

# DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

## **74HC/HCT390** Dual decade ripple counter

Product specification  
File under Integrated Circuits, IC06

December 1990

## Dual decade ripple counter

## 74HC/HCT390

## FEATURES

- Two BCD decade or bi-quinary counters
- One package can be configured to divide-by-2, 4, 5, 10, 20, 25, 50 or 100
- Two master reset inputs to clear each decade counter individually
- Output capability: standard
- I<sub>CC</sub> category: MSI

## GENERAL DESCRIPTION

The 74HC/HCT390 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT390 are dual 4-bit decade ripple counters divided into four separately clocked sections. The counters have two divide-by-2 sections and two divide-by-5 sections. These sections are normally used in a BCD

decade or bi-quinary configuration, since they share a common master reset input (nMR). If the two master reset inputs (1MR and 2MR) are used to simultaneously clear all 8 bits of the counter, a number of counting configurations are possible within one package. The separate clocks ( $\overline{nCP}_0$  and  $\overline{nCP}_1$ ) of each section allow ripple counter or frequency division applications of divide-by-2, 4, 5, 10, 20, 25, 50 or 100.

Each section is triggered by the HIGH-to-LOW transition of the clock inputs ( $\overline{nCP}_0$  and  $\overline{nCP}_1$ ). For BCD decade operation, the nQ<sub>0</sub> output is connected to the  $\overline{nCP}_1$  input of, the divide-by-5 section. For bi-quinary decade operation, the nQ<sub>3</sub> output is connected to the  $\overline{nCP}_0$  input and nQ<sub>0</sub> becomes the decade output.

The master reset inputs (1MR and 2MR) are active HIGH asynchronous inputs to each decade counter which operates on the portion of the counter identified by the "1" and "2" prefixes in the pin configuration. A HIGH level on the nMR input overrides the clocks and sets the four outputs LOW.

## QUICK REFERENCE DATA

GND = 0 V; T<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay	C <sub>L</sub> = 15 pF; V <sub>CC</sub> = 5 V			
	$\overline{nCP}_0$ to nQ <sub>0</sub>		14	18	ns
	$\overline{nCP}_1$ to nQ <sub>1</sub>		15	19	ns
	$\overline{nCP}_1$ to nQ <sub>2</sub>		23	26	ns
	$\overline{nCP}_1$ to nQ <sub>3</sub>		15	19	ns
	nMR to Q <sub>n</sub>	16	18	ns	
f <sub>max</sub>	maximum clock frequency $\overline{nCP}_0$ , $\overline{nCP}_1$		66	61	MHz
C <sub>I</sub>	input capacitance		3.5	3.5	pF
C <sub>PD</sub>	power dissipation capacitance per counter	notes 1 and 2	20	21	pF

## Notes

1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in MHz

f<sub>o</sub> = output frequency in MHz

$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs

C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in V

2. For HC the condition is V<sub>I</sub> = GND to V<sub>CC</sub>  
For HCT the condition is V<sub>I</sub> = GND to V<sub>CC</sub> -1.5 V

