



AiP74HC93/HCT93 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 AiP74HC/HCT93 is a 4-bit binary ripple counter.

Features:

- Supply voltage range:
AiP74HC93: 2V to 6V
AiP74HCT93: 4.5V to 5.5V
- Input levels:
AiP74HC93: CMOS level
AiP74HCT93: TTL level
- Temperature range: -40°C to +125°C
- Packaging information: DIP14/SOP14/TSSOP14

Ordering Information:

Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP74HC93DA14.TB	DIP14	74HC93	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP74HCT93DA14.TB	DIP14	74HCT93	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP74HC93SA14.TB	SOP14	74HC93	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
AiP74HCT93SA14.TB	SOP14	74HCT93	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
AiP74HC93TA14.TB	TSSOP14	74HC93	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
AiP74HCT93TA14.TB	TSSOP14	74HCT93	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
AiP74HC93SA14.TR	SOP14	74HC93	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
AiP74HCT93SA14.TR	SOP14	74HCT93	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
AiP74HC93TA14.TR	TSSOP14	74HC93	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
AiP74HCT93TA14.TR	TSSOP14	74HCT93	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

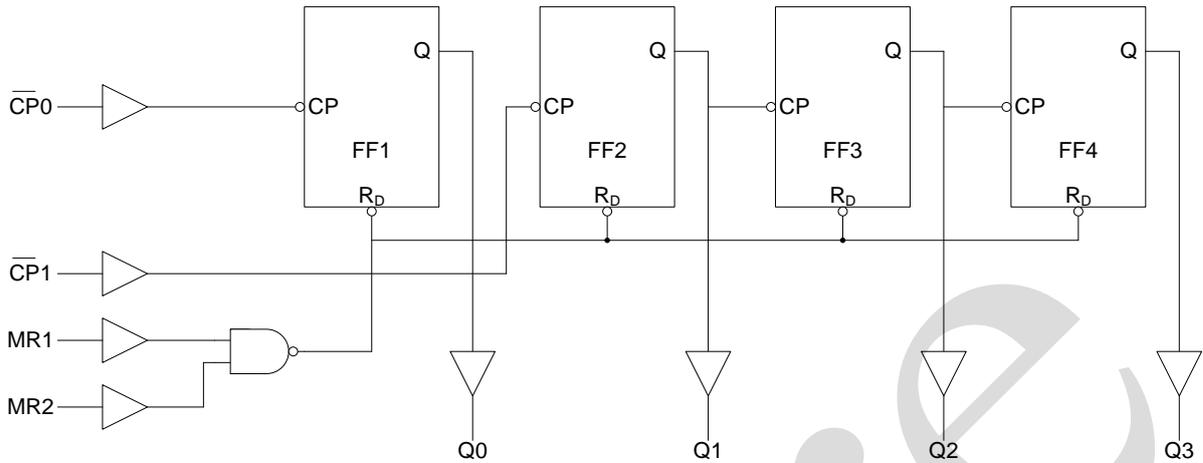


Figure 1. Logic symbol

2.2、Pin Configurations

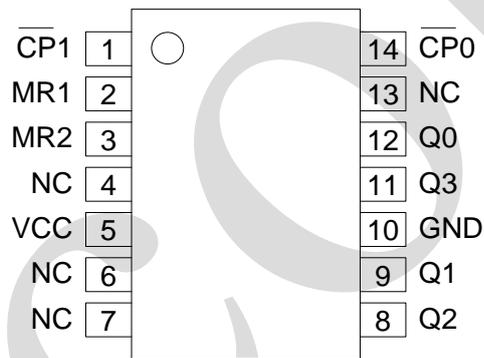


Figure 2. Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1	$\overline{\text{CP1}}$	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	$\overline{\text{CP0}}$	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 $\bar{CP}1$;

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	$^{\circ}C$
soldering temperature	T_L	10s	DIP		$^{\circ}C$
			SOP/TSSOP		
			245		
			260		

3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
AiP74HC93						
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	$^{\circ}C$
AiP74HCT93						
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	$^{\circ}C$



3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

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

Parameter	Symbol	V _{CC}	Conditions	Min.	Typ.	Max.	Unit
AiP74HC93							
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
AiP74HCT93							
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

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

Parameter	Symbol	V _{CC}	Conditions	Min.	Typ.	Max.	Unit
AiP74HC93							
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
AiP74HCT93							
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

