M74LS374P

OCTAL POSITIVE EDGE-TRIGGERED D-TYPE FLIP FLOPS WITH 3-STATE OUTPUTS

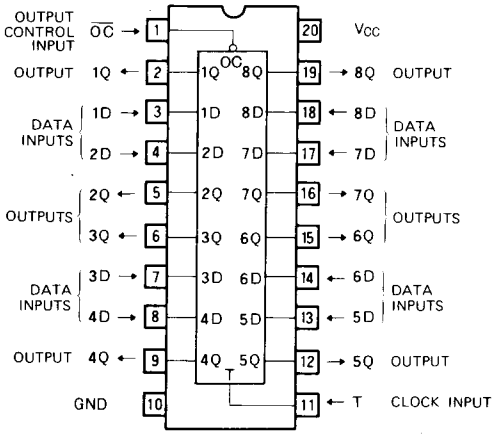
DESCRIPTION

The M74LS374P is a semiconductor integrated circuit containing 8 D-type positive edge-triggered flipflop circuits with 3-state output, and is provided with an output control input and a clock input, which are common to all the circuits.

FEATURES

- Positive edge triggering
- 3-state, high fan-out output
- The use of pnp transistor input for the output control and clock inputs has made the input load factor small
- The clock input has high noise margin. (Hysterisis = 400mV typical)
- Package density is high with 8 circuits in one package
- Provided with output control and clock inputs which are common to all 8 circuits.
- Wide operating temperature range (T_a = -20 ~ +75°C)

PIN CONFIGURATION (TOP VIEW)



Outline 20P4

APPLICATION

General purpose, for use in industrial and consumer equipment.

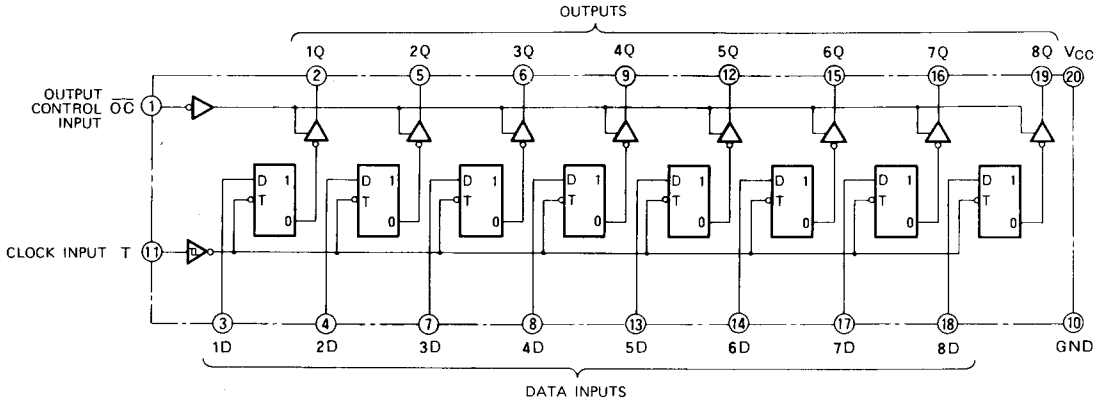
FUNCTIONAL DESCRIPTION

Since the 8 D-type ege-triggered flip-flop circuits use a pnp transistor input for the output control input $\overline{OC}$ and clock input T, which are common to all 8 circuits, the input load factor is small. With a hysterisis of 400mV (typical) specially given to the input circuit T, noise margin is high.

When T changes from low to high, the information of data input D immediately before the change appears in the output Q in accordance with the function table.

When $\overline{OC}$ is high, 1Q – 8Q are all put into the high-inpedance state, irrespective of other input signals. Since all outputs have high fan-out, this device is suitable for use as a buffer register, I/O port, or bi-directional bus driver.

BLOCK DIAGRAM



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FUNCTION TABLE (Note 1)

$\overline{OC}$	T	D	Q
L	↑	H	H
L	↑	L	L
L	L	X	Q^0
H	X	X	Z

Note 1: ↑ : transition from low to high level
Q^0 : level of Q before the indicated steady-state input conditions were established
Z : high-impedance
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	Off-state	$-0.5 \sim +7$	V
Topr	Operating free-air ambient temperature range		$-20 \sim +75$	℃
Tstg	Storage temperature range		$-65 \sim +150$	℃

