



# SN74LS390 (LX) Dual Decade Ripple Counter

## Product Specification

### Specification Revision History:

Version	Date	Description
2022-08-A1	2022-08	New



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## 1、General Description

The SN74LS390 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  $\overline{nCP0}$  and  $\overline{nCP1}$ , 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  $\overline{nCP0}$  and  $\overline{nCP1}$  trigger each section. For BCD decade operation, the nQ0 output is connected to the  $\overline{nCP1}$  input of the divide-by-5 section. For bi-quinary decade operation, the nQ3 output is connected to the  $\overline{nCP0}$  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  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- Packaging information: DIP16/SOP16/TSSOP16



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深圳市灵星芯微电子科技有限公司

Shenzhen Lingxing Microelectronics Technology Co., Ltd.

Tab: 835-12-B4

Number: SN74LS390-AX-LJ-A089EN

**Ordering Information:**

**Tube packing specifications:**

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
SN74LS390N (LX)	DIP16	SN74LS390N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74LS390D (LX)	SOP16	LS390	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
SN74LS390PW (LX)	TSSOP16	LS390	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm



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**Reel packing specifications:**

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
SN74LS390DR (LX)	SOP16	LS390	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
SN74LS390PW (LX)	TSSOP16	LS390	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing:0.65mm

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.



## 2、Block Diagram And Pin Description

### 2.1、Block Diagram

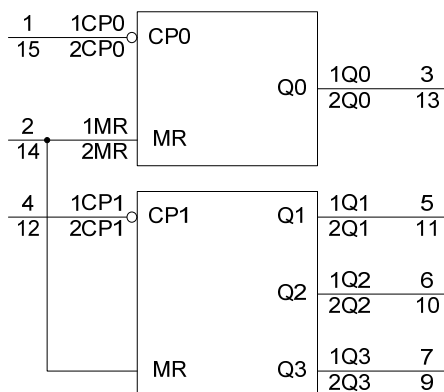


Figure 1. Logic symbol

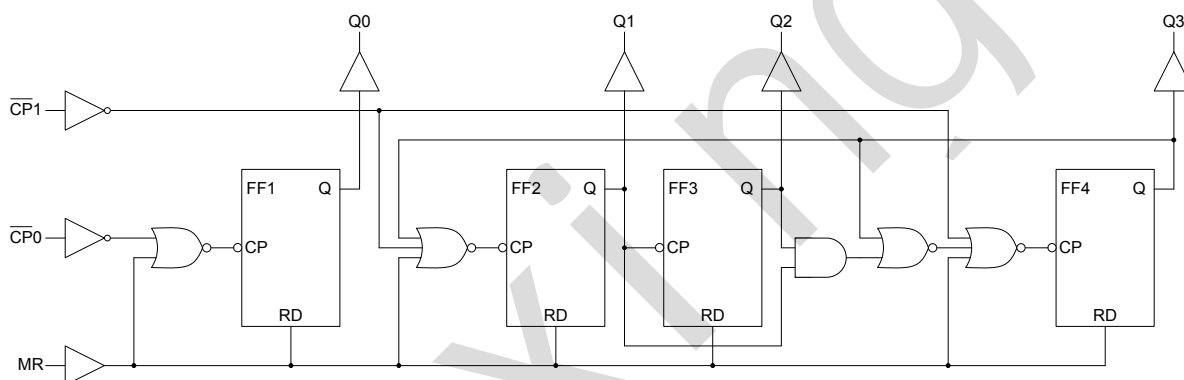
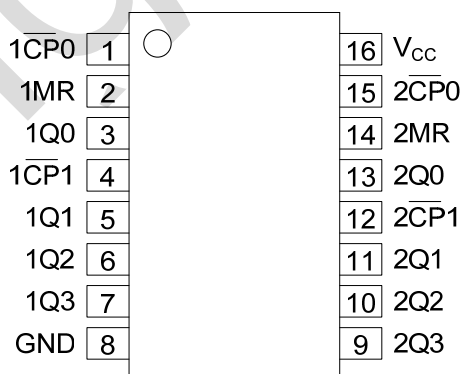


Figure 2. Logic diagram (one counter)

### 2.2、Pin Configurations





### 2.3、Pin Description

Pin No.	Pin Name	Description
1	$\overline{1CP0}$	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	$\overline{1CP1}$	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	$\overline{2CP1}$	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	$\overline{2CP0}$	clock input divide-by-2 section (HIGH-to-LOW; edge-triggered)
16	V <sub>CC</sub>	supply voltage

### 2.4、Function Table

#### 2.4.1、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  $\overline{nCP1}$ ; counter input on  $\overline{nCP0}$ .

