SN74HC93/HCT93(LX)
4-Bit Binary Ripple Counter

Product Specification

Specification Revision History：

Version	Date	Description
2023-10-A1	2023-10	New
2024-04-A1	2024-04	Modify the parameters

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1、General Description

The SN74HC/HCT93 is a 4-bit binary ripple counter.

Features:

- Supply voltage range:
  SN74HC93: 2V to 6V
  HCT93: 4.5V to 5.5V
- Input levels:
  SN74HC93: CMOS level
  HCT93: 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
SN74HC93N(LX)	DIP14	SN74HC93N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74HCT93N(LX)	DIP14	SN74HCT93N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74HC93DR(LX)	SOP14	HC93	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HCT93DR(LX)	SOP14	HCT93	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HC93PW(LX)	TSSOP14	HC93	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
SN74HCT93PW(LX)	TSSOP14	HCT93	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
SN74HC93DR(LX)	SOP14	HC93	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HCT93DR(LX)	SOP14	HCT93	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HC93PW(LX)	TSSOP14	HC93	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
SN74HCT93PW(LX)	TSSOP14	HCT93	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

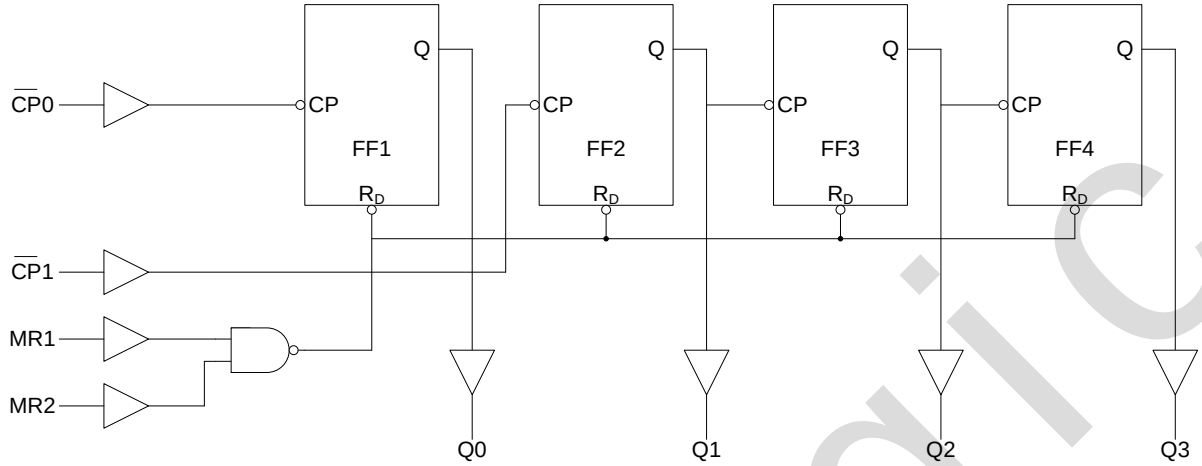


Figure 1. Logic symbol

2.2、Pin Configurations

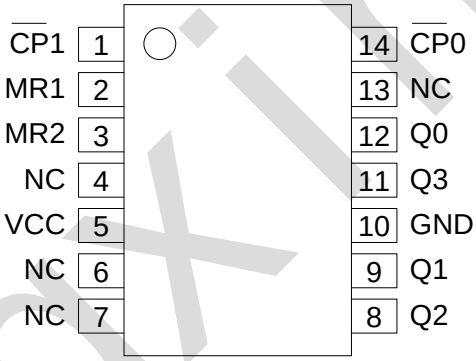


Figure 2. Pin Configurations

2.3、Pin Description

Pin No.	Pin Name	Description
1	$\overline{CP}$1	clock input 2nd, 3rd and 4th section (HIGH-to-LOW, edge-triggered)
2	MR1	asynchronous master reset input (active HIGH)
3	MR2	asynchronous master reset input (active HIGH)
4	NC	not connected
5	VCC	supply voltage
6	NC	not connected
7	NC	not connected
8	Q2	flip-flop output
9	Q1	flip-flop output
10	GND	ground (0V)
11	Q3	flip-flop output
12	Q0	flip-flop output
13	NC	not connected
14	$\overline{CP}$0	clock input 1st section (HIGH-to-LOW, edge-triggered)

2.4、Function Table

Count	Output			
	Q3	Q2	Q1	Q0
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

