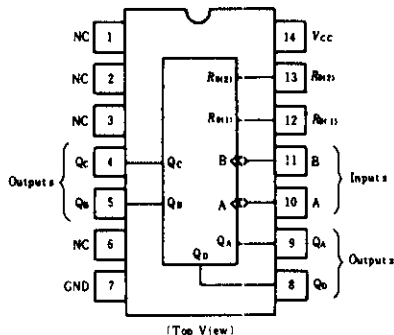


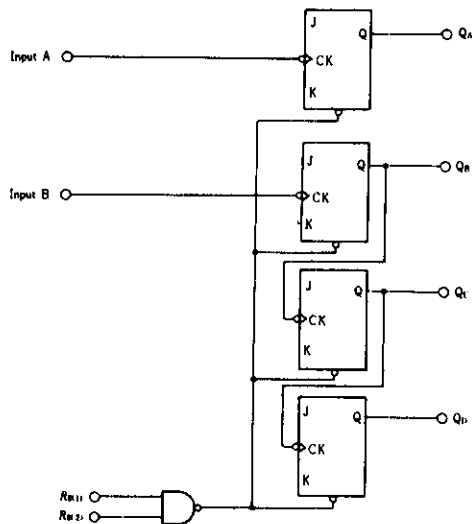
# HD74LS293 ● 4-bit Binary Counters

This counter contains four master-slave flip-flops and additional gating to provide a divide-by-two counter and divide-by-eight counter. This counter has a gated zero reset. To use the maximum count length of this counter, the B input is connected to the  $Q_A$  output. The input count pulses are applied to input A and the outputs are as described in the appropriate function table.

## ■ PIN ARRANGEMENT



## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Ratings	Unit
Supply voltage	$V_{CC}$	7.0	V
Input voltage	$R_0$ Inputs	7.0	V
	A, B Inputs	5.5	V
Operating temperature range	$T_{op}$	-20 ~ +75	°C
Storage temperature range	$T_{stg}$	-65 ~ +150	°C

## ■ FUNCTION TABLE

### ● Reset/Count

Reset Input		Outputs			
$R_{0(1)}$	$R_{0(2)}$	$Q_D$	$Q_C$	$Q_B$	$Q_A$
H	H	L	L	L	L
L	X	Count			
X	L	Count			

### ● BCD Count Sequence

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

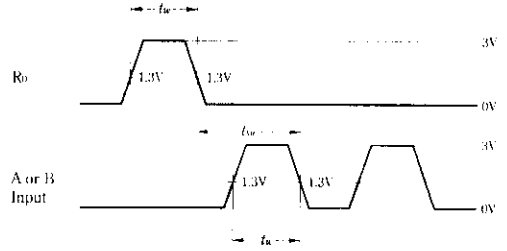
- Notes) 1. H; high level, L; low level, X; irrelevant.  
2. Output  $Q_A$  is connected to input B.

# HD74LS293

## RECOMMENDED OPERATING CONDITIONS

Item	Symbol	min	typ	max	Unit	
Output current	$I_{OH}$	—	—	-400	$\mu A$	
Output current	$I_{OL}$	—	—	8	mA	
Count frequency	A input	$f_{count}$	0	—	32	MHz
	B input		0	—	16	
Pulse width	A input	$t_w$	15	—	—	ns
	B input		30	—	—	
	Reset inputs		15	—	—	
Setup time	$t_{su}$	25	—	—	ns	

## TIMING DEFINITION



## ELECTRICAL CHARACTERISTICS ( $T_a = -20 \sim +75^\circ C$ )

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

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

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

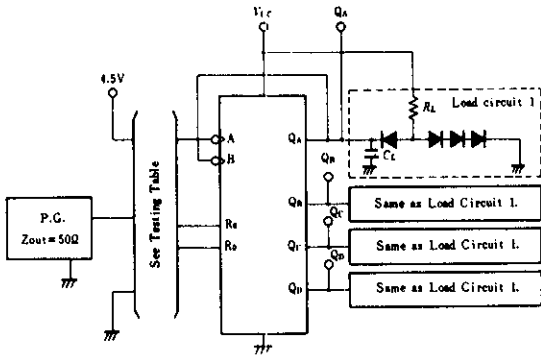
\*\*\*  $I_{CC}$  is measured with all outputs open, both  $R_0$  inputs grounded following momentary connection to 4.5V, and all other inputs grounded.

