

General Description

The SN74HC/HCT390 is a dual 4-bit decade ripple counter divided into four separately clocked sections. The counters have two divide-by-2 sections and two divide-by-5 sections. These sections share an asynchronous master reset input (nMR) and can be used in a BCD decade or bi-quinary configuration. If master reset inputs 1MR and 2MR are used to clear all 8 bits of the counter simultaneously, numerous counting configurations are possible within one package. Section clocks nCP 0 and nCP 1, allow ripple counter or frequency division applications of divide-by-2, 4, 5, 10, 20, 25, 50 or 100.

The HIGH_to_LOW transition of the clock inputs nCP 0 and nCP 1 trigger each section. For BCD decade operation, the nQ0 output is connected to the nCP 1 input of the divide-by-5 section. For bi-quinary decade operation, thenQ3 output is connected to the nCP 0 input and nQ0 becomes the decade output. A HIGH on the nMR input overrides the clocks and sets the four outputs LOW. Inputs include clamp diodes. It enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

Features

- Input levels:
For SN74HC390: CMOS level
For SN74HCT390: TTL level
- Two BCD decade or bi-quinary counters
- One device 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
- Specified from -40°C to +125°C
- Packaging information: DIP16/SOP16/TSSOP16

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW SN74HC390N	DIP-16	74HC390N	Tube	1000Pcs/Box
XBLW SN74HC390DTR	SOP-16	74HC390	Tape	2500Pcs/Reel
XBLW SN74HC390TDTR	TSSOP-16	74HC390	Tape	3000Pcs/Reel
XBLW SN74HCT390N	DIP-16	74HCT390N	Tube	1000Pcs/Box
XBLW SN74HCT390DTR	SOP-16	74HCT390	Tape	2500Pcs/Reel
XBLW SN74HCT390TDTR	TSSOP-16	74HCT390	Tape	3000Pcs/Reel

Block Diagram And Pin Description

Block Diagram

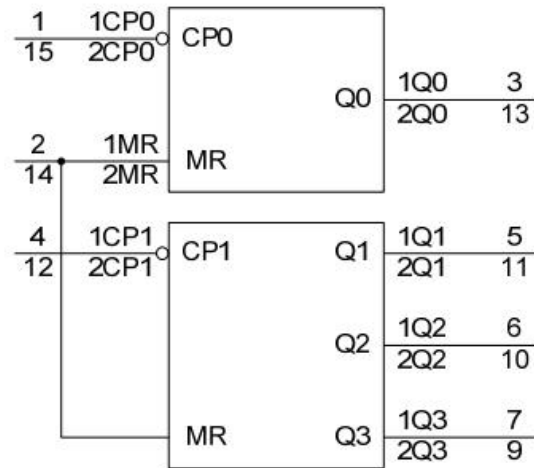


Figure 1. Logic symbol

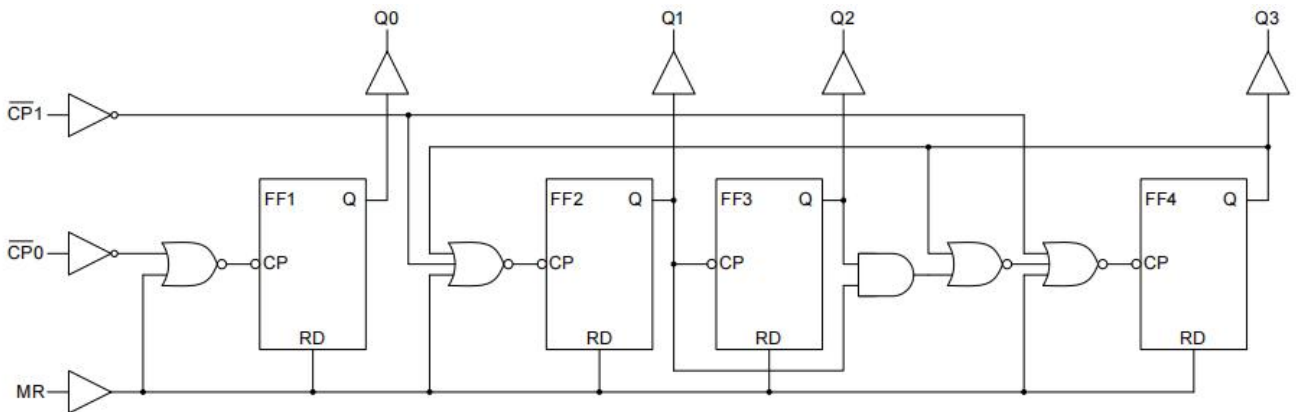
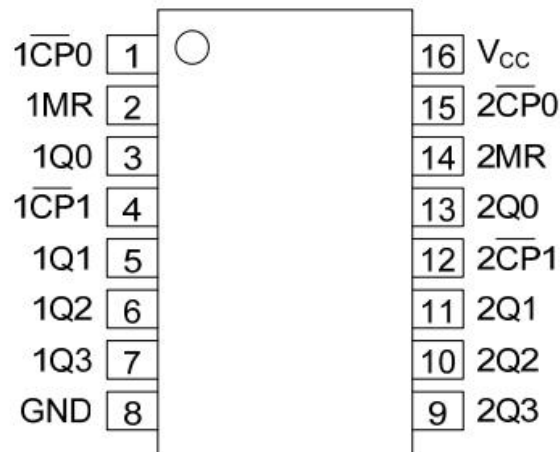


