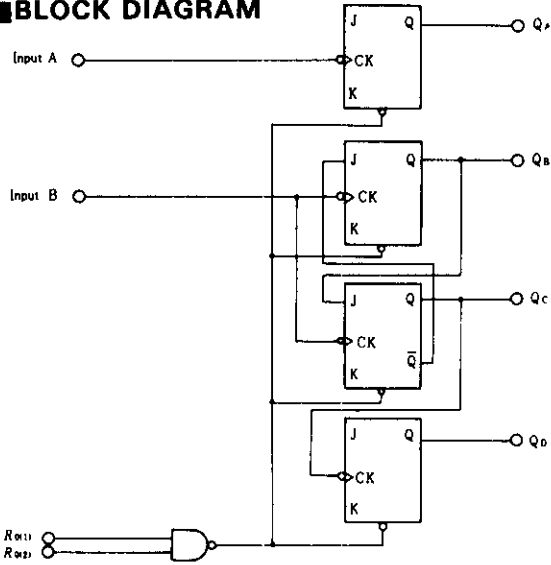


# HD74LS92 • Divide-by-Twelve Counters

The HD74LS92 contains four master-slave flip-flops and additional gating to provide a divide-by-two counter and three-stage binary counter for divide-by-six. 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 input A and the outputs are described in the appropriate function table.

## ■ BLOCK DIAGRAM



## ■ FUNCTION TABLE

### Reset/Count Function Table

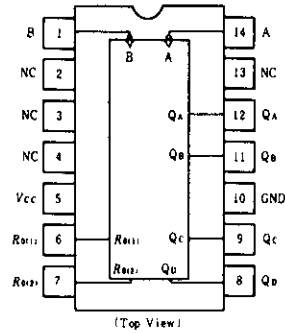
Reset Inputs		Outputs			
$R_{(01)}$	$R_{(02)}$	$Q_D$	$Q_C$	$Q_B$	$Q_A$
H	H	L	L	L	L
L	X	Count			
X	L	Count			

### BCD Count Sequence (Notes 1)

Count	Output			
	$Q_D$	$Q_C$	$Q_B$	$Q_A$
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	H	L	L	L
7	H	L	L	H
8	H	L	H	L
9	H	L	H	H
10	H	H	L	L
11	H	H	L	H

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

## ■ PIN ARRANGEMENT



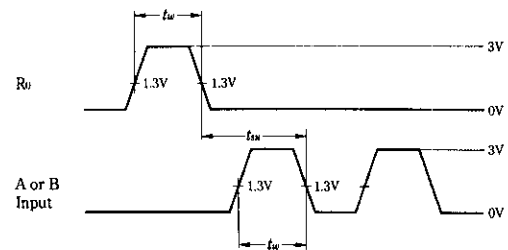
## ■ ABSOLUTE MAXIMUM RATINGS

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

## ■ 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



# HD74LS92

## ■ 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
		$V_{OL}$	$V_{CC} = 4.75\text{V}, V_{IH} = 2\text{V}, I_{OL} = 4\text{mA}^{**}$		-	-	0.4	V
		$V_{OL}$	$V_{IL} = 0.8\text{V}, I_{OL} = 8\text{mA}^{**}$		-	-	0.5	V
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			-	-	3.2	
		Any Reset	$I_{IH}$	$V_{CC} = 5.25\text{V}, V_I = 2.7\text{V}$	-	-	20	$\mu\text{A}$
		A input			-	-	40	
		B input			-	-	80	
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				-	-	0.4		
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		$V_{IK}$	$V_{CC} = 4.75\text{V}, I_{IK} = -18\text{mA}$		-	-	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.

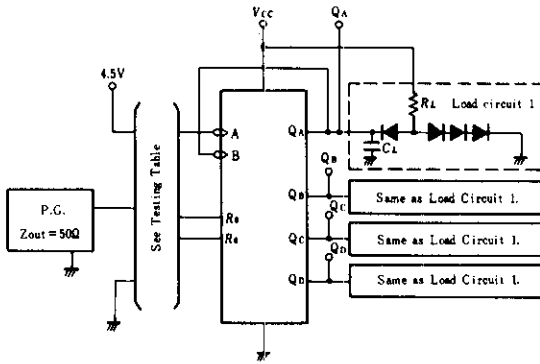
\*\*\*  $I_{CC}$  is measured with all outputs open both  $R_o$  inputs grounded following momentary connection to 4.5V, and all other inputs grounded.