# Dual decade ripple counter

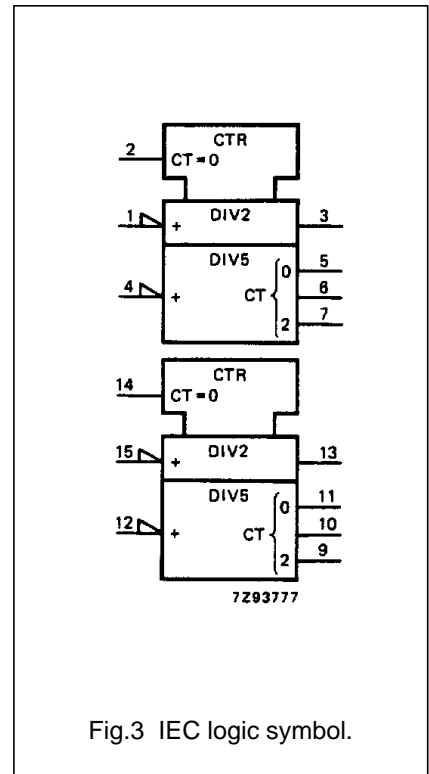
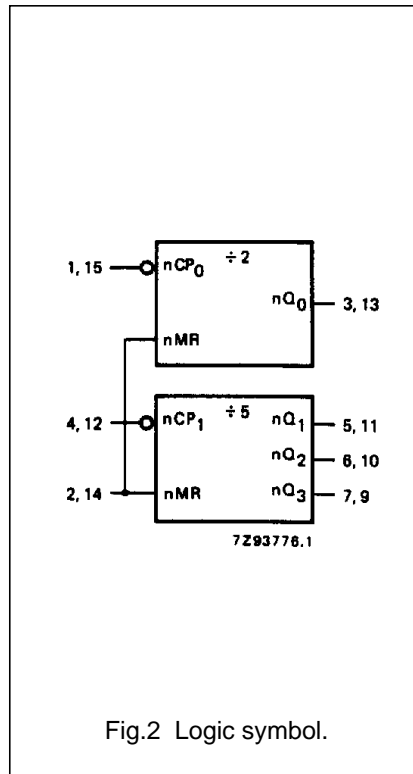
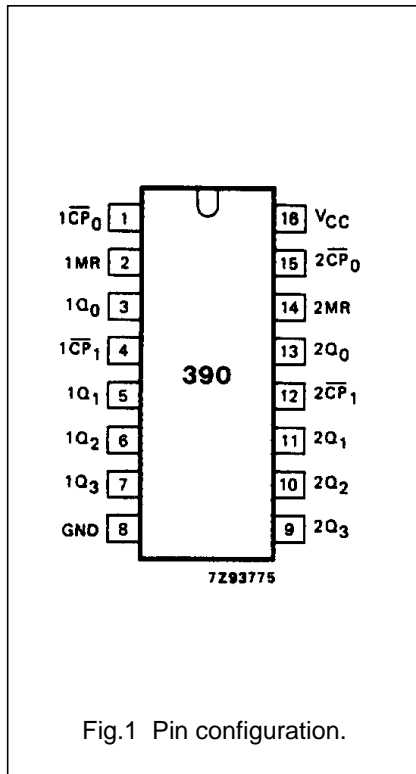
# 74HC/HCT390

## ORDERING INFORMATION

See "74HC/HCT/HCU/HCMOS Logic Package Information".

## PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1, 15	$1\overline{CP}_0, 2\overline{CP}_0$	clock input divide-by-2 section (HIGH-to-LOW, edge-triggered)
2, 14	1MR, 2MR	asynchronous master reset inputs (active HIGH)
3, 5, 6, 7	1Q <sub>0</sub> to 1Q <sub>3</sub>	flip-flop outputs
4, 12	$1\overline{CP}_1, 2\overline{CP}_1$	clock input divide-by-5 section (HIGH-to-LOW, edge triggered)
8	GND	ground (0 V)
13, 11, 10, 9	2Q <sub>0</sub> to 2Q <sub>3</sub>	flip-flop outputs
16	V <sub>CC</sub>	positive supply voltage



# Dual decade ripple counter

# 74HC/HCT390

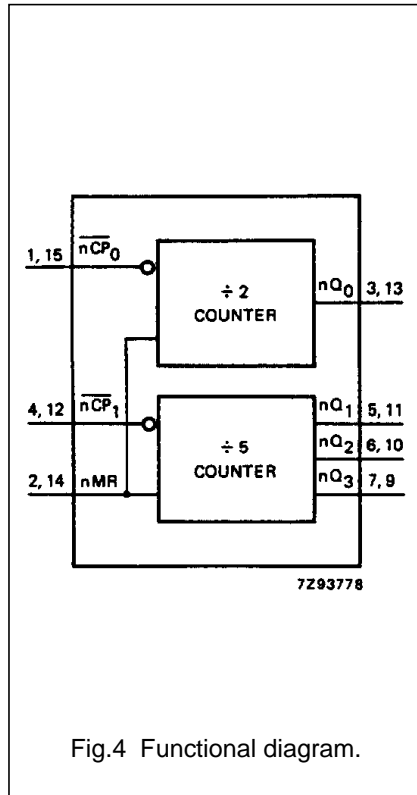


Fig.4 Functional diagram.