Figure 2. Logic diagram (one counter)

Pin Configurations



Pin Description

Pin No.	Pin Name	Description
1	1CP $\bar{0}$	clock input divide-by-2 section (HIGH-to-LOW; edge-triggered)
2	1MR	asynchronous master reset input (active HIGH)
3	1Q0	flip-flop outputs
4	1CP $\bar{1}$	clock input divide-by-5 section (HIGH-to-LOW; edge-triggered)
5	1Q1	flip-flop outputs
6	1Q2	flip-flop outputs
7	1Q3	flip-flop outputs
8	GND	ground (0V)
9	2Q3	flip-flop outputs
10	2Q2	flip-flop outputs
11	2Q1	flip-flop outputs
12	2CP $\bar{1}$	clock input divide-by-5 section (HIGH-to-LOW; edge-triggered)
13	2Q0	flip-flop outputs
14	2MR	asynchronous master reset input (active HIGH)
15	2CP $\bar{0}$	clock input divide-by-2 section (HIGH-to-LOW; edge-triggered)
16	Vcc	supply voltage

Function Table

1、BCD Count Sequence

Count	Output			
	nQ0	nQ1	nQ2	nQ3
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

Note: Output nQ0 connected to nCP1 ; counter input on nCP0 .

H=HIGH voltage level;

L=LOW voltage level;

.2、Bi-quinary Count Sequence

Count	Output			
	nQ0	nQ1	nQ2	nQ3
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	H	L	L
6	H	L	L	L
7	H	H	H	L
8	H	L	H	L
9	H	H	L	H

Note: Output nQ3 connected to nCP0 ; counter input on nCP1 .

H=HIGH voltage level;

L=LOW voltage level;

Electrical Parameter

Absolute Maximum Ratings

($T_{amb}=25^{\circ}\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified)

Characteristic	Symbol	Conditions	Min.	Max.	Unit
supply voltage	V_{CC}	-	-0.5	+7.0	V
input clamping current	I_{IK}	$V_I < -0.5\text{V}$ or $V_I > V_{CC} + 0.5\text{V}$	-	± 20	mA
output clamping current	I_{OK}	$V_I < -0.5\text{V}$ or $V_O > V_{CC} + 0.5\text{V}$	-	± 20	mA
output current	I_O	$0.5\text{V} < V_O < V_{CC} + 0.5\text{V}$	-	± 25	mA
supply current	I_{CC}	-	-	+50	mA
ground current	I_{GND}	-	-50	-	mA
storage temperature	T_{stg}	-	-65	+150	$^{\circ}\text{C}$
soldering temperature	T_L	10s	DIP		$^{\circ}\text{C}$
			SOP/TSSOP		$^{\circ}\text{C}$

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
SN74HC390						
supply voltage	V_{CC}	-	2.0	5.0	6.0	V
input voltage	V_I	-	0	-	V_{CC}	V
output voltage	V_O	-	0	-	V_{CC}	V
ambient temperature	T_{amb}	-	-40	-	+125	$^{\circ}\text{C}$
SN74HCT390						
supply voltage	V_{CC}	-	4.5	5.0	5.5	V
input voltage	V_I	-	0	-	V_{CC}	V
output voltage	V_O	-	0	-	V_{CC}	V
ambient temperature	T_{amb}	-	-40	-	+125	$^{\circ}\text{C}$

Electrical Characteristics
DC Characteristics 1

 (T_{amb}=25°C, voltages are referenced to GND (ground=0V), unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
SN74HC390							
HIGH-level input voltage	V _{IH}	V _{CC} =2.0V	1.5	1.2	-	V	
		V _{CC} =4.5V	3.15	2.4	-	V	
		V _{CC} =6.0V	4.2	3.2	-	V	
LOW-level input voltage	V _{IL}	V _{CC} =2.0V	-	0.8	0.5	V	
		V _{CC} =4.5V	-	2.1	1.35	V	
		V _{CC} =6.0V	-	2.8	1.8	V	
HIGH-level output voltage	V _{OH}	V _I =V _{IH} or V _{IL}	I _O =-20uA; V _{CC} =2.0V	1.9	2.0	-	V
			I _O =-20uA; V _{CC} =4.5V	4.4	4.5	-	V
			I _O =-20uA; V _{CC} =6.0V	5.9	6.0	-	V
			I _O =-4.0mA; V _{CC} =4.5V	3.98	4.32	-	V
			I _O =-5.2mA; V _{CC} =6.0V	5.48	5.81	-	V
LOW-level output voltage	V _{OL}	V _I =V _{IH} or V _{IL}	I _O =20uA; V _{CC} =2.0V	-	0	0.1	V
			I _O =20uA; V _{CC} =4.5V	-	0	0.1	V
			I _O =20uA; V _{CC} =6.0V	-	0	0.1	V
			I _O =4.0mA; V _{CC} =4.5V	-	0.15	0.26	V
			I _O =5.2mA; V _{CC} =6.0V	-	0.16	0.26	V
input leakage current	I _I	V _I =V _{CC} or GND; V _{CC} =6.0V	-	-	±1	uA	
supply current	I _{CC}	V _I =V _{CC} or GND; I _O =0A; V _{CC} =6.0V	-	-	8	uA	
SN74HCT390							
HIGH-level input voltage	V _{IH}	V _{CC} =4.5V to 5.5V	2.0	1.6	-	V	
LOW-level input voltage	V _{IL}	V _{CC} =4.5V to 5.5V	-	1.2	0.8	V	
HIGH-level output voltage	V _{OH}	V _I =V _{IH} or V _{IL} ; V _{CC} =4.5V	I _O =-20uA	4.4	4.5	-	V
			I _O =-4.0mA	3.98	4.32	-	V
LOW-level output voltage	V _{OL}	V _I =V _{IH} or V _{IL} ;	I _O =20uA	-	0	0.1	V
output voltage		V _{CC} =4.5V	I _O =4.0mA	-	0.15	0.26	V
input leakage current	I _I	V _I =V _{CC} or GND; V _{CC} =5.5V	-	-	±1	uA	
supply current	I _{CC}	V _I =V _{CC} or GND; I _O =0A; V _{CC} =5.5V	-	-	8	uA	
additional supply current	ΔI _{CC}	per input pin; V _I =V _{CC} -2.1V; other inputs at V _{CC} or GND; V _{CC} =4.5V to 5.5V	n \overline{CP} 0 inputs	-	45	162	uA
			n \overline{CP} 1, nMR inputs	-	60	216	uA

