

9300 ✓ 010669
~~93H00~~ ✓ 010258
 93L00 010199
 93S00 ✓ 010671

4-BIT UNIVERSAL SHIFT REGISTER

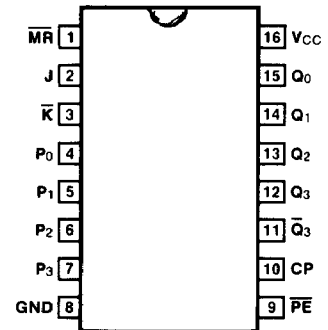
DESCRIPTION — The '00 is a 4-bit universal shift register. As a high speed multifunctional sequential logic block, it is useful in a wide variety of register and counter applications. It may be used in serial-serial, shift left, shift right, serial-parallel, parallel-serial, and parallel-parallel data register transfers.

- **ASYNCHRONOUS MASTER RESET**
- **J, K INPUTS TO FIRST STAGE**

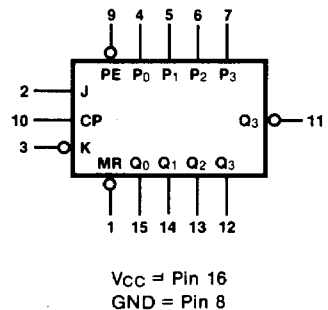
ORDERING CODE: See Section 9

PKGS	PIN OUT	COMMERCIAL GRADE	MILITARY GRADE	PKG TYPE
		$V_{CC} = +5.0 \text{ V} \pm 5\%$, $T_A = 0^\circ \text{C to } +70^\circ \text{C}$	$V_{CC} = +5.0 \text{ V} \pm 10\%$, $T_A = -55^\circ \text{C to } +125^\circ \text{C}$	
Plastic DIP (P)	A	9300PC, 93H00PC 93L00PC, 93S00PC		9B
Ceramic DIP (D)	A	9300DC, 93H00DC 93L00DC, 93S00DC	9300DM, 93H00DM 93L00DM, 93S00DM	6B
Flatpak (F)	A	9300FC, 93H00FC 93L00FC, 93S00FC	9300FM, 93H00FM 93L00FM, 93S00FM	4L

