



SN74LS93(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 SN74LS93 is a 4-bit binary ripple counter.

Features:

- Supply voltage range:2V to 6V
- 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
SN74LS93N(LX)	DIP14	SN74LS93N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74LS93DR(LX)	SOP14	LS93	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74LS93PW(LX)	TSSOP14	LS93	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
SN74LS93DR(LX)	SOP14	LS93	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74LS93PW(LX)	TSSOP14	LS93	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

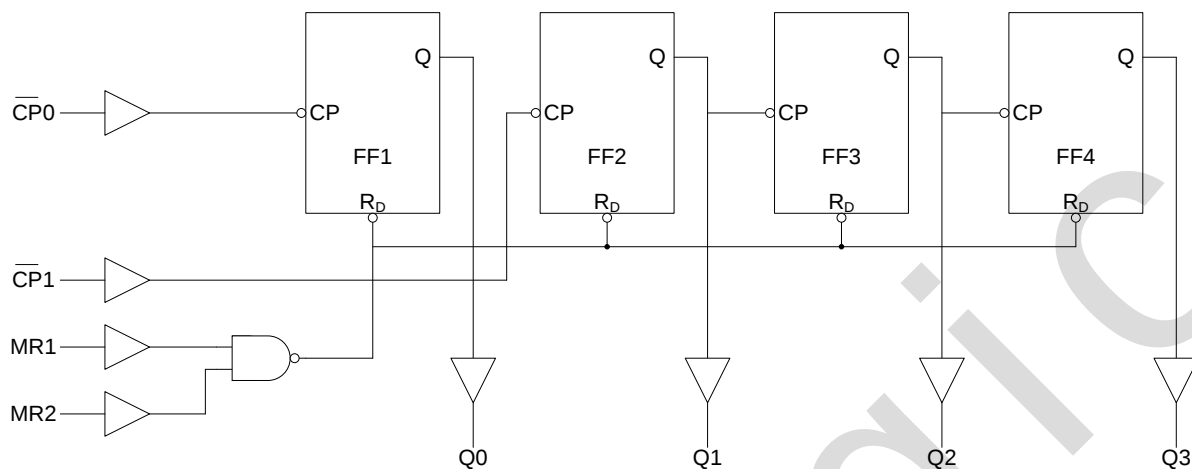


Figure 1. Logic symbol

2.2、Pin Configurations

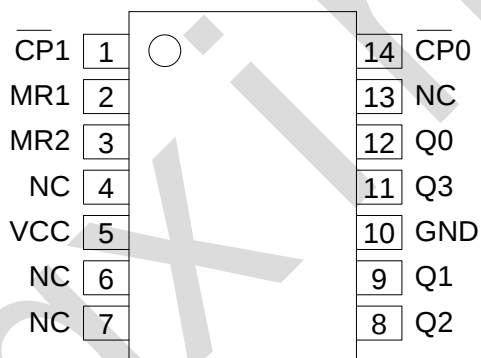


Figure 2. Pin Configurations



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 $\overline{CP1}$;

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	°C
soldering temperature	T _L	10s	DIP	245		°C
			SOP/TSSOP	260		

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	$^{\circ}C$



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
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	$I_O = -20\mu\text{A}$	1.9	2.0	-	V
		4.5V	$I_O = -20\mu\text{A}$	4.4	4.5	-	V
		6.0V	$I_O = -20\mu\text{A}$	5.9	6.0	-	V
		4.5V	$I_O = -4.0\text{mA}$	3.84	4.32	-	V
		6.0V	$I_O = -5.2\text{mA}$	5.34	5.81	-	V
LOW-level output voltage	V_{OL}	2.0V	$I_O = 20\mu\text{A}$	-	0	0.1	V
		4.5V	$I_O = 20\mu\text{A}$	-	0	0.1	V
		6.0V	$I_O = 20\mu\text{A}$	-	0	0.1	V
		4.5V	$I_O = 4.0\text{mA}$	-	0.15	0.33	V
		6.0V	$I_O = 5.2\text{mA}$	-	0.16	0.33	V
input leakage current	I_I	6.0V	$V_I = V_{CC}$ or GND	-	-	± 1	μA
supply current	I_{CC}	6.0V	$V_I = V_{CC}$ or GND; $I_O = 0\text{A}$	-	-	80	μA



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
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	$I_O = -20\mu\text{A}$	1.9	-	-	V
		4.5V	$I_O = -20\mu\text{A}$	4.4	-	-	V
		6.0V	$I_O = -20\mu\text{A}$	5.9	-	-	V
		4.5V	$I_O = -4.0\text{mA}$	3.7	-	-	V
		6.0V	$I_O = -5.2\text{mA}$	5.2	-	-	V
LOW-level output voltage	V_{OL}	2.0V	$I_O = 20\mu\text{A}$	-	-	0.1	V
		4.5V	$I_O = 20\mu\text{A}$	-	-	0.1	V
		6.0V	$I_O = 20\mu\text{A}$	-	-	0.1	V
		4.5V	$I_O = 4.0\text{mA}$	-	-	0.4	V
		6.0V	$I_O = 5.2\text{mA}$	-	-	0.4	V
input leakage current	I_I	6.0V	$V_I = V_{CC}$ or GND	-	-	± 1	μA
supply current	I_{CC}	6.0V	$V_I = V_{CC}$ or GND; $I_O = 0\text{A}$	-	-	160	μA