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

Parameter	Symbol	V _{CC}	Conditions	Min.	Typ.	Max.	Unit	
AiP74HC93								
CP0 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
CP1 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
CP1 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
CP1 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
CPn 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 nCP 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
AiP74HCT93								
CP1 to nQ0 propagation delay	t _{PLH} , t _{PHL}	4.5V	C _L =50pF	see Figure 4	-	18	43	ns
CP1 to Q1 propagation delay		4.5V	C _L =50pF		-	18	43	ns
CP1 to Q2 propagation delay		4.5V	C _L =50pF		-	24	58	ns
CP1 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
nCP HIGH or LOW pulse width	t_w	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 nCP recovery time	t_{rec}	4.5V	$C_L=50pF$	see Figure 5	13	3	-	ns
maximum clock frequency	f_{max}	4.5V	$C_L=50pF$	see Figure 4	24	70	-	MHz

3.3.4、AC Characteristics 2

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

Parameter	Symbol	V_{CC}	Conditions	Min.	Typ.	Max.	Unit	
AiP74HC93								
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
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
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
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	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
CPn HIGH or LOW pulse width	t_w	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 nCP	t_{rec}	2.0V	$C_L=50pF$	see Figure 5	75	-	-	ns



recovery time		4.5V	$C_L=50\text{pF}$		15	-	-	ns
		6.0V	$C_L=50\text{pF}$		13	-	-	ns
maximum clock frequency	fmax	2.0V	$C_L=50\text{pF}$	see Figure 4	4	-	-	MHz
		4.5V	$C_L=50\text{pF}$		20	-	-	MHz
		6.0V	$C_L=50\text{pF}$		24	-	-	MHz
AiP74HCT93								
CP1 to nQ0 propagation delay	t _{PLH} , t _{PHL}	4.5V	$C_L=50\text{pF}$	see Figure 4	-	-	51	ns
CP1 to Q1 propagation delay		4.5V	$C_L=50\text{pF}$		-	-	51	ns
CP1 to Q2 propagation delay		4.5V	$C_L=50\text{pF}$		-	-	69	ns
CP1 to Q3 propagation delay		4.5V	$C_L=50\text{pF}$		-	-	87	ns
MRn to Qn HIGH to LOW propagation delay	t _{PHL}	4.5V	$C_L=50\text{pF}$	see Figure 5	-	-	50	ns
transition time	t _{THL} , t _{TLH}	4.5V	$C_L=50\text{pF}$	see Figure 4	-	-	22	ns
nCP HIGH or LOW pulse width	tw	4.5V	$C_L=50\text{pF}$	see Figure 4	24	-	-	ns
nMR HIGH pulse width		4.5V	$C_L=50\text{pF}$	see Figure 5	24	-	-	ns
nMR to nCP recovery time	trec	4.5V	$C_L=50\text{pF}$	see Figure 5	15	-	-	ns
maximum clock frequency	fmax	4.5V	$C_L=50\text{pF}$	see Figure 4	20	-	-	MHz



4、Testing Circuit

4.1、AC Testing Circuit

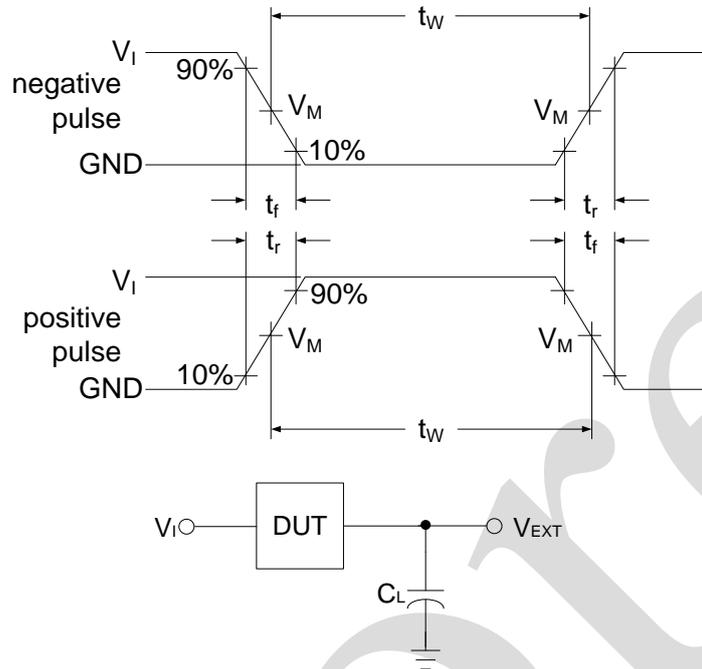


Figure 3. Test circuit for measuring switching times

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}
AiP74HC93	V_{CC}	6.0ns	15pF, 50pF	Open	V_{CC}	GND
AiP74HCT93	3.0V	6.0ns	15pF, 50pF	Open	V_{CC}	GND