### BCD COUNT SEQUENCE FOR 1/2 THE "390"

COUNT	OUTPUTS			
	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>
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

#### Notes

1. Output Q<sub>0</sub> connected to  $\overline{nCP_1}$  with counter input on  $\overline{nCP_0}$ .  
H = HIGH voltage level  
L = LOW voltage level

### BI-QUINARY COUNT SEQUENCE FOR 1/2 THE "390"

COUNT	OUTPUTS			
	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>
0	L	L	L	L
1	L	H	L	L
2	L	L	H	L
3	L	H	H	L
4	L	L	L	H
5	H	L	L	L
6	H	H	L	L
7	H	L	H	L
8	H	H	H	L
9	H	L	L	H

#### Note

1. Output Q<sub>3</sub> connected to  $\overline{nCP_0}$  with counter input on  $\overline{nCP_1}$ .

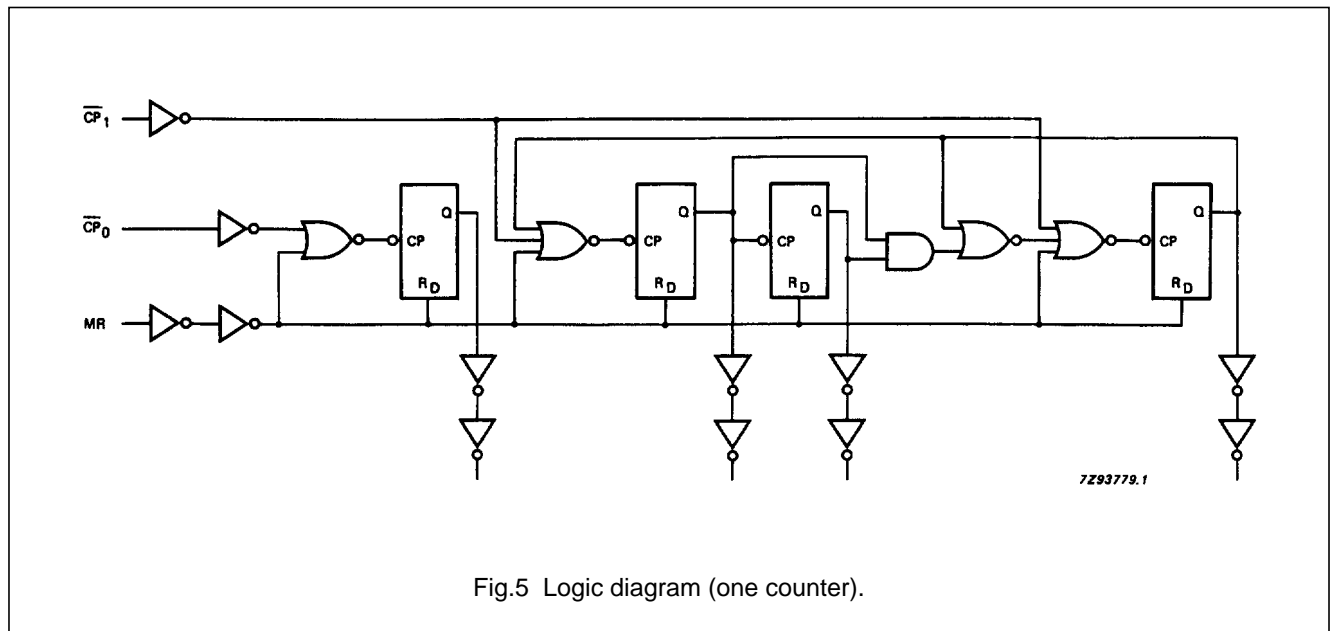


Fig.5 Logic diagram (one counter).