H=HIGH voltage level;

L=LOW voltage level;



### 2.4.2、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;

## 3、Electrical Parameter

### 3.1、Absolute Maximum Ratings

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





### 3.2、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

### 3.3、Electrical Characteristics

#### 3.3.1、DC Characteristics 1

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
HIGH-level input voltage	$V_{IH}$	$V_{CC}=2.0\text{V}$	1.5	1.2	-	V	
		$V_{CC}=4.5\text{V}$	3.15	2.4	-	V	
		$V_{CC}=6.0\text{V}$	4.2	3.2	-	V	
LOW-level input voltage	$V_{IL}$	$V_{CC}=2.0\text{V}$	-	0.8	0.5	V	
		$V_{CC}=4.5\text{V}$	-	2.1	1.35	V	
		$V_{CC}=6.0\text{V}$	-	2.8	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	2.0	-	V
			$I_O=-20\mu\text{A}; V_{CC}=4.5\text{V}$	4.4	4.5	-	V
			$I_O=-20\mu\text{A}; V_{CC}=6.0\text{V}$	5.9	6.0	-	V
			$I_O=-4.0\text{mA}; V_{CC}=4.5\text{V}$	3.98	4.32	-	V
			$I_O=-5.2\text{mA}; V_{CC}=6.0\text{V}$	5.48	5.81	-	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	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=4.5\text{V}$	-	0	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=6.0\text{V}$	-	0	0.1	V
			$I_O=4.0\text{mA}; V_{CC}=4.5\text{V}$	-	0.15	0.26	V
			$I_O=5.2\text{mA}; V_{CC}=6.0\text{V}$	-	0.16	0.26	V
input leakage current	$I_I$	$V_I=V_{CC}$ or GND; $V_{CC}=6.0\text{V}$	-	-	$\pm 1$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0\text{A}; V_{CC}=6.0\text{V}$	-	-	8	$\mu\text{A}$	



### 3.3.2、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	
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; $V_{CC} = 6.0\text{V}$	-	-	$\pm 1.0$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I = V_{CC}$ or GND; $I_O = 0\text{A}; V_{CC} = 6.0\text{V}$	-	-	80	$\mu\text{A}$	



### 3.3.3、DC Characteristics 3

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
HIGH-level input voltage	$V_{IH}$	$V_{CC}=2.0\text{V}$	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
			$I_O = -4.0\text{mA}; V_{CC} = 4.5\text{V}$	3.7	-	-	V
			$I_O = -5.2\text{mA}; V_{CC} = 6.0\text{V}$	5.2	-	-	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
			$I_O = 4.0\text{mA}; V_{CC} = 4.5\text{V}$	-	-	0.4	V
			$I_O = 5.2\text{mA}; V_{CC} = 6.0\text{V}$	-	-	0.4	V
input leakage current	$I_I$	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{V}$	-	-	$\pm 1.0$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I = V_{CC}$ or GND; $I_O = 0\text{A}; V_{CC} = 6.0\text{V}$	-	-	160	$\mu\text{A}$	