DC Characteristics 2

 ($T_{amb} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
SN74HC390							
HIGH-level input voltage	V_{IH}	$V_{CC}=2.0\text{V}$		1.5	-	-	V
		$V_{CC}=4.5\text{V}$		3.15	-	-	V
		$V_{CC}=6.0\text{V}$		4.2	-	-	V
LOW-level input voltage	V_{IL}	$V_{CC}=2.0\text{V}$		-	-	0.5	V
		$V_{CC}=4.5\text{V}$		-	-	1.35	V
		$V_{CC}=6.0\text{V}$		-	-	1.8	V
HIGH-level output voltage	V_{OH}	$V_i = V_{IH}$ or V_{IL}	$I_o = -20\mu\text{A}; V_{CC}=2.0\text{V}$	1.9	-	-	V
			$I_o = -20\mu\text{A}; V_{CC}=4.5\text{V}$	4.4	-	-	V
			$I_o = -20\mu\text{A}; V_{CC}=6.0\text{V}$	5.9	-	-	V
			$I_o = -4.0\text{mA}; V_{CC}=4.5\text{V}$	3.84	-	-	V
			$I_o = -5.2\text{mA}; V_{CC}=6.0\text{V}$	5.34	-	-	V
LOW-level output voltage	V_{OL}	$V_i = V_{IH}$ or V_{IL}	$I_o = 20\mu\text{A}; V_{CC}=2.0\text{V}$	-	-	0.1	V
			$I_o = 20\mu\text{A}; V_{CC}=4.5\text{V}$	-	-	0.1	V
			$I_o = 20\mu\text{A}; V_{CC}=6.0\text{V}$	-	-	0.1	V
			$I_o = 4.0\text{mA}; V_{CC}=4.5\text{V}$	-	-	0.33	V
			$I_o = 5.2\text{mA}; V_{CC}=6.0\text{V}$	-	-	0.33	V
input leakage current	I_i	$V_i = V_{CC}$ or GND; $V_{CC}=6.0\text{V}$		-	-	± 1.0	μA
supply current	I_{CC}	$V_i = V_{CC}$ or GND; $I_o = 0\text{A}; V_{CC}=6.0\text{V}$		-	-	80	μA
SN74HCT390							
HIGH-level input voltage	V_{IH}	$V_{CC}=4.5\text{V}$ to 5.5V		2.0	-	-	V
LOW-level input voltage	V_{IL}	$V_{CC}=4.5\text{V}$ to 5.5V		-	-	0.8	V
HIGH-level output voltage	V_{OH}	$V_i = V_{IH}$ or $V_{IL}; V_{CC}=4.5\text{V}$	$I_o = -20\mu\text{A}$	4.4	-	-	V
			$I_o = -4.0\text{mA}$	3.84	-	-	V
LOW-level output voltage	V_{OL}	$V_i = V_{IH}$ or $V_{IL}; V_{CC}=4.5\text{V}$	$I_o = 20\mu\text{A}$	-	-	0.1	V
			$I_o = 4.0\text{mA}$	-	-	0.33	V
input leakage current	I_i	$V_i = V_{CC}$ or GND; $V_{CC}=5.5\text{V}$		-	-	± 1.0	μA
supply current	I_{CC}	$V_i = V_{CC}$ or GND; $I_o = 0\text{A}; V_{CC}=5.5\text{V}$		-	-	80	μA
additional supply current	ΔI_{CC}	per input pin; $V_i = V_{CC} - 2.1\text{V}$; other	$n \overline{\text{CP}} 0$ inputs	-	-	202.5	μA
		inputs at V_{CC} or GND; $V_{CC}=4.5\text{V}$ to 5.5V	$n \text{CP} 1$, $n \text{MR}$ inputs	-	-	270	μA