## Dual decade ripple counter

## 74HC/HCT390

**DC CHARACTERISTICS FOR 74HC**

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard

I<sub>CC</sub> category: MSI

**AC CHARACTERISTICS FOR 74HC**

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 50 pF

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)						UNIT	TEST CONDITIONS		
		74HC							V <sub>CC</sub> (V)	WAVEFORMS	
		+25			-40 to +85		-40 to +125				
		min.	typ.	max.	min.	max.	min.				max.
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP <sub>0</sub> to nQ <sub>0</sub>		47 17 14	145 29 25		180 36 31		220 44 38	ns	2.0 4.5 6.0	Fig.6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP <sub>1</sub> to nQ <sub>1</sub>		50 18 14	155 31 26		195 39 33		235 47 40	ns	2.0 4.5 6.0	Fig.6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP <sub>1</sub> to nQ <sub>2</sub>		74 27 22	210 42 36		265 53 45		315 63 54	ns	2.0 4.5 6.0	Fig.6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP <sub>1</sub> to nQ <sub>3</sub>		50 18 14	155 31 26		195 39 33		235 47 40	ns	2.0 4.5 6.0	Fig.6
t <sub>PHL</sub>	propagation delay nMR to nQ <sub>n</sub>		52 19 15	165 33 28		205 41 35		250 50 43	ns	2.0 4.5 6.0	Fig.7
t <sub>THL</sub> / t <sub>TLH</sub>	output transition time		19 7 6	75 15 13		95 19 16		110 22 19	ns	2.0 4.5 6.0	Fig.6
t <sub>w</sub>	clock pulse width nCP <sub>0</sub> , nCP <sub>1</sub>	80 16 14	19 7 6		100 20 17		120 24 20		ns	2.0 4.5 6.0	Fig.6
t <sub>w</sub>	master reset pulse width HIGH	80 17 14	28 10 8		105 21 18		130 26 22		ns	2.0 4.5 6.0	Fig.7
t <sub>rem</sub>	removal time nMR to nCP <sub>n</sub>	75 15 13	22 8 6		95 19 16		110 22 19		ns	2.0 4.5 6.0	Fig.7
f <sub>max</sub>	maximum clock pulse frequency nCP <sub>0</sub> , nCP <sub>1</sub>	6.0 30 35	20 60 71		4.8 24 28		4.0 20 24		MHz	2.0 4.5 6.0	Fig.6

## Dual decade ripple counter

## 74HC/HCT390

**DC CHARACTERISTICS FOR 74HCT**

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard

I<sub>CC</sub> category: MSI

**Note to HCT types**

The value of additional quiescent supply current ( $\Delta I_{CC}$ ) for a unit load of 1 is given in the family specifications. To determine  $\Delta I_{CC}$  per input, multiply this value by the unit load coefficient shown in the table below.

INPUT	UNIT LOAD COEFFICIENT
$\overline{nCP_0}$	0.45
$\overline{nCP_1}$ , nMR	0.60

