HD74LS293 ●4-bit Binary Counters

PCB   24

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.

■BLOCK DIAGRAM

■PIN ARRANGEMENT

[Top View]
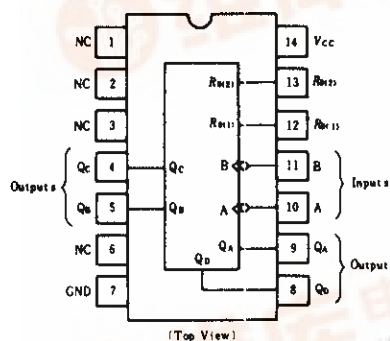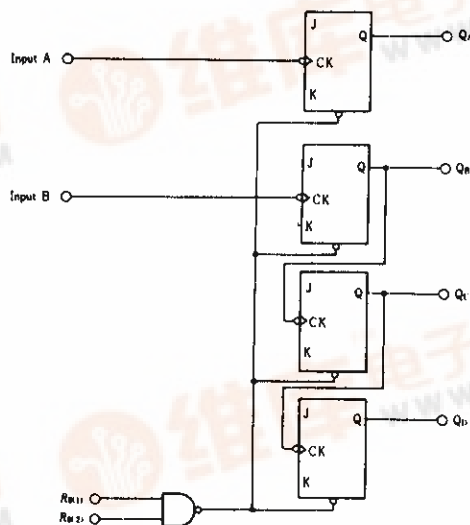
■ABSOLUTE MAXIMUM RATINGS

Item		Symbol	Ratings	Unit
Supply voltage		V_{CC}	7.0	V
Input voltage	R_0 Inputs	V_{IN}	7.0	V
	A, B Inputs		5.5	V
Operating temperature range		T_{opr}	$-20 \sim +75$	℃
Storage temperature range		T_{stg}	$-65 \sim +150$	℃

■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	×	Count			
×	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	μA
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
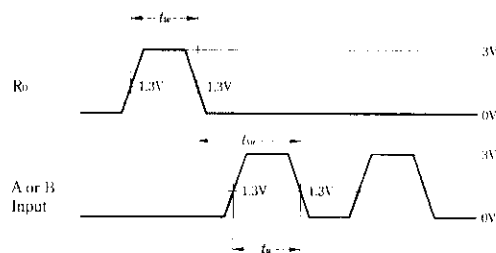
■ELECTRICAL CHARACTERISTICS ($Ta=-20\sim+75$℃)

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

* $V_{CC}=5$V, $Ta=25$℃
** 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 ($V_{CC}=5$V, $Ta=25$℃)

Item	Symbol	Inputs	Outputs	Test Conditions	min	typ	max	Unit
Maximum count frequency	f_{max}	A	Q_A		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	$C_L=15$pF, $R_L=2$kΩ	—	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

■TESTING METHOD

1) Test Circuit
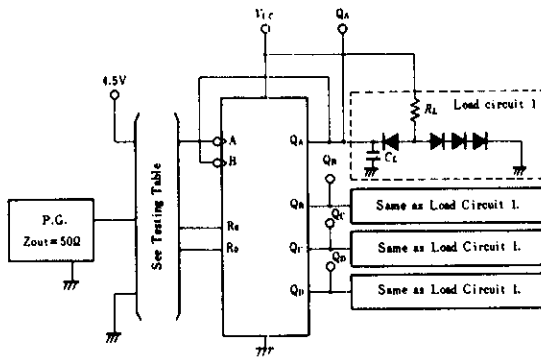
Notes) 1. C_L includes probe and jig capacitance.
2. All diodes are 1S2074 ⒣.

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
	A→Q_A	IN	to Q_A	GND	OUT	—	—	—
	A→Q_D	IN	to Q_A	GND	—	—	—	OUT
t_{PLH}	B→Q_B	4.5V	IN	GND	—	OUT	—	—
t_{PHL}	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)
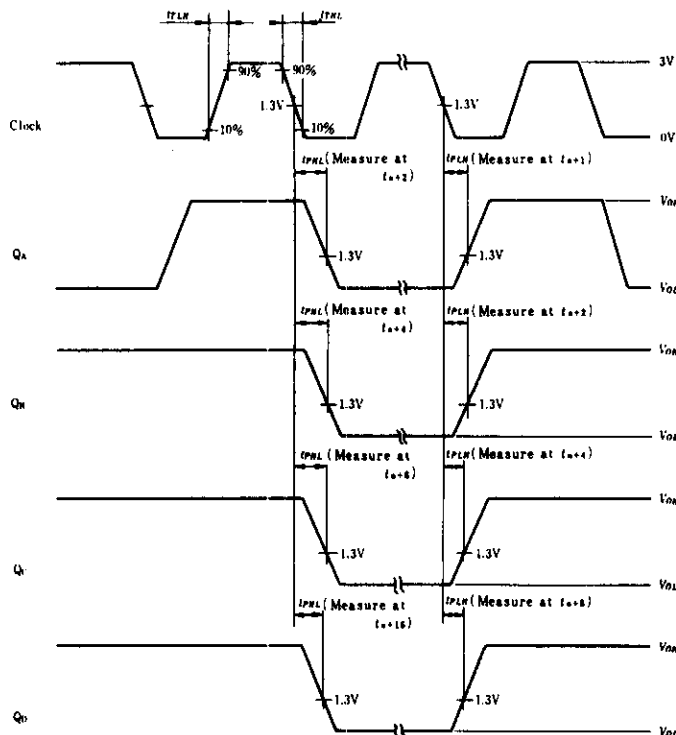
Notes) 1. Input pulse: $t_{TLH}≦15$ns, $t_{THL}≦5$ns, PRR=1MHz, duty cycle=50% and: for f_{max}, $t_{TLH}=t_{THL}≦2.5$ns.
2. t_n is reference bit time when all outputs are low.

