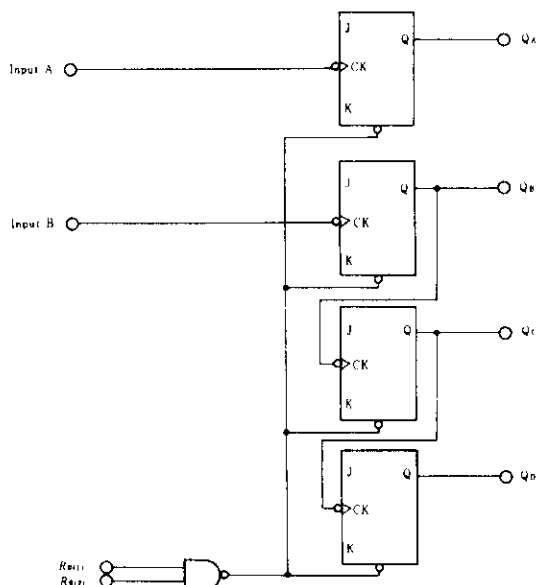


HD74LS93 4-bit Binary Counters

The HD74LS93 contains four master-slave flip-flops and additional gating to provide a divide-by-two counter and three-state binary counter for divide-by-eight. To use this maximum count length of this counter, the B input is connected to the Q_A output. The input count pulses are applied to the Q_A output. The input count pulses are described in the appropriate function table.

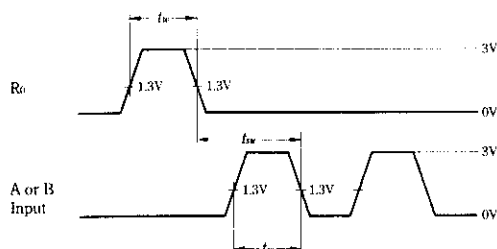
■ BLOCK DIAGRAM



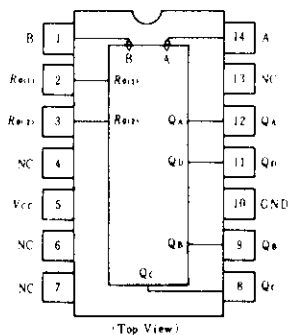
■ RECOMMENDED OPERATING CONDITIONS

Item	Symbol	min	typ	max	Unit
Count frequency	A input	0	—	32	MHz
	B input	0	—	16	
Pulse width	A input	15	—	—	ns
	B input	30	—	—	
	Reset inputs	15	—	—	
Setup time	t_{su}	25	—	—	ns

■ TIMING DEFINITION



■ PIN ARRANGEMENT



■ ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Ratings	Unit
Supply voltage	V_{CC}	7.0	V
Input voltage	R Inputs	7.0	V
	A, B Inputs	5.5	V
Operating temperature range	T_{opr}	-20 ~ +75	°C
Storage temperature range	T_{stg}	-65 ~ +150	°C

■ FUNCTION TABLE

● Reset/Count Function Table

Reset Inputs		Outputs			
R0(1)	R0(2)	QD	QC	QB	QA
H	H	L	L	L	L
L	X	Count			
X	L	Count			

● BCD Count Sequence (Notes 1)

Count	Outputs			
	QD	QC	QB	QA
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

Notes) 1. Output Q_A is connected to input B for BCD count.
2. H; high level, L; low level, X; irrelevant

■ ELECTRICAL CHARACTERISTICS ($T_a = -20 \sim +75^\circ\text{C}$)

Item	Symbol	Test Conditions	min	typ*	max	Unit		
Input voltage	V_{IH}		2.0	—	—	V		
	V_{IL}		—	—	0.8	V		
Output voltage	V_{OH}	$V_{CC}=4.75\text{V}, V_{IH}=2\text{V}, V_{IL}=0.8\text{V}, I_{OH}=-400\mu\text{A}$	2.7	—	—	V		
	V_{OL}	$V_{CC}=4.75\text{V}, V_{IH}=2\text{V}, V_{IL}=0.8\text{V}$	$I_{OL}=4\text{mA}^{**}$	—	—	0.4	V	
			$I_{OL}=8\text{mA}^{**}$	—	—	0.5		
Input current	Any Reset	I_{IL}	$V_{CC}=5.25\text{V}, V_I=0.4\text{V}$	—	—	-0.4	mA	
	A input			—	—	-2.4		
	B input			—	—	-1.6		
	Any Reset	I_{IH}	$V_{CC}=5.25\text{V}, V_I=2.7\text{V}$	—	—	20	μA	
	A input			—	—	40		
	B input			—	—	40		
	Any Reset	I_I	$V_{CC}=5.25\text{V}$	$V_I=7\text{V}$	—	—	0.1	mA
	A input			$V_I=5.5\text{V}$	—	—	0.2	
B input	$V_I=5.5\text{V}$			—	—	0.2		
Short-circuit output current	I_{OS}	$V_{CC}=5.25\text{V}$	-20	—	-100	mA		
Supply current	I_{CC}^{***}	$V_{CC}=5.25\text{V}$	—	9	15	mA		
Input clamp voltage	V_{IK}	$V_{CC}=4.75\text{V}, I_{IN}=-18\text{mA}$	—	—	-1.5	V		