CONNECTION DIAGRAM PINOUT A



LOGIC SYMBOL

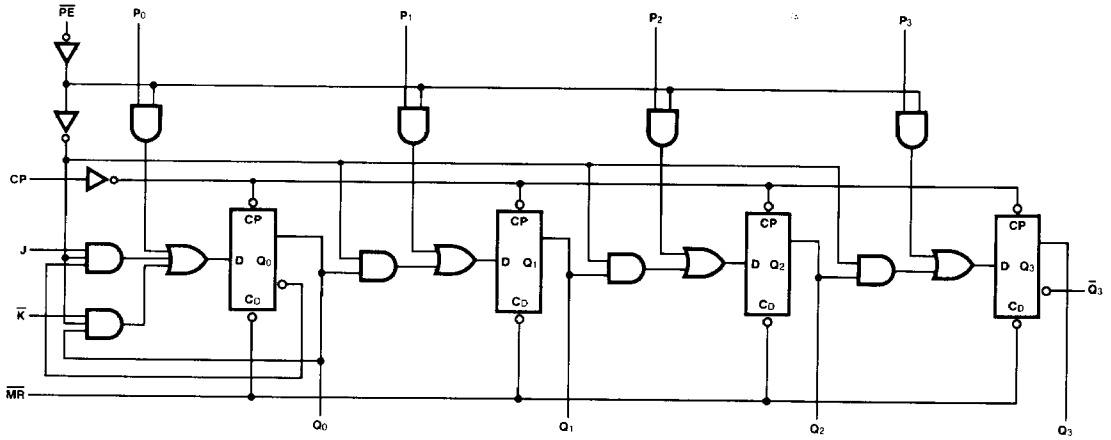


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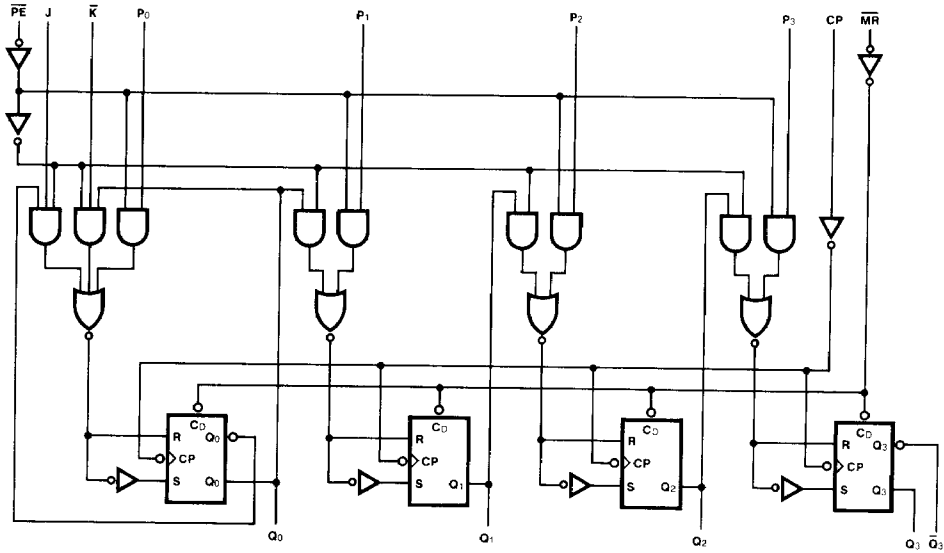
INPUT LOADING/FAN-OUT: See Section 3 for U.L. definitions

PIN NAMES	DESCRIPTION	93XX (U.L.) HIGH/LOW	93H (U.L.) HIGH/LOW	93L (U.L.) HIGH/LOW	93S (U.L.) HIGH/LOW
\overline{PE}	Parallel Enable Input (Active LOW)	2.3/2.3	1.0/1.0	1.15/0.575	1.25/1.25
$P_0 - P_3$	Parallel Inputs	1.0/1.0	1.0/1.0	0.5/0.25	1.0/1.0
J	First Stage J Input (Active HIGH)	1.0/1.0	1.0/1.0	0.5/0.25	1.0/1.0
\overline{K}	First Stage K Input (Active LOW)	1.0/1.0	1.0/1.0	0.5/0.25	1.0/1.0
CP	Clock Pulse Input (Active Rising Edge)	2.0/2.0	2.0/2.0	1.0/0.5	2.5/2.5
\overline{MR}	Master Reset Input	1.0/1.0	1.0/1.0	0.5/0.25	1.25/1.25
$Q_0 - Q_3$	Parallel Outputs	12/6.0	16/8.0	10/5.0 (3.0)	25/12.5
\overline{Q}_3	Complementary Last Stage Output	16/8.0	20/10	10/5.0 (3.0)	25/12.5

LOGIC DIAGRAMS
'00, 'H00, 'L00



'S00



FUNCTIONAL DESCRIPTION — The Logic Diagrams and Truth Table indicate the functional characteristics of the '00 4-bit shift register. The device is useful in a wide variety of shifting, counting and storage applications. It performs serial, parallel, serial-to-parallel, or parallel-to-serial data transfers.

The '00 has two primary modes of operation, shift right ($Q_0 \rightarrow Q_1$) and parallel load, which are controlled by the state of the Parallel Enable (\overline{PE}) input. When the \overline{PE} input is HIGH, serial data enters the first flip-flop Q_0 via the J and \overline{K} inputs and is shifted one bit in the direction $Q_0 \rightarrow Q_1 \rightarrow Q_2 \rightarrow Q_3$ following each LOW-to-HIGH clock transition. The JK inputs provide the flexibility of the JK type input for special applications, and the simple D-type input for general applications by tying the two pins together. When the \overline{PE} input is LOW, the '00 appears as four common clocked D flip-flops. The data on the parallel inputs $P_0 - P_3$ is transferred to the respective $Q_0 - Q_3$ outputs following the LOW-to-HIGH clock transition. Shift left operation ($Q_3 \rightarrow Q_2$) can be achieved by tying the Q_n outputs to the P_{n-1} inputs and holding the \overline{PE} input LOW.

