

HD74HC194 ● 4-bit Bidirectional Universal Shift Register

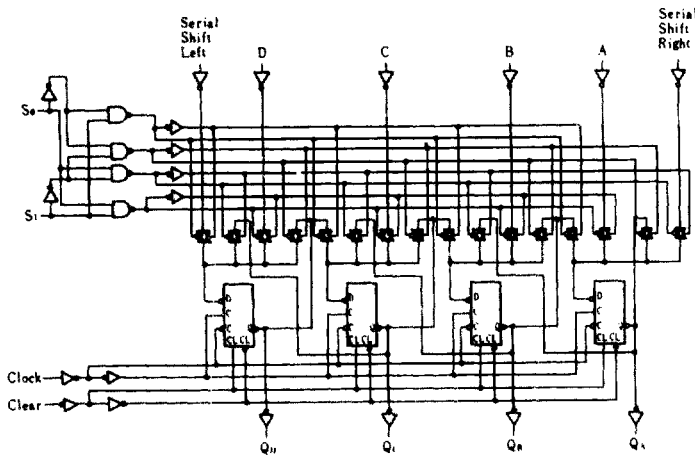
This bidirectional shift register is designed to incorporate virtually all of the features a system designer may want in a shift register. It features parallel inputs, parallel outputs, right shift and left shift serial inputs, operating mode control inputs, and a direct overriding clear line. The register has four distinct modes of operation: parallel (broadside) load, shift right (in the direction Q_A toward Q_D); shift left; inhibit clock (do nothing).

Synchronous parallel loading is accomplished by applying the four bits of data and taking both mode control inputs, S_0 and S_1 , high. The data are loaded into their respective flip-flops and appear at the outputs after the positive transition of the clock input. During loading, serial data flow is inhibited. Shift right is accomplished synchronously with the rising edge of the clock pulse when S_0 is high and S_1 is low. Serial data for this mode is entered at the shift right data input. When S_0 is low and S_1 is high, data shifts left synchronously and new data is entered at the shift left serial input. Clocking of the flip-flops is inhibited when both mode control inputs are low. The mode control inputs should be changed only when the clock input is high.

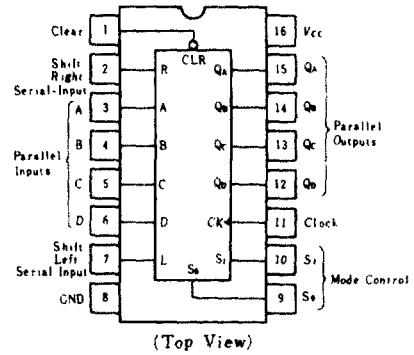
■ FEATURES

- High Speed Operation: t_{pd} (Clock to Q) = 12ns typ. ($C_L = 50pF$)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage: $V_{CC} = 2 \sim 6V$
- Low Input Current: $1\mu A$ max.
- Low Quiescent Supply Current: I_{CC} (static) = $4\mu A$ max.

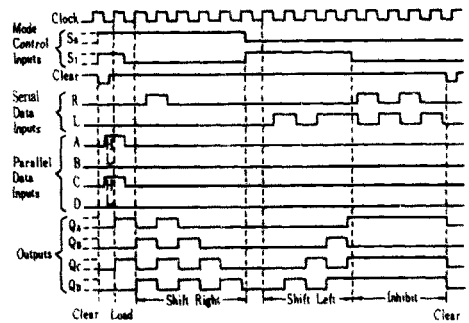
■ LOGIC DIAGRAM



■ PIN ARRANGEMENT



■ TIMING DIAGRAM



■ FUNCTION TABLE

Operating Mode	Inputs								Outputs					
	Clear	Mode		Clock	Serial		Parallel				Q _A	Q _B	Q _C	Q _D
		S _i	S ₀		Shift Left	Shift Right	A	B	C	D				
Clear	L	x	x	x	x	x	x	x	x	L	L	L	L	
Parallel Load	H	H	H		x	x	a	b	c	d	a	b	c	d
Shift Right	H	L	H		x	H	x	x	x	x	H	Q _{A0}	Q _{B0}	Q _{C0}
	H	L	H		x	L	x	x	x	x	L	Q _{A0}	Q _{B0}	Q _{C0}
Shift Left	H	H	L		H	x	x	x	x	x	Q _{B0}	Q _{C0}	Q _{D0}	H
	H	H	L		L	x	x	x	x	x	Q _{B0}	Q _{C0}	Q _{D0}	L
Hold	H	L	L	x	x	x	x	x	x	x	Q _{A0}	Q _{B0}	Q _{C0}	Q _{D0}
	H	x	x	L	x	x	x	x	x	x	Q _{A0}	Q _{B0}	Q _{C0}	Q _{D0}
	H	x	x	H	x	x	x	x	x	x	Q _{A0}	Q _{B0}	Q _{C0}	Q _{D0}

H = high level (Steady state)

L = low level (Steady state)

x = don't care

= transition from low to high level.

a, b, c, d = the level of steady-state input at inputs A, B, C or D respectively.