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

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

## TESTING METHOD

### 1) Test Circuit



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

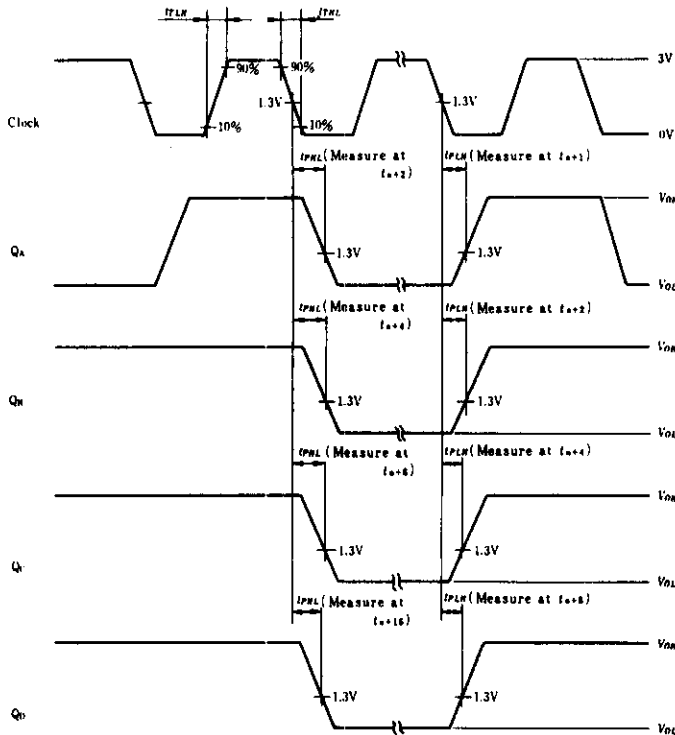
### 2) Testing Table

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
	$R_0$ → $Q^{**}$	IN*	to $Q_A$	IN	OUT	OUT	OUT	OUT

\* For initialized.

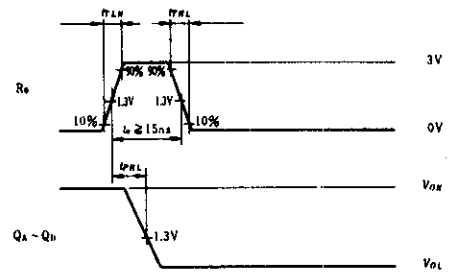
\*\* Measured with each input and unused inputs at 4.5V.

### Waveform 1. $f_{max}$ , $t_{PLH}$ , $t_{PHL}$ (Clock→Q)

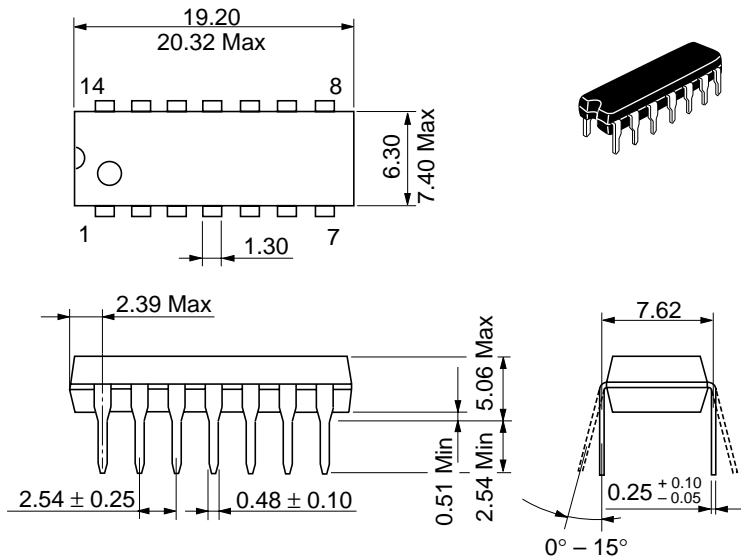


- Notes) 1. Input pulse:  $t_{TLH} \leq 15ns$ ,  $t_{THL} \leq 5ns$ ,  $PRR=1MHz$ , duty cycle=50% and: for  $f_{max}$ ,  $t_{TLH} = t_{THL} \leq 2.5ns$ .  
2.  $t_m$  is reference bit time when all outputs are low.

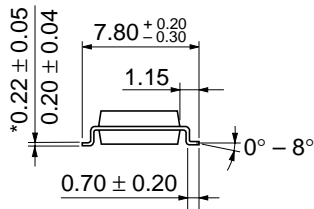
### Waveform 2. $t_{PHL}$ ( $R_0$ →Q)



Note)  $t_{TLH} \leq 15ns$ ,  $t_{THL} \leq 5ns$

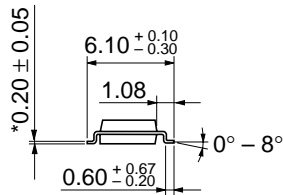
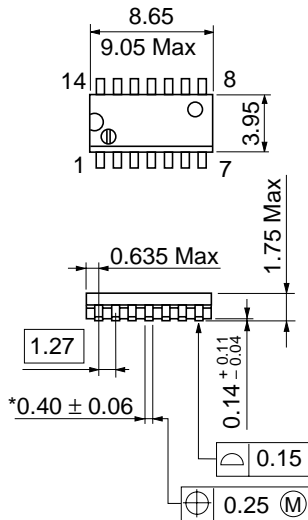


Hitachi Code	DP-14
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.97 g



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

\*Dimension including the plating thickness  
Base material dimension



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

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