SN74HC393/HCT393 (LX)
Dual 4-bit Binary Ripple Counter

Product Specification

Specification Revision History:

Version	Date	Description
2023-06-A0	2023-06	New
2023-11-A1	2023-11	Parameter modification

Contents

1、General Description

The SN74HC/HCT393 is a dual 4-stage binary ripple counter.

Features:

- Supply voltage range:
  SN74HC393: 2~6V
  SN74HCT393: 4.5~5.5V
- Input levels:
  SN74HC393: CMOS level
  SN74HCT393: TTL level
- Temperature range:-40℃ to +125℃
- Packaging information: DIP14/SOP14/TSSOP14

Ordering Information:

Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
SN74HC393N (LX)	DIP14	SN74HC393N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74HCT393N (LX)	DIP14	SN74HCT393N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74HC393DR(LX)	SOP14	74HC393	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HCT393DR (LX)	SOP14	74HCT393	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HC393PWR (LX)	TSSOP14	74HC393	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
SN74HCT393PWR (LX)	TSSOP14	74HCT393	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm

Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
SN74HC393DR(LX)	SOP14	HC393	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HCT393DR(LX)	SOP14	HCT393	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HC393PWR(LX)	TSSOP14	HC393	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
SN74HCT393PWR(LX)	TSSOP14	HCT393	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

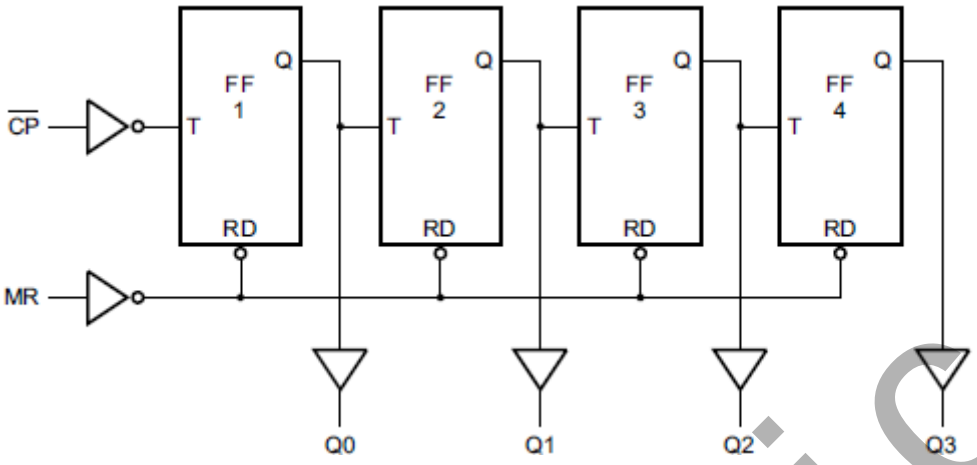
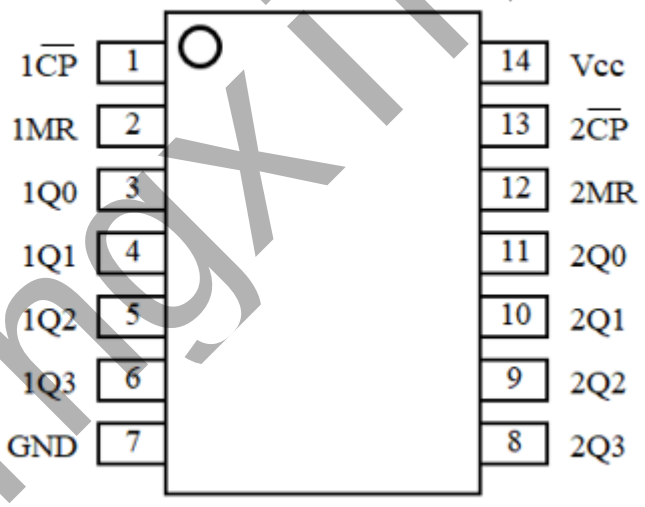


