MOTOROLA

MC74F194

4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER

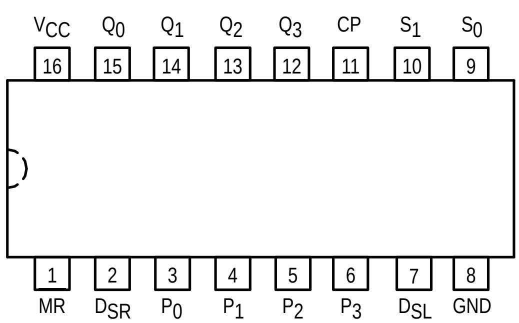
The MC74F194 is a high-speed 4-bit bidirectional universal shift register. As a high-speed multifunctional, sequential building block, it is useful in a wide variety of applications. It may be used in serial-serial, shift left, shift right, serial-parallel, parallel-serial, and parallel-parallel data register transfers. The F194 is similar in operation to the S195 universal shift register, with added features of shift left without external connections and hold (do nothing) modes of operation.

- Typical Shift Frequency of 150 MHz
- Asynchronous Master Reset
- Hold (Do Nothing) Mode
- Fully Synchronous Serial or Parallel Data Transfers

FUNCTIONAL DESCRIPTION

The F194 contains four edge-triggered D flip-flops and the necessary interstage logic to synchronously perform shift right, shift left, parallel load and hold operations. Signals applied to the Select (S_0, S_1) inputs determine the type of operation, as shown in the Function Table. Signals on the Select, Parallel data (P_0–P_3) and Serial data (D_{SR}, D_{SL}) inputs can change when the clock is in either state, provided only that the recommended setup and hold times, with respect to the clock rising edge, are observed. A LOW signal on Master Reset ($\overline{MR}$) overrides all other inputs and forces the outputs LOW.

CONNECTION DIAGRAM



FUNCTION TABLE

Operating Mode	Inputs						Outputs			
	$\overline{MR}$	S_1	S_0	D_{SR}	D_{SL}	P_n	Q_0	Q_1	Q_2	Q_3
Reset	L	X	X	X	X	X	L	L	L	L
Hold	H	I	I	X	X	X	q_0	q_1	q_2	q_3
Shift Left	H	h	I	X	I	X	q_1	q_2	q_3	L
	H	h	I	X	h	X	q_1	q_2	q_3	H
Shift Right	H	I	h	I	X	X	L	q_0	q_1	q_2
	H	I	h	h	X	X	H	q_0	q_1	q_2
Parallel Load	H	h	h	X	X	p_n	p_0	p_1	p_2	p_3

I = LOW voltage level one setup time prior to the LOW-to-HIGH clock transition.
h = HIGH voltage level one setup time prior to the LOW-to-HIGH clock transition.
p_n, q_n = Lower case letters indicate the state of the referenced input or output one setup time prior to the LOW-to-HIGH clock transition.
H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER

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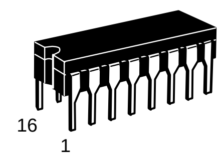
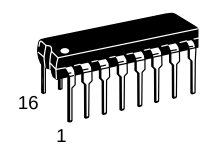
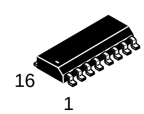