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

Item	Symbol	Input	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	-	-	MHz
Propagation delay time	$t_{PLH}$	A	$Q_A$		-	10	16	ns
					$t_{PHL}$	$Q_A$	-	12
	$t_{PLH}$	A	$Q_D$				-	32
					$t_{PHL}$	$Q_D$	-	34
	$t_{PLH}$	B	$Q_B$				-	10
					$t_{PHL}$	$Q_B$	-	14
	$t_{PLH}$	B	$Q_C$				-	10
					$t_{PHL}$	$Q_C$	-	14
	$t_{PLH}$	B	$Q_D$				-	21
					$t_{PHL}$	$Q_D$	-	23
	$t_{PHL}$	Set to 0	$Q_A - Q_D$	-			26	40

## TESTING METHOD

### 1) Test Circuit



- Notes) 1. Input pulse;  $t_{TLH} \leq 15\text{ns}$ ,  $t_{THL} \leq 6\text{ns}$ ,  $PRR=1\text{MHz}$ , duty cycle=50%  
 2.  $C_L$  includes probe and jig capacitance.  
 3. All diodes are 1S2074  $\text{\textcircled{P}}$ .

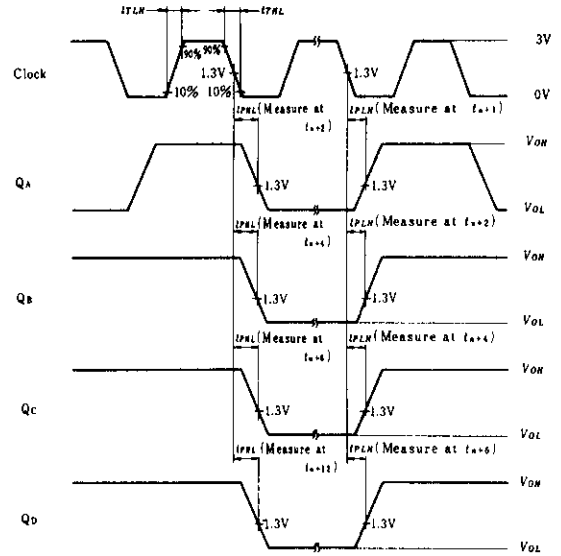
### 2) Testing Table

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

\*; For initialized.

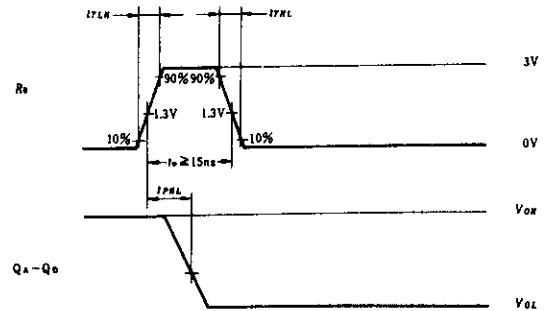
\*\*; Measured with each input and unused inputs at 4.5V.

### Waveform-1 $f_{max}, t_{PLH}, t_{PHL}(\text{Clock} \rightarrow \text{Q})$



- Notes) 1. Input pulse;  $t_{TLH} \leq 15\text{ns}$ ,  $t_{THL} \leq 6\text{ns}$ ,  $PRR=1\text{MHz}$ , duty cycle=50% and: for  $f_{max}$ ,  $t_{TLH}=t_{THL} \leq 2.5\text{ns}$ .  
 2.  $t_n$  is reference bit time when all outputs are low.

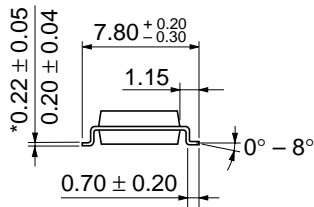
### Waveform-2 $t_{PHL}(R_0 \rightarrow \text{Q})$



- Notes) 1.  $t_{TLH} \leq 15\text{ns}$ ,  $t_{THL} \leq 6\text{ns}$ .



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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