

MITSUBISHI LSTTLs
M74LS194AP

4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER WITH RESET

DESCRIPTION

The M74LS194AP is a semiconductor integrated circuit with a 4-bit bidirectional serial/parallel input-serial/parallel output shift register functions.

FEATURES

- Synchronous serial/parallel input-serial/parallel/output
- Right shift and left shift functions
- Mode control input provided
- Direct reset input provided
- Hold mode function
- Wide operating temperature range ($T_a = -20 \sim +75^\circ\text{C}$)

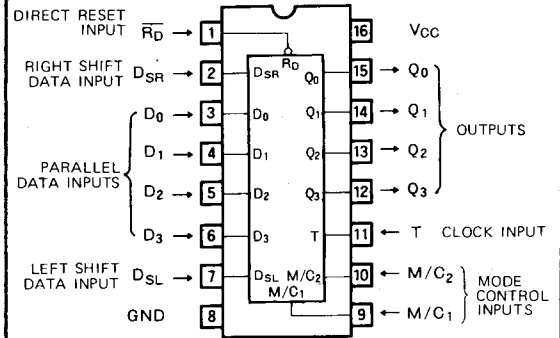
APPLICATION

General purpose, for use in industrial and consumer equipment.

FUNCTIONAL DESCRIPTION

This device is usable as a serial input-serial/parallel output and parallel input-serial/parallel output shift register with the modes control inputs M/C_1 and M/C_2 . When M/C_1 is kept in high and M/C_2 in low, the serial data are applied to right shift data input D_{SR} and the clock pulse is applied to clock input T, the serial data are shifted sequentially to outputs $Q_0 \sim Q_3$ in synchronization with the clock pulse. When M/C_1 is kept in low and M/C_2 in high the serial data are applied to left shift data input D_{SL} and clock pulse is applied to clock input T, the serial data are shifted sequentially in synchronization with the clock pulse. The $D_0 \sim D_3$ signal appears in $Q_0 \sim Q_3$ by keeping M/C_1 and M/C_2 in high, applying the parallel data to parallel data inputs $D_0 \sim D_3$ and applying a 1-bit clock pulse to clock input T. When both M/C_1 and M/C_2 are kept in low, the status of the flip-flops does not change even if the clock

PIN CONFIGURATION (TOP VIEW)

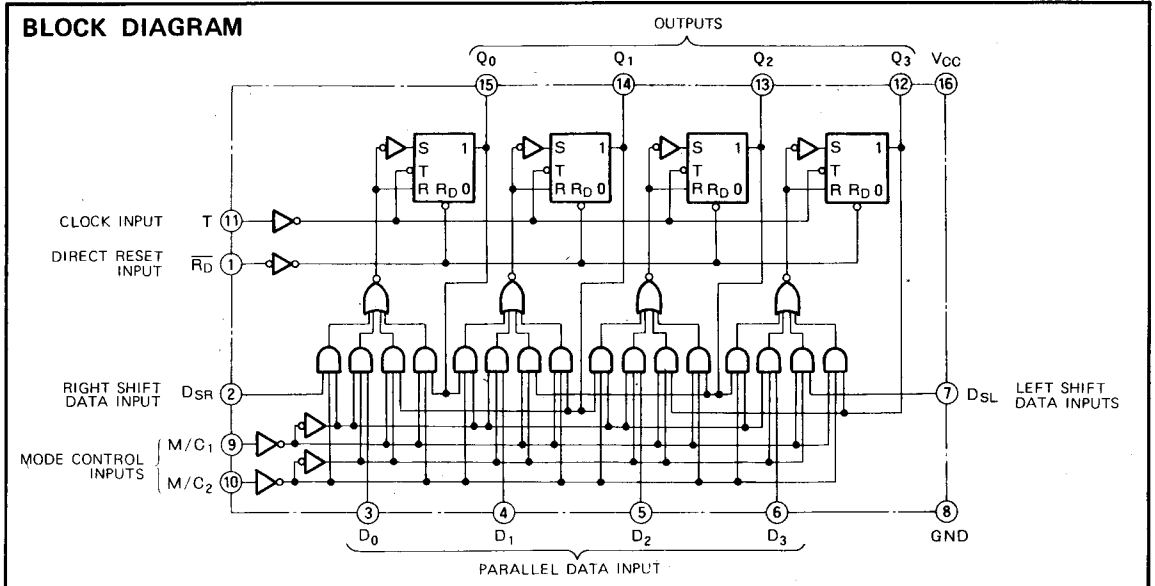


Outline 16P4

pulse is applied to the clock input T.

When T changes from low to high, the right shift, left shift or parallel data are read in. $Q_0 \sim Q_3$ are set low by setting direct reset input \bar{R}_D low irrespective of the status of the other input signals.

