

MITSUBISHI LSTTLs
M74LS164P

8-BIT SERIAL-IN PARALLEL-OUT SHIFT REGISTER

DESCRIPTION

The M74LS164P is a semiconductor integrated circuit containing an 8-bit serial input-serial/parallel output shift register function with direct reset input.

FEATURES

- Serial input-serial/parallel output
- Direct reset input provided
- 8-bit for high space factor
- Input load factor of 1 for each input
- Wide operating temperature range ($T_a = -20 \sim +75^\circ\text{C}$)

APPLICATION

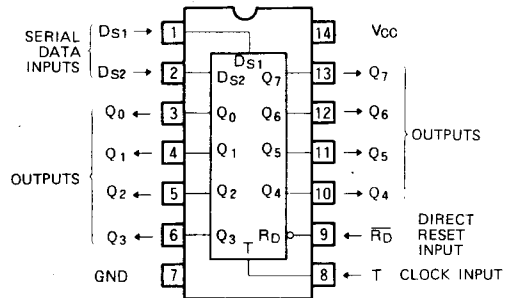
General purpose, for use in industrial and consumer equipment.

FUNCTIONAL DESCRIPTION

This device is configured with 9 D-type edge-triggered flip-flops and the serial data inputs D_{S1} and D_{S2} logic product $D_{S1} \times D_{S2}$ represents the first-stage flip-flop data input. Outputs $Q_0 \sim Q_7$ are taken out from the flip-flop Q outputs. When D_{S1} and D_{S2} are both high and the clock pulse is applied to T, the high signal is shifted in sequence into $Q_0, Q_1 \dots Q_7$. When either D_{S1} or D_{S2} or both are low and the clock pulse is applied to T, the low signal is shifted into $Q_0, Q_1 \dots Q_7$ in sequence. Shifting is performed when T changes from low to high.

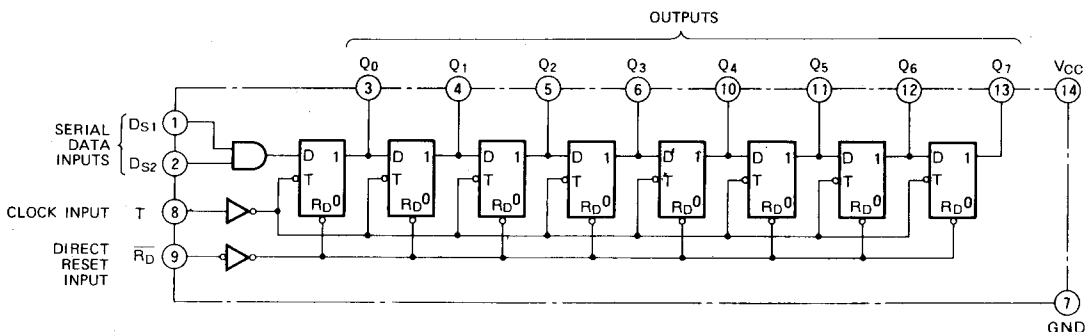
When the direct reset input R_D is set low, all the outputs are reset low irrespective of the other input signals. R_D should be kept at high when using this device as a shift register.

PIN CONFIGURATION (TOP VIEW)