Reset Inputs		Outputs			
MR1	**MR2**	**Q3**	**Q2**	**Q1**	**Q0**
H	H	L	L	L	L
L	H	count			
H	L	count			
L	L	count			

Notes:

Output Q0 connected to $\overline{CP}$1;

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
SN74HC93						
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	℃
SN74HCT93						
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
SN74HC93							
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
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND;I_O=0A	-	-	80	uA
SN74HCT93							
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
supply current	I_{CC}	5.5V	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
SN74HC93							
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
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND;I_O=0A	-	-	160	uA
SN74HCT93							
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
supply current	I_{CC}	5.5V	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
SN74HC93								
$\overline{CP}$0 to Q0 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
		6.0V	C_L=50pF		-	12	26	ns
$\overline{CP}$1 to Q1 propagation delay		2.0V	C_L=50pF		-	49	170	ns
		4.5V	C_L=50pF		-	16	34	ns
		6.0V	C_L=50pF		-	13	29	ns
$\overline{CP}$1 to Q2 propagation delay		2.0V	C_L=50pF		-	61	230	ns
		4.5V	C_L=50pF		-	22	46	ns
		6.0V	C_L=50pF		-	18	39	ns
$\overline{CP}$1 to Q3 propagation delay		2.0V	C_L=50pF		-	80	305	ns
		4.5V	C_L=50pF		-	29	61	ns
		6.0V	C_L=50pF		-	23	52	ns
MRn to Qn HIGH to LOW propagation delay	t_{PHL}	2.0V	C_L=50pF	see Figure 5	-	50	195	ns
		4.5V	C_L=50pF		-	18	39	ns
		6.0V	C_L=50pF		-	14	33	ns
output 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
$\overline{CP}$n HIGH or LOW pulse width	tw	2.0V	C_L=50pF	see Figure 4	100	14	-	ns
		4.5V	C_L=50pF		20	5	-	ns
		6.0V	C_L=50pF		17	4	-	ns
MRn HIGH pulse width		2.0V	C_L=50pF	see Figure 5	100	8	-	ns
		4.5V	C_L=50pF		20	3	-	ns
		6.0V	C_L=50pF		17	2	-	ns
MRn to n$\overline{CP}$ recovery time	trec	2.0V	C_L=50pF	see Figure 5	65	8	-	ns
		4.5V	C_L=50pF		13	3	-	ns
		6.0V	C_L=50pF		11	2	-	ns
maximum clock frequency	fmax	2.0V	C_L=50pF	see Figure 4	4.8	30	-	MHz
		4.5V	C_L=50pF		24	91	-	MHz
		6.0V	C_L=50pF		28	108	-	MHz
SN74HCT93								
$\overline{CP}$1 to nQ0 propagation delay	t_{PLH}, t_{PHL}	4.5V	C_L=50pF	see Figure 4	-	18	43	ns
$\overline{CP}$1 to Q1 propagation delay		4.5V	C_L=50pF		-	18	43	ns
$\overline{CP}$1 to Q2 propagation delay		4.5V	C_L=50pF		-	24	58	ns
$\overline{CP}$1 to Q3		4.5V	C_L=50pF		-	30	73	ns

propagation delay								
MRn to Qn HIGH to LOW propagation delay	t_{PHL}	4.5V	C_L=50pF	see Figure 5	-	17	41	ns
transition time	t_{THL}, t_{TLH}	4.5V	C_L=50pF	see Figure 4	-	7	19	ns
$\overline{nCP}$ HIGH or LOW pulse width	tw	4.5V	C_L=50pF	see Figure 4	20	7	-	ns
nMR HIGH pulse width		4.5V	C_L=50pF	see Figure 5	20	5	-	ns
nMR to $\overline{nCP}$ recovery time	trec	4.5V	C_L=50pF	see Figure 5	13	3	-	ns
maximum clock frequency	fmax	4.5V	C_L=50pF	see Figure 4	24	70	-	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
SN74HC93								
$\overline{CP0}$ to Q0 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
$\overline{CP1}$ to Q1 propagation delay		2.0V	C_L=50pF		-	-	205	ns
		4.5V	C_L=50pF		-	-	41	ns
		6.0V	C_L=50pF		-	-	35	ns
$\overline{CP1}$ to Q2 propagation delay		2.0V	C_L=50pF		-	-	280	ns
		4.5V	C_L=50pF		-	-	56	ns
		6.0V	C_L=50pF		-	-	48	ns
$\overline{CP1}$ to Q3 propagation delay		2.0V	C_L=50pF		-	-	370	ns
		4.5V	C_L=50pF		-	-	71	ns
		6.0V	C_L=50pF		-	-	63	ns
MRn to Qn HIGH to LOW propagation delay	t_{PHL}	2.0V	C_L=50pF	see Figure 5	-	-	235	ns
		4.5V	C_L=50pF		-	-	47	ns
		6.0V	C_L=50pF		-	-	40	ns
output 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
$\overline{CPn}$ 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
MRn 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
MRn to $\overline{nCP}$	trec	2.0V	C_L=50pF	see Figure 5	75	-	-	ns