### 3.3.4、AC Characteristics 1

( $T_{amb}=25^{\circ}\text{C}$ ,  $\text{GND}=0\text{V}$ ,  $C_L=50\text{pF}$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ. <sup>[1]</sup>	Max.	Unit	
propagation delay	$t_{PLH}$ , $t_{PHL}$	$\overline{nCP0}$ to $nQ0$ ; see Figure 4	$V_{CC}=2.0\text{V}$	-	47	145	ns
			$V_{CC}=4.5\text{V}$	-	17	29	ns
			$V_{CC}=5.0\text{V}$ ; $C_L=15\text{pF}$	-	14	-	ns
			$V_{CC}=6.0\text{V}$	-	14	25	ns
		$\overline{nCP1}$ to $nQ1$ ; see Figure 4	$V_{CC}=2.0\text{V}$	-	50	155	ns
			$V_{CC}=4.5\text{V}$	-	18	31	ns
			$V_{CC}=5.0\text{V}$ ; $C_L=15\text{pF}$	-	15	-	ns
			$V_{CC}=6.0\text{V}$	-	14	26	ns
		$\overline{nCP1}$ to $nQ2$ ; see Figure 4	$V_{CC}=2.0\text{V}$	-	74	210	ns
			$V_{CC}=4.5\text{V}$	-	27	42	ns
			$V_{CC}=5.0\text{V}$ ; $C_L=15\text{pF}$	-	23	-	ns
			$V_{CC}=6.0\text{V}$	-	22	36	ns
		$\overline{nCP1}$ to $nQ3$ ; see Figure 4	$V_{CC}=2.0\text{V}$	-	50	155	ns
			$V_{CC}=4.5\text{V}$	-	18	31	ns
			$V_{CC}=5.0\text{V}$ ; $C_L=15\text{pF}$	-	15	-	ns
			$V_{CC}=6.0\text{V}$	-	14	26	ns
HIGH to LOW Propagation delay	$t_{PHL}$	$nMR$ to $nQn$ ; see Figure 5	$V_{CC}=2.0\text{V}$	-	52	165	ns
			$V_{CC}=4.5\text{V}$	-	19	33	ns
			$V_{CC}=5.0\text{V}$ ; $C_L=15\text{pF}$	-	16	-	ns
			$V_{CC}=6.0\text{V}$	-	15	28	ns
transition time	$t_{THL}$ , $t_{TLH}$	$nQn$ ; see Figure 4	$V_{CC}=2.0\text{V}$	-	19	75	ns
			$V_{CC}=4.5\text{V}$	-	7	15	ns
			$V_{CC}=6.0\text{V}$	-	6	13	ns
pulse width	$t_w$	$\overline{nCP0}$ , $\overline{nCP1}$ ; HIGH or LOW; see Figure 4	$V_{CC}=2.0\text{V}$	80	19	-	ns
			$V_{CC}=4.5\text{V}$	16	7	-	ns
			$V_{CC}=6.0\text{V}$	14	6	-	ns
		$nMR$ HIGH; see Figure 5	$V_{CC}=2.0\text{V}$	80	28	-	ns
			$V_{CC}=4.5\text{V}$	17	10	-	ns
			$V_{CC}=6.0\text{V}$	14	8	-	ns
recovery time	$t_{rec}$	$nMR$ to $\overline{nCPn}$ ; see Figure 5	$V_{CC}=2.0\text{V}$	75	22	-	ns
			$V_{CC}=4.5\text{V}$	15	8	-	ns
			$V_{CC}=6.0\text{V}$	13	6	-	ns
maximum frequency	$f_{max}$	$\overline{nCPn}$ ; see Figure 4	$V_{CC}=2.0\text{V}$	6	20	-	MHz
			$V_{CC}=4.5\text{V}$	30	60	-	MHz
			$V_{CC}=5.0\text{V}$ ; $C_L=15\text{pF}$	-	66	-	MHz
			$V_{CC}=6.0\text{V}$	35	71	-	MHz

Note:

[1] All typical values are measured at  $T_{amb}=25^{\circ}\text{C}$ .