Figure 1. Logic symbol

2.2、Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1	1CP	clock input (HIGH-to-LOW, edge-triggered)
2	1MR	asynchronous master reset input (active HIGH)
3	1Q0	flip-flop output
4	1Q1	flip-flop output
5	1Q2	flip-flop output
6	1Q3	flip-flop output
7	GND	ground (0V)

8	2Q3	flip-flop output
9	2Q2	flip-flop output
10	2Q1	flip-flop output
11	2Q0	flip-flop output
12	2MR	asynchronous master reset input (active HIGH)
13	$2\overline{CP}$	clock input (HIGH-to-LOW, edge-triggered)
14	V_{CC}	supply voltage

2.4、Function Table

Count	Output			
	nQ3	nQ2	nQ1	nQ0
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

Note: H=HIGH voltage level; L=LOW voltage level.

3、Electrical Parameter

3.1、Absolute Maximum Ratings

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Max.	Unit
supply voltage	V_{CC}	-		-0.5	+7	V
supply current	I_{CC}	-		-	50	mA
ground current	I_{GND}	-		-50	-	mA
input clamping current	I_{IK}	$V_I < -0.5V$ or $V_I > V_{CC}+0.5V$		-	±20	mA
output clamping current	I_{OK}	$V_O < -0.5V$ or $V_O > V_{CC}+0.5V$		-	±20	mA
output current	I_O	$-0.5V < V_O < V_{CC}+0.5V$		-	±25	mA
storage temperature	T_{stg}	-		-65	+150	℃
soldering temperature	T_L	10s	DIP	245		℃

			SOP/TSSOP	260	

3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
SN74HC393						
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	℃
SN74HCT393						
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	℃

3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

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

Parameter	Symbol	V_{CC}	Conditions	Min.	Typ.	Max.	Unit
SN74HC393							
HIGH-level input voltage	V_{IH}	2.0V	-	1.5	1.2	-	V
		4.5V	-	3.15	2.4	-	V
		6.0V	-	4.2	3.2	-	V
LOW-level input voltage	V_{IL}	2.0V	-	-	0.8	0.5	V
		4.5V	-	-	2.1	1.35	V
		6.0V	-	-	2.8	1.8	V
HIGH-level output voltage	V_{OH}	2.0V	I_O=-20uA	1.9	2.0	-	V
		4.5V	I_O=-20uA	4.4	4.5	-	V
		6.0V	I_O=-20uA	5.9	6.0	-	V
		4.5V	I_O=-4.0mA	3.84	4.32	-	V
		6.0V	I_O=-5.2mA	5.34	5.81	-	V
LOW-level output voltage	V_{OL}	2.0V	I_O=20uA	-	0	0.1	V
		4.5V	I_O=20uA	-	0	0.1	V
		6.0V	I_O=20uA	-	0	0.1	V
		4.5V	I_O=4.0mA	-	0.15	0.33	V
		6.0V	I_O=5.2mA	-	0.16	0.33	V
input leakage current	I_I	6.0V	V_I=V_{CC} or GND	-	-	±1	uA
OFF-state output current	I_{OZ}	6.0V	V_I=V_{IH} or V_{IL}; V_O=V_{CC} or GND	-	-	±5	uA
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND;I_O=0A	-	-	80	uA
SN74HCT393							
HIGH-level input voltage	V_{IH}	4.5~ 5.5V	-	2.0	1.6	-	V

