M74LS195AP

4-BIT PARALLEL-ACCESS SHIFT REGISTER WITH RESET

DESCRIPTION

The M74LS195AP is a semiconductor integrated circuit containing a 4-bit serial/parallel input-serial/parallel output shift register function with a direct reset input.

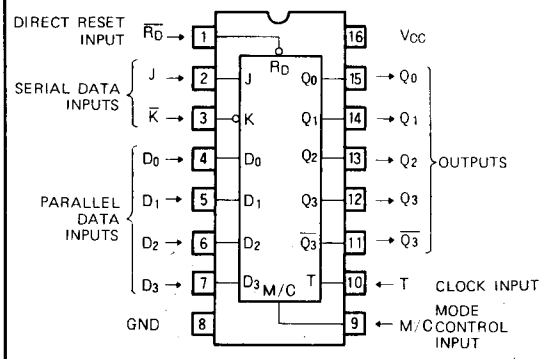
FEATURES

- Synchronous serial/parallel input-serial/parallel output
- Right shift function
- Left shift function available with external connection
- Mode control input provided
- Serial inputs J and $\overline{K}$ provided
- Direct reset input provided
- Q_3 and $\overline{Q_3}$ outputs provided
- Wide operating temperature range (T_a= −20~+75°C)

APPLICATION

General purpose, for use in industrial and consumer equipment.

PIN CONFIGURATION (TOP VIEW)



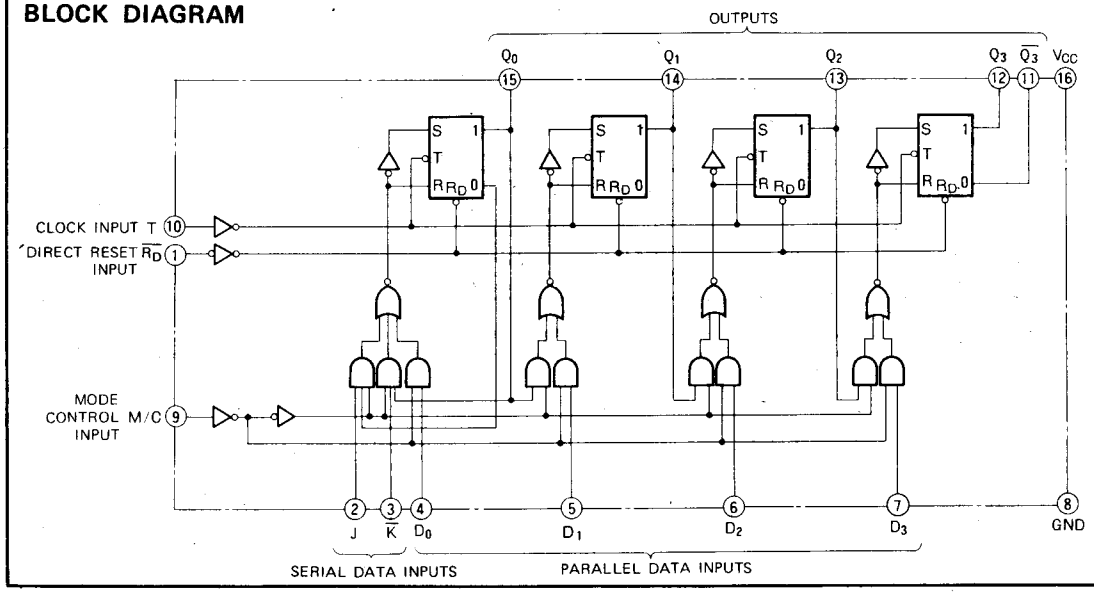
Outline 16P4

FUNCTIONAL DESCRIPTION

This device can be used as a serial input-serial/parallel output and parallel input-serial/parallel output shift register with the mode control input M/C signal. When M/C is kept in high, the serial data are applied to serial data inputs J and $\overline{K}$ and the clock pulse is applied to clock input T, the serial data are shifted sequentially into outputs Q_0~$\overline{Q_3}$ in synchronization with the clock pulse. The first stage flip-flop with J and $\overline{K}$ functions as a J-K flip-flop. When serial data are applied from line 1, J and $\overline{K}$ are mutually connected and used as serial input pins. When M/C is kept in low, the parallel data are applied to parallel data inputs D_0~D_3 and a 1-bit clock pulse is applied to T, the D_0~D_3 signals appears in Q_0~$\overline{Q_3}$. When T changes from low to high, the shift or parallel reading operation is performed.

The last stage flip-flop output has mutually complementary outputs Q_3 and $\overline{Q_3}$. Q_0~Q_3 are reset low and $\overline{Q_3}$ high by setting direct reset input $\overline{R_D}$ low irrespective of all the other input signals.