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	
$\overline{\text{CP0}}$ to Q0 propagation delay	$t_{\text{PLH}}, t_{\text{PHL}}$	2.0V	$C_L=50\text{pF}$	see Figure 4	-	41	155	ns
		4.5V	$C_L=50\text{pF}$		-	15	31	ns
		6.0V	$C_L=50\text{pF}$		-	12	26	ns
$\overline{\text{CP1}}$ to Q1 propagation delay		2.0V	$C_L=50\text{pF}$		-	49	170	ns
		4.5V	$C_L=50\text{pF}$		-	16	34	ns
		6.0V	$C_L=50\text{pF}$		-	13	29	ns
$\overline{\text{CP1}}$ to Q2 propagation delay		2.0V	$C_L=50\text{pF}$		-	61	230	ns
		4.5V	$C_L=50\text{pF}$		-	22	46	ns
		6.0V	$C_L=50\text{pF}$		-	18	39	ns
$\overline{\text{CP1}}$ to Q3 propagation delay		2.0V	$C_L=50\text{pF}$		-	80	305	ns
		4.5V	$C_L=50\text{pF}$		-	29	61	ns
		6.0V	$C_L=50\text{pF}$		-	23	52	ns
MRn to Qn HIGH to LOW propagation delay	t_{PHL}	2.0V	$C_L=50\text{pF}$	see Figure 5	-	50	195	ns
		4.5V	$C_L=50\text{pF}$		-	18	39	ns
		6.0V	$C_L=50\text{pF}$		-	14	33	ns
output transition time	$t_{\text{THL}}, t_{\text{TLH}}$	2.0V	$C_L=50\text{pF}$	see Figure 4	-	19	95	ns
		4.5V	$C_L=50\text{pF}$		-	7	19	ns
		6.0V	$C_L=50\text{pF}$		-	6	16	ns
$\overline{\text{CPn}}$ HIGH or LOW pulse width	tw	2.0V	$C_L=50\text{pF}$	see Figure 4	100	14	-	ns
		4.5V	$C_L=50\text{pF}$		20	5	-	ns
		6.0V	$C_L=50\text{pF}$		17	4	-	ns
MRn HIGH pulse width		2.0V	$C_L=50\text{pF}$	see Figure 5	100	8	-	ns
		4.5V	$C_L=50\text{pF}$		20	3	-	ns
		6.0V	$C_L=50\text{pF}$		17	2	-	ns
MRn to n $\overline{\text{CP}}$ recovery time	trec	2.0V	$C_L=50\text{pF}$	see Figure 5	65	8	-	ns
		4.5V	$C_L=50\text{pF}$		13	3	-	ns
		6.0V	$C_L=50\text{pF}$		11	2	-	ns
maximum clock frequency	fmax	2.0V	$C_L=50\text{pF}$	see Figure 4	4.8	30	-	MHz
		4.5V	$C_L=50\text{pF}$		24	91	-	MHz
		6.0V	$C_L=50\text{pF}$		28	108	-	MHz



3.3.4、AC 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	
$\overline{\text{CP0}}$ to Q0 propagation delay	$t_{\text{PLH}}, t_{\text{PHL}}$	2.0V	C _L =50pF	see Figure 4	-	-	190	ns
		4.5V	C _L =50pF		-	-	38	ns
		6.0V	C _L =50pF		-	-	32	ns
$\overline{\text{CP1}}$ 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
$\overline{\text{CP1}}$ 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
$\overline{\text{CP1}}$ 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	$t_{\text{THL}}, t_{\text{TLH}}$	2.0V	C _L =50pF	see Figure 4	-	-	110	ns
		4.5V	C _L =50pF		-	-	22	ns
		6.0V	C _L =50pF		-	-	19	ns
$\overline{\text{CPn}}$ 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 n $\overline{\text{CP}}$ recovery time	t_{rec}	2.0V	C _L =50pF	see Figure 5	75	-	-	ns
		4.5V	C _L =50pF		15	-	-	ns
		6.0V	C _L =50pF		13	-	-	ns
maximum clock frequency	f_{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



