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XINBOLE

Product Specification

XBLW SN74HC390

Dual Decade Ripple Counter

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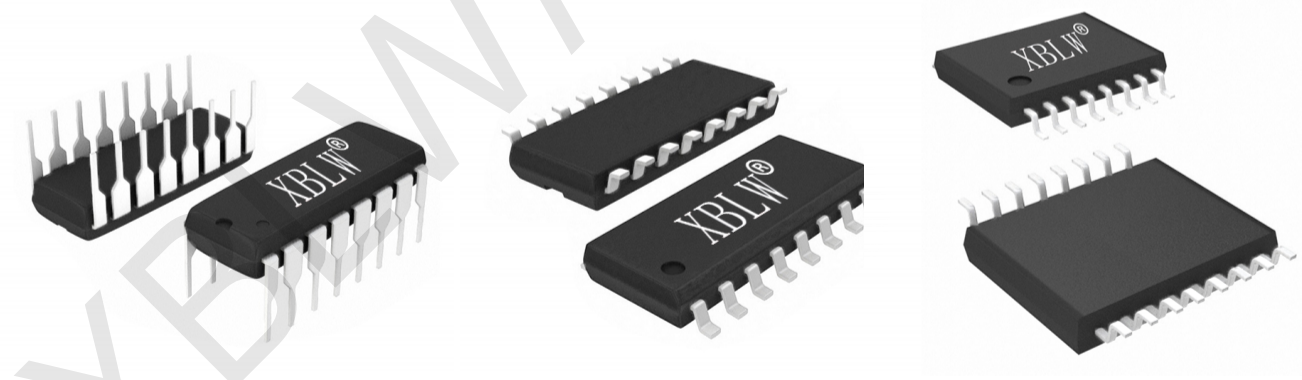
Description

The SN74HC390 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 asyn chronous master reset input (nMR) and can be used in a BCD decade or bi-quinary configuration. If mas ter 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 $n\overline{CP}0$ and $n\overline{CP}1$, 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 $n\overline{CP}0$ and $n\overline{CP}1$ trigger each section. For BCD decade operation, the nQ0 output is connected to the $n\overline{CP}1$ input of the divide-by-5 section. For bi-quinary decade operation, the nQ3 output is connected to the $n\overline{CP}0$ 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

- 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℃ to +125℃
- Packaging information: DIP-16/SOP-16/TSSOP-16