DC Characteristics 3

 (T_{amb}=-40°C to +125°C, voltages are referenced to GND (ground=0V), unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
SN74HC390							
HIGH-level input voltage	V _{IH}	V _{CC} =2.0V	1.5	-	-	V	
		V _{CC} =4.5V	3.15	-	-	V	
		V _{CC} =6.0V	4.2	-	-	V	
LOW-level input voltage	V _{IL}	V _{CC} =2.0V	-	-	0.5	V	
		V _{CC} =4.5V	-	-	1.35	V	
		V _{CC} =6.0V	-	-	1.8	V	
HIGH-level output voltage	V _{OH}	V _I =V _{IH} or V _{IL}	I _O =-20uA; V _{CC} =2.0V	1.9	-	-	V
			I _O =-20uA; V _{CC} =4.5V	4.4	-	-	V
			I _O =-20uA; V _{CC} =6.0V	5.9	-	-	V
			I _O =-4.0mA; V _{CC} =4.5V	3.7	-	-	V
			I _O =-5.2mA; V _{CC} =6.0V	5.2	-	-	V
LOW-level output voltage	V _{OL}	V _I =V _{IH} or V _{IL}	I _O =20uA; V _{CC} =2.0V	-	-	0.1	V
			I _O =20uA; V _{CC} =4.5V	-	-	0.1	V
			I _O =20uA; V _{CC} =6.0V	-	-	0.1	V
			I _O =4.0mA; V _{CC} =4.5V	-	-	0.4	V
			I _O =5.2mA; V _{CC} =6.0V	-	-	0.4	V
input leakage current	I _I	V _I =V _{CC} or GND; V _{CC} =6.0V	-	-	±1.0	uA	
supply current	I _{CC}	V _I =V _{CC} or GND; I _O =0A; V _{CC} =6.0V	-	-	160	uA	
SN74HCT390							
HIGH-level input voltage	V _{IH}	V _{CC} =4.5V to 5.5V	2.0	-	-	V	
LOW-level input voltage	V _{IL}	V _{CC} =4.5V to 5.5V	-	-	0.8	V	
HIGH-level output voltage	V _{OH}	V _I =V _{IH} or V _{IL} ; V _{CC} =4.5V	I _O =-20uA	4.4	-	-	V
			I _O =-4.0mA	3.7	-	-	V
LOW-level output voltage	V _{OL}	V _I =V _{IH} or V _{IL} ; V _{CC} =4.5V	I _O =20uA	-	-	0.1	V
			I _O =4.0mA	-	-	0.4	V
input leakage current	I _I	V _I =V _{CC} or GND; V _{CC} =5.5V	-	-	±1.0	uA	
supply current	I _{CC}	V _I =V _{CC} or GND; I _O =0A; V _{CC} =5.5V	-	-	160	uA	
additional supply current	ΔI _{CC}	per input pin; V _I =V _{CC} -2.1V; other inputs at V _{CC} or GND; V _{CC} =4.5V to 5.5V	n $\overline{\text{CP}}$ 0 inputs	-	-	220.5	uA
			n $\overline{\text{CP}}$ 1, nMR inputs	-	-	294	uA

AC Characteristics 1

(T_{amb}=25°C, GND=0V, C_L=50pF, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ. ^[1]	Max.	Unit	
SN74HC390							
propagation delay	t _{PLH} , t _{PHL}	nCP0 to nQ0; see Figure 4	V _{CC} =2.0V	-	47	145	ns
			V _{CC} =4.5V	-	17	29	ns
			V _{CC} =5.0V; C _L =15pF	-	14	-	ns
			V _{CC} =6.0V	-	14	25	ns
		nCP1 to nQ1; see Figure 4	V _{CC} =2.0V	-	50	155	ns
			V _{CC} =4.5V	-	18	31	ns
			V _{CC} =5.0V; C _L =15pF	-	15	-	ns
			V _{CC} =6.0V	-	14	26	ns
		nCP1 to nQ2; see Figure 4	V _{CC} =2.0V	-	74	210	ns
			V _{CC} =4.5V	-	27	42	ns
			V _{CC} =5.0V; C _L =15pF	-	23	-	ns
			V _{CC} =6.0V	-	22	36	ns
		nCP1 to nQ3; see Figure 4	V _{CC} =2.0V	-	50	155	ns
			V _{CC} =4.5V	-	18	31	ns
			V _{CC} =5.0V; C _L =15pF	-	15	-	ns
			V _{CC} =6.0V	-	14	26	ns
HIGH to LOW Propagation delay	t _{PHL}	nMR to nQn; see Figure 5	V _{CC} =2.0V	-	52	165	ns
			V _{CC} =4.5V	-	19	33	ns
			V _{CC} =5.0V; C _L =15pF	-	16	-	ns
			V _{CC} =6.0V	-	15	28	ns
transition time	t _{THL} , t _{TLH}	nQn; see Figure 4	V _{CC} =2.0V	-	19	75	ns
			V _{CC} =4.5V	-	7	15	ns
			V _{CC} =6.0V	-	6	13	ns
pulse width	t _w	nCP0, nCP1; HIGH or LOW; see Figure 4	V _{CC} =2.0V	80	19	-	ns
			V _{CC} =4.5V	16	7	-	ns
			V _{CC} =6.0V	14	6	-	ns
		nMR HIGH; see Figure 5	V _{CC} =2.0V	80	28	-	ns
			V _{CC} =4.5V	17	10	-	ns
			V _{CC} =6.0V	14	8	-	ns
recovery time	t _{rec}	nMR to nCPn; see Figure 5	V _{CC} =2.0V	75	22	-	ns
			V _{CC} =4.5V	15	8	-	ns
			V _{CC} =6.0V	13	6	-	ns
maximum frequency	f _{max}	nCPn; see Figure 4	V _{CC} =2.0V	6	20	-	MHz
			V _{CC} =4.5V	30	60	-	MHz
			V _{CC} =5.0V; C _L =15pF	-	66	-	MHz
			V _{CC} =6.0V	35	71	-	MHz
SN74HCT390							
propagation delay	t _{PLH} , t _{PHL}	nCP0 to nQ0; see Figure 4	V _{CC} =4.5V	-	21	34	ns
			V _{CC} =5.0V; C _L =15pF	-	18	-	ns
		nCP1 to nQ1; see Figure 4	V _{CC} =4.5V	-	22	38	ns
			V _{CC} =5.0V; C _L =15pF	-	19	-	ns
		nCP1 to nQ2; see Figure 4	V _{CC} =4.5V	-	30	51	ns
			V _{CC} =5.0V; C _L =15pF	-	26	-	ns
		nCP1 to nQ3; see	V _{CC} =4.5V	-	22	38	ns
			V _{CC} =5.0V; C _L =15pF	-	19	-	ns

