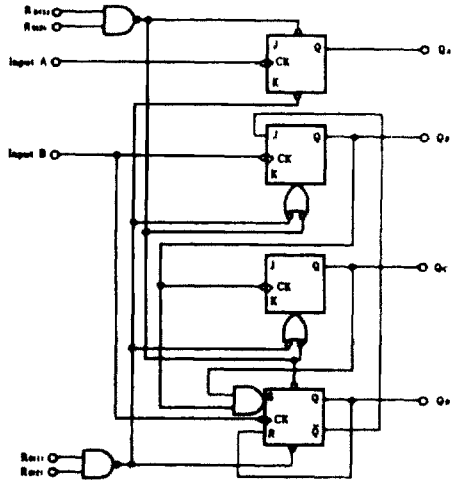
HD74LS290 ●Decade Counters

This counter contains four master-slave flip-flops and additional gating to provide a divide-by-two counter and divide-by-five counter.

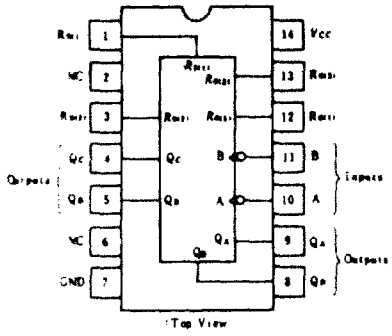
The HD74LS290 also has gated set-to-nine inputs for use in BCD nine's complement applications. To use the maximum count length of this counter, the B input is connected to the Q_A output. The input count pulses are applied to input A and the outputs are as described in the appropriate function table.

A symmetrical divide-by-ten count can be obtained from the HD74LS290 counter by connecting the Q_D output to the A input and applying the input count to the B input which gives a divide-by-ten square wave at output Q_A.

■BLOCK DIAGRAM



■PIN ARRANGEMENT



■ABSOLUTE MAXIMUM RATINGS

Item		Symbol	Ratings	Unit
Supply voltage		V_{CC}	7.0	V
Input voltage	R Inputs	V_{IN}	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

Reset Inputs				Outputs			
$R_{0(1)}$	$R_{0(2)}$	$R_{9(1)}$	$R_{9(2)}$	Q_D	Q_C	Q_B	Q_A
H	H	L	×	L	L	L	L
H	H	×	L	L	L	L	L
×	×	H	H	H	L	L	H
×	L	×	L	Count			
L	×	L	×	Count			
L	×	×	L	Count			
×	L	L	×	Count			

● BCD Count Sequence (Notes 1)

Count	Outputs			
	Q_D	Q_C	Q_B	Q_A
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

● Bi-Quinary Count Sequence (Notes 2)

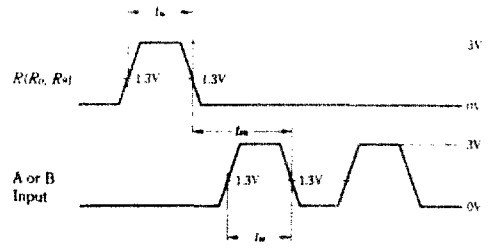
Count	Outputs			
	Q_A	Q_D	Q_C	Q_B
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	H	L	L	L
6	H	L	L	H
7	H	L	H	L
8	H	L	H	H
9	H	H	L	L

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

RECOMMENDED OPERATING CONDITIONS

Item		Symbol	min	typ	max	Unit
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				—	—	−3.2	
	Any Reset	I_{IH}	V_{CC}=5.25V, V_I=2.7V		—	—	20	μA
	A input				—	—	40	
	B input				—	—	80	
	Any Reset	I_I	V_{CC}=5.25V	V_I=7V	—	—	0.1	mA
	A input			V_I=5.5V	—	—	0.2	
	B input				—	—	0.4	
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.