All serial and parallel data transfers are synchronous, occurring after each LOW-to-HIGH clock transition. Since the '00 utilizes edge triggering, there is no restriction on the activity of the J, K, P_n and \overline{PE} inputs for logic operation — except for the setup and release time requirements. A LOW on the asynchronous Master Reset (\overline{MR}) input sets all Q outputs LOW, independent of any other input condition.

TRUTH TABLE

OPERATING MODE	INPUTS ($\overline{MR} = H$)							OUTPUTS @ t_{n+1}				
	\overline{PE}	J	\overline{K}	P_0	P_1	P_2	P_3	Q_0	Q_1	Q_2	Q_3	$\overline{Q_3}$
SHIFT MODE	H	L	L	X	X	X	X	L	Q_0	Q_1	Q_2	$\overline{Q_2}$
	H	L	H	X	X	X	X	$\overline{Q_0}$	Q_0	Q_1	Q_2	$\overline{Q_2}$
	H	H	L	X	X	X	X	$\overline{Q_0}$	Q_0	Q_1	Q_2	$\overline{Q_2}$
	H	H	H	X	X	X	X	H	Q_0	Q_1	Q_2	$\overline{Q_2}$
PARALLEL ENTRY MODE	L	X	X	L	L	L	L	L	L	L	L	H
	L	X	X	H	H	H	H	H	H	H	H	L

* t_{n+1} = Indicates state after next LOW-to-HIGH clock transition.

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

SYMBOL	PARAMETER	93XX		93H		93L		93S		UNITS	CONDITIONS
		Min	Max	Min	Max	Min	Max	Min	Max		
I _{os}	Output Short Circuit Current	-20	-80	-30	-100					mA	V _{CC} = Max, V _{OUT} = 0 V
I _{cc}	Power Supply Current	XC	92		112			23	120	mA	V _{CC} = Max
		XM	86		102						

AC CHARACTERISTICS: V_{CC} = +5.0 V, T_A = +25°C (See Section 3 for waveforms and load configurations)

SYMBOL	PARAMETER	93XX		93H		93L		93S		UNITS	CONDITIONS
		C _L = 15 pF		C _L = 15 pF		C _L = 15 pF		C _L = 15 pF			
		Min	Max	Min	Max	Min	Max	Min	Max		
f _{max}	Maximum Shift Frequency	30		45		10		70		MHz	Figs. 3-1, 3-8
t _{PLH}	Propagation Delay CP to Q _n		22		16		35		8.5	ns	Figs. 3-1, 3-8
t _{PHL}			26		21		51		12		
t _{PHL}	Propagation Delay MR to Q _n		40		28		60		23	ns	Figs. 3-1, 3-17

AC OPERATING REQUIREMENTS: V_{CC} = +5.0 V, T_A = +25°C

SYMBOL	PARAMETER	93XX		93H		93L		93S		UNITS	CONDITIONS
		Min	Max	Min	Max	Min	Max	Min	Max		
t _s (H)	Setup Time HIGH or LOW, J, \bar{K} and P ₀ —P ₃ to CP	20		12		60		6.0		ns	Fig. 3-6
t _s (L)		20		12		60		6.0			
t _h (H)	Hold Time HIGH or LOW, J, \bar{K} and P ₀ —P ₃ to CP	0		0		0		0		ns	Fig. 3-6
t _h (L)		0		0		0		0			
t _s (H)	Setup Time HIGH or LOW, $\bar{P}\bar{E}$ to CP	39		15		68		8.0		ns	Fig. 3-6
t _s (L)		39		15		68		8.0			
t _h (H)	Hold Time HIGH or LOW, $\bar{P}\bar{E}$ to CP	-10		0		-20		0		ns	Fig. 3-8
t _h (L)		-10		0		-20		0			
t _w (H)	CP Pulse Width HIGH or LOW	17		12		38		7.0		ns	Fig. 3-8
t _w (L)		17		12		38		7.0			
t _w (L)	$\bar{M}\bar{R}$ Pulse Width LOW	25		19		53		12		ns	Fig. 3-16
t _{rec}	Recovery Time MR to CP	25		7.0		70		5.0		ns	