

GD54/74HC393, GD54/74HCT393

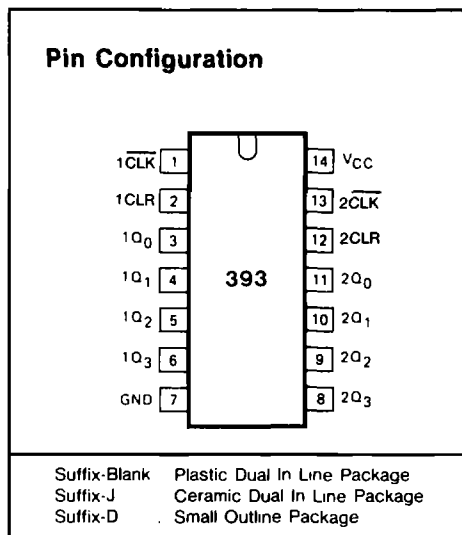
DUAL 4-BIT BINARY COUNTERS

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: 1 μ A Max
- Low quiescent current: 80 μ A Max. (74HC)
- High noise immunity characteristic of CMOS
- Diode protection on all inputs



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

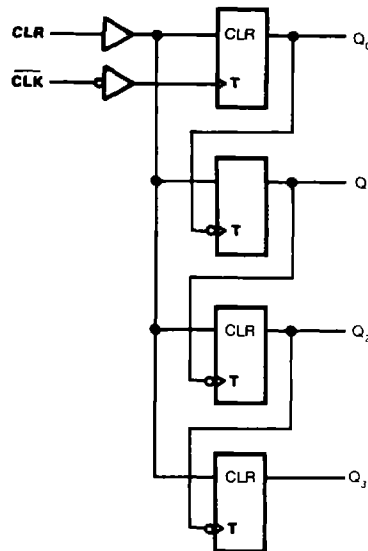


Fig. 1 Logic diagram

GD54/74HC393, GD54/74HCT393

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}	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}	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}	2.0 4.5 6.0			0.1 0.1 0.1		0.1 0.1 0.1		0.1 0.1 0.1	V
		or V _{IL}	4.5 6.0		0.17 0.15	0.26 0.26		0.33 0.33		0.4 0.4	
I _{IN}	Input leakage Current	V _{IN} =V _{CC} or GND	6.0			0.1		1.0		1.0	μA
I _{CC}	Quiescent Supply Current	V _{IN} =V _{CC} or GND I _{out} =0μA	6.0			8		80		160	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}	4.5	4.4	4.5		4.4		4.4		V
		or V _{IL}	4.5	3.98	4.3		3.84		3.7		
V _{OL}	LOW level output voltage	V _{IN} =V _{IH}	4.5			0.1		0.1		0.1	V
		or V _{IL}	4.5		0.17	0.26		0.33		0.4	
I _{IN}	Input leakage Current	V _{IN} =V _{CC} or GND	5.5			0.1		1.0		1.0	μA
I _{CC}	Quiescent Supply Current	V _{IN} =V _{CC} or GND I _{out} =0μA	5.5			8		80		160	μA

GD54/74HC393, GD54/74HCT393

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

SYMBOL	PARAMETER	V _{CC} (V)	T _A =25°C			GD74HC393		GD54HC393		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t _w	Pulse width	$\overline{\text{CLK}}$ high or low 2.0 4.5 6.0	80			100		120		ns
			16			20		24		
			14			18		20		
	CLR high	2.0 4.5 6.0	80			100		120		ns
			16			20		24		
			14			18		20		
t _{rec}	Recovery time	CLR to $\overline{\text{CLK}}$	5			5		5		ns
			5			5		5		
			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°C			GD74HC393		GD54HC393		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
f _{max}	Maximum Clock Pulse Frequency	2.0 4.5 6.0	6	20		5		4	2	MHz
			31	60		25		21		
			36	71		28		25		
t _{PLH} ' t _{PHL}	Propagation Delay Time $\overline{\text{CLK}}$ to Q ₀	2.0 4.5 6.0		41	125		150		180	ns
				14	24		30		37	
				12	20		25		31	
t _{PLH} ' t _{PHL}	Propagation Delay Time $\overline{\text{CLK}}$ to Q ₃	2.0 4.5 6.0		83	260		315		390	ns
				29	50		64		79	
				24	44		52		67	
t _{PHL}	Propagation Delay Time CLR to Q _n	2.0 4.5 6.0		39	140		175		210	ns
				14	28		35		42	
				11	14		30		36	
t _{TLH} ' t _{THL}	Output Transition Time	2.0 4.5 6.0		28	75		95		110	ns
				7	15		19		22	
				6	13		16		19	

GD54/74HC393, GD54/74HCT393

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	$\overline{\text{CLK}}$ high or low	4.5	19			24		29		ns
		CLR high	4.5	16			20		24		ns
t_{rec}	Recovery time	CLR to $\overline{\text{CLK}}$	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}^1 t_{PHL}	Propagation Delay Time $\overline{\text{CLK}}$ to Q_0		4.5		20	30		36		43	ns
t_{PLH}^1 t_{PHL}	Propagation Delay Time $\overline{\text{CLK}}$ 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}^1 t_{THL}	Output Transition Time		4.5		7	15		19		22	ns

AC Waveforms