**AC CHARACTERISTICS FOR 74HCT**

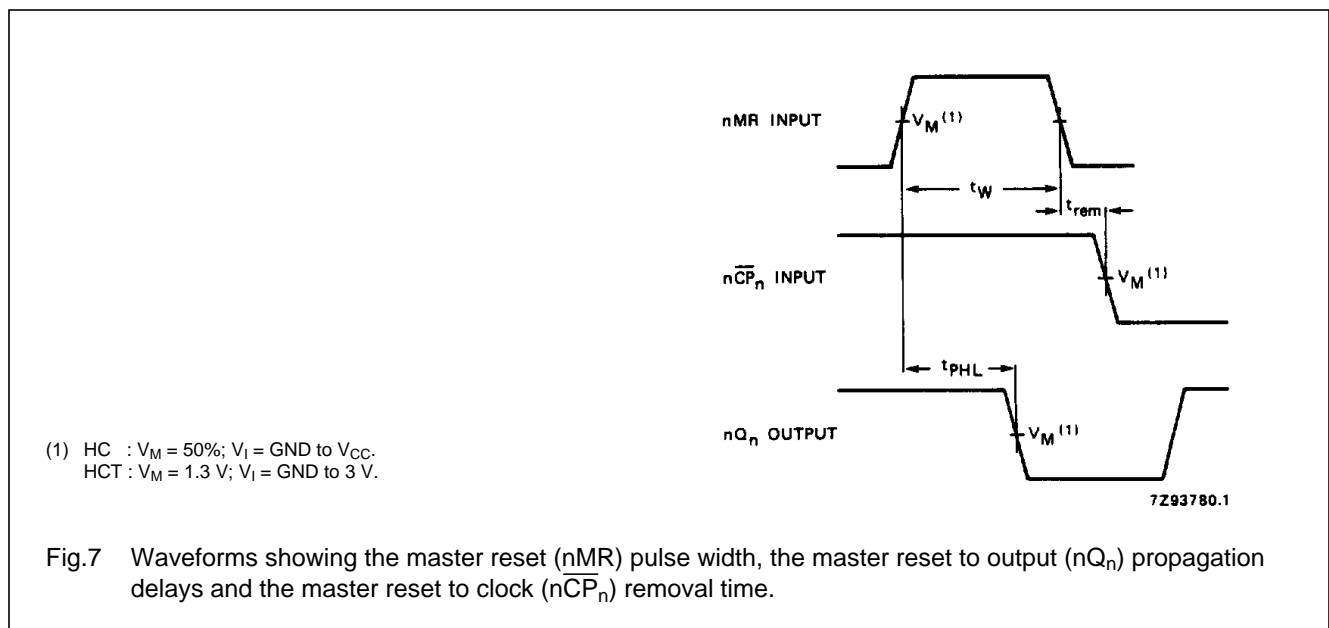
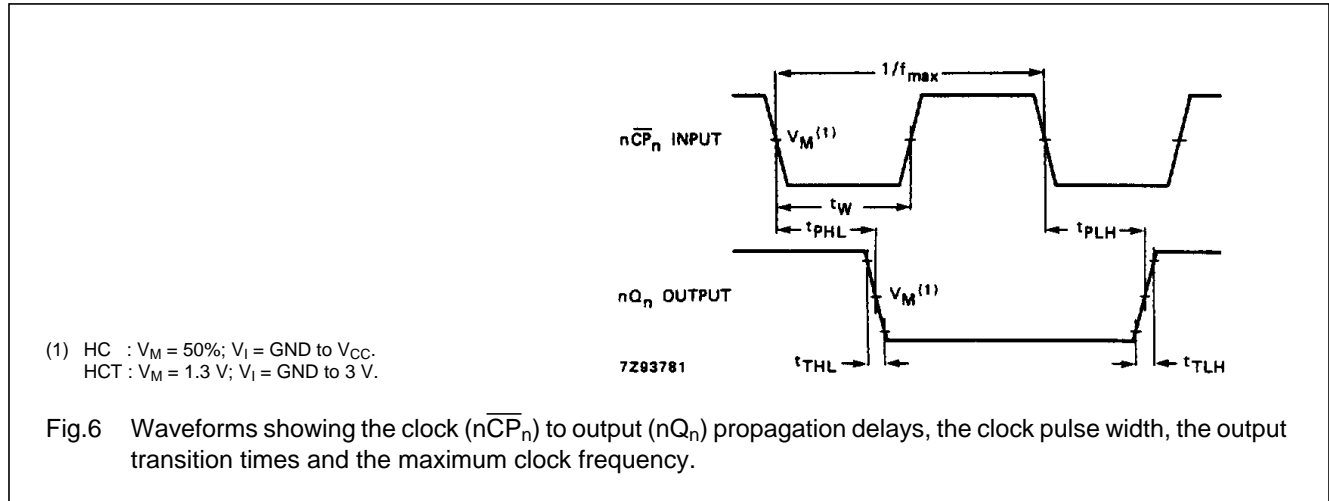
GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)								UNIT	TEST CONDITIONS	
		74HCT									V <sub>CC</sub> (V)	WAVEFORMS
		+25			-40 to +85		-40 to +125					
		min.	typ.	max.	min.	max.	min.	max.				
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP <sub>0</sub> to nQ <sub>0</sub>		21	34		43		51	ns	4.5	Fig.6	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP <sub>1</sub> to nQ <sub>1</sub>		22	38		48		57	ns	4.5	Fig.6	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP <sub>1</sub> to nQ <sub>2</sub>		30	51		64		77	ns	4.5	Fig.6	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nCP <sub>1</sub> to nQ <sub>3</sub>		22	38		48		57	ns	4.5	Fig.6	
t <sub>PHL</sub>	propagation delay nMR to nQ <sub>n</sub>		21	36		45		54	ns	4.5	Fig.7	
t <sub>THL</sub> / t <sub>TLH</sub>	output transition time		7	15		19		22	ns	4.5	Fig.6	
t <sub>w</sub>	clock pulse width nCP <sub>0</sub> , nCP <sub>1</sub>	18	8		23		27		ns	4.5	Fig.6	
t <sub>w</sub>	master reset pulse width HIGH	17	10		21		26		ns	4.5	Fig.7	
t <sub>rem</sub>	removal time nMR to nCP <sub>n</sub>	15	8		19		22		ns	4.5	Fig.7	
f <sub>max</sub>	maximum clock pulse frequency nCP <sub>0</sub> , nCP <sub>1</sub>	27	55		22		18		MHz	4.5	Fig.6	