### 3.3.5、AC Characteristics 2

( $T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $GND = 0\text{V}$ ,  $C_L = 50\text{pF}$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
propagation delay	$t_{PLH}, t_{PHL}$	$\overline{nCP0}$ to $nQ0$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	180	ns
			$V_{CC} = 4.5\text{V}$	-	-	36	ns
			$V_{CC} = 6.0\text{V}$	-	-	31	ns
		$\overline{nCP1}$ to $nQ1$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	195	ns
			$V_{CC} = 4.5\text{V}$	-	-	39	ns
			$V_{CC} = 6.0\text{V}$	-	-	33	ns
		$\overline{nCP1}$ to $nQ2$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	265	ns
			$V_{CC} = 4.5\text{V}$	-	-	53	ns
			$V_{CC} = 6.0\text{V}$	-	-	45	ns
		$\overline{nCP1}$ to $nQ3$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	195	ns
			$V_{CC} = 4.5\text{V}$	-	-	39	ns
			$V_{CC} = 6.0\text{V}$	-	-	33	ns
HIGH to LOW Propagation delay	$t_{PHL}$	$nMR$ to $nQn$ ; see Figure 5	$V_{CC} = 2.0\text{V}$	-	-	205	ns
			$V_{CC} = 4.5\text{V}$	-	-	41	ns
			$V_{CC} = 6.0\text{V}$	-	-	35	ns
transition time	$t_{THL}, t_{TLH}$	$nQn$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	95	ns
			$V_{CC} = 4.5\text{V}$	-	-	19	ns
			$V_{CC} = 6.0\text{V}$	-	-	16	ns
pulse width	$t_w$	$\overline{nCP0}, \overline{nCP1}$ ; HIGH or LOW; see Figure 4	$V_{CC} = 2.0\text{V}$	100	-	-	ns
			$V_{CC} = 4.5\text{V}$	20	-	-	ns
			$V_{CC} = 6.0\text{V}$	17	-	-	ns
		$nMR$ HIGH; see Figure 5	$V_{CC} = 2.0\text{V}$	105	-	-	ns
			$V_{CC} = 4.5\text{V}$	21	-	-	ns
			$V_{CC} = 6.0\text{V}$	18	-	-	ns
recovery time	$t_{rec}$	$nMR$ to $\overline{nCPn}$ ; see Figure 5	$V_{CC} = 2.0\text{V}$	95	-	-	ns
			$V_{CC} = 4.5\text{V}$	19	-	-	ns
			$V_{CC} = 6.0\text{V}$	16	-	-	ns
maximum frequency	$f_{max}$	$\overline{nCPn}$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	4.8	-	-	MHz
			$V_{CC} = 4.5\text{V}$	24	-	-	MHz
			$V_{CC} = 6.0\text{V}$	28	-	-	MHz