recovery time		4.5V	C_L=50pF		15	-	-	ns
		6.0V	C_L=50pF		13	-	-	ns
maximum clock frequency	fmax	2.0V	C_L=50pF	see Figure 4	4	-	-	MHz
		4.5V	C_L=50pF		20	-	-	MHz
		6.0V	C_L=50pF		24	-	-	MHz
SN74HCT93								
$\overline{CP}$1 to nQ0 propagation delay	t_{PLH}, t_{PHL}	4.5V	C_L=50pF	see Figure 4	-	-	51	ns
$\overline{CP}$1 to Q1 propagation delay		4.5V	C_L=50pF		-	-	51	ns
$\overline{CP}$1 to Q2 propagation delay		4.5V	C_L=50pF		-	-	69	ns
$\overline{CP}$1 to Q3 propagation delay		4.5V	C_L=50pF		-	-	87	ns
MRn to Qn HIGH to LOW propagation delay	t_{PHL}	4.5V	C_L=50pF	see Figure 5	-	-	50	ns
transition time	t_{THL}, t_{TLH}	4.5V	C_L=50pF	see Figure 4	-	-	22	ns
n$\overline{CP}$ HIGH or LOW pulse width	tw	4.5V	C_L=50pF	see Figure 4	24	-	-	ns
nMR HIGH pulse width		4.5V	C_L=50pF	see Figure 5	24	-	-	ns
nMR to n$\overline{CP}$ recovery time	trec	4.5V	C_L=50pF	see Figure 5	15	-	-	ns
maximum clock frequency	fmax	4.5V	C_L=50pF	see Figure 4	20	-	-	MHz

4、Testing Circuit

4.1、AC Testing Circuit

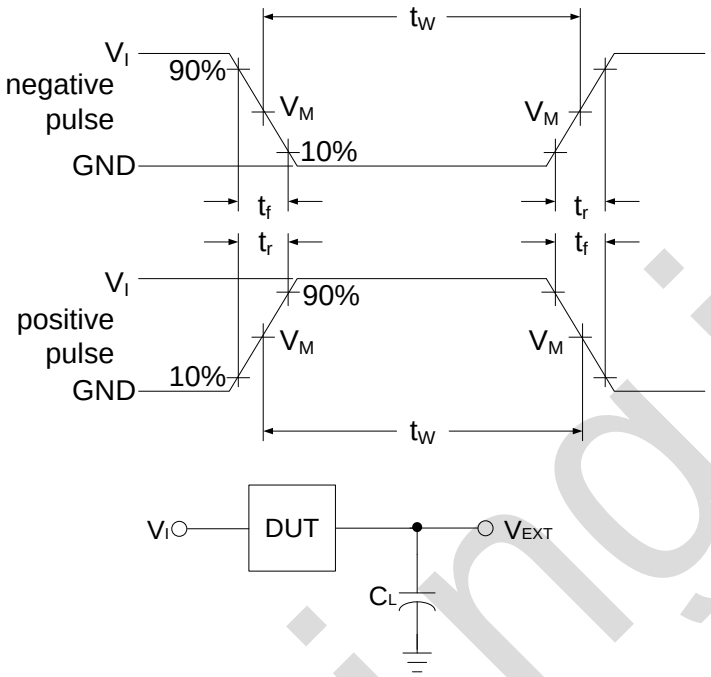


Figure 3. Test circuit for measuring switching times

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}
SN74HC93	V_{CC}	6.0ns	15pF, 50pF	Open	V_{CC}	GND
SN74HCT93	3.0V	6.0ns	15pF, 50pF	Open	V_{CC}	GND