DIP-16　　SOP-16　　TSSOP-16

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

Block Diagram

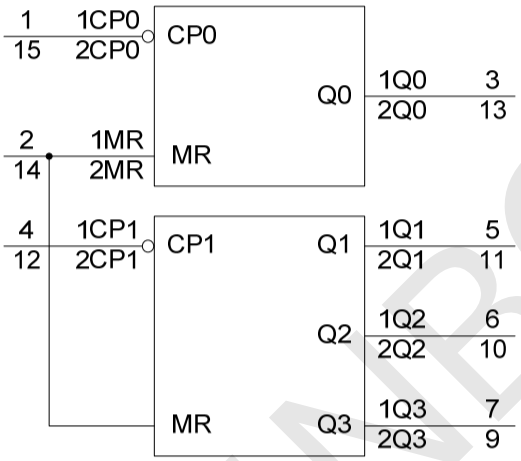


Figure 1. Logic symbol

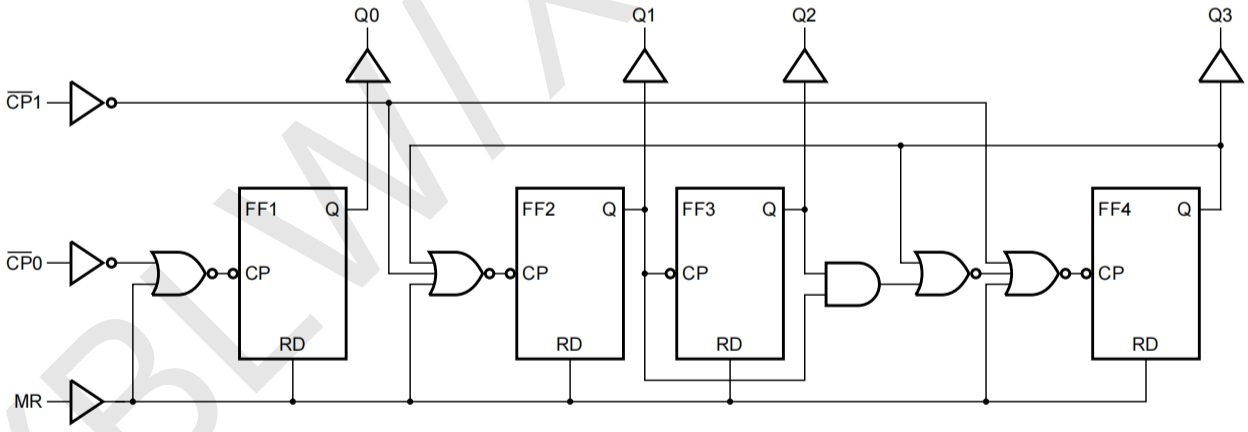
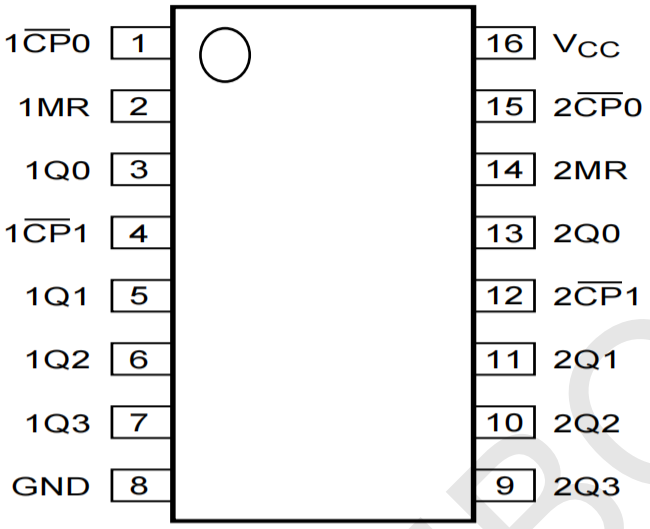


Figure 2. Logic diagram (one counter)

Pin Configurations



Pin Description

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

Function Table

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 n$\overline{CP}$1 ; counter input on n$\overline{CP}$0 . H=HIGH voltage level; L=LOW voltage level;

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 n$\overline{CP}$0 ; counter input on n$\overline{CP}$1 . H=HIGH voltage level;L =LOW voltage level;

Electrical Parameter

Absolute Maximum Ratings

(T_{amb}=25°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<-0.5V or V_I>V_{CC}+0.5V		-	±20	mA
output clamping current	I_{OK}	V_I<-0.5V or V_O>V_{CC}+0.5V		-	±20	mA
output current	I_O	0.5V<V_O<V_{CC}+0.5V		-	±25	mA
supply current	I_{CC}	-		-	+50	mA
ground current	I_{GND}	-		-50	-	mA
storage temperature	T_{stg}	-		-65	+150	°C
soldering temperature	T_L	10s	DIP	245		°C
			SOP/TSSOP	260		°C

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
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	°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
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

DC Characteristics 2

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
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	3.84	-	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.34	-	-	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	-	-	0.33	V
			I_O=5.2mA; V_{CC}=6.0V	-	-	0.33	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		-	-	80	uA

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
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

AC Characteristics 1

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

Parameter	Symbol	Conditions		Min.	Typ.[1]	Max.	Unit
propagation delay	t_{PLH}, t_{PHL}	n $\overline{CP}$0 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
		n $\overline{CP}$1 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
		n $\overline{CP}$1 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
		n $\overline{CP}$1 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	n $\overline{CP}$0 , n $\overline{CP}$1 ; 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 $\overline{nCPn}$; 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}	$\overline{nCPn}$; 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

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
propagation delay	t_{PLH}, t_{PHL}	n $\overline{CP0}$ to nQ0; see Figure 4	V_{CC}=2.0V	-	-	180	ns
			V_{CC}=4.5V	-	-	36	ns
			V_{CC}=6.0V	-	-	31	ns
		n $\overline{CP1}$ to nQ1; see Figure 4	V_{CC}=2.0V	-	-	195	ns
			V_{CC}=4.5V	-	-	39	ns
			V_{CC}=6.0V	-	-	33	ns
		n $\overline{CP1}$ to nQ2; see Figure 4	V_{CC}=2.0V	-	-	265	ns
			V_{CC}=4.5V	-	-	53	ns
			V_{CC}=6.0V	-	-	45	ns
		n $\overline{CP1}$ 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	n $\overline{CP0}$, n $\overline{CP1}$; 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}	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