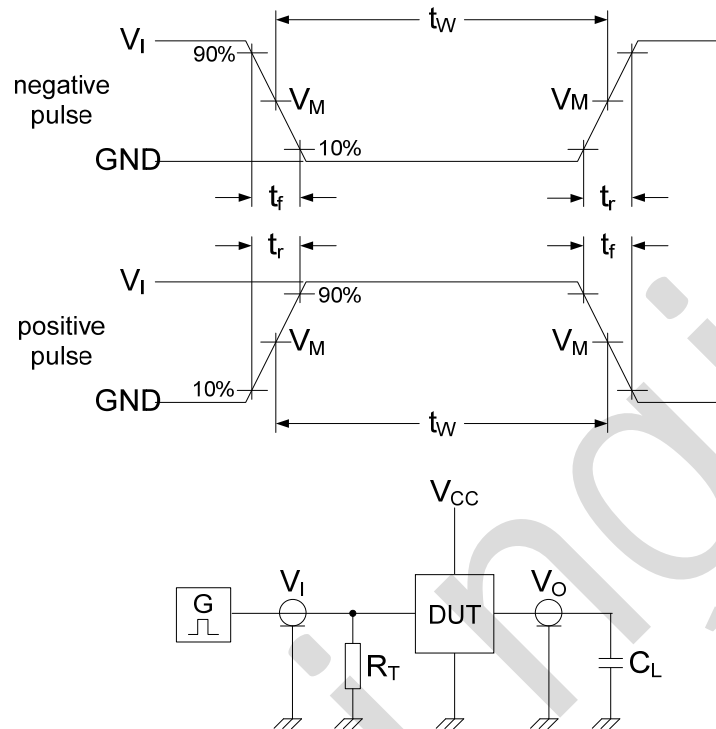
### 3.3.6、AC Characteristics 3

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
propagation delay	$t_{pd}$	$\overline{nCP0}$ to $nQ0$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	220	ns
			$V_{CC} = 4.5\text{V}$	-	-	44	ns
			$V_{CC} = 6.0\text{V}$	-	-	38	ns
		$\overline{nCP1}$ to $nQ1$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	235	ns
			$V_{CC} = 4.5\text{V}$	-	-	47	ns
			$V_{CC} = 6.0\text{V}$	-	-	40	ns
		$\overline{nCP1}$ to $nQ2$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	315	ns
			$V_{CC} = 4.5\text{V}$	-	-	63	ns
			$V_{CC} = 6.0\text{V}$	-	-	54	ns
		$\overline{nCP1}$ to $nQ3$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	235	ns
			$V_{CC} = 4.5\text{V}$	-	-	47	ns
			$V_{CC} = 6.0\text{V}$	-	-	40	ns
HIGH to LOW Propagation delay	$t_{PHL}$	$nMR$ to $nQn$ ; see Figure 5	$V_{CC} = 2.0\text{V}$	-	-	250	ns
			$V_{CC} = 4.5\text{V}$	-	-	50	ns
			$V_{CC} = 6.0\text{V}$	-	-	43	ns
transition time	$t_t$	$nQn$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	-	-	110	ns
			$V_{CC} = 4.5\text{V}$	-	-	22	ns
			$V_{CC} = 6.0\text{V}$	-	-	19	ns
pulse width	$t_w$	$\overline{nCP0}$ , $\overline{nCP1}$ ; HIGH or LOW; see Figure 4	$V_{CC} = 2.0\text{V}$	120	-	-	ns
			$V_{CC} = 4.5\text{V}$	24	-	-	ns
			$V_{CC} = 6.0\text{V}$	20	-	-	ns
		$nMR$ HIGH; see Figure 5	$V_{CC} = 2.0\text{V}$	130	-	-	ns
			$V_{CC} = 4.5\text{V}$	26	-	-	ns
			$V_{CC} = 6.0\text{V}$	22	-	-	ns
recovery time	$t_{rec}$	$nMR$ to $\overline{nCPn}$ ; see Figure 5	$V_{CC} = 2.0\text{V}$	110	-	-	ns
			$V_{CC} = 4.5\text{V}$	22	-	-	ns
			$V_{CC} = 6.0\text{V}$	19	-	-	ns
maximum frequency	$f_{max}$	$\overline{nCPn}$ ; see Figure 4	$V_{CC} = 2.0\text{V}$	4	-	-	MHz
			$V_{CC} = 4.5\text{V}$	20	-	-	MHz
			$V_{CC} = 6.0\text{V}$	24	-	-	MHz

## 4、Testing Circuit

### 4.1、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

### 4.2、AC Testing Waveforms

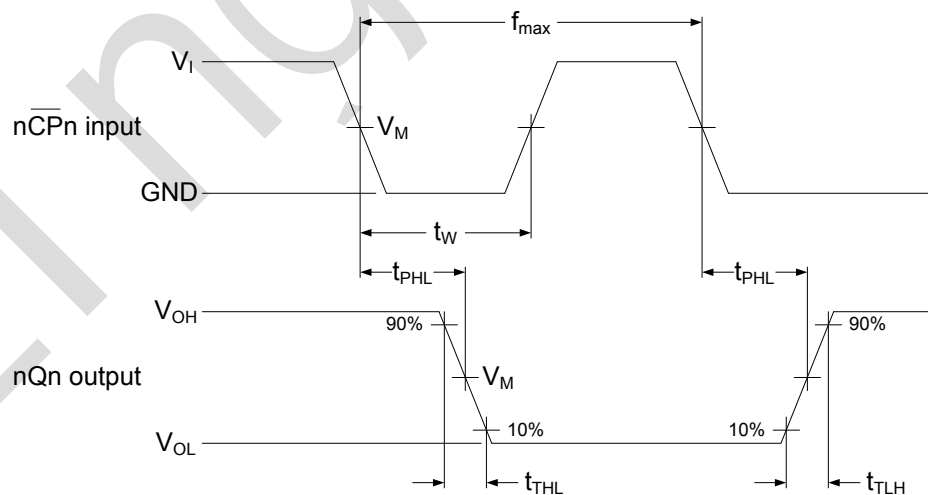


Figure 4. The clock input ( $\overline{nCPn}$ ) to output ( $nQn$ ) propagation delays, output transition time, clock pulse width and maximum clock frequency

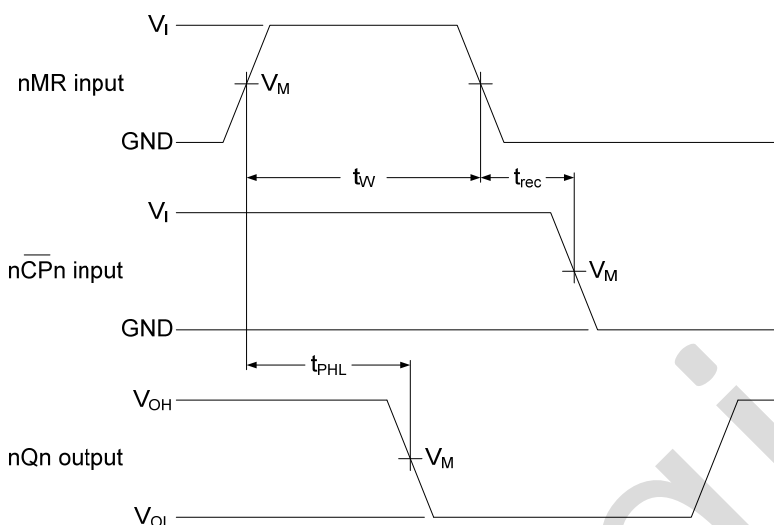


Figure 5. The master reset (nMR) pulse width, master reset to output (nQn) propagation delays and master reset to clock ( $\overline{nCPn}$ ) recovery time