4.3、AC Testing Waveforms

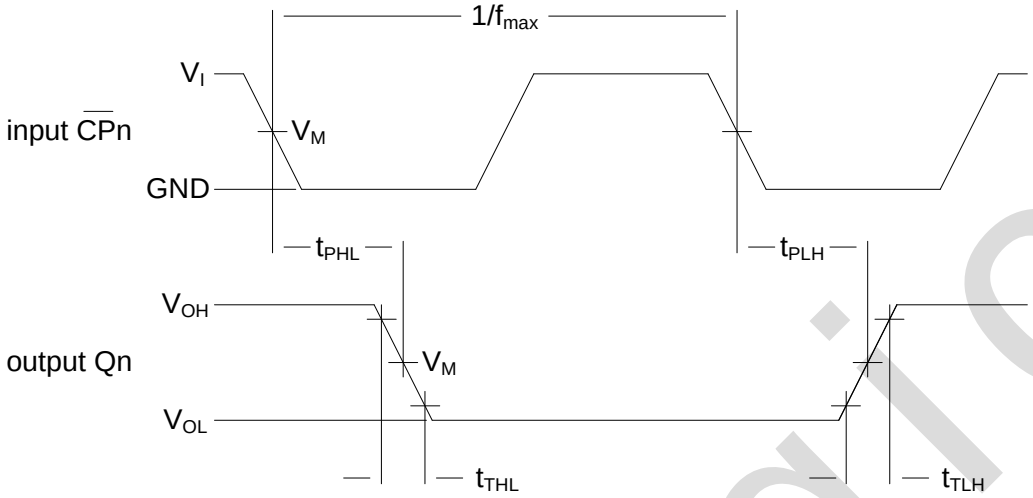


Figure 4. Propagation delay, output transition time

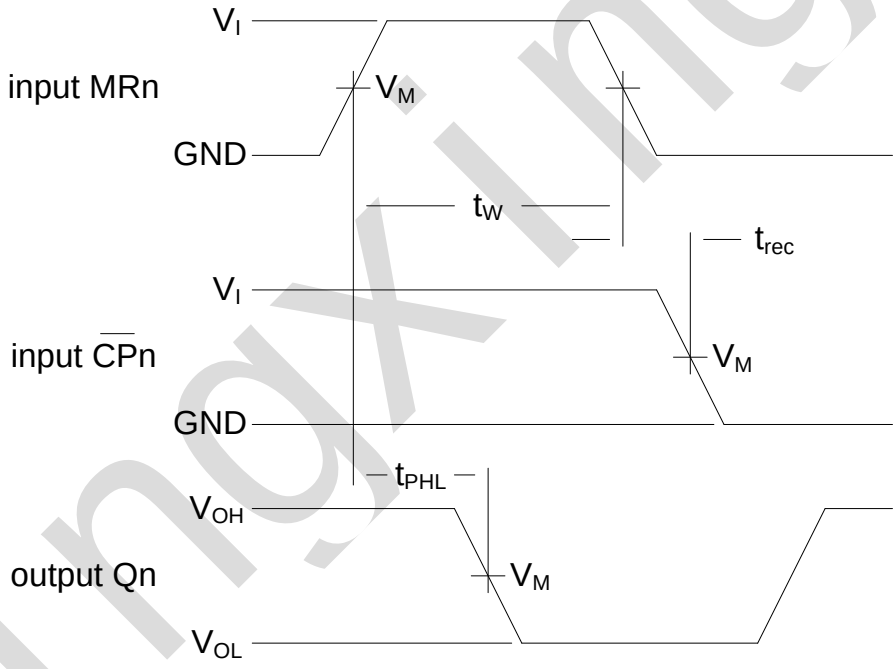


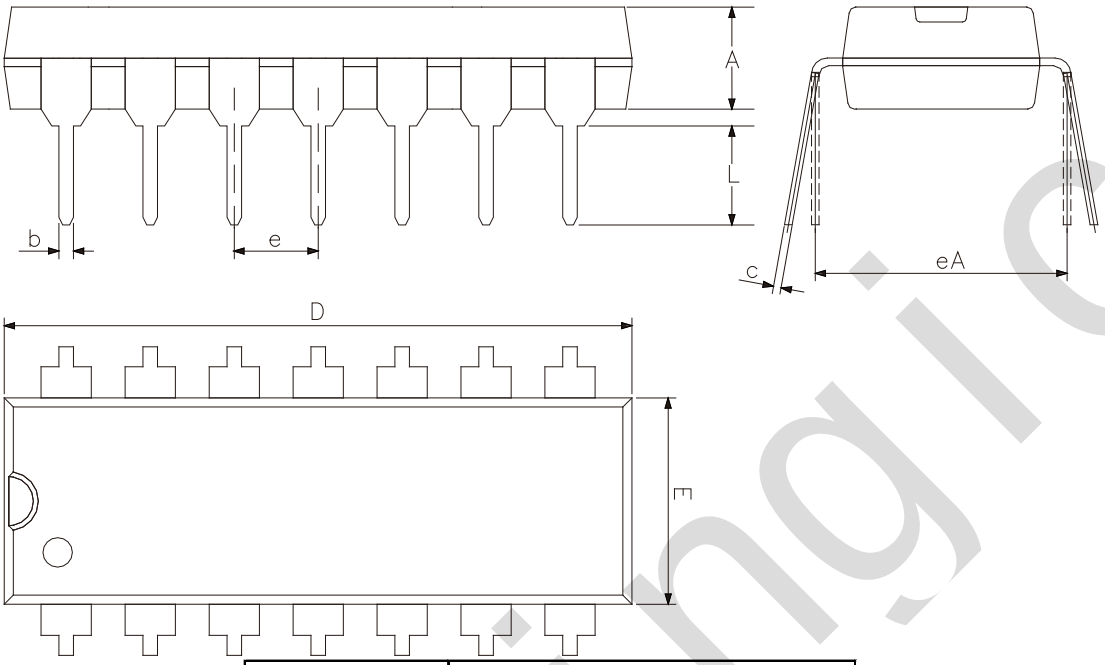
Figure 5. Propagation delays clock ($\overline{CP}$n) to output (Qn), pulse width master reset (MRn), and recovery time master reset (MRn) to clock ($\overline{CP}$n)