Outline 14P4

BLOCK DIAGRAM



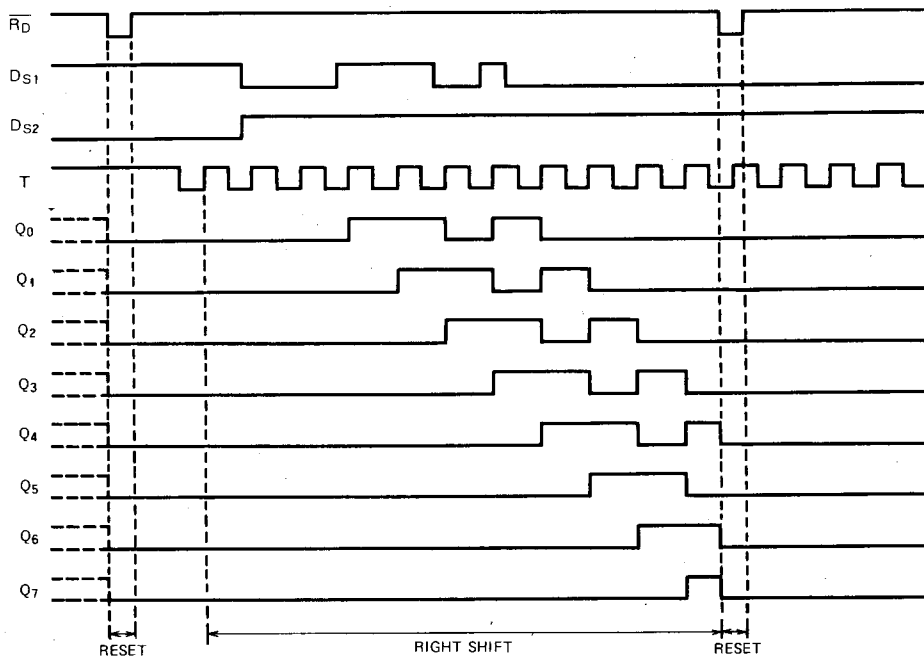
8-BIT SERIAL-IN PARALLEL-OUT SHIFT REGISTER

FUNCTION TABLE (Note 1)

Operational mode	$\overline{R_D}$	T	DS1	DS2	Q ₀	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇
Reset	L	X	X	X	L	L	L	L	L	L	L	L
Right shift	H	↑	L	L	L	Q ₀ ⁰	Q ₁ ⁰	Q ₂ ⁰	Q ₃ ⁰	Q ₄ ⁰	Q ₅ ⁰	Q ₆ ⁰
	H	↑	H	L	L	Q ₀ ⁰	Q ₁ ⁰	Q ₂ ⁰	Q ₃ ⁰	Q ₄ ⁰	Q ₅ ⁰	Q ₆ ⁰
	H	↑	L	H	L	Q ₀ ⁰	Q ₁ ⁰	Q ₂ ⁰	Q ₃ ⁰	Q ₄ ⁰	Q ₅ ⁰	Q ₆ ⁰
	H	↑	H	H	L	Q ₀ ⁰	Q ₁ ⁰	Q ₂ ⁰	Q ₃ ⁰	Q ₄ ⁰	Q ₅ ⁰	Q ₆ ⁰

Note 1 ↑ : Transition from low to high (positive edge trigger)
Q⁰ : Level of output before the change from low to high
X : Irrelevant

OPERATION TIMING DIAGRAM



ABSOLUTE MAXIMUM RATINGS (T_a = -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 (T_a = -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

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ELECTRICAL CHARACTERISTICS (Ta = -20 ~ +75°C, unless otherwise noted)

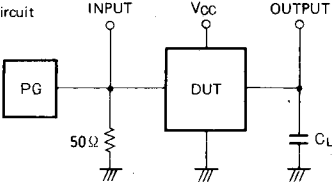
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ *	Max	
V _{IH}	High-level input voltage		2			V
V _{IL}	Low-level input voltage				0.8	V
V _{IC}	Input clamp voltage	V _{CC} = 4.75V, I _{IC} = -18mA			-1.5	V
V _{OH}	High-level output voltage	V _{CC} = 4.75V, V _I = 0.8V V _I = 2V, I _{OH} = -400μA	2.7	3.5		V
V _{OL}	Low-level output voltage	V _{CC} = 4.75V V _I = 0.8V, V _I = 2V		0.25	0.4	V
		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 V _{CC} = 5.25V, V _I = 10V			20 0.1	μA 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)		16	27	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 D_{S1} and D_{S2} at 0V, 4.5V applied to T after R_D has been set from 0V to 4.5V.