		Figure 4					
HIGH to LOW Propagation delay	t _{PHL}	nMR to nQn; see Figure 5	V _{CC} =4.5V	-	21	36	ns
			V _{CC} =5.0V; C _L =15pF	-	18	-	ns
transition time	t _{THL} , t _{TLH}	nQn; V _{CC} =4.5V; see Figure 4		-	7	15	ns
pulse width	t _w	nCP0, nCP1; HIGH or LOW; V _{CC} =4.5V; see Figure 4		18	8	-	ns
		nMR HIGH; V _{CC} =4.5V; see Figure 5		17	10	-	ns
recovery time	t _{rec}	nMR to nCPn; V _{CC} =4.5V; see Figure 5		15	8	-	ns
maximum frequency	f _{max}	nCPn; see Figure 4	V _{CC} =4.5V	27	55	-	MHz
			V _{CC} =5.0V; C _L =15pF	-	61	-	MHz

Note:

[1] All typical values are measured at T_{amb}=25°C.

AC Characteristics 2

(T_{amb}=-40°C to +85°C, GND=0V, C_L=50pF, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
SN74HC390							
propagation delay	t _{PLH} , t _{PHL}	nCP0 to nQ0; see Figure 4	V _{CC} =2.0V	-	-	180	ns
			V _{CC} =4.5V	-	-	36	ns
			V _{CC} =6.0V	-	-	31	ns
		nCP1 to nQ1; see Figure 4	V _{CC} =2.0V	-	-	195	ns
			V _{CC} =4.5V	-	-	39	ns
			V _{CC} =6.0V	-	-	33	ns
		nCP1 to nQ2; see Figure 4	V _{CC} =2.0V	-	-	265	ns
			V _{CC} =4.5V	-	-	53	ns
			V _{CC} =6.0V	-	-	45	ns
		nCP1 to nQ3; see Figure 4	V _{CC} =2.0V	-	-	195	ns
			V _{CC} =4.5V	-	-	39	ns
			V _{CC} =6.0V	-	-	33	ns
HIGH to LOW Propagation delay	t _{PHL}	nMR to nQn; see Figure 5	V _{CC} =2.0V	-	-	205	ns
			V _{CC} =4.5V	-	-	41	ns
			V _{CC} =6.0V	-	-	35	ns
transition time	t _{THL} , t _{TLH}	nQn; see Figure 4	V _{CC} =2.0V	-	-	95	ns
			V _{CC} =4.5V	-	-	19	ns
			V _{CC} =6.0V	-	-	16	ns
pulse width	t _w	nCP0, nCP1; HIGH or LOW; see Figure 4	V _{CC} =2.0V	100	-	-	ns
			V _{CC} =4.5V	20	-	-	ns
			V _{CC} =6.0V	17	-	-	ns
		nMR HIGH; see Figure 5	V _{CC} =2.0V	105	-	-	ns
			V _{CC} =4.5V	21	-	-	ns
			V _{CC} =6.0V	18	-	-	ns

