

GD54/74HC393, GD54/74HCT393

DUAL 4-BIT BINARY COUNTERS

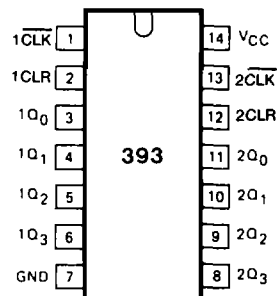
General Description

These devices are identical in pinout to the 54/74LS393. They consist of two independent 4-Bit binary ripple counters with parallel outputs from each counter stage. A divide-by-256 counter can be obtained by cascading the two binary counters. Each of the two 4-bit counters is incremented on the falling edge of the clock input, and each has an independent clear input. When clear is set high all four bits of each counter are set to a low level. This enables count truncation and allows the implementation of divide-by-N counter configurations. These devices are characterized for operation over wide temperature ranges to meet industry and military specifications.

Features

- Low Power consumption characteristic of CMOS devices
- Output drive capability: 10 LS TTL Loads Min.
- Operating speed superior to LS TTL
- Wide operating voltage range: for HC 2 to 6 volts
for HCT 4.5 to 5.5 volts
- Low input current: 1μA Max
- Low quiescent current: 80μA Max. (74HC)
- High noise immunity characteristic of CMOS
- Diode protection on all inputs

Pin Configuration



Suffix-Blank Plastic Dual In Line Package
 Suffix-J Ceramic Dual In Line Package
 Suffix-D Small Outline Package

Function Table

COUNT	OUTPUTS			
	Q ₀	Q ₁	Q ₂	Q ₃
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H
10	L	H	L	H
11	H	H	L	H
12	L	L	H	H
13	H	L	H	H
14	L	H	H	H
15	H	H	H	H

Absolute Maximum Ratings

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	DC Supply voltage		-0.5	+7	V
I_{IK}, I_{OK}	DC input or output diode current	for $V_I < -0.5$ or $V_I > V_{CC} + 0.5V$		20	mA
I_O	DC output source or sink current	for $-0.5V < V_O < V_{CC} + 0.5V$		35	mA
I_{CC}	DC V_{CC} or GND current			70	mA
T_{stg}	Storage temperature range		-65	150	°C
P_D	Power dissipation per package	above +70°C. derate linearly with 8mW/K		500	mW
T_L	Lead temperature	At distance 1/16 ± 1/32 in. from case for 60 sec(CERAMIC) 10 sec(PLASTIC)		300 260	°C

Recommended Operating Conditions

CHARACTERISTIC	LIMITS		UNITS
	MIN.	MAX.	
Supply-Voltage Range V_{CC} : GD54/74HC Types GD54/74HCT Types	2 4.5	6 5.5	V
DC Input or Output Voltage V_I, V_O	0	V_{CC}	V
Operating Temperature T_A : GD74 Types GD54 Types	-40 -55	+85 +125	°C
Input Rise and Fall times t_r, t_f : GD54/74HC Types at 2V at 4.5V at 6V GD54/74HCT Types at 4.5V		1000 500 400 500	ns

Logic Diagram

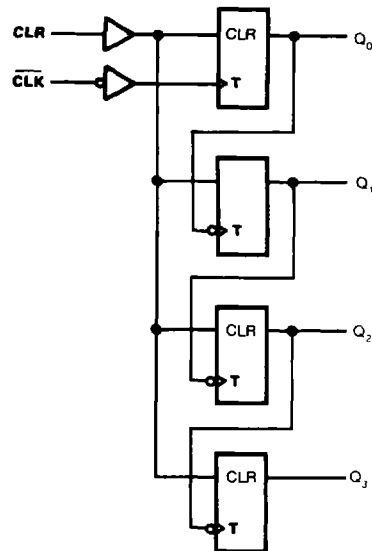


Fig. 1 Logic diagram

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A = 25 °C			GD74HC393		GD54HC393		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
V _{IH}	HIGH level input Voltage		2.0 4.5 6.0	1.5 3.15 4.2			1.5 3.15 4.2		1.5 3.15 4.2		V
V _{IL}	LOW level input voltage		2.0 4.5 6.0			0.3 0.9 1.2		0.3 0.9 1.2		0.3 0.9 1.2	V
V _{OH}	HIGH level output voltage	V _{IN} = V _{IH}	I _{OH} = -20 μA	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	1.9 4.4 5.9		1.9 4.4 5.9		V
		or V _{IL}	I _{OH} = -4 mA I _{OH} = -5.2 mA	4.5 6.0	3.98 5.48	4.3 5.2	3.84 5.34		3.7 5.2		
V _{OL}	LOW level output voltage	V _{IN} = V _{IH}	I _{OL} = 20 μA	2.0 4.5 6.0			0.1 0.1 0.1		0.1 0.1 0.1		V
		or V _{IL}	I _{OL} = 4 mA I _{OL} = 5.2 mA	4.5 6.0		0.17 0.15	0.26 0.26		0.33 0.33		
I _{IN}	Input leakage Current	V _{IN} = V _{CC} or GND		6.0			0.1		1.0		μA
I _{CC}	Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{out} = 0 μA		6.0			8		80		μA