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	$V_{OH} \geq 2.4V$	0		−2.6	mA
I_{OL}	Low-level output current	$V_{OL} \leq 0.4V$	0		12	mA
		$V_{OL} \leq 0.5V$	0		24	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	$V_{CC} = 4.75V$, $V_I = 0.8V$ $V_I = 2V$, $I_{OH} = -2.6mA$		2.4	3.1		V
V_{OL}	Low-level output voltage	$V_{CC} = 4.75V$	$I_{OL} = 12mA$		0.25	0.4	V
		$V_I = 0.8V, V_I = 2V$	$I_{OL} = 24mA$		0.35	0.5	V
I_{OZH}	Off-state high-level output current	$V_{CC} = 5.25V$, $V_I = 2V$, $V_O = 2.7V$				20	μA
I_{OZL}	Off-state low-level output current	$V_{CC} = 5.25V$, $V_I = 2V$, $V_O = 0.4V$				−20	μA
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)	$V_{CC} = 5.25V$, $V_O = 0V$		−30		−130	mA
I_{CCZ}	Supply current, all outputs off	$V_{CC} = 5.25V$ (Note 3)			27	45	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.
3: I_{CCZ} is measured with OC input at 4.5V.

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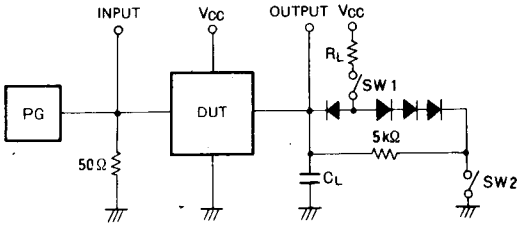
SWITCHING CHARACTERISTICS (V_{CC}=5V, Ta=25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
fmax	Maximum clock frequency	C_L=45pF (Note 4)	35	40		MHz
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input T to output 1Q~8Q			10	28	ns
t_{PHL}				13	28	ns
t_{PZH}	Output enable time to high-level	R_L=667Ω, C_L=45pF (Note 4)		14	28	ns
t_{PZL}	Output enable time to low-level	R_L=667Ω, C_L=45pF (Note 4)		14	28	ns
t_{PHZ}	Output disable time from high-level	R_L=667Ω, C_L= 5pF (Note 4)		16	20	ns
t_{PLZ}	Output disable time from low-level	R_L=667Ω, C_L= 5pF (Note 4)		8	25	ns

Note 4: Measurement circuit



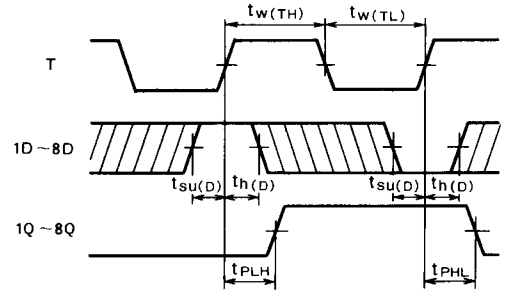
Symbol	SW1	SW2
t_{PZH}	Open	Closed
t_{PZL}	Closed	Open
t_{PLZ}	Closed	Closed
t_{PHZ}	Closed	Closed

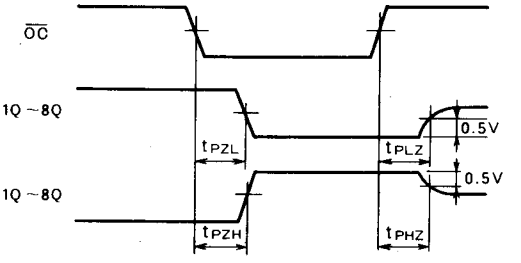
(1) The pulse generator (PG) has the following characteristics:
PRR = 1MHz, t_r = 6ns, t_f = 6ns, t_W = 500ns,
V_P = $3V_{P-P}$, Z_O = 50Ω
(2) All diodes are switching diodes ($t_{rr} \leqq$ 4ns)
(3) C_L includes probe and jig capacitance.

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

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$t_{W(TH)}$	Clock input T high pulse width		15	5		ns
$t_{W(TL)}$	Clock input T low pulse width		18	15		ns
$t_{SU(D)}$	Setup time 1D~8D to T		20	6		ns
$t_{h(D)}$	Hold time 1D~8D to T		4	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.