LOW-level input voltage	V_{IL}	4.5~5.5V	-	-	1.2	0.8	V
HIGH-level output voltage	V_{OH}	4.5V	I_O=-20uA	4.4	4.5	-	V
			I_O=-4.0mA	3.84	4.32	-	V
LOW-level output voltage	V_{OL}	4.5V	I_O=20uA	-	0	0.1	V
			I_O=4.0mA	-	0.15	0.33	V
input leakage current	I_I	5.5V	V_I=V_{CC} or GND	-	-	±1	uA
OFF-state output current	I_{OZ}	5.5V	V_I=V_{IH} or V_{IL}; V_O=V_{CC} or GND	-	-	±5	uA
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND;I_O=0A	-	-	80	uA
additional supply current	ΔI_{CC}	4.5~5.5V	One input at V_I=V_{CC}-2.1V; Other inputs at V_{CC} or GND; I_O=0A	-	-	135	uA

3.3.2、DC Characteristics 2

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

Parameter	Symbol	V_{CC}	Conditions	Min.	Typ.	Max.	Unit
SN74HC393							
HIGH-level input voltage	V_{IH}	2.0V	-	1.5	-	-	V
		4.5V	-	3.15	-	-	V
		6.0V	-	4.2	-	-	V
LOW-level input voltage	V_{IL}	2.0V	-	-	-	0.5	V
		4.5V	-	-	-	1.35	V
		6.0V	-	-	-	1.8	V
HIGH-level output voltage	V_{OH}	2.0V	I_O=-20uA	1.9	-	-	V
		4.5V	I_O=-20uA	4.4	-	-	V
		6.0V	I_O=-20uA	5.9	-	-	V
		4.5V	I_O=-4.0mA	3.7	-	-	V
		6.0V	I_O=-5.2mA	5.2	-	-	V
LOW-level output voltage	V_{OL}	2.0V	I_O=20uA	-	-	0.1	V
		4.5V	I_O=20uA	-	-	0.1	V
		6.0V	I_O=20uA	-	-	0.1	V
		4.5V	I_O=4.0mA	-	-	0.4	V
		6.0V	I_O=5.2mA	-	-	0.4	V
input leakage current	I_I	6.0V	V_I=V_{CC} or GND	-	-	±1	uA
OFF-state output current	I_{OZ}	6.0V	V_I=V_{IH} or V_{IL}; V_O=V_{CC} or GND	-	-	±10	uA
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND;I_O=0A	-	-	160	uA
SN74HCT393							
HIGH-level input voltage	V_{IH}	4.5~5.5V	-	2.0	-	-	V
LOW-level input voltage	V_{IL}	4.5~5.5V	-	-	-	0.8	V
HIGH-level output voltage	V_{OH}	4.5V	I_O=-20uA	4.4	-	-	V
			I_O=-4.0mA	3.7	-	-	V
LOW-level output voltage	V_{OL}	4.5V	I_O=20uA	-	-	0.1	V
			I_O=4.0mA	-	-	0.4	V
input leakage current	I_I	5.5V	V_I=V_{CC} or GND	-	-	±1	uA
OFF-state output current	I_{OZ}	5.5V	V_I=V_{IH} or V_{IL}; V_O=V_{CC} or GND	-	-	±10	uA
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND;I_O=0A	-	-	160	uA
additional supply current	ΔI_{CC}	4.5~5.5V	One input at V_I=V_{CC}-2.1V; Other inputs at V_{CC} or GND; I_O=0A	-	-	147	uA