4.3、AC Testing Waveforms

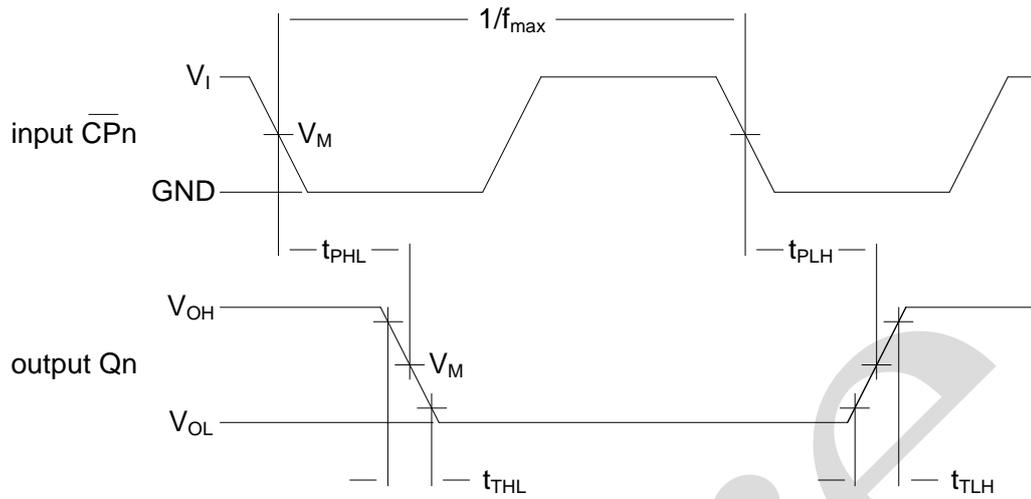


Figure 4. Propagation delay, output transition time

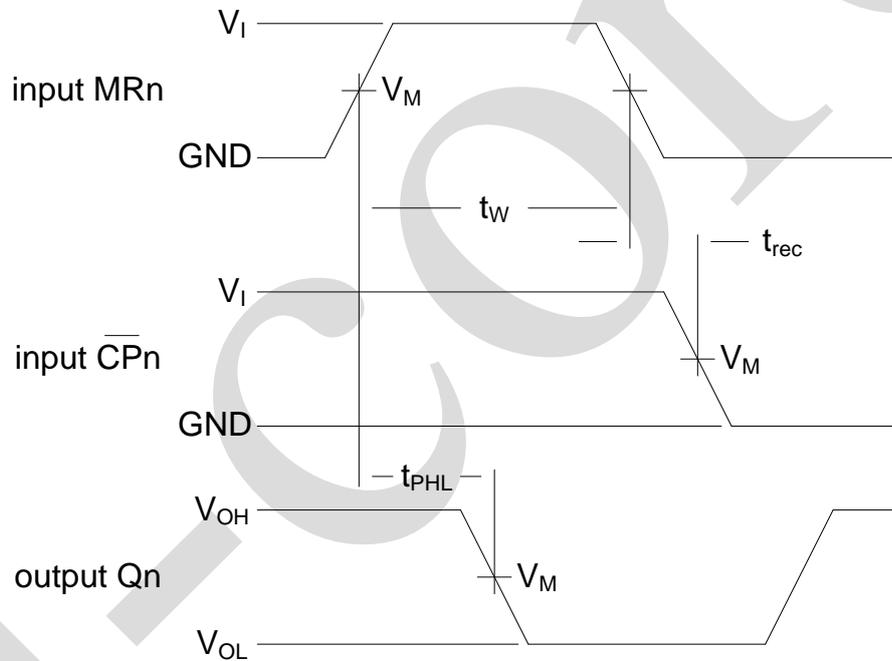


Figure 5. Propagation delays clock (\overline{CPn}) to output (Qn), pulse width master reset (MRn), and recovery time master reset (MRn) to clock (\overline{CPn})