recovery time	t_{rec}	\overline{nMR} to \overline{nCPn} ; see Figure 5	$V_{CC}=2.0V$	95	-	-	ns
			$V_{CC}=4.5V$	19	-	-	ns
			$V_{CC}=6.0V$	16	-	-	ns
maximum frequency	f_{max}	\overline{nCPn} ; see Figure 4	$V_{CC}=2.0V$	4.8	-	-	MHz
			$V_{CC}=4.5V$	24	-	-	MHz
			$V_{CC}=6.0V$	28	-	-	MHz
SN74HCT390							
propagation delay	t_{PLH}, t_{PHL}	$\overline{nCP0}$ to $\overline{nQ0}$; $V_{CC}=4.5V$; see Figure 4	-	-	43	ns	
		$\overline{nCP1}$ to $\overline{nQ1}$; $V_{CC}=4.5V$; see Figure 4	-	-	48	ns	
		$\overline{nCP1}$ to $\overline{nQ2}$; $V_{CC}=4.5V$; see Figure 4	-	-	64	ns	
		$\overline{nCP1}$ to $\overline{nQ3}$; $V_{CC}=4.5V$; see Figure 4	-	-	48	ns	
HIGH to LOW Propagation delay	t_{PHL}	\overline{nMR} to \overline{nQn} ; $V_{CC}=4.5V$; see Figure 5	-	-	45	ns	
transition time	t_{THL}, t_{TLH}	\overline{nQn} ; $V_{CC}=4.5V$; see Figure 4	-	-	19	ns	
pulse width	t_w	$\overline{nCP0}$, $\overline{nCP1}$; HIGH or LOW; $V_{CC}=4.5V$; see Figure 4	23	-	-	ns	
		\overline{nMR} HIGH; $V_{CC}=4.5V$; see Figure 5	21	-	-	ns	
recovery time	t_{rec}	\overline{nMR} to \overline{nCPn} ; $V_{CC}=4.5V$; see Figure 5	19	-	-	ns	
maximum frequency	f_{max}	\overline{nCPn} ; $V_{CC}=4.5V$; see Figure 4	22	-	-	MHz	

AC Characteristics 3

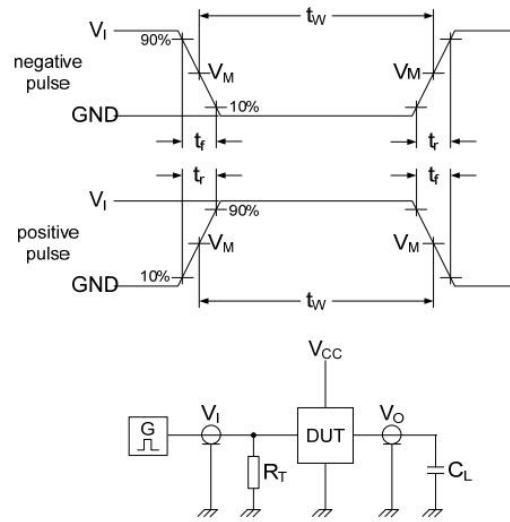
($T_{amb}=-40^{\circ}C$ to $+125^{\circ}C$, $GND=0V$, $C_L=50pF$, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
SN74HC390							
propagation delay	t_{pd}	$\overline{nCP0}$ to $\overline{nQ0}$; see Figure 4	$V_{CC}=2.0V$	-	-	220	ns
			$V_{CC}=4.5V$	-	-	44	ns
			$V_{CC}=6.0V$	-	-	38	ns
		$\overline{nCP1}$ to $\overline{nQ1}$; see Figure 4	$V_{CC}=2.0V$	-	-	235	ns
			$V_{CC}=4.5V$	-	-	47	ns
			$V_{CC}=6.0V$	-	-	40	ns
		$\overline{nCP1}$ to $\overline{nQ2}$; see Figure 4	$V_{CC}=2.0V$	-	-	315	ns
			$V_{CC}=4.5V$	-	-	63	ns
			$V_{CC}=6.0V$	-	-	54	ns
		$\overline{nCP1}$ to $\overline{nQ3}$; see Figure 4	$V_{CC}=2.0V$	-	-	235	ns
			$V_{CC}=4.5V$	-	-	47	ns
			$V_{CC}=6.0V$	-	-	40	ns
HIGH to LOW Propagation delay	t_{PHL}	\overline{nMR} to \overline{nQn} ; see Figure 5	$V_{CC}=2.0V$	-	-	250	ns
			$V_{CC}=4.5V$	-	-	50	ns
			$V_{CC}=6.0V$	-	-	43	ns
transition time	t_t	\overline{nQn} ; see Figure 4	$V_{CC}=2.0V$	-	-	110	ns
			$V_{CC}=4.5V$	-	-	22	ns
			$V_{CC}=6.0V$	-	-	19	ns
pulse width	t_w	$\overline{nCP0}$, $\overline{nCP1}$; HIGH or LOW;	$V_{CC}=2.0V$	120	-	-	ns
			$V_{CC}=4.5V$	24	-	-	ns

		see Figure 4	V _{CC} =6.0V	20	-	-	ns
		nMR HIGH; see Figure 5	V _{CC} =2.0V	130	-	-	ns
			V _{CC} =4.5V	26	-	-	ns
			V _{CC} =6.0V	22	-	-	ns
recovery time	t _{rec}		nMR to nCPn ; see Figure 5	V _{CC} =2.0V	110	-	-
			V _{CC} =4.5V	22	-	-	ns
			V _{CC} =6.0V	19	-	-	ns
maximum frequency	f _{max}	nCPn ; see Figure 4	V _{CC} =2.0V	4	-	-	MHz
			V _{CC} =4.5V	20	-	-	MHz
			V _{CC} =6.0V	24	-	-	MHz
SN74HCT390							
propagation delay	t _{pd}	nCP 0 to nQ0; V _{CC} =4.5V; see Figure 4	-	-	51	ns	
		nCP1 to nQ1; V _{CC} =4.5V; see Figure 4	-	-	57	ns	
		nCP1 to nQ2; V _{CC} =4.5V; see Figure 4	-	-	77	ns	
		nCP1 to nQ3; V _{CC} =4.5V; see Figure 4	-	-	57	ns	
HIGH to LOW Propagation delay	t _{PHL}	nMR to nQn; V _{CC} =4.5V; see Figure 5	-	-	54	ns	
transition time	t _t	nQn; V _{CC} =4.5V; see Figure 4	-	-	22	ns	
pulse width	t _w	nCP 0 , nCP1 ; HIGH or LOW; V _{CC} =4.5V; see Figure 4	27	-	-	ns	
		nMR HIGH; V _{CC} =4.5V; see Figure 5	26	-	-	ns	
recovery time	t _{rec}	nMR to nCPn ; V _{CC} =4.5V; see Figure 5	22	-	-	ns	
maximum frequency	f _{max}	nCPn ; V _{CC} =4.5V; see Figure 4	18	-	-	MHz	