* $V_{CC}=5\text{V}, T_a=25^\circ\text{C}$

** Q_A output is tested at specified I_{OL} plus the limit value of I_{IL} for the B input. This permits driving the B input while maintaining full fan-out capability.

*** I_{CC} is measured with all outputs open, both R_0 inputs grounded following momentary connection to 4.5V, and all other inputs grounded.

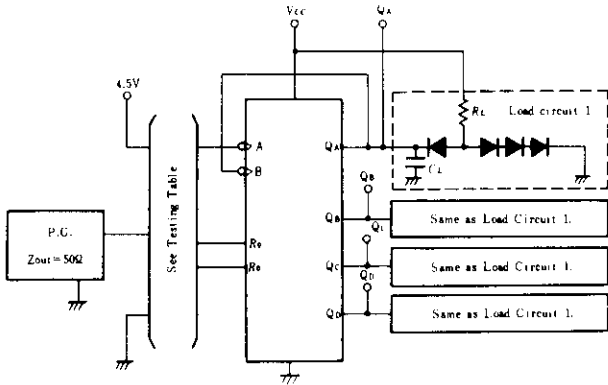
■ SWITCHING CHARACTERISTICS ($V_{CC}=5\text{V}, T_a=25^\circ\text{C}$)

Item	Symbol	Inputs	Outputs	Test Conditions	min	typ	max	Unit
Maximum count frequency	f_{max}	A	Q_A	$C_L=15\text{pF}, R_L=2\text{k}\Omega$	32	42	—	MHz
		B	Q_B		16	—	—	
Propagation delay time	t_{PLH}	A	Q_A		—	10	16	ns
	t_{PHL}				—	12	18	
	t_{PLH}	A	Q_D		—	46	70	ns
	t_{PHL}				—	46	70	
	t_{PLH}	B	Q_B		—	10	16	ns
	t_{PHL}				—	14	21	
	t_{PLH}	B	Q_C		—	21	32	ns
	t_{PHL}				—	23	35	
	t_{PLH}	B	Q_D	—	34	51	ns	
	t_{PHL}			—	34	51		
t_{PHL}		Set-to-0	$Q_A \sim Q_D$	—	26	40	ns	

HD74LS93

TESTING METHOD

1) Test Circuit



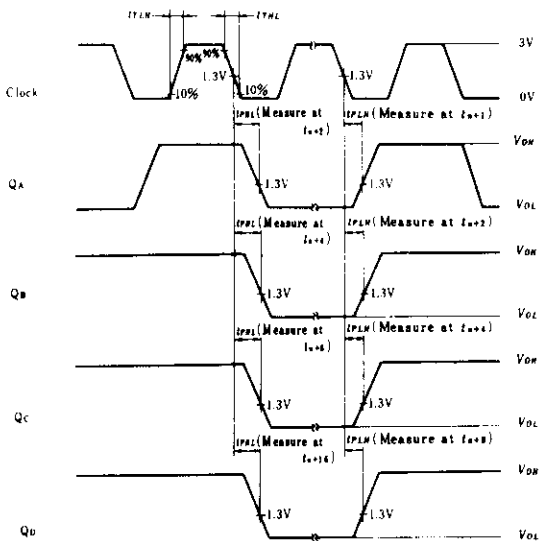
- Notes) 1. C_L includes probe and jig capacitance.
2. All diodes are 1S2074 (D).