Dual decade ripple counter

74HC/HCT390

AC WAVEFORMS



PACKAGE OUTLINES

See "74HC/HCT/HCU/HCMOS Logic Package Outlines".

# 74HC/HCT390; Dual decade ripple counter

Information as of 2003-04-22

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## Models

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## General description

The 74HC/HCT390 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT390 are dual 4-bit decade ripple counters divided into four separately clocked sections. The counters have two divide-by-2 sections and two divide-by-5 sections. These sections are normally used in a BCD decade or bi-quinary configuration, since they share a common master reset input (nMR). If the two master reset inputs (1MR and 2MR) are used to simultaneously clear all 8 bits of the counter, a number of counting configurations are possible within one package. The separate clocks (nCP<sub>0</sub> and nCP<sub>1</sub>) of each section allow ripple counter or frequency division applications of divide-by-2, 4, 5, 10, 20, 25, 50 or 100.

Each section is triggered by the HIGH-to-LOW transition of the clock inputs (nCP<sub>0</sub> and nCP<sub>1</sub>). For BCD decade operation, the nQ<sub>0</sub> output is connected to the nCP<sub>1</sub> input of, the divide-by-5 section. For bi-quinary decade operation, the nQ<sub>3</sub> output is connected to the nCP<sub>0</sub> input and nQ<sub>0</sub> becomes the decade output.


The master reset inputs (1MR and 2MR) are active HIGH asynchronous inputs to each decade counter which operates on the portion of the counter identified by the '1' and '2' prefixes in the pin configuration. A HIGH level on the nMR input overrides the clocks and sets the four outputs LOW.

## Features

- Two BCD decade or bi-quinary counters
- One package can be configured to divide-by-2, 4, 5, 10, 20, 25, 50 or 100
- Two master reset inputs to clear each decade counter individually
- Output capability: standard
- I<sub>CC</sub> category: MSI






## □ Datasheet

<u>Type number</u>	<u>Title</u>	<u>Publication release date</u>	<u>Datasheet status</u>	<u>Page count</u>	<u>File size (kB)</u>	<u>Datasheet</u>
74HC/HCT390	Dual decade ripple counter	12/1/1990	Product specification	7	46	 <a href="#">Download</a>

## Additional datasheet info

To complete the device datasheet with package and family information, also download the following PDF files. The "Logic Package Information" document is required to determine in which package(s) this device is available.

<u>Document</u>	<u>Description</u>
1  <a href="#">HCT_FAMILY_SPECIFICATIONS</a>	HC/T Family Specifications, The IC06 74HC/HCT/HCMOS Logic Family Specifications
2  <a href="#">HCT_PACKAGE_INFO</a>	HC/T Package Info, The IC06 74HC/HCT/HCMOS Logic Package Information
3  <a href="#">HCT_PACKAGE_OUTLINES</a>	HC/T Package Outlines, The IC06 74HC/HCT/HCMOS Logic Package Outlines