Testing Circuit

AC Testing Circuit



Definitions test circuit:

R_T =termination resistance should be equal to output impedance Z_o of the pulse generator. C_L =load capacitance including jig and probe capacitance.

Figure 3. Test circuit for measuring switching times

AC Testing Waveforms

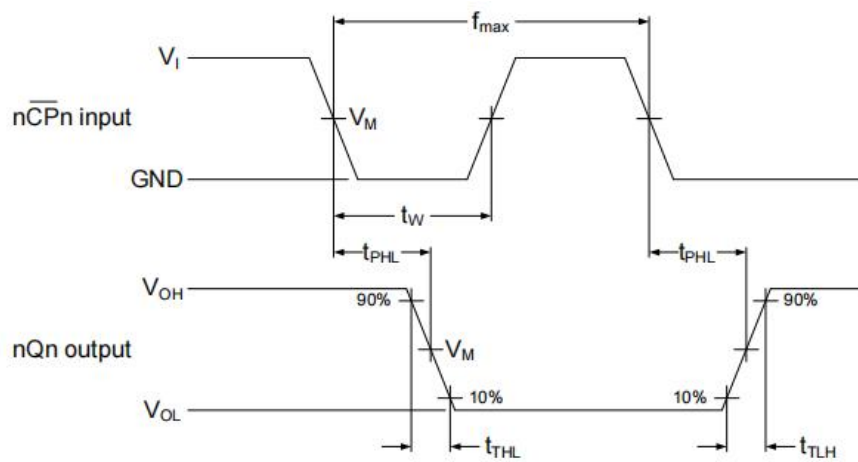


Figure 4. The clock input ($n\overline{CP}n$) to output (nQn) propagation delays, output transition time, clock pulse width and maximum clock frequency

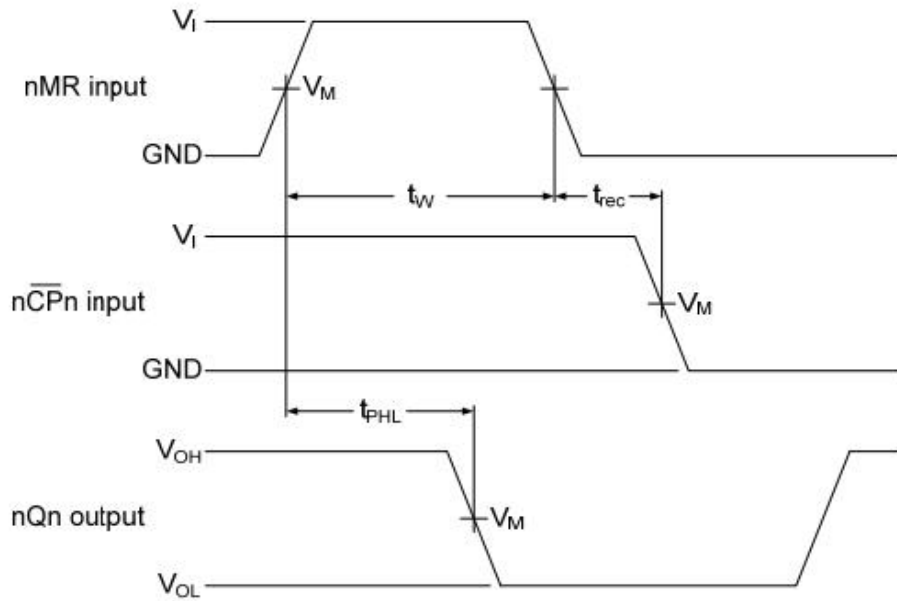


Figure 5. The master reset (nMR) pulse width, master reset to output (nQn) propagation delays and master reset to clock (nCPn) recovery time

