

74LS393 Counter

Dual 4-Bit Binary Ripple Counter
Product Specification

Logic Products

FEATURES

- Two 4-bit binary counters
- Divide-by any binary module up to 28 in one package
- Two Master Resets to clear each 4-bit counter individually

DESCRIPTION

The '393 is a Dual 4-bit Binary Ripple Counter with separate Clock and Master Reset inputs to each counter. The operation of each half of the '393 is the same as the '93 except no external clock connections are required. The counters are triggered by a HIGH-to-LOW transition of the Clock (\overline{CP}_a and \overline{CP}_b) inputs. The counter outputs are internally connected to provide Clock inputs to succeeding stages. The outputs of the ripple counter do not change synchronously and should not be used for high speed address decoding.

TYPE	TYPICAL f_{MAX}	TYPICAL SUPPLY CURRENT (TOTAL)
74LS393	35MHz	15mA

ORDERING CODE

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 5\%$; $T_A = 0^\circ C$ to $+70^\circ C$
Plastic DIP	N74LS393N
Plastic SO-14	N74LS393D

NOTE:

For information regarding devices processed to Military Specifications, see the Signetics Military Products Data Manual.

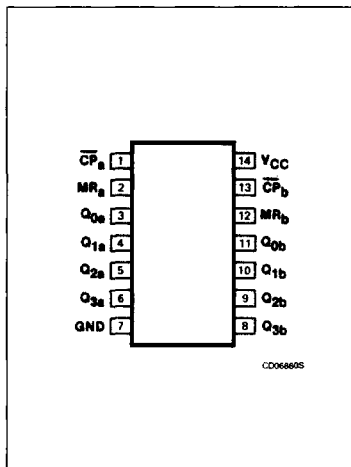
INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74LS
MR	Master Reset input	1LSul
\overline{CP}	Clock input	4LSul
Q	Output	10LSul

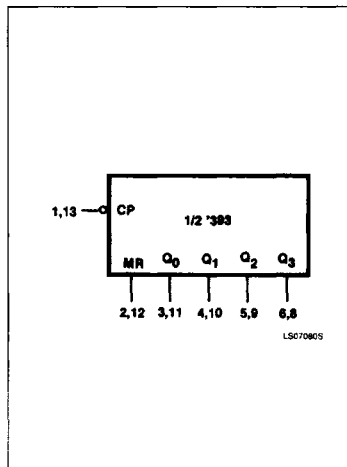
NOTE:

Where a 74LS unit load (LSul) is $20\mu A I_{IH}$ and $-0.4mA I_{IL}$.

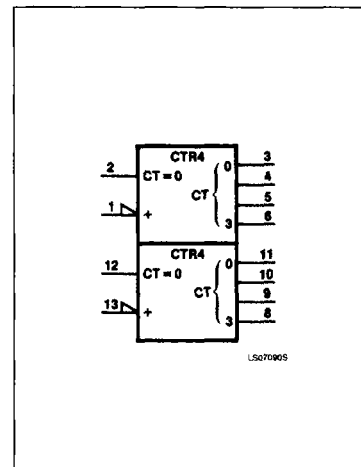
PIN CONFIGURATION



LOGIC SYMBOL



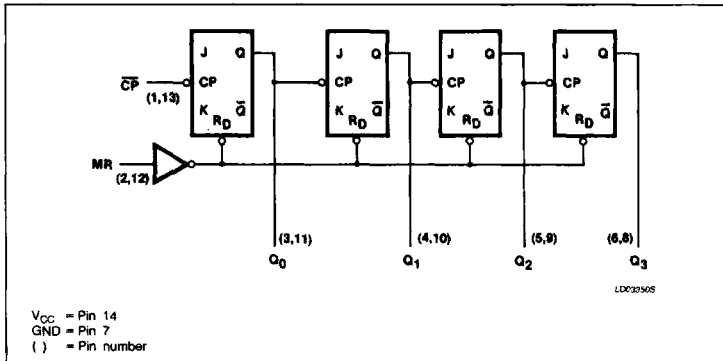
LOGIC SYMBOL (IEEE/IEC)



Counter

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LOGIC DIAGRAM



The Master Resets (MR_a and MR_b) are active-HIGH asynchronous inputs to each 4-bit counter identified by the "a" and "b" suffixes in the Pin Configuration. A HIGH level on the MR input overrides the clock and sets the outputs LOW.

COUNT SEQUENCE FOR 1/2 THE '393

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

H = HIGH voltage level
L = LOW voltage level

ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

PARAMETER	74LS	UNIT
V_{CC} Supply voltage	7.0	V
V_{IN} Input voltage	-0.5 to +7.0	V
I_{IN} Input current	-30 to +1	mA
V_{OUT} Voltage applied to output in HIGH output state	-0.5 to + V_{CC}	V
T_A Operating free-air temperature range	0 to 70	°C

RECOMMENDED OPERATING CONDITIONS

PARAMETER	74LS			UNIT
	Min	Nom	Max	
V_{CC} Supply voltage	4.75	5.0	5.25	V
V_{IH} HIGH-level input voltage	2.0			V
V_{IL} LOW-level input voltage			+0.8	V
I_{IK} Input clamp current			-18	mA
I_{OH} HIGH-level output current			-400	μA
I_{OL} LOW-level output current			8	mA
T_A Operating free-air temperature	0		70	°C