## □ Parametrics

<u>Type number</u>	<u>Package</u>	<u>Description</u>	<u>Propagation Delay(ns)</u>	<u>Voltage</u>	<u>No. of Pins</u>	<u>Power Dissipation Considerations</u>	<u>Logic Switching Levels</u>	<u>Output Drive Capability</u>
74HC390D	<a href="#">SOT109</a> (SO16)	Dual Decade Ripple Counter	15	5 Volts +	16	Low Power or Battery Applications	CMOS	Low
74HC390DB	<a href="#">SOT338-1</a> (SSOP16)	Dual Decade Ripple Counter	15	5 Volts +	16	Low Power or Battery Applications	CMOS	Low
74HC390N	<a href="#">SOT38-1</a> (DIP16)	Dual Decade Ripple Counter	15	5 Volts +	16	Low Power or Battery Applications	CMOS	Low
74HC390PW	<a href="#">SOT403-1</a> (TSSOP16)	Dual Decade Ripple Counter	15	5 Volts +	16	Low Power or Battery Applications	CMOS	Low
74HCT390D	<a href="#">SOT109</a> (SO16)	Dual Decade Ripple Counter; TTL Enabled	15	5 Volts +	16	Low Power or Battery Applications	TTL	Low
74HCT390DB	<a href="#">SOT338-1</a> (SSOP16)	Dual Decade Ripple Counter; TTL Enabled	15	5 Volts +	16	Low Power or Battery Applications	TTL	Low

74HCT390N	<a href="#">SOT38-1</a> (DIP16)	Dual Decade Ripple Counter; TTL Enabled	15	5 Volts +	16	Low Power or Battery Applications	TTL	Low
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## □ Products, packages, availability and ordering

<u>Type number</u>	<u>North American type number</u>	<u>Ordering code (12NC)</u>	<u>Marking/Packing</u> <a href="#">Discretes packing info</a>	<u>Package</u>	<u>Device status</u>	<u>Buy online</u>
74HC390D	74HC390D	9337 147 20652	Standard Marking * Bulk Pack, CECC	<a href="#">SOT109</a> (SO16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
	74HC390D-T	9337 147 20653	Standard Marking * Reel Pack, SMD, 13", CECC	<a href="#">SOT109</a> (SO16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
74HC390DB	74HC390DB	9351 893 30112	Standard Marking * Bulk Pack	<a href="#">SOT338-1</a> (SSOP16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
	74HC390DB-T	9351 893 30118	Standard Marking * Reel Pack, SMD, 13"	<a href="#">SOT338-1</a> (SSOP16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
74HC390N	74HC390N	9336 696 30652	Standard Marking * Bulk Pack, CECC	<a href="#">SOT38-1</a> (DIP16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
74HC390PW	74HC390PW	9351 890 60112	Standard Marking * Bulk Pack	<a href="#">SOT403-1</a> (TSSOP16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
	74HC390PW-T	9351 890 60118	Standard Marking * Reel Pack, SMD, 13"	<a href="#">SOT403-1</a> (TSSOP16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
74HCT390D	74HCT390D	9337 152 00652	Standard Marking * Bulk Pack, CECC	<a href="#">SOT109</a> (SO16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
	74HCT390D-T	9337 152 00653	Standard Marking * Reel Pack, SMD, 13", CECC	<a href="#">SOT109</a> (SO16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
74HCT390DB	74HCT390DB	9351 899 30112	Standard Marking * Bulk Pack	<a href="#">SOT338-1</a> (SSOP16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
	74HCT390DB-T	9351 899 30118	Standard Marking * Reel Pack, SMD, 13"	<a href="#">SOT338-1</a> (SSOP16)	Full production	<a href="#">order this</a> <input type="checkbox"/>
74HCT390N	74HCT390N	9336 702 60652	Standard Marking * Bulk Pack, CECC	<a href="#">SOT38-1</a> (DIP16)	Full production	<a href="#">order this</a> <input type="checkbox"/>

Products in the above table are all in production. Some variants are discontinued; [click here](#) for information on these variants.

## ▣ Similar products

▣ [74HC/HCT390](#) links to the similar products page containing an overview of products that are similar in function or related to the type number(s) as listed on this page. The similar products page includes products from the same catalog tree(s), relevant selection guides and products from the same functional category.

## ▣ Support & tools

▣ [HC/T Family Specifications, The IC06 74HC/HCT/HCMOS Logic Family Specifications](#)(date 01-Mar-98)

▣ [HC/T User Guide](#)(date 01-Nov-97)

## ▣ Email/translate this product information

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