4.4、Measurement Points

Type	Input	Output
	V_M	V_M
SN74HC93	0.5×V_{CC}	0.5×V_{CC}
SN74HCT93	1.3V	1.3V

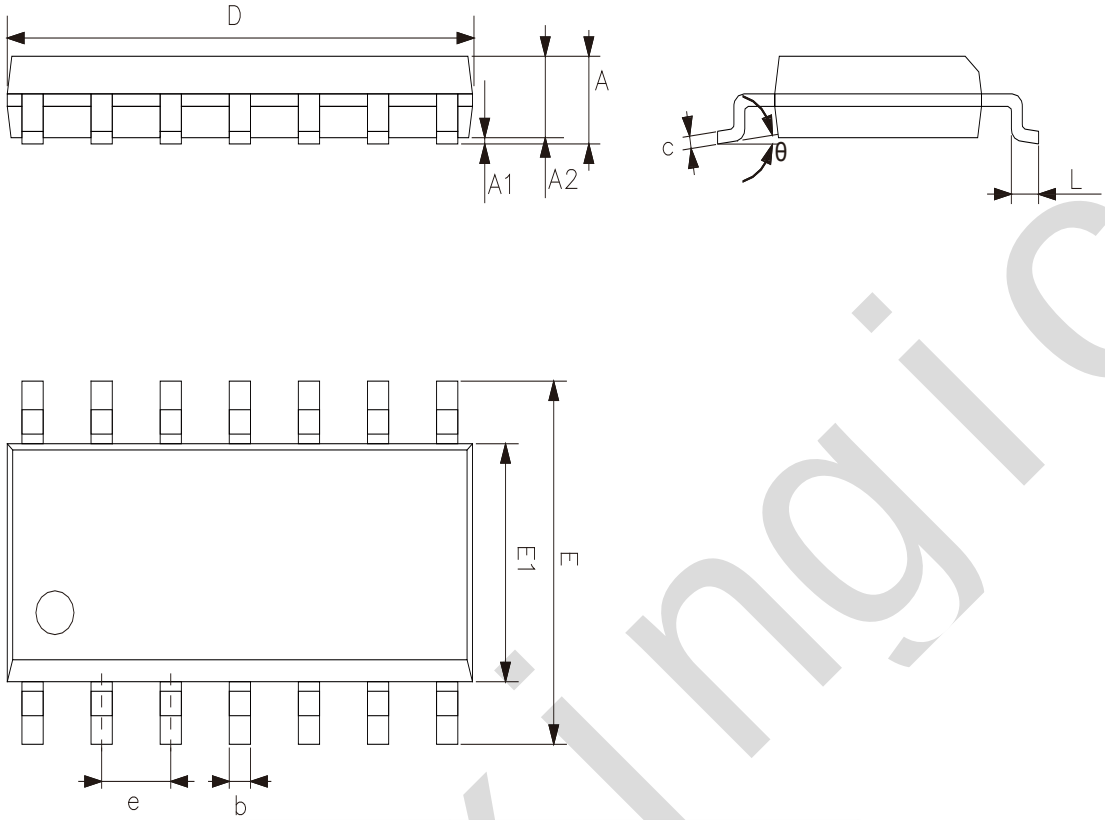
5、Package Information

5.1、DIP14



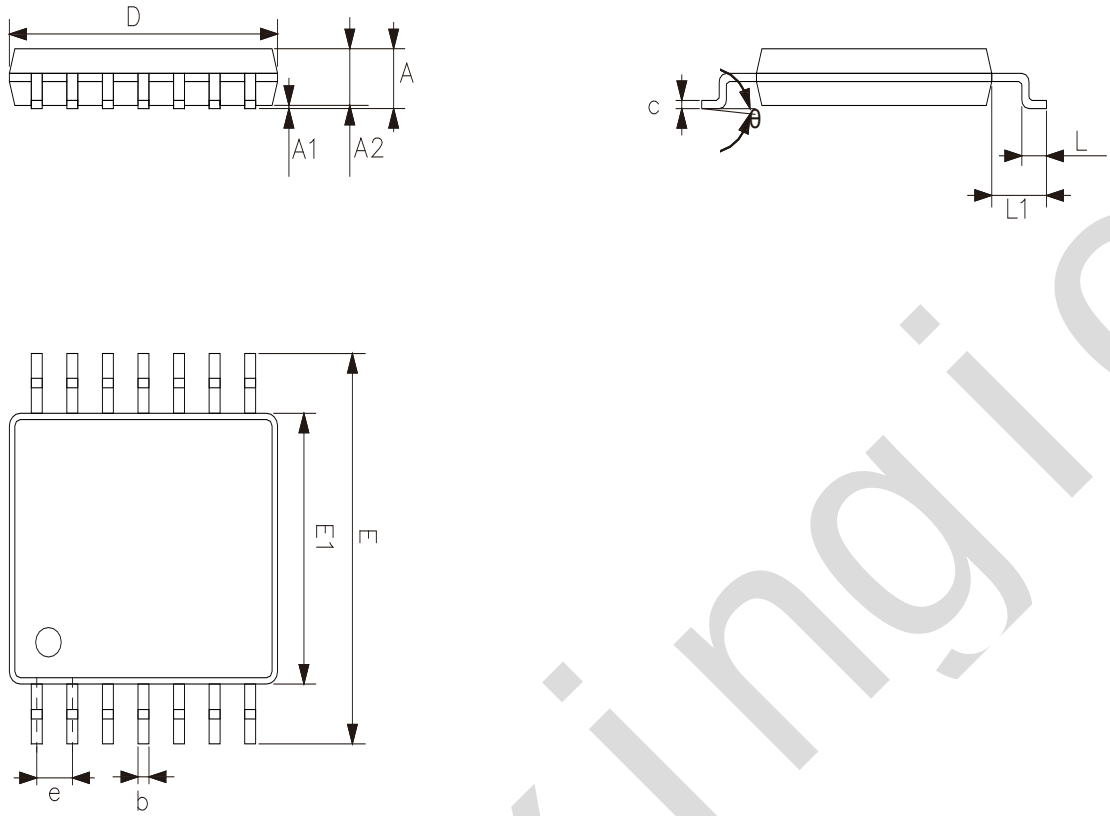
2023/12/A	Dimensions In Millimeters	
Symbol	**Min**	**Max**
A	3.05	3.60
b	0.33	0.56
c	0.20	0.36
D	18.80	19.40
E	6.20	6.60
e	2.54	
eA	7.62	10.90
L	2.92	—

5.2、SOP14



2023/12/A	Dimensions In Millimeters	
Symbol	**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



2023/12/A	Dimensions In Millimeters	
Symbol	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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