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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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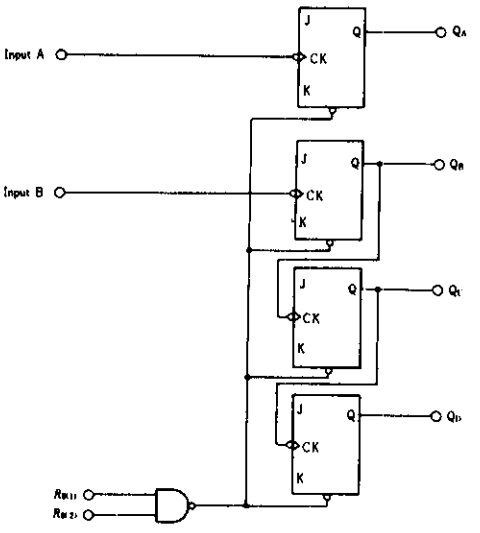
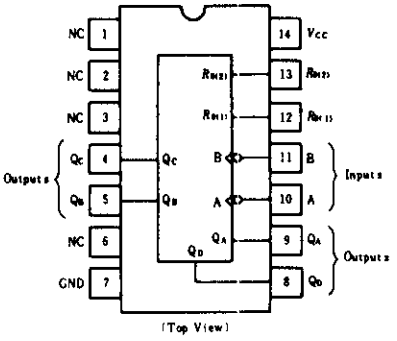
HD74LS293 ●4-bit Binary Counters

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.

■BLOCK DIAGRAM



■PIN ARRANGEMENT



■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～+75	℃
Storage temperature range		T_{stg}	−65～+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

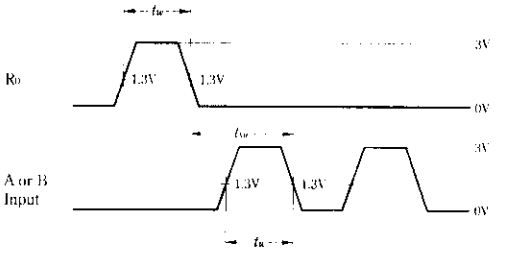
Count	Outputs				Count	Outputs			
	Q_D	Q_C	Q_B	Q_A		Q_D	Q_C	Q_B	Q_A
0	L	L	L	L	8	H	L	L	L
1	L	L	L	H	9	H	L	L	H
2	L	L	H	L	10	H	L	H	L
3	L	L	H	H	11	H	L	H	H
4	L	H	L	L	12	H	H	L	L
5	L	H	L	H	13	H	H	L	H
6	L	H	H	L	14	H	H	H	L
7	L	H	H	H	15	H	H	H	H

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

■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～+75°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}=−400μA		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_{IL}	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	μA
	A input				—	—	40	
	B input				—	—	40	
	Any Reset	I_I	V_{CC}=5.25V	V_I=7V	—	—	0.1	mA
	A input			V_I=5.5V	—	—	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, Ta=25°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.

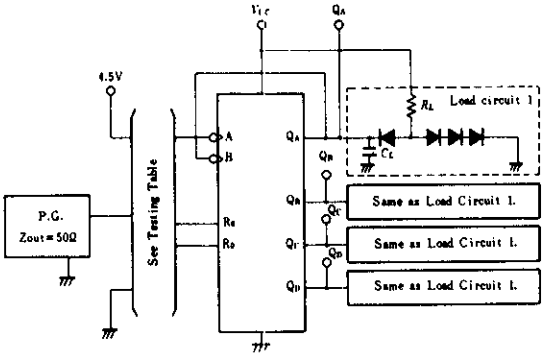
*** I_{CC} is measured with all outputs open, both R_0 inputs grounded following momentary connection to 4.5V, and all other inputs grounded.

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

Item	Symbol	Inputs	Outputs	Test Conditions	min	typ	max	Unit
Maximum count frequency	f_{max}	A	Q_A	C_L=15pF, R_L=2kΩ	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～Q_D		—	26	40	ns

■TESTING METHOD

1) Test Circuit



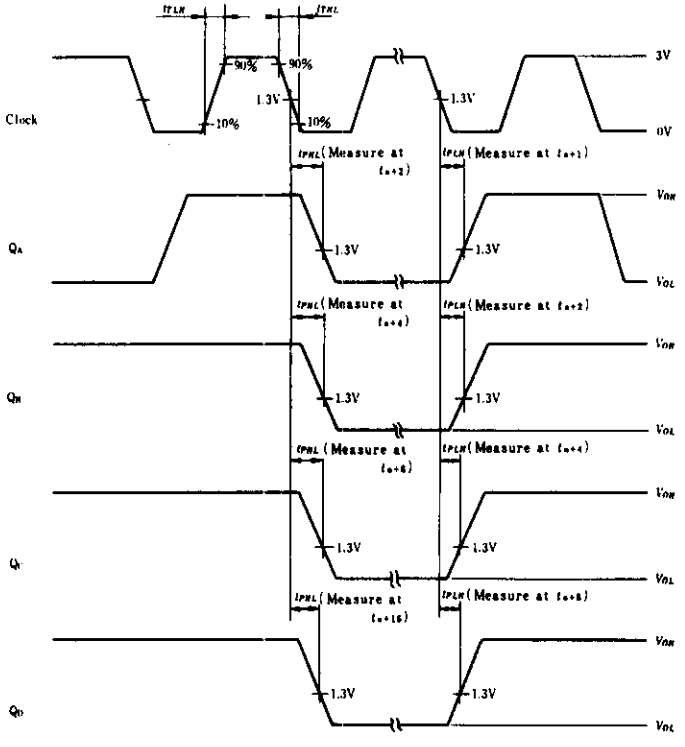
Notes) 1. C_L includes probe and jig capacitance.
2. All diodes are 1S2074 Ⓗ.