BLOCK DIAGRAM



4-BIT PARALLEL-ACCESS SHIFT REGISTER WITH RESET

FUNCTION TABLE (Note 1)

Operational mode	T	$\overline{R_D}$	M/C	J	$\overline{K}$	$D_0 \sim D_3$	Q_0	Q_1	Q_2	Q_3	$\overline{Q_3}$
Direct reset	X	L	X	X	X	X	L	L	L	L	H
Right shift	↑	H	H	H	H	X	H	Q_0^0	Q_1^0	Q_2^0	$\overline{Q_2^0}$
	↑	H	H	L	L	X	L	Q_0^0	Q_1^0	Q_2^0	$\overline{Q_2^0}$
	↑	H	H	H	L	X	$\overline{Q_0^0}$	Q_0^0	Q_1^0	Q_2^0	$\overline{Q_2^0}$
	↑	H	H	L	H	X	Q_0^0	Q_0^0	Q_1^0	Q_2^0	$\overline{Q_2^0}$
Parallel read	↑	H	L	X	X	$D_0 \sim D_3$	D_0	D_1	D_2	D_3	$\overline{D_3}$

Note 1. ↑ : Transition from low to high (positive edge triggering)
Q^0 : Level of Q before the indicated steady-state input conditions were established
X : Irrelevant

ABSOLUTE MAXIMUM RATINGS ($T_a = -20 \sim +75°C$, unless otherwise noted)

Symbol	Parameter	Conditions	Limits	Unit
V_{CC}	Supply voltage		$-0.5 \sim +7$	V
V_I	Input voltage		$-0.5 \sim +15$	V
V_O	Output voltage	High-level output	$-0.5 \sim V_{CC}$	V
Topr	Operating free-air ambient temperature range		$-20 \sim +75$	°C
Tstg	Storage temperature range		$-65 \sim +150$	°C

RECOMMENDED OPERATING CONDITIONS ($T_a = -20 \sim +75°C$, unless otherwise noted)

Symbol	Parameter		Limits			Unit
			Min	Typ	Max	
V_{CC}	Supply voltage		4.75	5	5.25	V
I_{OH}	High-level output current	$V_{OH} \geqq 2.7V$	0		-400	μA
I_{OL}	Low-level output current	$V_{OL} \leqq 0.4V$	0		4	mA
		$V_{OL} \leqq 0.5V$	0		8	mA

ELECTRICAL CHARACTERISTICS ($T_a = -20 \sim +75°C$, unless otherwise noted)

Symbol	Parameter	Test conditions		Limits			Unit
				Min	Typ*	Max	
V_{IH}	High-level input voltage			2			V
V_{IL}	Low-level input voltage					0.8	V
V_{IC}	Input clamp voltage	$V_{CC} = 4.75V$, $I_{IC} = -18mA$				-1.5	V
V_{OH}	High-level output voltage	$V_{CC} = 4.75V$, $V_I = 0.8V$ $V_I = 2V$, $I_{OH} = -400\mu A$		2.7	3.4		V
V_{OL}	Low-level output voltage	$V_{CC} = 4.75V$	$I_{OL} = 4mA$		0.25	0.4	V
		$V_I = 0.8V, V_I = 2V$	$I_{OL} = 8mA$		0.35	0.5	V
I_{IH}	High-level input current	$V_{CC} = 5.25V$, $V_I = 2.7V$				20	μA
		$V_{CC} = 5.25V$, $V_I = 10V$				0.1	mA
I_{IL}	Low-level input current	$V_{CC} = 5.25V$, $V_I = 0.4V$				-0.4	mA
I_{OS}	Short-circuit output current (Note 2)	$V_{CC} = 5.25V$, $V_O = 0V$		-20		-100	mA
I_{CC}	Supply current	$V_{CC} = 5.25V$ (Note 3)			14	21	mA

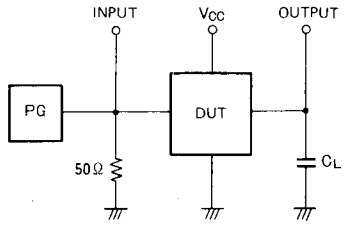
* : All typical values are at $V_{CC} = 5V$, $Ta = 25°C$.
Note 2: All measurements should be done quickly and not more than one output should be shorted at a time.
Note 3: I_{CC} is measured with M/C at 0V, J, $\overline{K}$ and $D_0 \sim D_3$ at 4.5V, with $\overline{R_D}$ kept at 4.5V after changing from 0V and after changing T from 0V to 4.5V.

4-BIT PARALLEL-ACCESS SHIFT REGISTER WITH RESET

SWITCHING CHARACTERISTICS (V_{CC}=5V, T_a=25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
f_{max}	Maximum clock frequency	C_L=15pF (Note 4)	30	60		MHz
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input T to outputs $Q_0 \sim Q_3$, $\overline{Q_3}$			12	22	ns
t_{PHL}				12	26	ns
t_{PHL}	High-to-low-level output propagation time, from input $\overline{R_D}$ to output $Q_0 \sim Q_3$			14	30	ns
t_{PLH}	Low-to-high-level output propagation time, from input $\overline{R_D}$ to output $\overline{Q_3}$			12	30	ns