Q_{A0}, Q_{B0}, Q_{C0}, Q_{D0} = the level of Q_A, Q_B, Q_C or Q_D respectively, before the indicated steady-state input conditions were established.

Q_{A0}, Q_{B0}, Q_{C0}, Q_{D0} = the level of Q_A, Q_B, Q_C or Q_D respectively, before the most recent transition of the clock.

■ DC CHARACTERISTICS

Item	Symbol	V _{CC} (V)	Test Conditions	T _a = 25°C			T _a = -40 ~ +85°C		Unit	
				min	typ	max	min	max		
Input Voltage	V _{IH}	2.0		1.5	-	-	1.5	-	V	
		4.5		3.15	-	-	3.15	-		
		6.0		4.2	-	-	4.2	-		
	V _{IL}	2.0		-	-	0.5	-	0.5	V	
		4.5		-	-	1.35	-	1.35		
		6.0		-	-	1.8	-	1.8		
Output Voltage	V _{OH}	2.0	V _{is} = V _{IH} or V _{IL}	I _{OH} = -20μA	1.9	2.0	-	1.9	-	V
		4.5			4.4	4.5	-	4.4	-	
		6.0			5.9	6.0	-	5.9	-	
		4.5		4.18	-	-	4.13	-		
	V _{OL}	2.0	V _{is} = V _{IH} or V _{IL}	I _{OL} = 20μA	-	0.0	0.1	-	0.1	V
		4.5			-	0.0	0.1	-	0.1	
		6.0			-	0.0	0.1	-	0.1	
		4.5			-	-	0.26	-	0.33	
Input Current	I _{is}	6.0	V _{is} = V _{CC} or GND	-	-	±0.1	-	±1.0	μA	
				Quiescent Supply Current	I _{CC}	6.0	V _{is} = V _{CC} or GND, I _{in} = 0 μA	-	-	4.0

■ AC CHARACTERISTICS ($C_L=50\text{pF}$, Input $t_r=t_f=6\text{ns}$)

Item	Symbol	$V_{CC}(\text{V})$	Test Conditions	$T_a=25^\circ\text{C}$			$T_a=-40\sim+85^\circ\text{C}$		Unit	
				min	typ	max	min	max		
Maximum Clock Frequency	f_{max}	2.0		—	—	6	—	5	MHz	
		4.5		—	—	30	—	24		
		6.0		—	—	35	—	28		
Propagation Delay Time	t_{PHL}	2.0	Clock to Q	—	—	140	—	175	ns	
		4.5		—	12	28	—	35		
		6.0		—	—	24	—	30		
	t_{PLH}	2.0		—	—	140	—	175	ns	
		4.5		—	12	28	—	35		
		6.0		—	—	24	—	30		
	t_{PHL}	2.0		Clear to Q	—	—	150	—	190	ns
		4.5			—	13	30	—	38	
		6.0			—	—	26	—	33	
Pulse Width	t_w	2.0	Clock or Clear		80	—	—	100	—	ns
		4.5			16	6	—	20	—	
		6.0			14	—	—	17	—	
Setup Time	t_{su}	2.0	A, B, C or D to Clock		100	—	—	125	—	ns
		4.5			20	7	—	25	—	
		6.0			17	—	—	21	—	
	t_{su}	2.0	Mode Controls to Clock	150	—	—	187	—	ns	
		4.5		30	17	—	37	—		
		6.0		25	—	—	31	—		
Hold Time	t_h	2.0	Any Input	0	—	—	0	—	ns	
		4.5		0	-4	—	0	—		
		6.0		0	—	—	0	—		
Removal Time	t_{rem}	2.0	Clear inactive to Clock	25	—	—	31	—	ns	
		4.5		5	1	—	6	—		
		6.0		4	—	—	5	—		
Output Rise / Fall Time	t_{TLH} t_{THL}	2.0		—	—	75	—	95	ns	
		4.5		—	5	15	—	19		
		6.0		—	—	13	—	16		
Input Capacitance	C_{ix}	—		—	5	10	—	10	pF	