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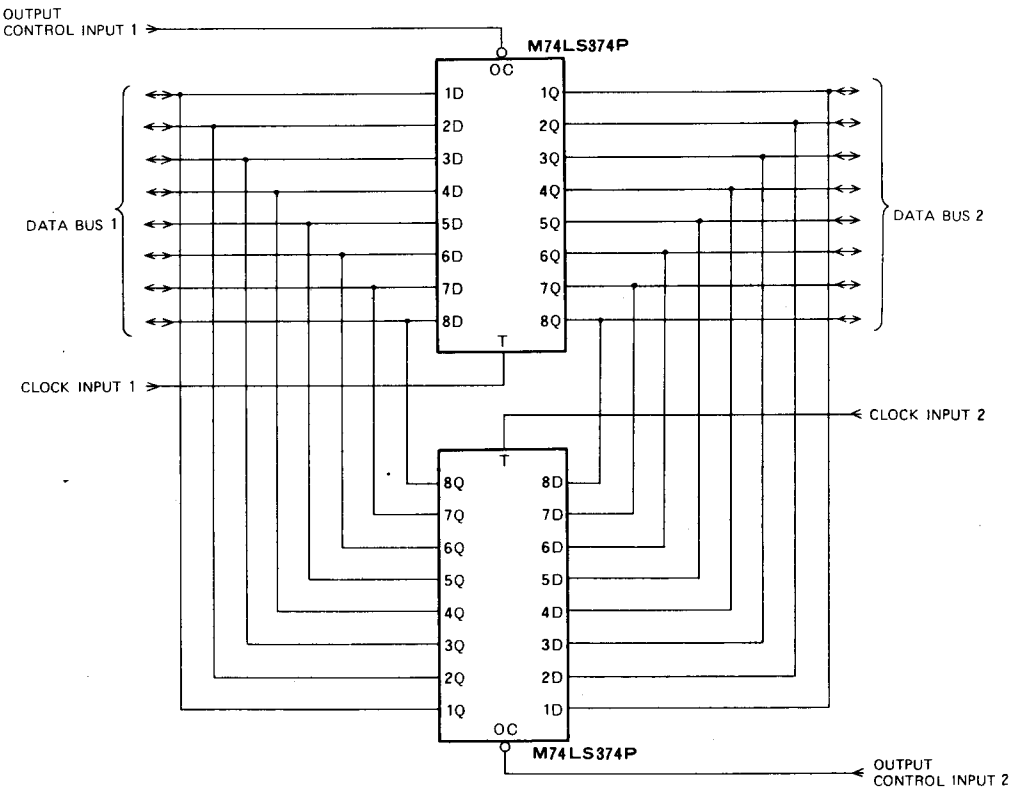
APPLICATION EXAMPLE

8-Bit shift register



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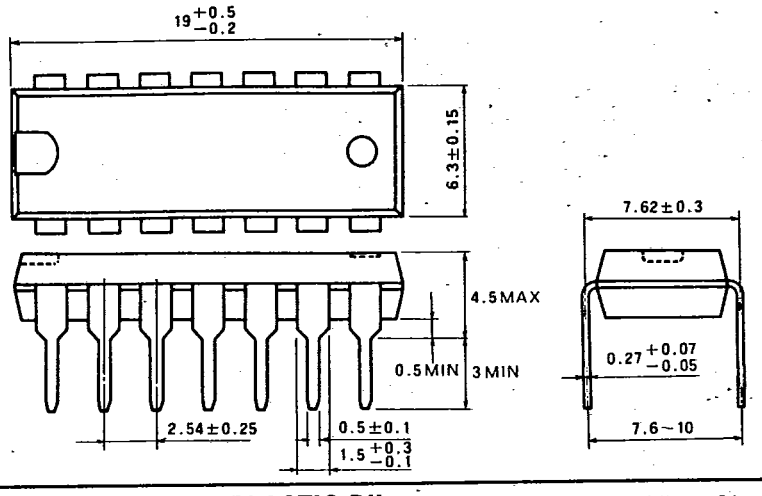
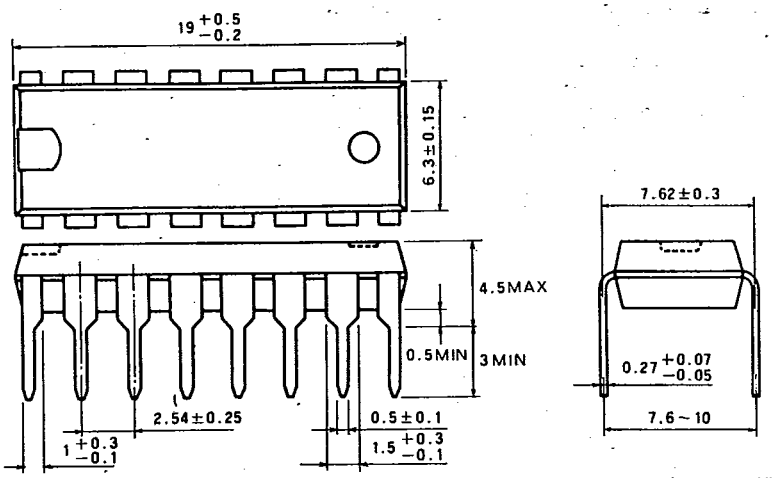
TYPE 14P4 14-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 20P4 20-PIN MOLDED PLASTIC DIL

Dimension in mm