BLOCK DIAGRAM



4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER WITH RESET

FUNCTION TABLE (Note 1)

Operational mode	\overline{RD}	M/C ₁	M/C ₂	T	D _{SR}	D _{SL}	D ₀ ~D ₃	Q ₀	Q ₁	Q ₂	Q ₃
Direct reset	L	X	X	X	X	X	X	L	L	L	L
Right shift	H	H	L	↑	L	X	X	L	Q ₀ ⁰	Q ₁ ⁰	Q ₂ ⁰
	H	H	L	↑	H	X	X	H	Q ₀ ⁰	Q ₁ ⁰	Q ₂ ⁰
Left shift	H	L	H	↑	X	L	X	Q ₁ ⁰	Q ₂ ⁰	Q ₃ ⁰	L
	H	L	H	↑	X	H	X	Q ₁ ⁰	Q ₂ ⁰	Q ₃ ⁰	H
Parallel read	H	H	H	↑	X	X	D ₀ ~D ₃	D ₀	D ₁	D ₂	D ₃
Clock inhibit	H	L	L	X	X	X	X	Q ₀ ⁰	Q ₁ ⁰	Q ₂ ⁰	Q ₃ ⁰

Note 1. ↑ : Transition from low to high (positive edge trigger)

Q⁰ : Level of Q before the indicated steady-state input conditions were established

X : Irrelevant

ABSOLUTE MAXIMUM RATINGS (Ta = -20 ~ +75°C, unless otherwise noted)

Symbol	Parameter	Conditions	Limits	Unit
V _{CC}	Supply voltage		-0.5 ~ +7	V
V _I	Input voltage		-0.5 ~ +15	V
V _O	Output voltage	High-level state	-0.5 ~ V _{CC}	V
T _{opr}	Operating free-air ambient temperature range		-20 ~ +75	°C
T _{stg}	Storage temperature range		-65 ~ +150	°C

RECOMMENDED OPERATING CONDITIONS (Ta = -20 ~ +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} ≥ 2.7V	0	-400	μA
I _{OL}	Low-level output current	V _{OL} ≤ 0.4V	0	4	mA
		V _{OL} ≤ 0.5V	0	8	mA

ELECTRICAL CHARACTERISTICS (Ta = -20 ~ +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} = -400μA	2.7	3.4		V
V _{OL}	Low-level output voltage	V _{CC} = 4.75V		0.25	0.4	V
		V _I = 0.8V, V _I = 2V I _{OL} = 4mA 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)		15	23	mA

* : All typical values are at V_{CC} = 5V, Ta = 25°C.

Note 2: All measurements must be done quickly and not more than one output should be shorted at a time.

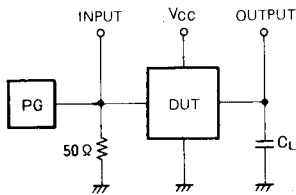
Note 3: I_{CC} is measured after D₀~D₃ have been set to 0V, D_{SR}, D_{SL}, M/C₁, M/C₂ and \overline{RD} to 4.5V and T to 4.5V from 0V.

4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER WITH RESET

SWITCHING CHARACTERISTICS ($V_{CC}=5V$, $T_a=25^\circ C$, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
f_{max}	Maximum clock frequency	$C_L = 15pF$ (Note 4)	25	45		MHz
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input T to outputs $Q_0 \sim Q_3$			10	22	ns
t_{PHL}	High-to-low-level output propagation time, from input \bar{R}_D to outputs $Q_0 \sim Q_3$			12	26	ns
t_{PHL}	High-to-low-level output propagation time, from input \bar{R}_D to outputs $Q_0 \sim Q_3$			8	30	ns