#### 4.3. Measurement Points

Input	Output
$V_M$	$V_M$
$0.5V_{CC}$	$0.5V_{CC}$

#### 4.4. Test Data

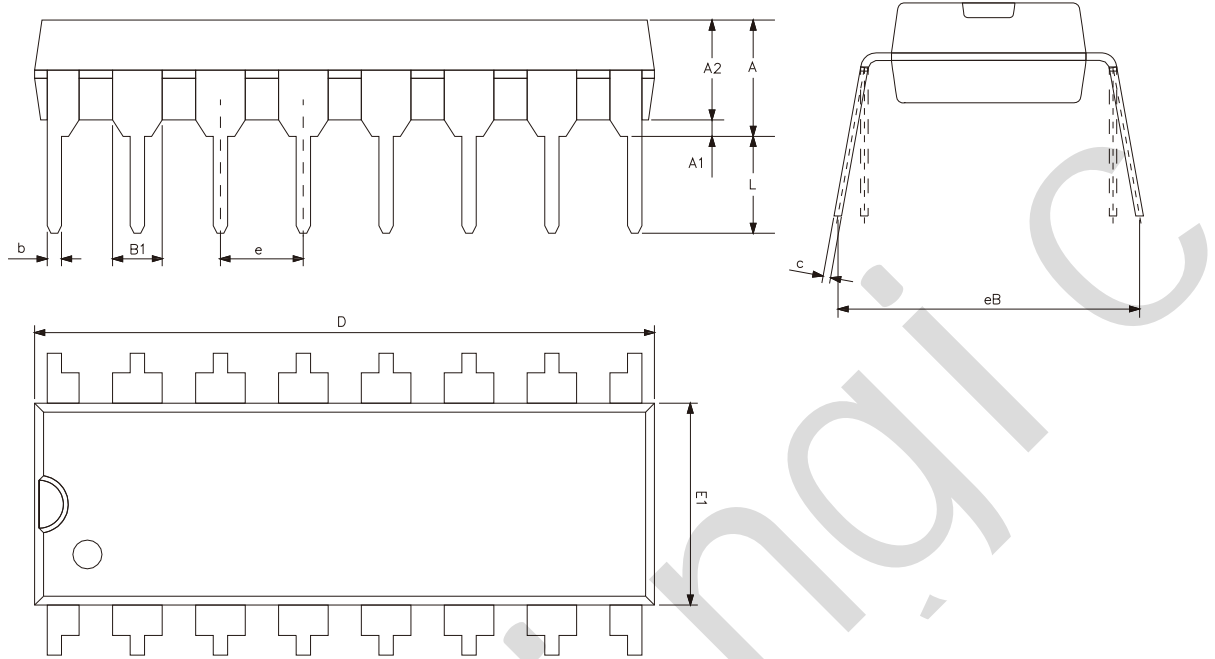
Input		Load	Test
$V_I$	$t_r, t_f$	$C_L$	
$V_{CC}$	6ns	15pF, 50pF	$t_{PHL}, t_{PLH}$





