

GD54/74LS93

4-BIT BINARY COUNTER DIVIDE-BY-TWO AND DIVIDE-BY-EIGHT

Description

This is an asynchronous 4-bit binary (hexadecimal) counter function with direct reset inputs.

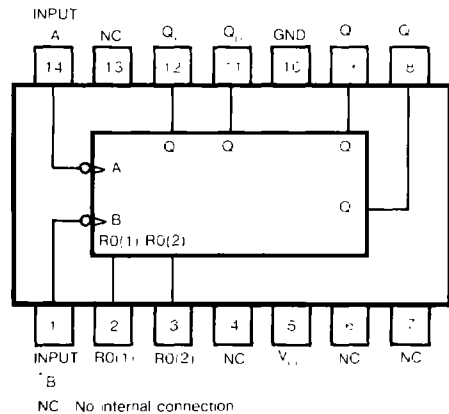
This device is composed of independent binary and octal counters. Clock input A and output Q_A are employed for use as a binary counter while clock input B and Q_B . Q_C and Q_D are employed for use as an octal counter. When employed as a hexadecimal counter, the pure binary code output appears in the Q_A , Q_B , Q_C , and Q_D outputs by connecting Q_A and B, and making A the input. Counting is performed when A and B change from high to low. The binary and octal counters can be reset simultaneously by setting direct reset inputs $RO_{(1)}$ or $RO_{(2)}$ high. For use as a counter, either $RO_{(1)}$ or $RO_{(2)}$ or both, is set low.

Count Sequence

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	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

* Output Q_D is connected to input B

Pin Configuration

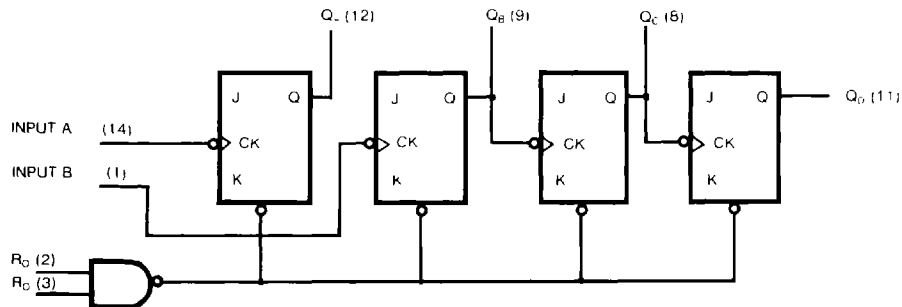


Suffix-Blank Plastic Dual In Line Package
 Suffix-J Ceramic Dual In Line Package

Reset/Count Function Table

Reset Inputs		Output			
$RO(1)$	$RO(2)$	Q_D	Q_C	Q_B	Q_A
H	H	L	L	L	L
L	X	COUNT			
X	L	COUNT			

Function Block Diagram



Absolute Maximum Ratings

- Supply voltage, V_{CC} 7V
- Input voltage: R inputs 7V
 A and B inputs 5.5V
- Operating free-air temperature range 54LS -55°C to 125°C
 74LS 0°C to 70°C
- Storage temperature range -65°C to 150°C

Recommended Operating Conditions

SYMBOL	PARAMETER		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		4.75		5.25	V
I_{OH}	High-level output current	54,74			-400	μA
I_{OL}	Low-level output current	54			4	mA
		74			8	
f_{count}	Count frequency	A input	0		32	MHz
		B input	0		16	
t_w	Pulse width	A input	15			ns
		B input	30			
		Reset input	15			
t_{SU}	Reset inactive-state setup time		25			ns
T_A	Operating free-air temperature		0		70	$^{\circ}\text{C}$

Electrical Characteristics over recommended operating free air temperature (unless otherwise noted)

SYMBOL	PARAMETER		TEST CONDITIONS		MIN	TYP (Note 1)	MAX	UNIT
V_{IH}	High-level input voltage				2			V
V_{IL}	Low-level input voltage				54		0.7	V
					74		0.8	
V_{IK}	Input clamp voltage		$V_{CC}=\text{Min}$, $I_I = -18\text{mA}$				-1.5	V
V_{OH}	High-level output voltage		$V_{CC}=\text{Min}$	$V_{IL}=\text{Max}$	54	2.5	3.4	V
			$I_{OH}=\text{Max}$	$V_{IH}=\text{Min}$	74	2.7	3.4	
V_{OL}	Low-level output voltage (Note 4)		$V_{CC}=\text{Min}$	$I_{OL}=4\text{mA}$	54,74	0.25	0.4	V
			$V_{IL}=\text{Max}$	$I_{OL}=8\text{mA}$	74	0.35	0.5	
I_I	Input current at maximum input voltage	Any reset	$V_{CC}=\text{Max}$, $V_I=7\text{V}$				0.1	mA
		A or B input	$V_{CC}=\text{Max}$, $V_I=5.5\text{V}$				0.2	
I_{IH}	High-level input current	Any reset	$V_{CC}=\text{Max}$, $V_I=2.7\text{V}$				20	μA
		A or B input					80	
I_{IL}	Low-level input current	Any reset	$V_{CC}=\text{Max}$, $V_I=0.4\text{V}$				-0.4	mA
		A input					-2.4	
		B input					-1.6	
I_{OS}	Short-circuit output current		$V_{CC}=\text{Max}$ (Note 2)		-20		-100	mA
I_{CCH}	Supply current		$V_{CC}=\text{Max}$ (Note 3)			9	15	mA

Note 1: All typical values are at $V_{CC}=5\text{V}$, $T_A=25^{\circ}\text{C}$.

Note 2: Not more than one output should be shorted at a time, and duration should not exceed one second.

Note 3: f_{CC} is measured with all outputs open, RO inputs grounded following momentary connection to 4.5V and all other inputs grounded.

Note 4: O_A outputs are tested at $I_{OL}=\text{max}$ plus the limit value of I_{IL} for the B input. This permits driving the B input while maintaining full fan-out capability.

Switching Characteristics, $V_{CC} = 5V$, $T_A = 25^\circ C$

PARAMETER*	FROM (INPUT)	TO (OUTPUT)	TEST CONDITION	MIN	TYP	MAX	UNIT
f_{max}	A	Q_A	$C_L = 15pF$ $R_L = 2k\Omega$	32	42		MHz
	B	Q_B		16			
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	Any			26	40	ns

- * f_{max} = maximum count frequency
- * t_{PLH} = propagation delay time, low-to-high-level output
- * t_{PHL} = propagation delay time, high-to-low-level output