2) Testing Table

Item	From input to output	Inputs			Outputs			
		A	B	R_0	Q_A	Q_B	Q_C	Q_D
f_{max}	A → Q	IN	to Q_A	GND	Out	Out	Out	Out
	B → Q	4.5V	IN	GND	—	Out	Out	Out
t_{PLH}	A → Q_A	IN	to Q_A	GND	Out	—	—	—
	A → Q_D	IN	to Q_A	GND	—	—	—	Out
t_{PHL}	B → Q_B	4.5V	IN	GND	—	Out	—	—
	B → Q_C	4.5V	IN	GND	—	—	Out	—
	B → Q_D	4.5V	IN	GND	—	—	—	Out
	$R_0^* \rightarrow Q$	IN*	to Q_A	IN	Out	Out	Out	Out

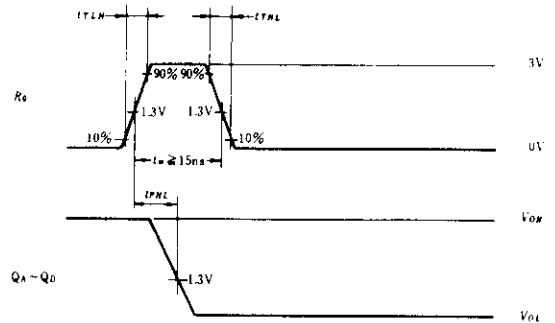
- * For initialized.
** Measured with each input and unused inputs at 4.5V.

Waveform-1 f_{max} , t_{PLH} , t_{PHL} , (Clock → Q)

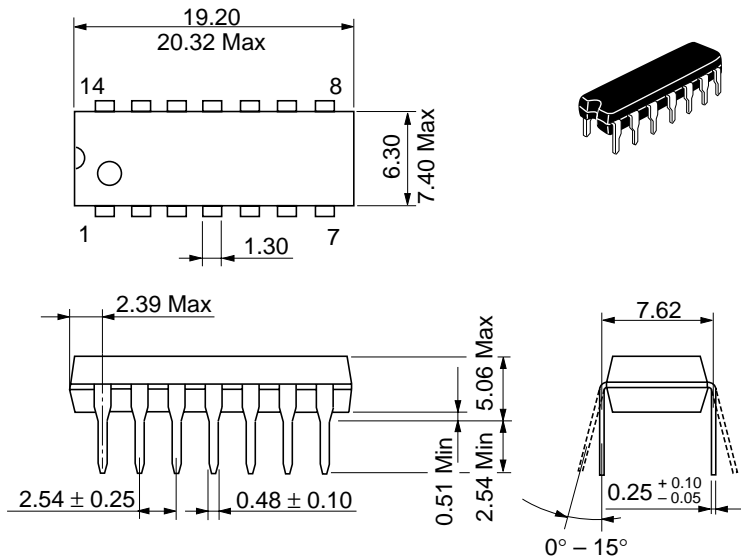


- Notes) 1. Input pulse; $t_{TLH} \leq 15ns$, $t_{THL} \leq 5ns$, $PRR=1MHz$, duty cycle=50% and for f_{max} , $t_{TLH}=t_{THL} \leq 2.5ns$.
2. t_H is reference bit time when all outputs are low.

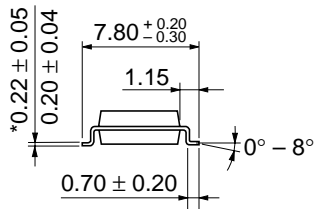
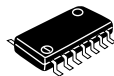
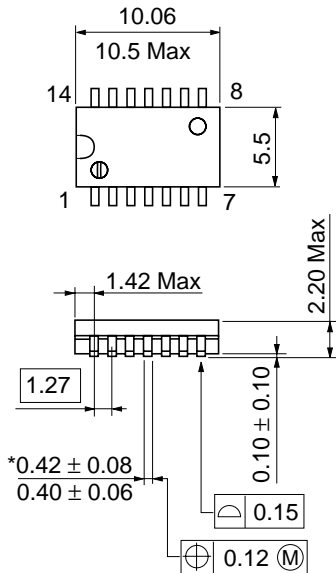
Waveform-2 $t_{PHL}(R_0 \rightarrow Q)$



- Notes) 1. $t_{TLH} \leq 15ns$, $t_{THL} \leq 5ns$.

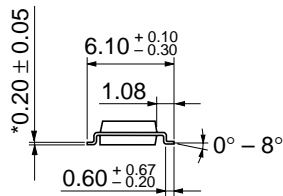
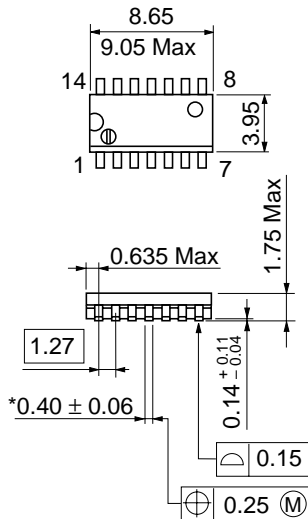


Hitachi Code	DP-14
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.97 g



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-14DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.23 g



Hitachi Code	FP-14DN
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EIAJ	Conforms
Weight (reference value)	0.13 g

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