M74LS393P

DUAL 4-BIT BINARY COUNTERS

DESCRIPTION

The M74LS393P is a semiconductor integrated circuit containing two 4-bit binary (hexadecimal) asynchronous counter circuits with direct reset inputs

FEATURES

- High package density with 2 circuits equivalent to LS93 or LS293
- 2 discrete direct reset inputs
- High-speed counting (f_{max} = 75MHz typical)
- Wide operating temperature range (T_a = -20 ~ +75°C)

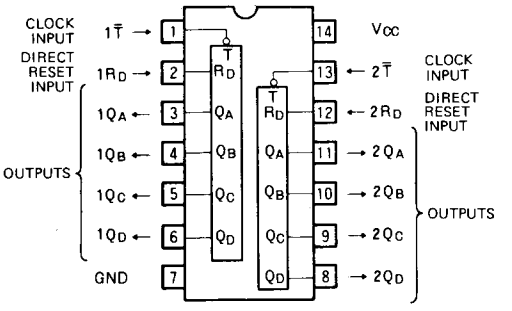
APPLICATION

General purpose, for use in industrial and consumer equipment.

FUNCTIONAL DESCRIPTION

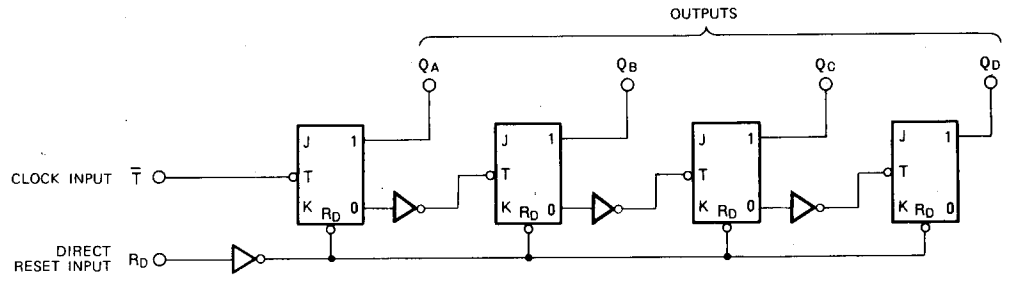
When a count pulse is fed to the clock input $\overline{T}$, pure binary code appear in at outputs Q_A, Q_B, Q_C, and Q_D. Counting is performed when $\overline{T}$ changes from high to low. Reset is affected by making the direct reset input R_D high. For use as a counter, hold R_D low.

PIN CONFIGURATION (TOP VIEW)



Outline 14P4

BLOCK DIAGRAM (EACH BLOCK)



DUAL 4-BIT BINARY COUNTERS

FUNCTION TABLE (Note 1)

$\overline{T}$	R_D	Q_A	Q_B	Q_C	Q_D
X	H	L	L	L	L
↓	L	Count			

Note 1: ↓ : transition from high to low-level
X : irrelevant

Count	Q_A	Q_B	Q_C	Q_D
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H
10	L	H	L	H
11	H	H	L	H
12	L	L	H	H
13	H	L	H	H
14	L	H	H	H
15	H	H	H	H

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

Symbol	Parameter	Conditions	Limits	Unit
V_{CC}	Supply voltage		$-0.5 \sim +7$	V
V_I	Input voltage	$\overline{T}$ input	$-0.5 \sim +5.5$	V
		R_D input	$-0.5 \sim +15$	
V_O	Output voltage	High-level state	$-0.5 \sim V_{CC}$	V
Topr	Operating free-air ambient temperature range		$-20 \sim +75$	°C
Tstg	Storage temperature range		$-65 \sim +150$	°C

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

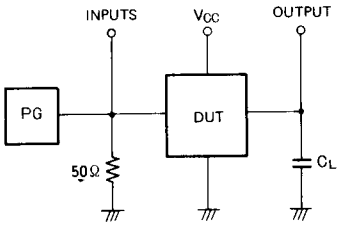
Symbol	Parameter		Test conditions		Limits			Unit
					Min	Typ*	Max	
V_{IH}	High-level input voltage				2			V
V_{IL}	Low-level input voltage						0.8	V
V_{IC}	Input clamp voltage		$V_{CC}=4.75V$, $I_{IC}=-18mA$				−1.5	V
V_{OH}	High-level output voltage		$V_{CC}=4.75V$, $V_I=0.8V$, $V_I=2V$, $I_{OH}=-400\mu A$		2.7	3.4		V
V_{OL}	Low-level output voltage		$V_{CC}=4.75V$, $V_I=0.8V$, $V_I=2V$	$I_{OL}=4mA$		0.25	0.4	V
				$I_{OL}=8mA$		0.35	0.5	V
I_{IH}	High-level input current	R_D	$V_{CC}=5.25V$, $V_I=2.7V$				20	μA
		$\overline{T}$					100	
		R_D	$V_{CC}=5.25V$, $V_I=10V$				0.1	mA
		$\overline{T}$	$V_{CC}=5.25V$, $V_I=5.5V$				0.2	mA
I_{IL}	Low-level input current	R_D	$V_{CC}=5.25V$, $V_I=0.4V$				−0.4	mA
		$\overline{T}$					−1.6	
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	26	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_{CC} is measured with $\overline{T}$ input grounded and a momentary 4.5V, then grounded, applied R_D input.