## 5、Package Information

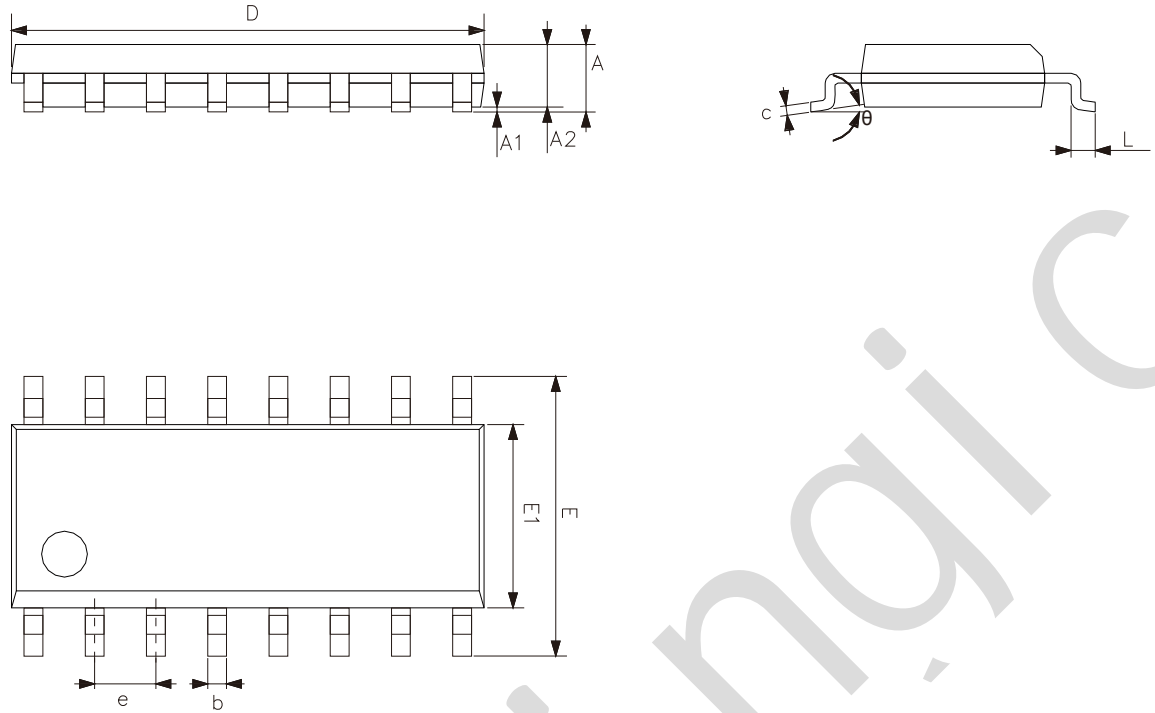
### 5.1、DIP16



Symbol	Dimensions (mm)	
	Min.	Max.
A2	3.20	3.60
A1	0.51	-
A	3.60	5.33
L	3.00	3.60
b	0.36	0.56
B1	1.52	
D	18.80	19.94
E1	6.20	6.60
e	2.54	
c	0.20	0.36
eB	7.62	9.30



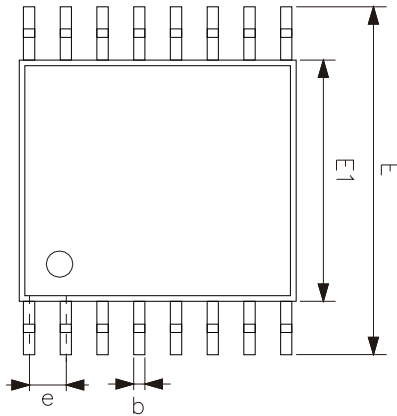
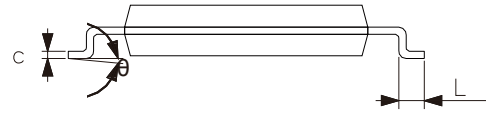
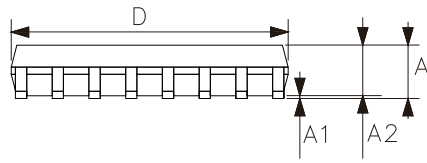
## 5.2、SOP16



Symbol	Dimensions (mm)	
	Min.	Max.
A	1.35	1.80
A1	0.10	0.25
A2	1.25	1.55
b	0.33	0.51
c	0.19	0.25
D	9.50	10.10
E	5.80	6.30
E1	3.70	4.10
e	1.27	
L	0.35	0.89
$\theta$	0°	8°



### 5.3、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
$\theta$	0°	8°



## 6、 Statements And Notes

### 6.1、 The name and content of Hazardous substances or Elements in the product

Part name	Hazardous substances or Elements									
	Lead and lead compounds	Mercury and mercury compounds	Cadmium and cadmium compounds	Hexavalent chromium compounds	Polybrominated biphenyls	Polybrominated biphenyl ethers	Dibutyl phthalate	Butylbenzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
Lead frame	○	○	○	○	○	○	○	○	○	○
Plastic resin	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
The lead	○	○	○	○	○	○	○	○	○	○
Plastic sheet installed	○	○	○	○	○	○	○	○	○	○
explanation	○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. ×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements.									

### 6.2、 Notes

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