3.3.3、AC Characteristics 1

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

Parameter	Symbol	V_{CC}	Conditions		Min.	Typ.	Max.	Unit
SN74HC393								
$n\overline{CP}$ to nQ0 propagation delay	t_{PLH}, t_{PHL}	2.0V	C_L=50pF	see Figure 4	-	41	155	ns
		4.5V	C_L=50pF		-	15	31	ns
		5.0V	C_L=15pF		-	12	-	ns
		6.0V	C_L=50pF		-	12	26	ns
nQx to nQ(x+1) propagation delay		2.0V	C_L=50pF		-	14	55	ns
		4.5V	C_L=50pF		-	5	11	ns
		5.0V	C_L=15pF		-	5	-	ns
		6.0V	C_L=50pF		-	4	9	ns
nMR to nQx HIGH to LOW propagation delay	t_{PHL}	2.0V	C_L=50pF	see Figure 5	-	39	175	ns
		4.5V	C_L=50pF		-	14	35	ns
		5.0V	C_L=15pF		-	11	-	ns
		6.0V	C_L=50pF		-	11	30	ns
transition time	t_{THL}, t_{TLH}	2.0V	C_L=50pF	see Figure 4	-	19	95	ns
		4.5V	C_L=50pF		-	7	19	ns
		6.0V	C_L=50pF		-	6	16	ns
$n\overline{CP}$ HIGH or LOW pulse width	tw	2.0V	C_L=50pF	see Figure 4	100	17	-	ns
		4.5V	C_L=50pF		20	6	-	ns
		6.0V	C_L=50pF		17	5	-	ns
nMR HIGH pulse width		2.0V	C_L=50pF	see Figure 5	100	19	-	ns
		4.5V	C_L=50pF		20	7	-	ns
		6.0V	C_L=50pF		17	6	-	ns
nMR to $n\overline{CP}$ recovery time	trec	2.0V	C_L=50pF	see Figure 5	5	3	-	ns
		4.5V	C_L=50pF		5	1	-	ns
		6.0V	C_L=50pF		5	1	-	ns
maximum clock frequency	fclk(max)	2.0V	C_L=50pF	see Figure 4	5	30	-	MHZ
		4.5V	C_L=50pF		24	90	-	MHZ
		5.0V	C_L=15pF		-	99	-	MHZ
		6.0V	C_L=50pF		28	107	-	MHZ
SN74HCT393								
$n\overline{CP}$ to nQ0 propagation delay	t_{PLH}, t_{PHL}	4.5V	C_L=50pF	see Figure 4	-	15	31	ns
		5.0V	C_L=15pF		-	20	-	ns
nQx to nQ(x+1) propagation delay		4.5V	C_L=50pF		-	6	13	ns
		5.0V	C_L=15pF		-	6	-	ns
nMR to nQx HIGH to LOW propagation delay	t_{PHL}	4.5V	C_L=50pF	see Figure 5	-	18	40	ns
		5.0V	C_L=15pF		-	15	-	ns
transition time	t_{THL}, t_{TLH}	4.5V	C_L=50pF	see Figure 4	-	7	19	ns
$n\overline{CP}$ HIGH or	tw	4.5V	C_L=50pF	see Figure 4	24	11	-	ns

LOW pulse width								
nMR HIGH pulse width		4.5V	C_L=50pF	see Figure 5	20	6	-	ns
nMR to nCP recovery time	trec	4.5V	C_L=50pF	see Figure 5	5	0	-	ns
maximum clock frequency	fclk(max)	4.5V	C_L=50pF	see Figure 4	22	48	-	MHZ
		5.0V	C_L=15pF		-	53	-	MHZ