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)	25	75		MHz
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input $\overline{T}$ to output Q_A			8	20	ns
t_{PHL}				8	20	ns
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input $\overline{T}$ to output Q_D			36	60	ns
t_{PHL}				36	60	ns
t_{PHL}	High-to-low-level output propagation time, from input R_D to output Q_A, Q_B, Q_C, Q_D			11	39	ns

Note 4: Measurement circuit

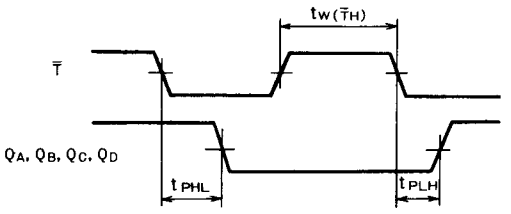


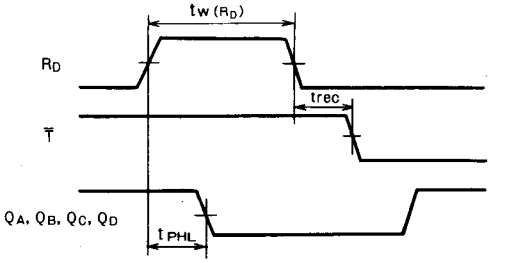
(1) The pulse generator (PG) has the following characteristics:
PRR = 1MHz, t_r = 6ns, t_f = 6ns, t_w = 500ns,
V_P = $3V_{P-P}$, Z_O = 50Ω
(2) C_L includes probe and jig capacitance.

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

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$t_{W(\overline{T}H)}$	Clock input $\overline{T}$ high pulse width		20	4		ns
$t_{W(R_D)}$	Direct reset input R_D pulse width		20	4		ns
t_r	Clock pulse rise time			400	100	ns
t_f	Clock pulse fall time			300	100	ns
$t_{rec(R_D)}$	Recovery time R_D to $\overline{T}$		25	7		ns

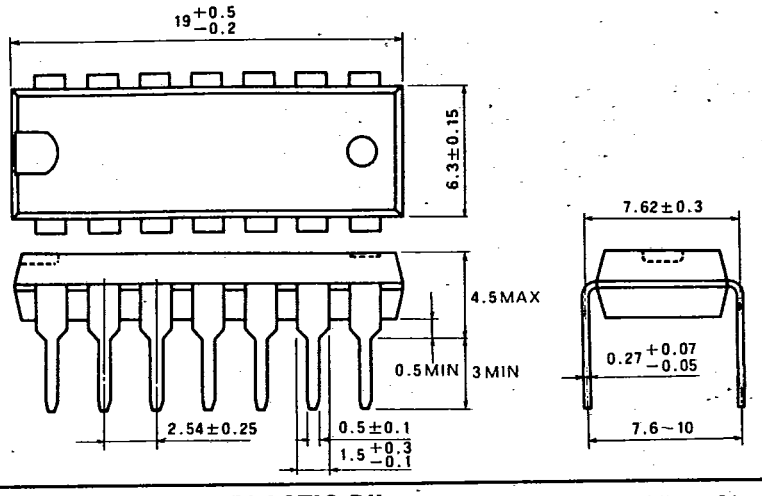
TIMING DIAGRAM (Reference level = 1.3V)





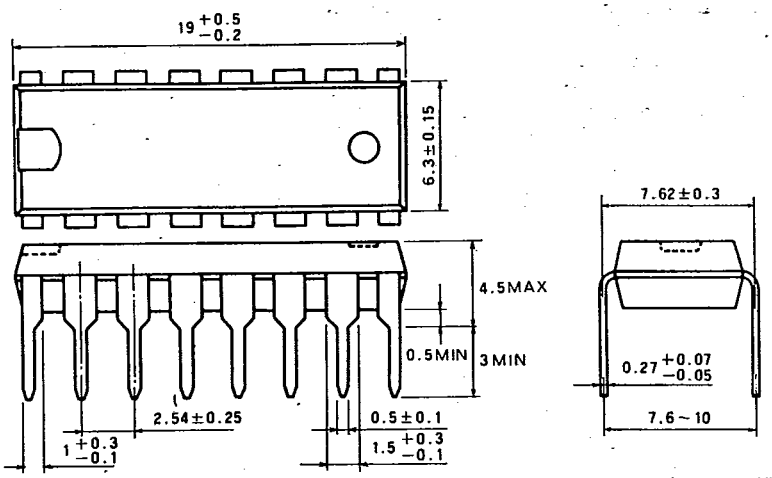
TYPE 14P4 14-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 20P4 20-PIN MOLDED PLASTIC DIL

Dimension in mm