J SUFFIX
CERAMIC
CASE 620-09



N SUFFIX
PLASTIC
CASE 648-08

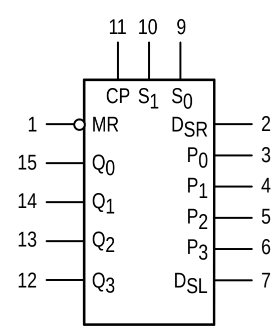


D SUFFIX
SOIC
CASE 751B-03

ORDERING INFORMATION

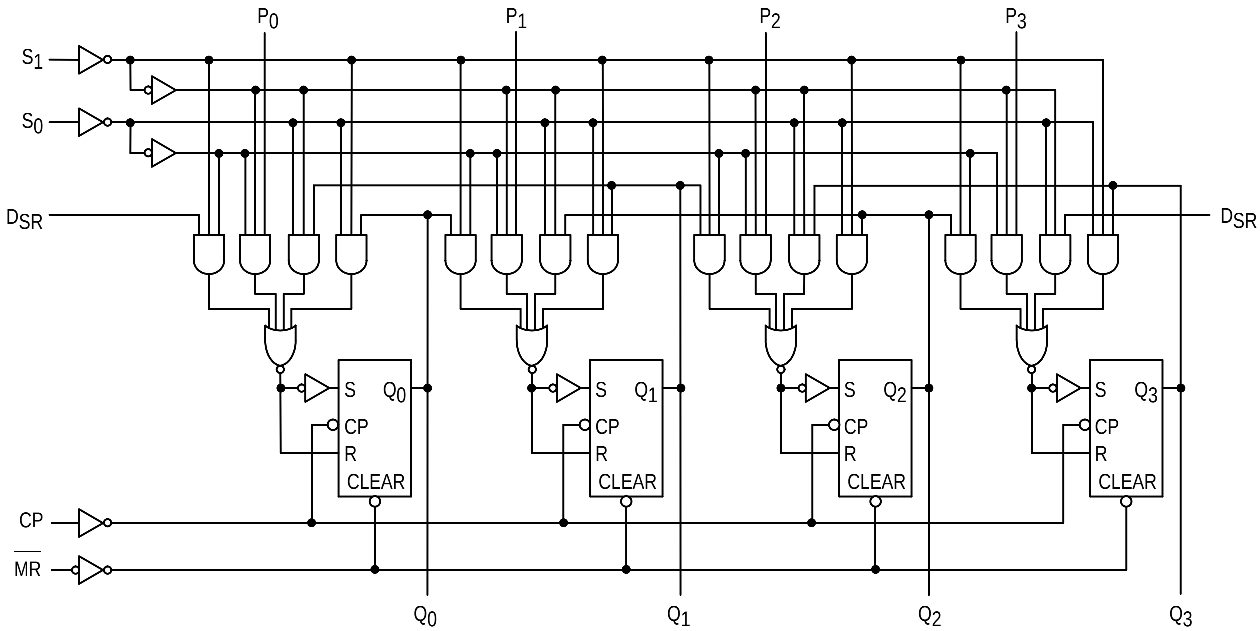
MC74FXXXJ	Ceramic
MC74FXXXN	Plastic
MC74FXXXD	SOIC

LOGIC SYMBOL



V_{CC} = PIN 16
GND = PIN 8

LOGIC DIAGRAM



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

GUARANTEED OPERATING RANGES

Symbol	Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	74	4.5	5.0	5.5	V
T_A	Operating Ambient Temperature Range	74	0	25	70	°C
I_{OH}	Output Current — High	74			–1.0	mA
I_{OL}	Output Current — Low	74			20	mA

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter		Limits Min	Limits Typ	Limits Max	Unit	Test Conditions	
V_{IH}	Input HIGH Voltage		2.0			V	Guaranteed Input HIGH Voltage	
V_{IL}	Input LOW Voltage				0.8	V	Guaranteed Input LOW Voltage	
V_{IK}	Input Clamp Diode Voltage				–1.2	V	I_{IN} = –18 mA	V_{CC} = MIN
V_{OH}	Output HIGH Voltage	74	2.5	3.4		V	I_{OH} = –1.0 mA	V_{CC} = 4.5 V
		74	2.7	3.4		V	I_{OH} = –1.0 mA	V_{CC} = 4.75 V
V_{OL}	Output LOW Voltage			0.35	0.5	V	I_{OL} = 20 mA	V_{CC} = MIN
I_{IH}	Input HIGH Current				20	µA	V_{IN} = 2.7 V	V_{CC} = MAX
					100	µA	V_{IN} = 7.0 V	
I_{IL}	Input LOW Current				–0.6	mA	V_{IN} = 0.5 V	V_{CC} = MAX
I_{OS}	Output Short Circuit Current (Note 2)		–60		–150	mA	V_{OUT} = 0 V	V_{CC} = MAX
I_{CC}	Power Supply Current			33	46	mA	S_n, $\overline{MR}$, D_{SR}, D_{SL} = 4.5 V P_n = Gnd, CP =	V_{CC} = MAX

NOTES:
1. For conditions such as MIN or MAX, use the appropriate value specified under guaranteed operating ranges.
2. Not more than one output should be shorted at a time, nor for more than 1 second.

AC CHARACTERISTICS

Symbol	Parameter	74F $T_A = +25°C$ $V_{CC} = +5.0$ V $C_L = 50$ pF		74F $T_A = 0$ to $+70°C$ $V_{CC} = 5.0$ V ±10% $C_L = 50$ pF		Unit
		Min	Max	Min	Max	
f_{max}	Maximum Shift Frequency	105		90		MHz
t_{PLH} t_{PHL}	Propagation Delay CP to Q_n	3.0 3.5	7.0 7.5	3.5 3.5	8.0 8.0	ns
t_{PHL}	Propagation Delay $\overline{MR}$ to Q_n	4.5	12	4.5	14	ns

AC OPERATING REQUIREMENTS

Symbol	Parameter	74F $T_A = +25°C$ $V_{CC} = +5.0$ V		74F $T_A = 0$ to $+70°C$ $V_{CC} = 5.0$ V ±10%		Unit
		Min	Max	Min	Max	
$t_S(H)$ $t_S(L)$	Set up Time, HIGH or LOW P_n or D_{SR} or D_{SL} to CP	4.0 4.0		4.0 4.0		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW P_n or D_{SR} or D_{SL} to CP	0 0		1.0 1.0		
$t_S(H)$ $t_S(L)$	Set up Time, HIGH or LOW S_n to CP	8.0 8.0		9.0 8.0		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW S_n to CP	0 0		0 0		
$t_W(H)$	CP Pulse Width HIGH	5.0		5.5		ns
$t_W(L)$	$\overline{MR}$ Pulse Width LOW	5.0		5.0		ns
t_{rec}	Recovery Time $\overline{MR}$ to CP	7.0		8.0		ns

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