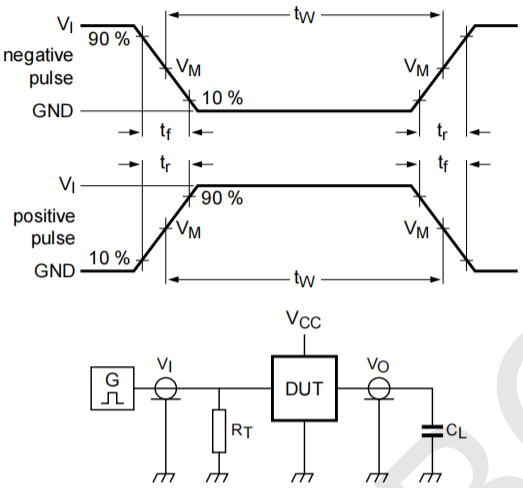
AC Characteristics 3

(T_{amb}=-40℃ to +125℃, GND=0V, C_L=50pF, unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{pd}	n $\overline{CPO}$ to nQ0; see Figure 4	V_{CC}=2.0V	-	-	220	ns
			V_{CC}=4.5V	-	-	44	ns
			V_{CC}=6.0V	-	-	38	ns
		n $\overline{CP1}$ to nQ1; see Figure 4	V_{CC}=2.0V	-	-	235	ns
			V_{CC}=4.5V	-	-	47	ns
			V_{CC}=6.0V	-	-	40	ns
		n $\overline{CP1}$ to nQ2; see Figure 4	V_{CC}=2.0V	-	-	315	ns
			V_{CC}=4.5V	-	-	63	ns
			V_{CC}=6.0V	-	-	54	ns
		n $\overline{CP1}$ to 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}	nMR to 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	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	n $\overline{CP0}$, n $\overline{CP1}$; HIGH or LOW; see Figure 4	V_{CC}=2.0V	120	-	-	ns
			V_{CC}=4.5V	24	-	-	ns
			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 n$\overline{CPn}$; see Figure 5	V_{CC}=2.0V	110	-	-	ns
			V_{CC}=4.5V	22	-	-	ns
			V_{CC}=6.0V	19	-	-	ns
maximum frequency	f_{max}	n$\overline{CPn}$; see Figure 4	V_{CC}=2.0V	4	-	-	MHz
			V_{CC}=4.5V	20	-	-	MHz
			V_{CC}=6.0V	24	-	-	MHz

Testing Circuit

AC Testing Circuit



Definitions test circuit:

RT=termination resistance should be equal to output impedance Z_o of the pulse generator.

CL=load capacitance including jig and probe capacitance

Figure 3. Test circuit for measuring switching times

AC Testing Waveforms

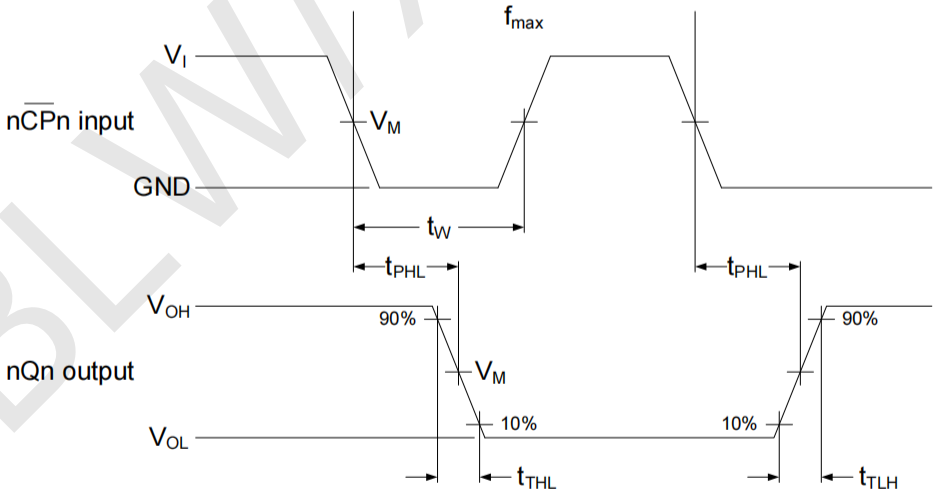


Figure 4. The clock input ($\overline{nCPn}$) to output (nQn) propagation delays, output transition time, clock pulse width and maximum clock frequency