3.3.4、AC Characteristics 2

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

Parameter	Symbol	V_{CC}	Conditions		Min.	Typ.	Max.	Unit
SN74HC393								
$\overline{nCP}$ to nQ0 propagation delay	t_{PLH}, t_{PHL}	2.0V	C_L=50pF	see Figure 4	-	-	190	ns
		4.5V	C_L=50pF		-	-	38	ns
		6.0V	C_L=50pF		-	-	32	ns
nQx to nQ(x+1) propagation delay		2.0V	C_L=50pF		-	-	70	ns
		4.5V	C_L=50pF		-	-	14	ns
		6.0V	C_L=50pF		-	-	12	ns
nMR to nQx HIGH to LOW propagation delay	t_{PHL}	2.0V	C_L=50pF	see Figure 5	-	-	210	ns
		4.5V	C_L=50pF		-	-	42	ns
		6.0V	C_L=50pF		-	-	36	ns
transition time	t_{THL}, t_{TLH}	2.0V	C_L=50pF	see Figure 4	-	-	110	ns
		4.5V	C_L=50pF		-	-	22	ns
		6.0V	C_L=50pF		-	-	19	ns
$\overline{nCP}$ HIGH or LOW pulse width	tw	2.0V	C_L=50pF	see Figure 4	120	-	-	ns
		4.5V	C_L=50pF		24	-	-	ns
		6.0V	C_L=50pF		20	-	-	ns
nMR HIGH pulse width		2.0V	C_L=50pF	see Figure 5	120	-	-	ns
		4.5V	C_L=50pF		24	-	-	ns
		6.0V	C_L=50pF		20	-	-	ns
nMR to $\overline{nCP}$ recovery time	trec	2.0V	C_L=50pF	see Figure 5	5	-	-	ns
		4.5V	C_L=50pF		5	-	-	ns
		6.0V	C_L=50pF		5	-	-	ns
maximum clock frequency	fclk(max)	2.0V	C_L=50pF	see Figure 4	4	-	-	MHZ
		4.5V	C_L=50pF		20	-	-	MHZ
		6.0V	C_L=50pF		24	-	-	MHZ
SN74HCT393								
$\overline{nCP}$ to nQ0 propagation delay	t_{PLH}, t_{PHL}	4.5V	C_L=50pF	see Figure 4	-	-	38	ns
nQx to nQ(x+1) propagation delay		4.5V	C_L=50pF		-	-	15	ns
nMR to nQx HIGH to LOW propagation delay	t_{PHL}	4.5V	C_L=50pF	see Figure 5	-	-	48	ns
transition time	t_{THL}, t_{TLH}	4.5V	C_L=50pF	see Figure 4	-	-	22	ns
$\overline{nCP}$ HIGH or LOW pulse width	tw	4.5V	C_L=50pF	see Figure 4	29	-	-	ns
nMR HIGH pulse width		4.5V	C_L=50pF	see Figure 5	24	-	-	ns

nMR to nCP recovery time	trec	4.5V	C_L=50pF	see Figure 5	5	-	-	ns
maximum clock frequency	fclk(max)	4.5V	C_L=50pF	see Figure 4	18	-	-	MHZ

4、Testing Circuit

4.1、AC Testing Circuit

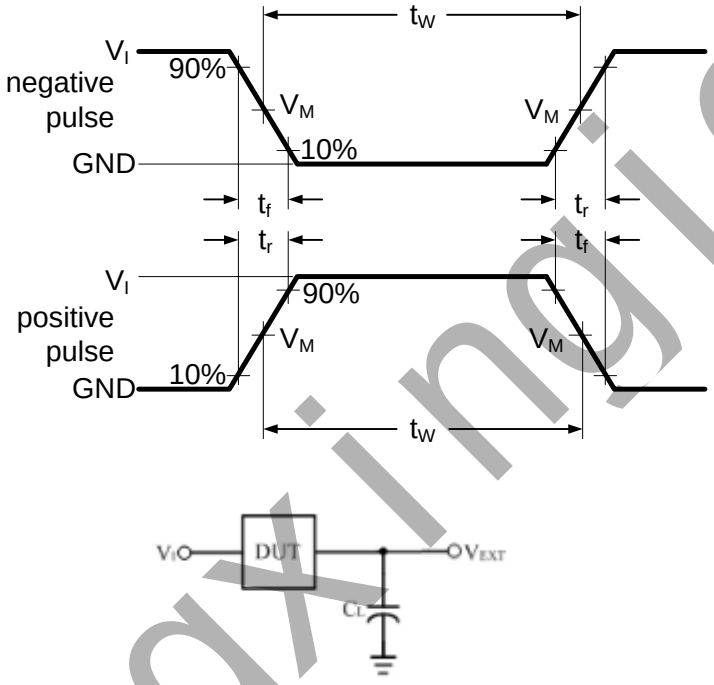


Figure 3. Test circuit for measuring switching times

C_L includes probe and jig capacitance.