DC Electrical Characteristics for HCT

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A = 25 °C			GD74HCT393		GD54HCT393		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
V _{IH}	HIGH level input Voltage		4.5 to 5.5	2.0			2.0		2.0		V
V _{IL}	LOW level input voltage		4.5 to 5.5			0.8		0.8		0.8	V
V _{OH}	HIGH level output voltage	V _{IN} = V _{IH}	I _{OH} = -20 μA	4.5	4.4	4.5	4.4		4.4		V
		or V _{IL}	I _{OH} = -4 mA	4.5	3.98	4.3	3.84		3.7		
V _{OL}	LOW level output voltage	V _{IN} = V _{IH}	I _{OL} = 20 μA	4.5			0.1		0.1		V
		or V _{IL}	I _{OL} = 4 mA	4.5		0.17	0.26		0.33		
I _{IN}	Input leakage Current	V _{IN} = V _{CC} or GND		5.5			0.1		1.0		μA
I _{CC}	Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{out} = 0 μA		5.5			8		80		μA

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Timing Requirements for HC: $t_r = t_f = 6\text{ns}$ $C_L = 50\text{ pF}$

SYMBOL	PARAMETER	V_{CC} (V)	$T_A = 25^\circ\text{C}$			GD74HC393		GD54HC393		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_w	Pulse width	$\overline{\text{CLK}}$ high or low	2.0	80		100		120		ns
			4.5	16		20		24		
			6.0	14		18		20		
		CLR high	2.0	80		100		120		ns
			4.5	16		20		24		
			6.0	14		18		20		
t_{rec}	Recovery time	CLR to $\overline{\text{CLK}}$	2.0	5		5		5		ns
			4.5	5		5		5		
			6.0	5		5		5		

AC Characteristics for HC: $t_r = t_f = 6\text{ns}$ $C_L = 50\text{ pF}$

SYMBOL	PARAMETER	V_{CC} (V)	$T_A = 25^\circ\text{C}$			GD74HC393		GD54HC393		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
f_{max}	Maximum Clock Pulse Frequency	2.0	6	20		5		4	2	MHz
		4.5	31	60		25		21		
		6.0	36	71		28		25		
$t_{\text{PLH}}'/$ t_{PHL}	Propagation Delay Time $\overline{\text{CLK}}$ to Q_0	2.0		41	125		150		180	ns
		4.5		14	24		30		37	
		6.0		12	20		25		31	
$t_{\text{PLH}}'/$ t_{PHL}	Propagation Delay Time $\overline{\text{CLK}}$ to Q_3	2.0		83	260		315		390	ns
		4.5		29	50		64		79	
		6.0		24	44		52		67	
t_{PHL}	Propagation Delay Time CLR to Q_n	2.0		39	140		175		210	ns
		4.5		14	28		35		42	
		6.0		11	14		30		36	
$t_{\text{TLH}}'/$ t_{THL}	Output Transition Time	2.0		28	75		95		110	ns
		4.5		7	15		19		22	
		6.0		6	13		16		19	

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Timing Requirements for HCT: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

SYMBOL	PARAMETER	V_{CC} (V)	$T_A=25^\circ\text{C}$			GD74HCT393		GD54HCT393		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_w	Pulse width	CLK high or low	4.5	19		24		29		ns
		CLR high	4.5	16		20		24		ns
t_{rec}	Recovery time	CLR to CLK	4.5	5		5		5		ns

AC Characteristics for HCT: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

SYMBOL	PARAMETER	V_{CC}	$T_A=25^\circ\text{C}$			GD74HCT393		GD54HCT393		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
f_{max}	Maximum Clock Pulse Frequency	4.5	27			22		18		MHz
t_{PLH} ; t_{PHL}	Propagation Delay Time CLK to Q_0	4.5		20	30		36		43	ns
t_{PLH} ; t_{PHL}	Propagation Delay Time CLK to Q_3	4.5		38	58		70		89	ns
t_{PHL}	Propagation Delay Time CLR to Q_n	4.5		18	32		39		47	ns
t_{TLH} ; t_{THL}	Output Transition Time	4.5		7	15		19		22	ns

AC Waveforms