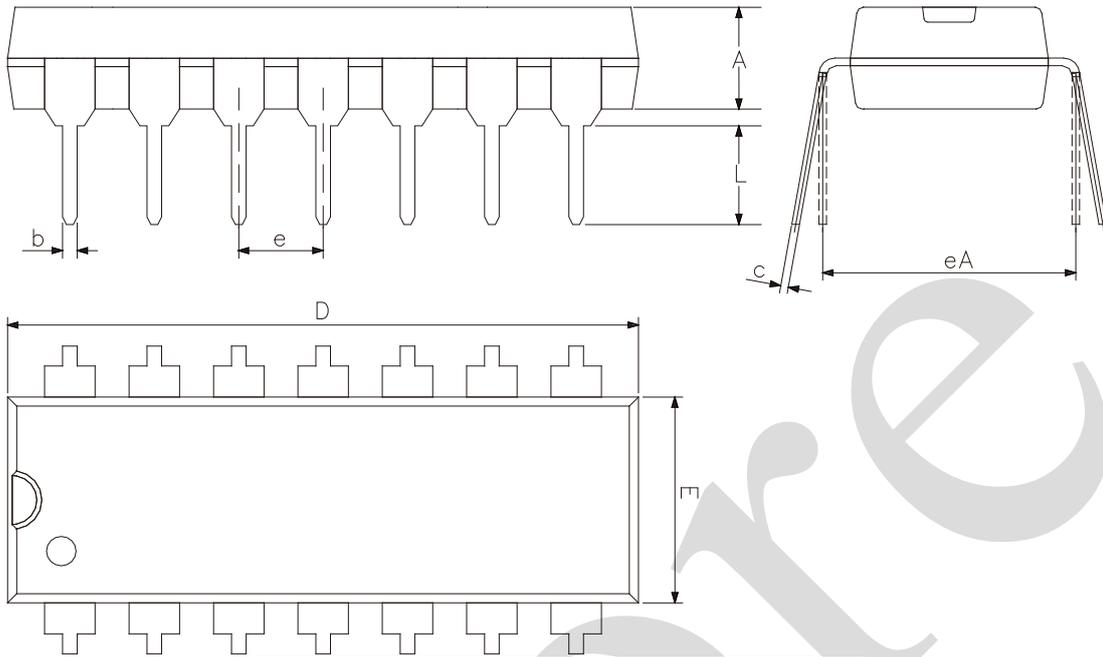
4.4、Measurement Points

Type	Input	Output
	V_M	V_M
AiP74HC93	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
AiP74HCT93	1.3V	1.3V



5、Package Information

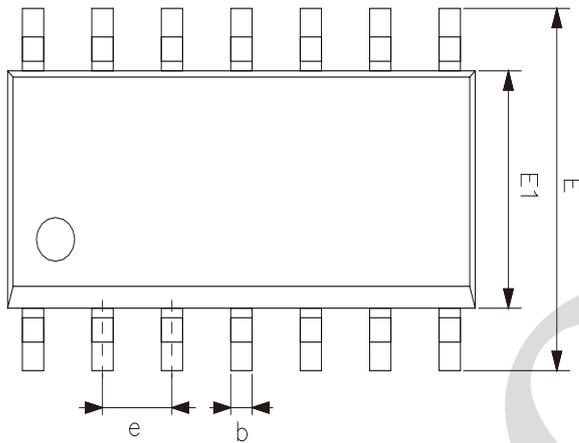
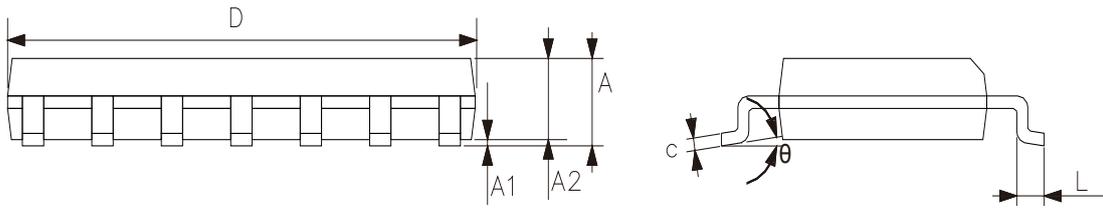
5.1、DIP14



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	—



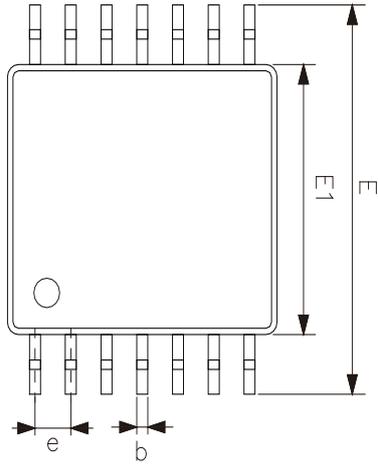
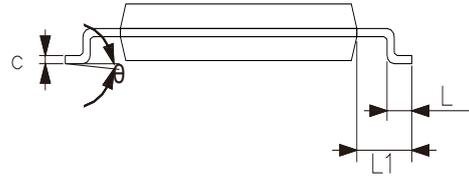
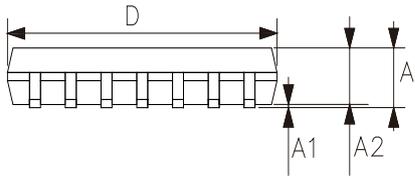
5.2、SOP14



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

We recommend you to read this chapter carefully before using this product.

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