4.2、Test Data

Type	Input		Load	V_{EXT}		
	V_I	$t_r = t_f$	C_L	t_{PLH}/t_{PHL}	t_{PLZ}/t_{PZL}	t_{PHZ}/t_{PZH}
SN74HC393	V_{CC}	6.0ns	15pF, 50pF	Open	V_{CC}	GND
SN74HCT393	3.0V	6.0ns	15pF, 50pF	Open	V_{CC}	GND

4.3、AC Testing Waveforms

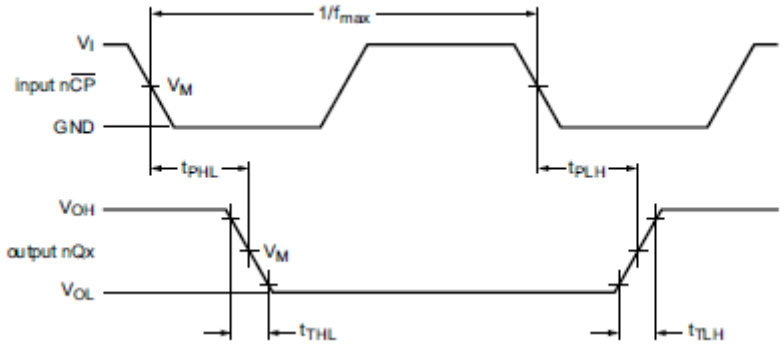


Figure 4. Propagation delay, output transition time

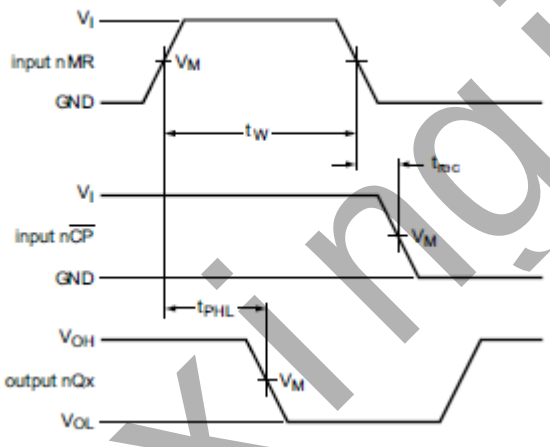


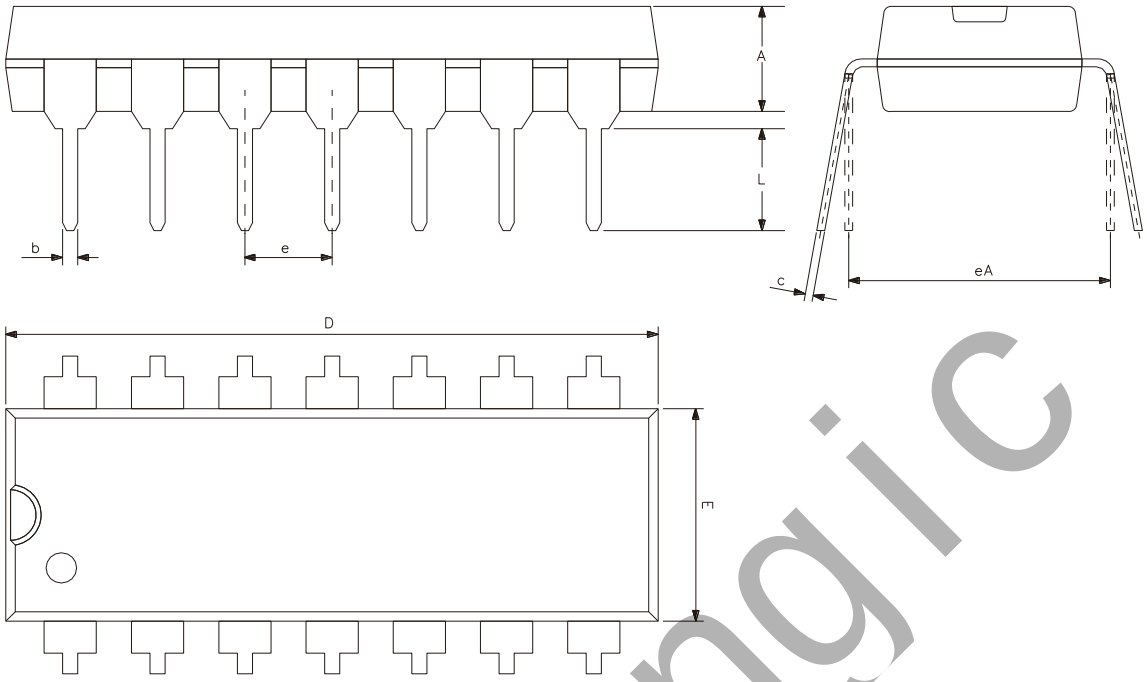
Figure 5. Propagation delays clock (nCP) to output (nQx), pulse width master reset (nMR), and recovery time master reset (nMR) to clock (nCP)