Waveform 2. t_{PHL} (R_0→Q)
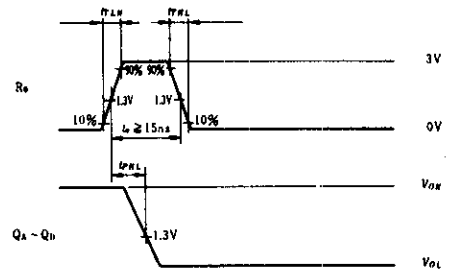
Note) $t_{TLH}≦15$ns, $t_{THL}≦5$ns

Unit: mm

19.20
20.32 Max

14   8

6.30
7.40 Max

1   7

1.30

2.39 Max

5.06 Max
5.06 Min

0.51 Min
2.54 Min

2.54 ± 0.25   0.48 ± 0.10

7.62

$0.25 ^{+0.10}_{-0.05}$

0° − 15°

Unit: mm

10.06
10.5 Max

14 | | 8

5.5

1 | | 7

2.20 Max

1.42 Max

1.27

0.10 ± 0.10

*0.42 ± 0.08
0.40 ± 0.06

◻ 0.15

⊕ 0.12 Ⓜ

*0.22 ± 0.05
0.20 ± 0.04

7.80 +0.20 −0.30

1.15

0° − 8°

0.70 ± 0.20

Unit: mm

8.65

9.05 Max

14 | 8

3.95

1 | 7

0.635 Max

1.75 Max

1.27

*0.40 ± 0.06

$0.14^{+0.11}_{-0.04}$

△ | 0.15

⊕ | 0.25 Ⓜ

*0.20 ± 0.05

$6.10^{+0.10}_{-0.30}$

1.08

0° – 8°

$0.60^{+0.67}_{-0.20}$
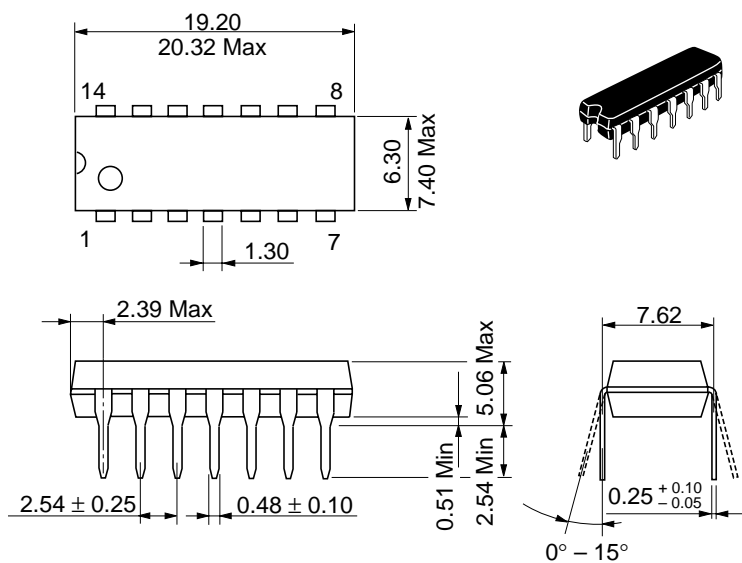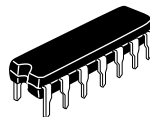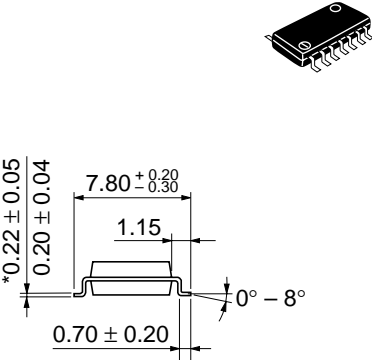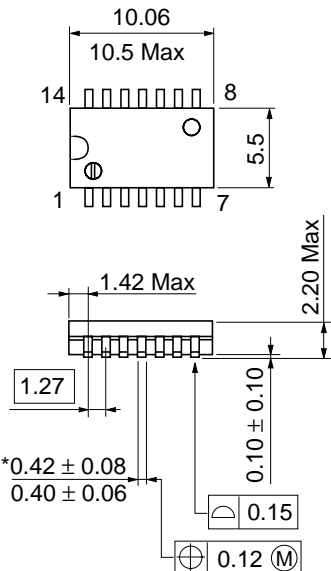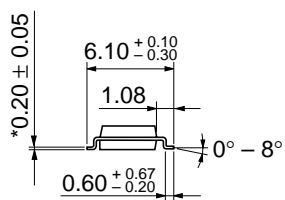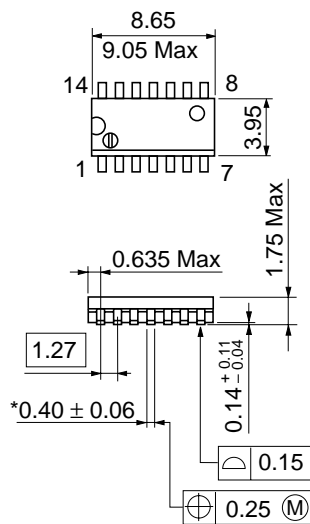
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