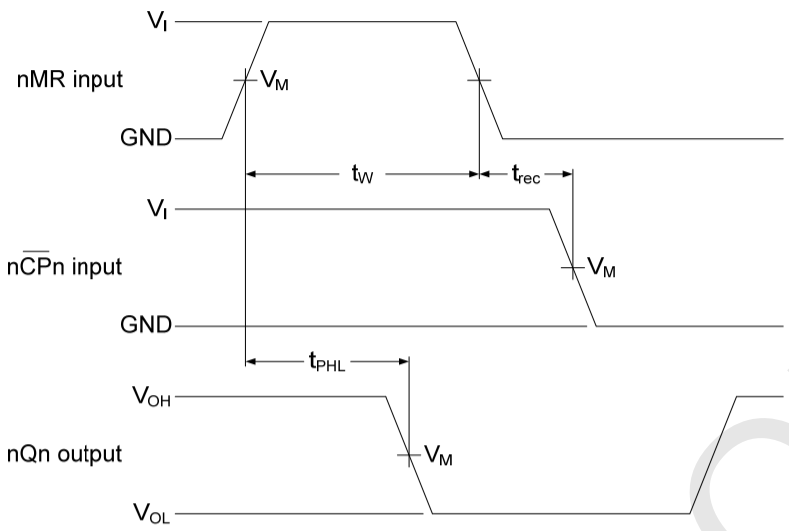


Figure 5. The master reset (nMR) pulse width, master reset to output (nQn) propagation delays and master reset to clock ($\overline{nCPn}$) recovery time

Measurement Points

Type	Input	Output
	V_M	V_M
SN74HC390	0.5V_{CC}	0.5V_{CC}

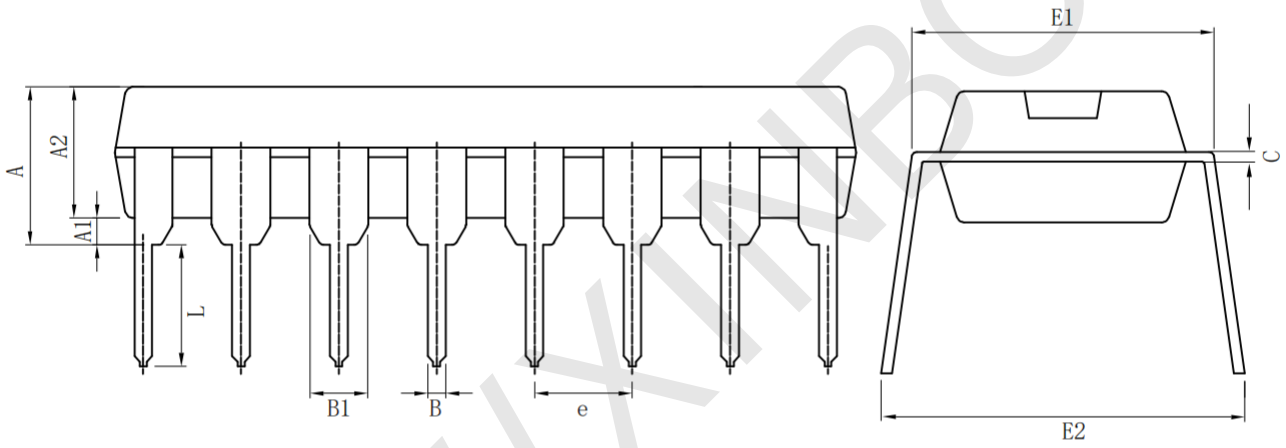
Test Data

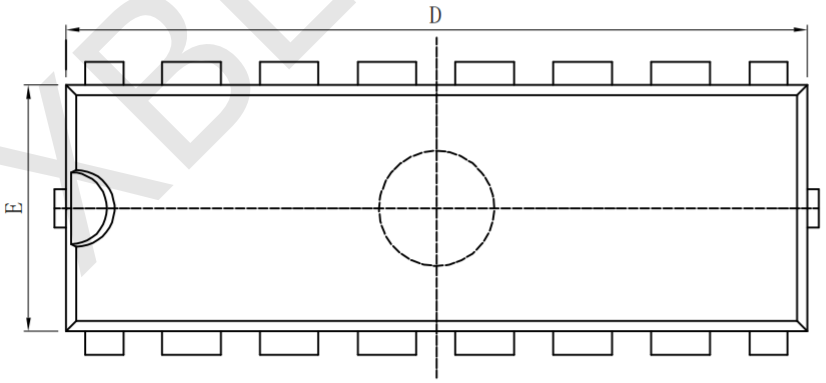
Type	Input		Load	Test
	V_I	t_r, t_f	C_L	
SN74HC390	V_{CC}	6ns	15pF, 50pF	t_{PHL}, t_{PLH}