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

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
f _{max}	Maximum clock frequency		25	50		MHz
t _{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input T to outputs Q ₀ ~ Q ₇	C _L = 15pF (Note 4)		13	27	ns
t _{PHL}	High-to-low-level, high-to-low-level output propagation time, from input T to outputs Q ₀ ~ Q ₇			14	32	ns
t _{PHL}	Low-to-high-level, high-to-low-level output propagation time, input R _D to outputs Q ₀ ~ Q ₇			18	36	ns

Note 4: Measurement circuit

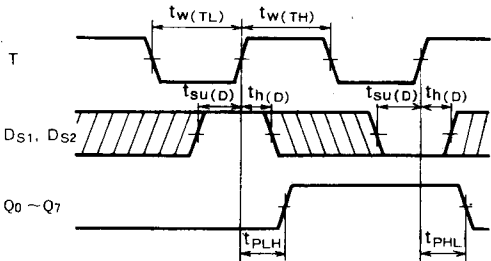
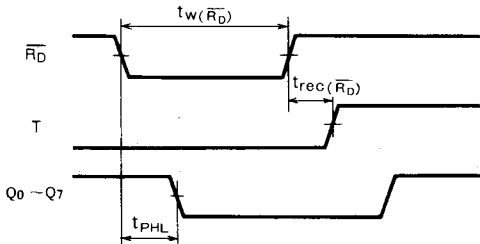


- (1) The pulse generator (PG) has the following characteristics:
PRR=1MHz, t_r=6ns, t_f=6ns, t_w=500ns, V_p=3V_{p-p}, Z_o=50Ω.
(2) C_L includes probe and jig capacitance

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

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
t _w (T _H)	Clock input T high pulse width		20	8		ns
t _w (T _L)	Clock input T low pulse width		20	10		ns
t _w (R _D)	Direct reset R _D pulse width		20	9		ns
t _{SU} (D)	Setup time D _{S1} , D _{S2} to T		15	3		ns
t _H (D)	Hold time D _{S1} , D _{S2} to T		5	2		ns
t _{rec} (R _D)	Recovery time R _D to T		20	-1		ns

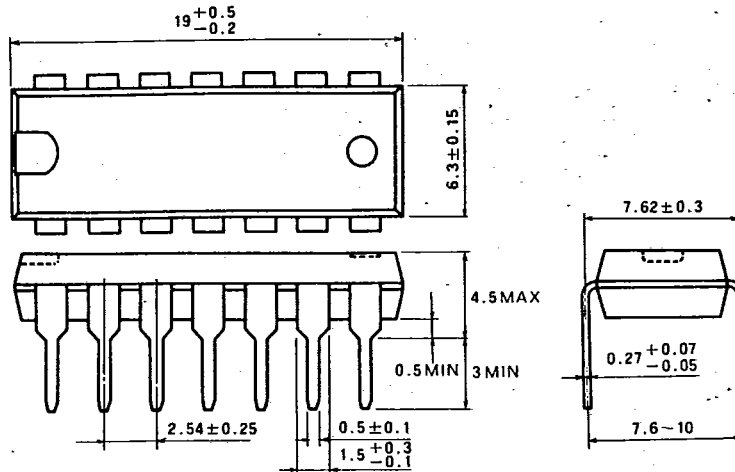
TIMING DIAGRAM (Reference level = 1.3V)



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

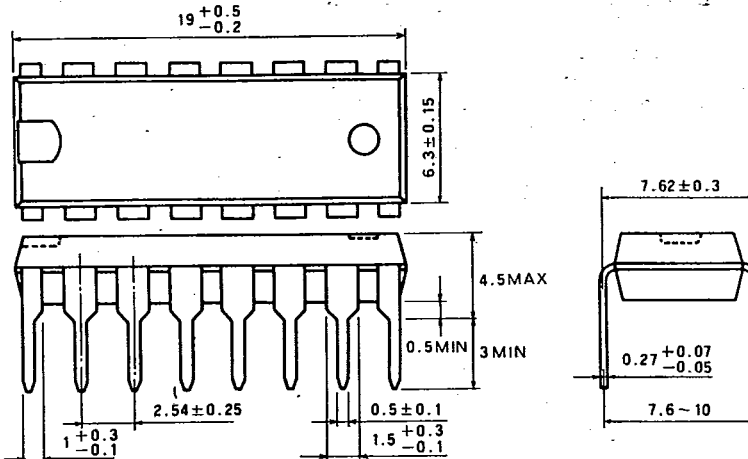
TYPE 14P4 14-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 20P4 20-PIN MOLDED PLASTIC DIL

Dimension in mm