Measurement Points

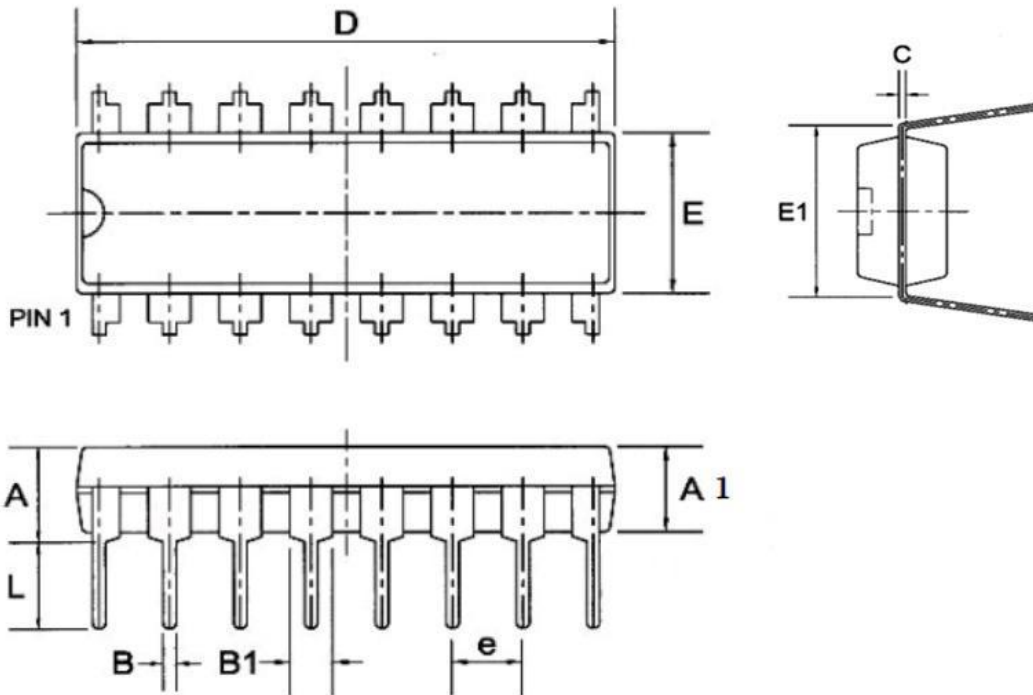
Type	Input	Output
	V _M	V _M
SN74HC390	0.5V _{CC}	0.5V _{CC}
SN74HCT390	1.3V	1.3V

Test Data

Type	Input		Load	Test
	V _I	t _r , t _f	C _L	
SN74HC390	V _{CC}	6ns	15pF, 50pF	t _{PHL} , t _{PLH}
SN74HCT390	3V	6ns	15pF, 50pF	t _{PHL} , t _{PLH}

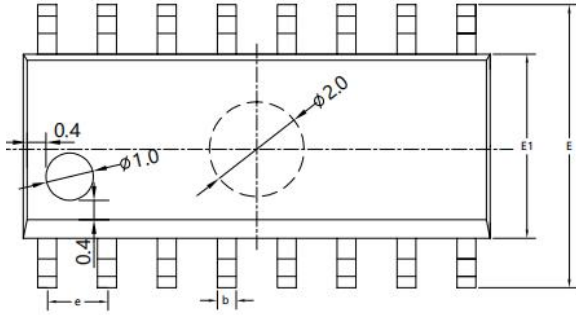
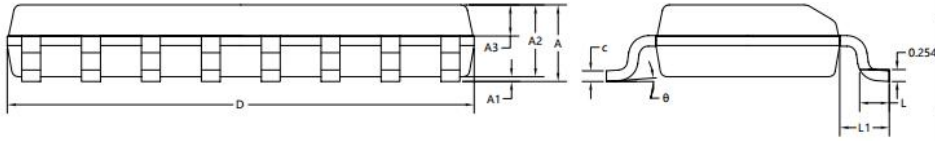
Package Information

DIP16



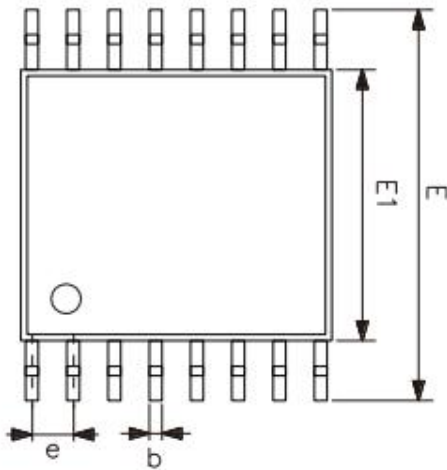
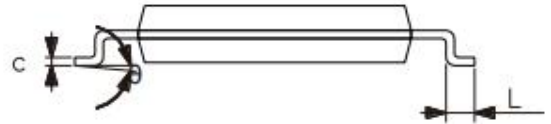
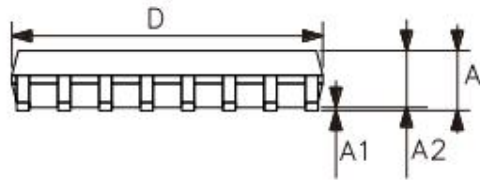
Symbol	Dimensions in Millimeters		
	Min	Nom	Max
A	--	--	4.31
A1	3.15	3.30	3.65
B	--	0.50	--
B1	--	1.6	--
C	--	0.27	--
D	19.00	19.20	19.60
E	6.20	6.50	6.60
E1	--	8.0	--
e	--	2.3	--
L	3.00	3.20	3.60

SOP16



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.50	1.60	1.70
A1	0.10	0.15	0.25
A2	1.40	1.45	1.50
A3	0.60	0.65	0.70
b	0.30	0.40	0.50
c	0.15	0.20	0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.85	3.90	3.95
e	1.27BSC		
L	0.50	0.60	0.70
L1	1.05BSC		
θ	0°	4°	8°

TSSOP16



Symbol	Dimensions (mm)	
	Min.	Max.
A	-	1.20
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	4.90	5.10
E1	4.30	4.50
E	6.20	6.60
e	0.65	
L	0.45	0.75
θ	0°	8°

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