Package Information

· DIP-16

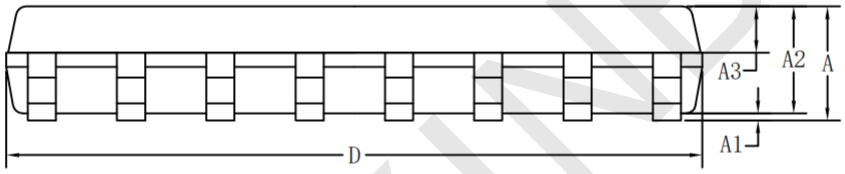
Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	3.710	4.310	A	0.146	0.170
A1	0.510		A1	0.020	
A2	3.200	3.600	A2	0.126	0.142
B	0.380	0.570	B	0.015	0.022
B1	1.524(BSC)		B1	0.060(BSC)	
C	0.204	0.360	C	0.008	0.014
D	18.80	19.20	D	0.740	0.756
E	6.200	6.600	E	0.244	0.260
E1	7.320	7.920	E1	0.288	0.312
e	2.540(BSC)		e	0.100(BSC)	
L	3.000	3.600	L	0.118	0.142
E2	8.400	9.000	E2	0.331	0.354

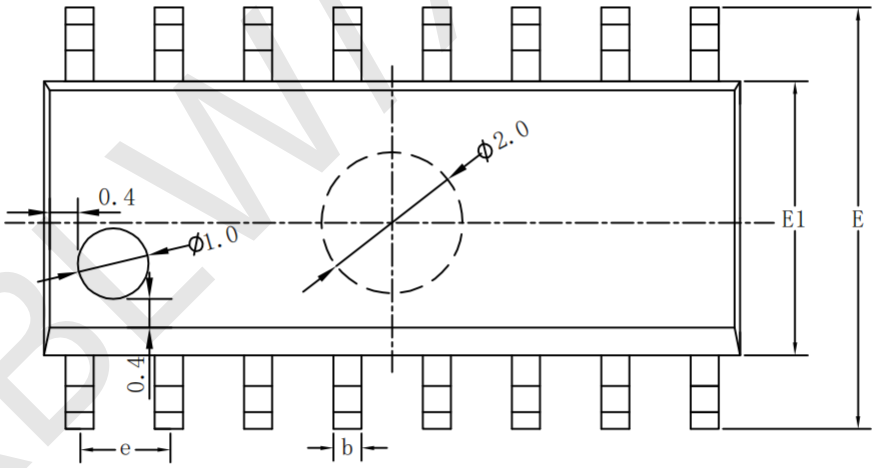


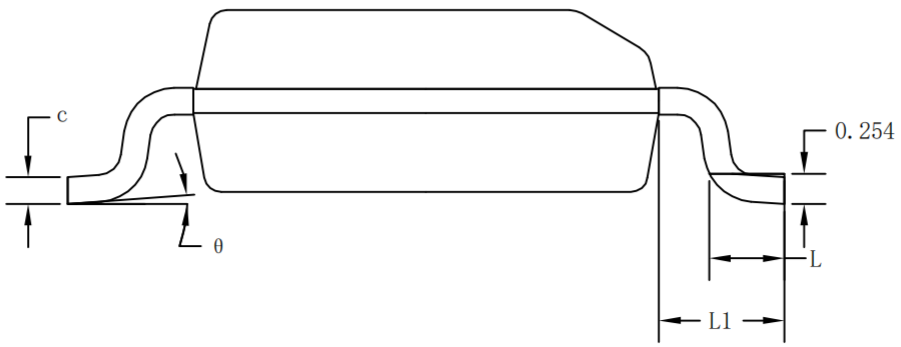


· SOP-16

Size / Symbol	Dimensions In Millimeters			Size / Symbol	Dimensions In Inches		
	Min(mm)	Nom(mm)	Max(mm)		Min(in)	Nom(in)	Max(in)
A	1.500	1.600	1.700	A	0.059	0.063	0.067
A1	0.100	0.150	0.250	A1	0.004	0.006	0.010
A2	1.400	1.450	1.500	A2	0.055	0.057	0.059