2) Testing Table

Item	From input to output	Inputs A	Inputs B	Inputs R_0	Outputs Q_A	Outputs Q_B	Outputs Q_C	Outputs 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} t_{PHL}	A→Q_A	IN	to Q_A	GND	OUT	—	—	—
	A→Q_D	IN	to Q_A	GND	—	—	—	OUT
	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

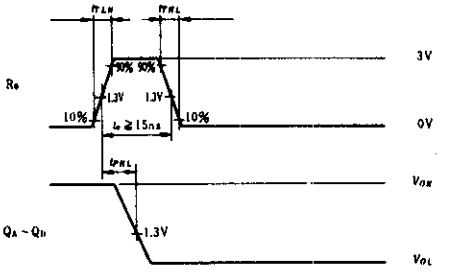
* For initialized.
** Measured with each input and unused inputs at 4.5V.

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



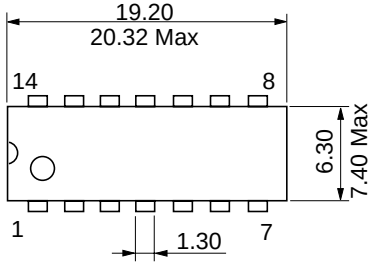
Notes) 1. Input pulse: t_{TLH}≦15ns, t_{THL}≦5ns, PRR=1MHz, duty cycle=50% and: for f_{max}, t_{TLH}=t_{THL}≦2.5ns.
2. t_n is reference bit time when all outputs are low.

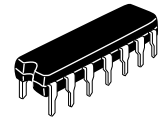
Waveform 2. t_{PHL} (R_0→Q)

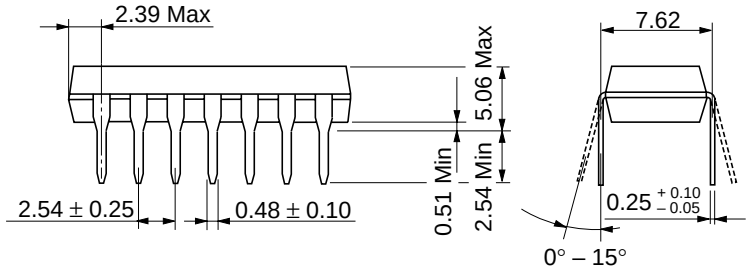


Note) t_{TLH}≦15ns, t_{THL}≦5ns

Unit: mm







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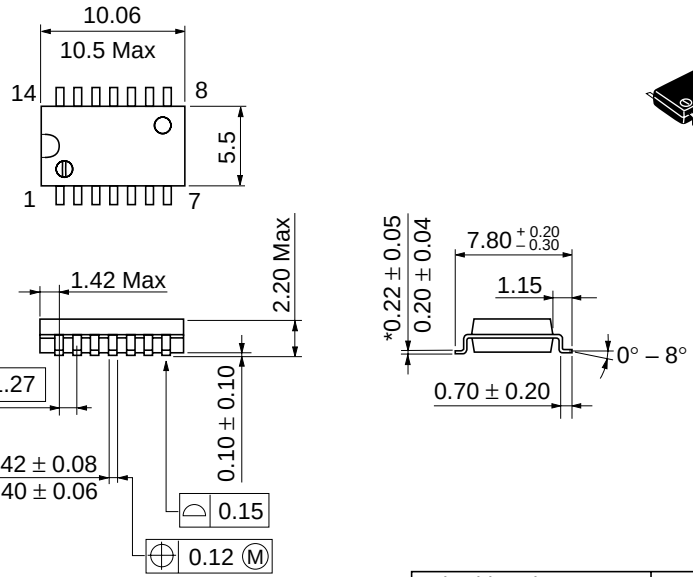
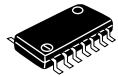
EIAJ	Conforms
Weight (reference value)	0.97 g

Unit: mm

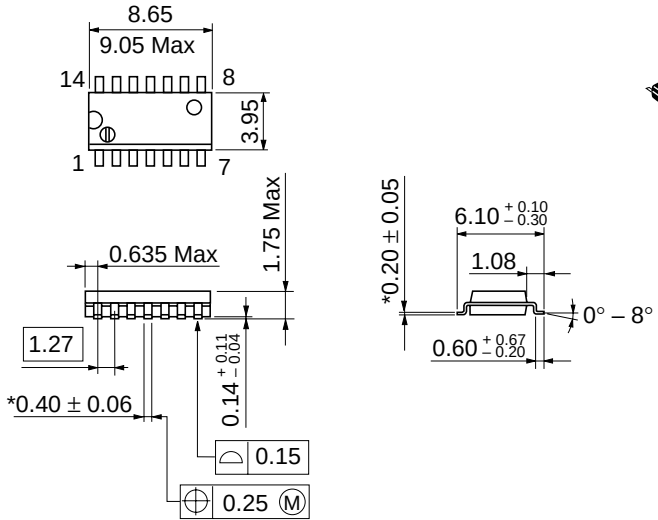




Hitachi Code	FP-14DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.23 g

*Dimension including the plating thickness
Base material dimension

Unit: mm



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EIAJ	Conforms
Weight (reference value)	0.13 g

*Pd plating

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