4.4、Measurement Points

Type	Input	Output
	V_M	V_M
SN74HC393	$0.5\times V_{CC}$	$0.5\times V_{CC}$
SN74HCT393	1.3V	1.3V

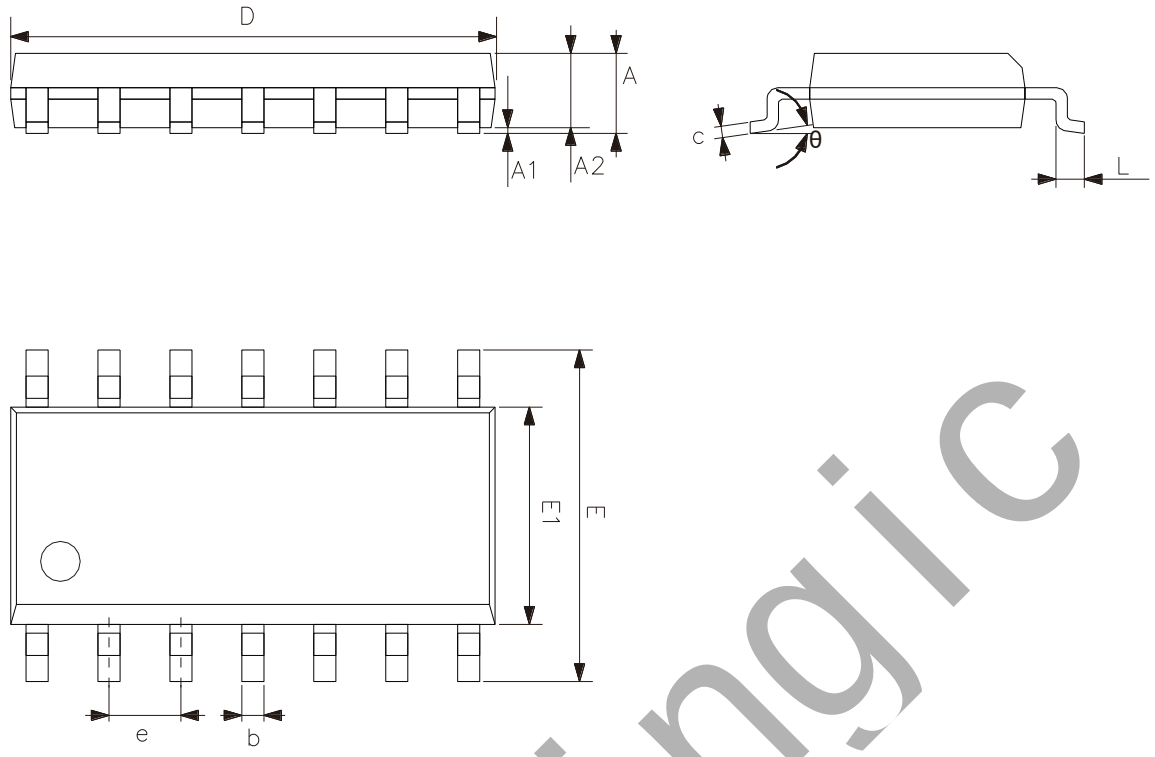
5、Package Information

5.1、DIP14



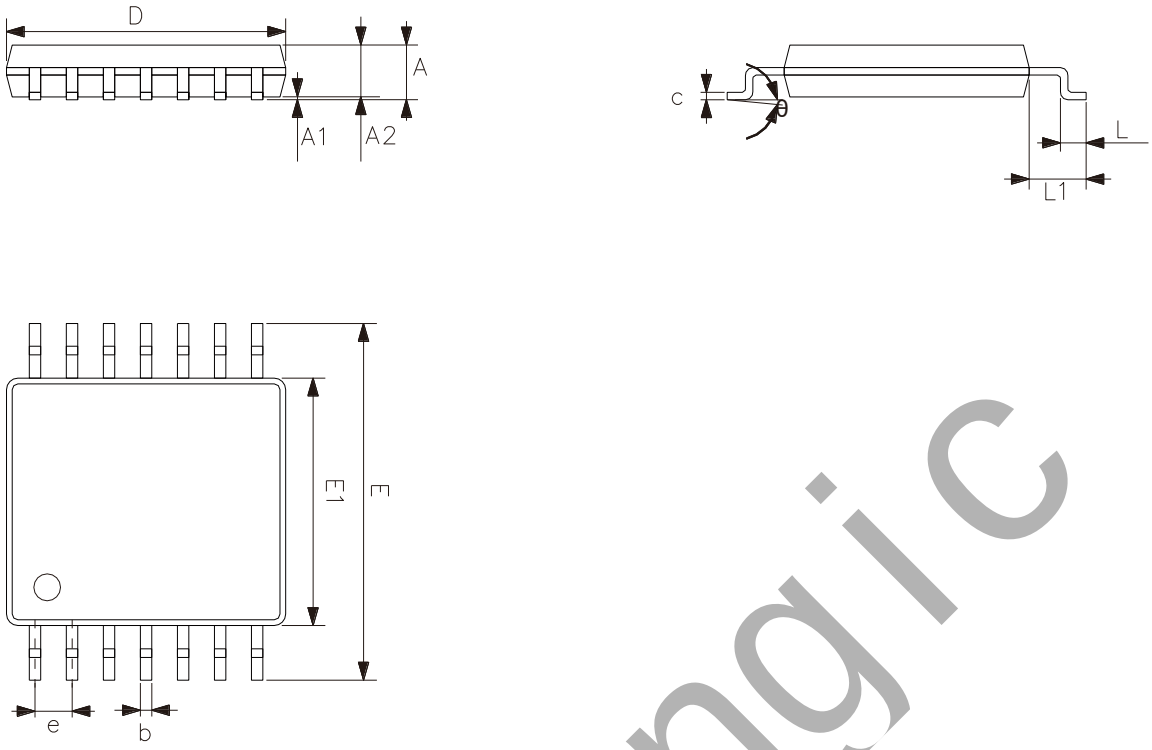
Symbol	Dimensions (mm)	
	Min.	Max.
A	3.05	3.60
b	0.33	0.56
c	0.20	0.36
D	18.80	19.40
E	6.20	6.60
e	2.54	
eA	7.62	10.90
L	2.92	-

5.2、SOP14



Symbol	Dimensions (mm)	
	Min.	Max.
A	1.50	1.75
A1	0.05	0.25
A2	1.30	-
b	0.33	0.50
c	0.19	0.25
D	8.43	8.76
E	5.80	6.25
E1	3.75	4.00
e	1.27	
L	0.40	0.89
θ	0°	8°

5.3、TSSOP14



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
L1	1.00	
θ	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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