Note 4: Measurement circuit

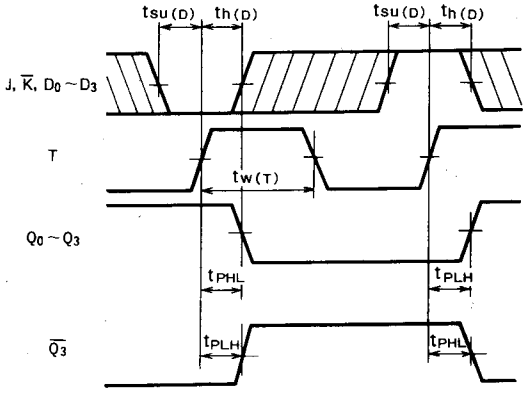


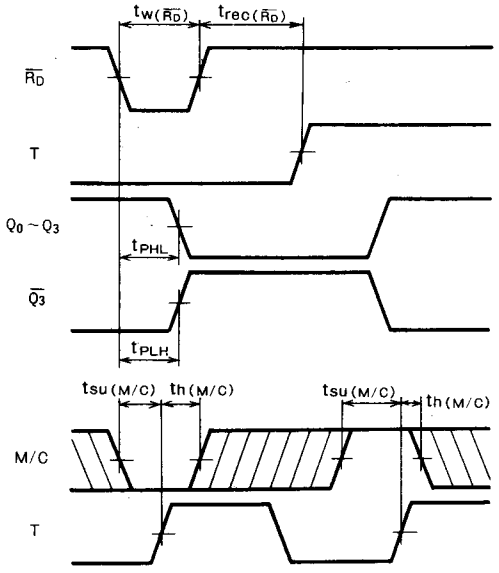
(1) The pulse generator has the following characteristics: PRR = 1MHz, t_r = 6ns, t_f = 6ns, t_w = 500ns, V_P = $3V_{P-P}$, Z_O = 50Ω.
(2) C_L includes probe and jig capacitance.

TIMING REQUIREMENTS (V_{CC}=5V, T_a=25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$t_{W(T)}$	Clock input T high pulse width		16	10		ns
$t_{W(\overline{R_D})}$	Direct reset $\overline{R_D}$ pulse width		12	6		ns
$t_{SU(D)}$	Setup time input data to T		15	3		ns
$t_{SU(M/C)}$	Setup time M/C to T		25	10		ns
$t_{h(D)}$	Hold time input data to T		3	−1		ns
$t_{h(M/C)}$	M/C hold time to T		0	−7		ns
$t_{rec(\overline{R_D})}$	Direct reset recovery time to T		25	5		ns

TIMING DIAGRAM (Reference level = 1.3V)





Note 5: The shaded areas indicate when the input is permitted to change for predictable output performance.

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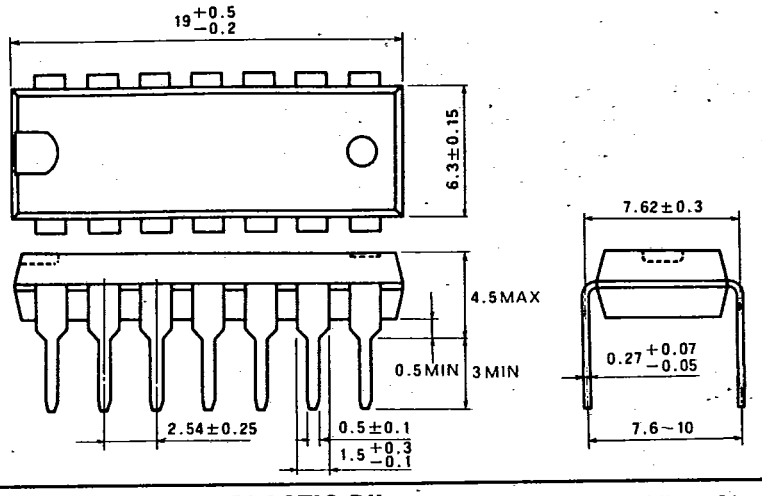
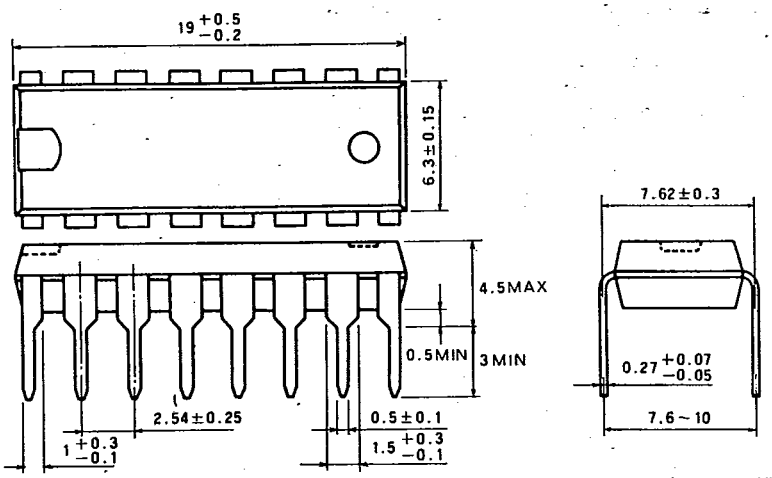
TYPE 14P4 14-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 20P4 20-PIN MOLDED PLASTIC DIL

Dimension in mm