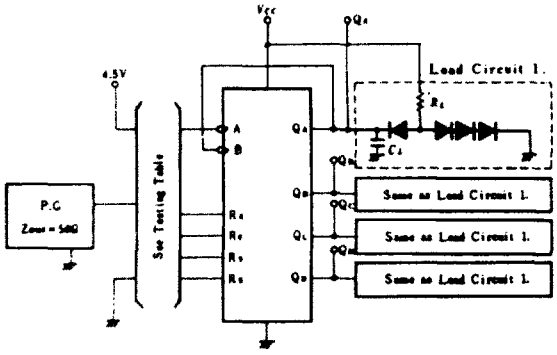
*** I_{CC} is measured with all outputs open, both R_0 inputs grounded following momentary connection to 4.5V, and all other inputs grounded.

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		—	32	48	ns
	t_{PHL}				—	34	50	
	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		—	21	32	ns
	t_{PHL}				—	23	35	
	t_{PHL}	Set-to-0	Q_A ~ Q_D		—	26	40	ns
	t_{PLH}	Set-to-9	Q_A, Q_D		—	20	30	ns
	t_{PHL}		Q_B, Q_C		—	26	40	

■TESTING METHOD

1) Test Circuit



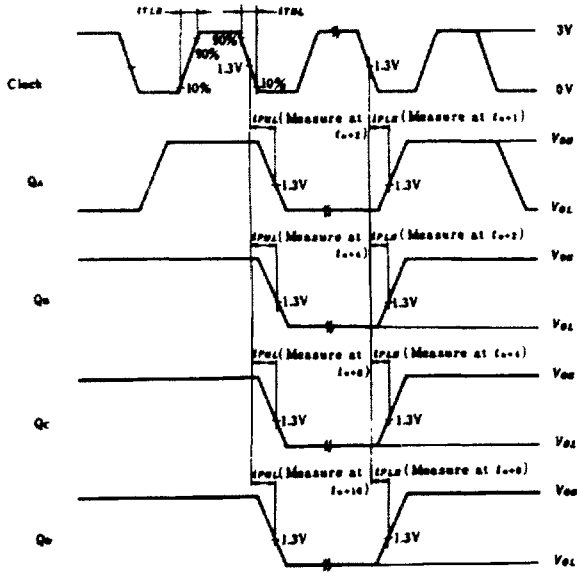
Notes) 1. C_L includes probe and jig capacitance.
2. All diodes are 1S2074 Ⓗ.

2) Testing Table

Item	From input to output	Inputs				Outputs			
		A	B	R_0	R_9	Q_A	Q_B	Q_C	Q_D
f_{max}	A→Q	IN	to Q_A	GND	GND	OUT	OUT	OUT	OUT
	B→Q	4.5V	IN	GND	GND	—	OUT	OUT	OUT
t_{PLH} t_{PHL}	A→Q_A	IN	to Q_A	GND	GND	OUT	—	—	—
	A→Q_D	IN	to Q_A	GND	GND	—	—	—	OUT
	B→Q_B	4.5V	IN	GND	GND	—	OUT	—	—
	B→Q_C	4.5V	IN	GND	GND	—	—	OUT	—
	B→Q_D	4.5V	IN	GND	GND	—	—	—	OUT
	R_0→Q**	IN*	to Q_A	IN	GND	OUT	OUT	OUT	OUT
	R_9→Q**	IN*	to Q_A	GND	IN	OUT	OUT	OUT	OUT

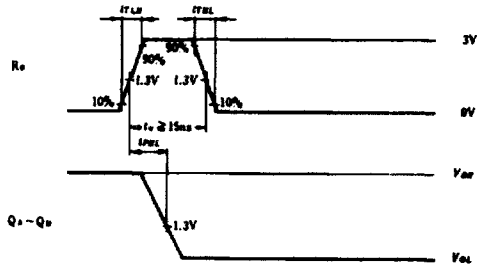
* For initialized
** Measured with each input and unused inputs at 4.5V.

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



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

Waveform 2. t_{PHL} (R_0→Q)



Waveform 3. t_{PLH}, t_{PHL} (R_9→Q)