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DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER	TEST CONDITIONS ¹	74LS393			UNIT	
		Min	Typ ²	Max		
V _{OH} HIGH-level output voltage	V _{CC} = MIN, V _{IH} = MIN, V _{IL} = MAX, I _{OH} = MAX	2.7	3.4		V	
V _{OL} LOW-level output voltage	V _{CC} = MIN, V _{IH} = MIN, V _{IL} = MAX	I _{OL} = MAX		0.35	0.5	V
		I _{OL} = 4mA (74LS)		0.25	0.4	V
V _{IK} Input clamp voltage	V _{CC} = MIN, I _I = I _{IK}			-1.5	V	
I _I Input current at maximum input voltage	V _{CC} = MAX	V _I = 7.0V	MR input		0.1	mA
		V _I = 5.5V	\overline{CP} input		0.2	mA
I _{IH} HIGH-level input current	V _{CC} = MAX, V _I = 2.7V	MR input			20	μ A
		\overline{CP} input			100	μ A
I _{IL} LOW-level input current	V _{CC} = MAX, V _I = 0.4V	MR input			-0.4	mA
		\overline{CP} input			-1.6	mA
I _{OS} Short-circuit output current ³	V _{CC} = MAX	-20		-100	mA	
I _{CC} Supply current ⁴ (total)	V _{CC} = MAX		15	26	mA	

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V_{CC} = 5V, T_A = 25°C.
- I_{OS} is tested with V_{OUT} = +0.5V and V_{CC} = V_{CC} MAX + 0.5V. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.
- Measure I_{CC} with both MR inputs grounded following momentary connection to 4.5V, all other inputs grounded and all outputs open.

AC ELECTRICAL CHARACTERISTICS T_A = 25°C, V_{CC} = 5.0V

PARAMETER	TEST CONDITIONS	74LS		UNIT
		C _L = 15pF, R _L = 2k Ω		
		Min	Max	
f _{MAX} \overline{CP} input count frequency	Waveform 1	25		MHz
t _{PLH} Propagation delay	Waveform 1		20	ns
t _{PHL} \overline{CP} to Q ₀			20	
t _{PLH} Propagation delay	Waveform 1		60	ns
t _{PHL} \overline{CP} to Q ₃			60	
t _{PHL} Propagation delay, MR to Q	Waveform 2		39	ns

NOTE:

Per industry convention, f_{MAX} is the worst case value of the maximum device operating frequency with no constraints on t_r, t_f, pulse width or duty cycle.

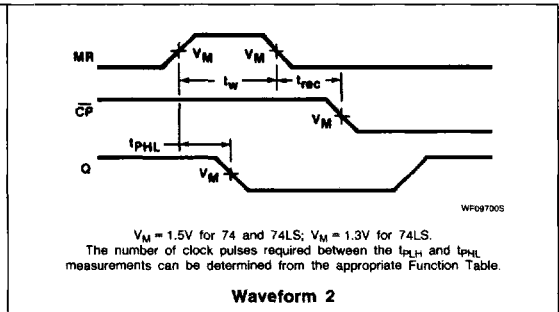
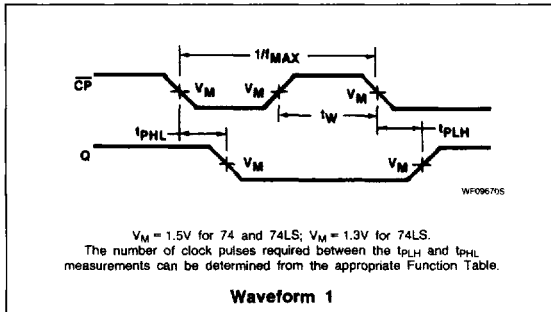
AC SET-UP REQUIREMENTS T_A = 25°C, V_{CC} = 5.0V

PARAMETER	TEST CONDITIONS	74LS		UNIT
		Min	Max	
t _w \overline{CP} pulse width	Waveform 1	20		ns
t _w MR pulse width	Waveform 2	20		ns
t _{rec} Recovery time, MR to \overline{CP}	Waveform 2	25		ns

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AC WAVEFORMS



TEST CIRCUITS AND WAVEFORMS

TC029405

WF064505

$V_M = 1.3V$ for 74LS; $V_M = 1.5V$ for all other TTL families.

Test Circuit For 74 Totem-Pole Outputs

DEFINITIONS
 R_L = Load resistor to V_{CC} ; see AC CHARACTERISTICS for value.
 C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.
 R_T = Termination resistance should be equal to Z_{OUT} of Pulse Generators.
 D = Diodes are 1N916, 1N3064, or equivalent.
 t_{TLH} , t_{THL} Values should be less than or equal to the table entries.

Input Pulse Definition

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	Pulse Width	t_{TLH}	t_{THL}
74	3.0V	1MHz	500ns	7ns	7ns
74LS	3.0V	1MHz	500ns	15ns	6ns
74S	3.0V	1MHz	500ns	2.5ns	2.5ns