Note 4: Measurement circuit

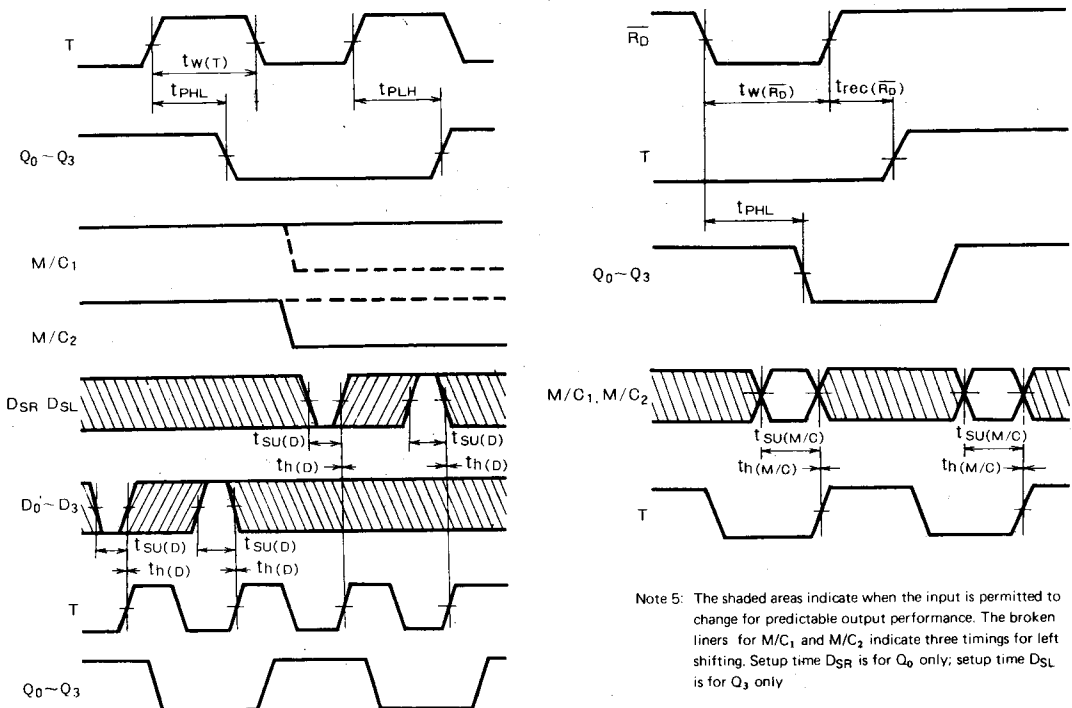


- (1) The pulse generator (PG) has the following characteristics:
 $PRR = 1MHz$, $t_r = 6ns$, $t_f = 6ns$, $t_w = 500ns$,
 $V_p = 3V_{p.p.}$, $Z_0 = 50\Omega$.
- (2) C_L includes probe and jig capacitance.

TIMING REQUIREMENTS ($V_{CC}=5V$, $T_a=25^\circ C$, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$t_w(T)$	Clock input T high pulse width		20	5		ns
$t_w(\bar{R}_D)$	Direct reset input \bar{R}_D pulse width		20	6		ns
$t_{su}(D)$	Setup time D to T		20	7		ns
$t_{su}(M/C)$	Setup time M/C ₁ , M/C ₂ to T		30	12		ns
$t_h(D)$	Hold time D to T		0	-3		ns
$t_h(M/C)$	Hold time M/C ₁ , M/C ₂ to T		0	-6		ns
$t_{rec}(\bar{R}_D)$	Recovery time to direct reset		25	3		ns

TIMING DIAGRAM (Reference level = 1.3V)

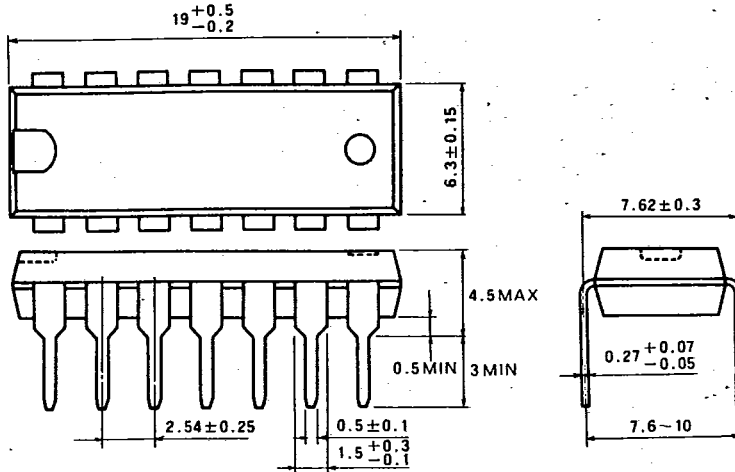


Note 5: The shaded areas indicate when the input is permitted to change for predictable output performance. The broken liners for M/C₁ and M/C₂ indicate three timings for left shifting. Setup time D_{SR} is for Q_0 only; setup time D_{SL} is for Q_3 only.

T-90-20

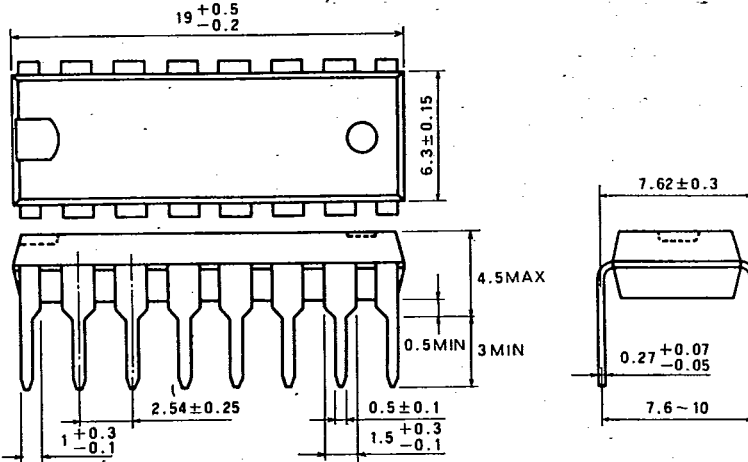
TYPE 14P4 14-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 20P4 20-PIN MOLDED PLASTIC DIL

Dimension in mm

