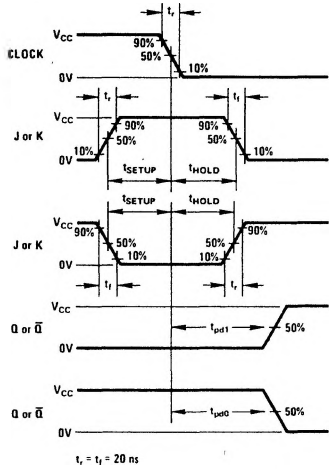


Guaranteed Noise Margin as a Function of V_{CC}



Switching Time Waveforms

CMOS to CMOS



$t_r = t_f = 20$ ns