A3	0.600	0.650	0.700	A3	0.024	0.026	0.028
b	0.300	0.400	0.500	b	0.012	0.016	0.020
c	0.150	0.200	0.250	c	0.006	0.008	0.010
D	9.800	9.900	10.00	D	0.386	0.390	0.394
E	5.800	6.000	6.200	E	0.228	0.236	0.244
E1	3.850	3.900	3.950	E1	0.152	0.154	0.156
e		1.27(BSC)		e		0.050(BSC)	
L	0.500	0.600	0.700	L	0.020	0.024	0.028
L1		1.05(BSC)		L1		0.041(BSC)	
θ	0°	4°	8°	θ	0°	4°	8°

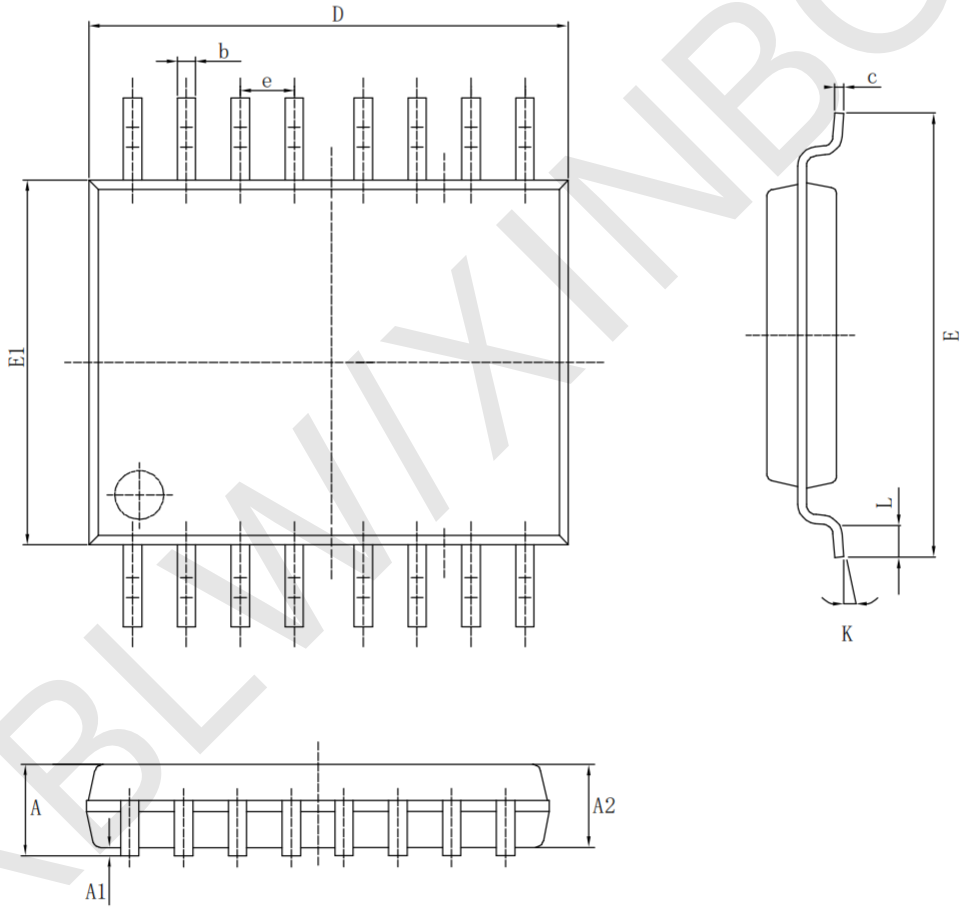






· TSSOP-16

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A		1.200	A		0.047
A1	0.050	0.150	A1	0.002	0.006
A2	0.800	1.050	A2	0.031	0.041
b	0.190	0.300	b	0.007	0.012
c	0.090	0.200	c	0.004	0.0089
D	4.900	5.100	D	0.193	0.201
E	6.200	6.600	E	0.244	0.260
E1	4.300	4.480	E1	0.169	0.176
e	0.65(BSC)		e	0.0256(BSC)	
K	0°	8°	K	0°	8°
L	0.450	0.750	L	0.018	0.030



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