4、Testing Circuit

4.1、AC Testing Circuit

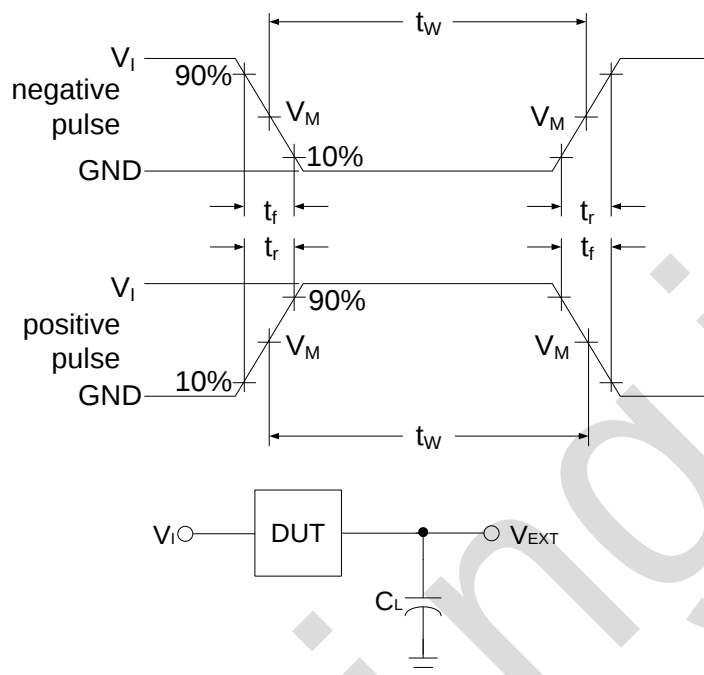


Figure 3. Test circuit for measuring switching times

C_L includes probe and jig capacitance.

4.2、Test Data

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



4.3、AC Testing Waveforms

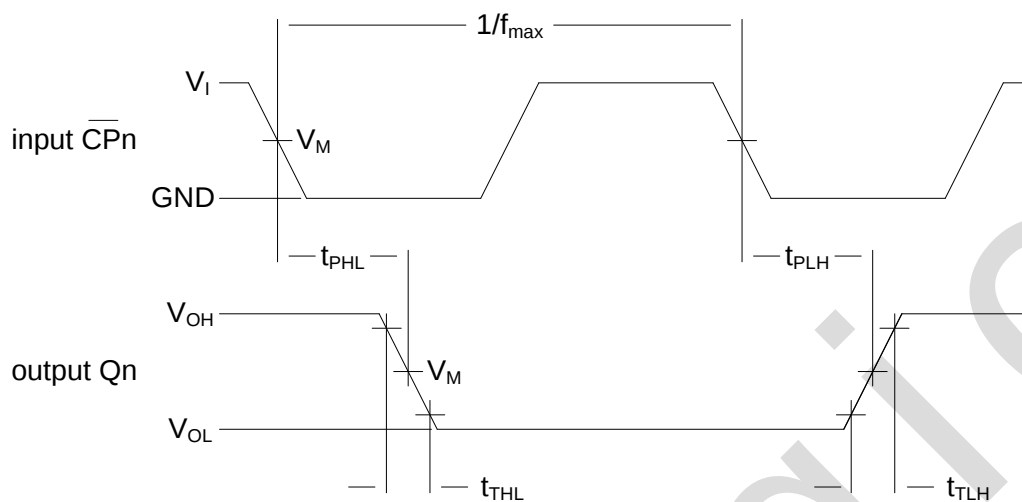


Figure 4. Propagation delay, output transition time

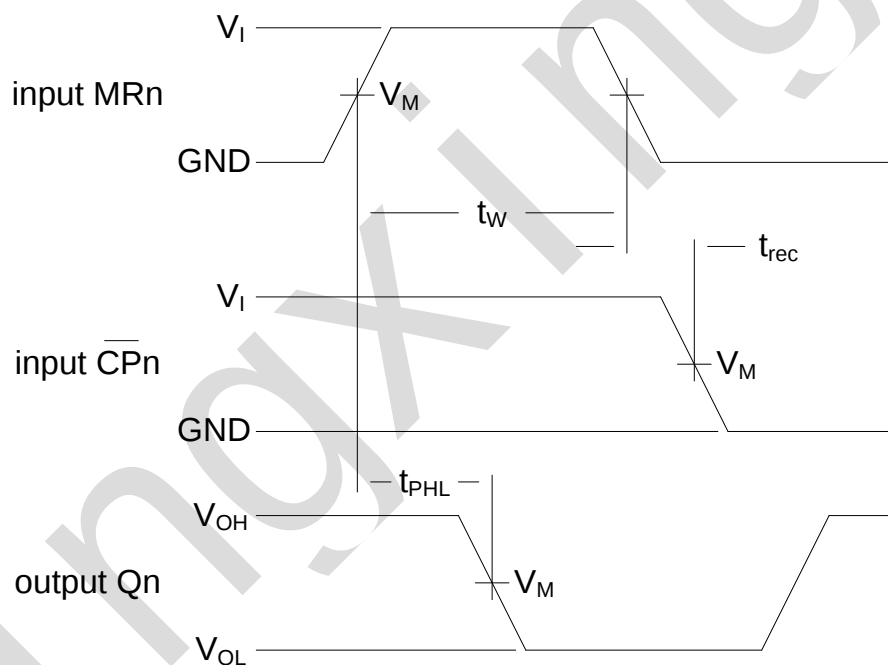


Figure 5. Propagation delays clock ($\overline{CPn}$) to output (Qn), pulse width master reset (MRn), and recovery time master reset (MRn) to clock ($\overline{CPn}$)

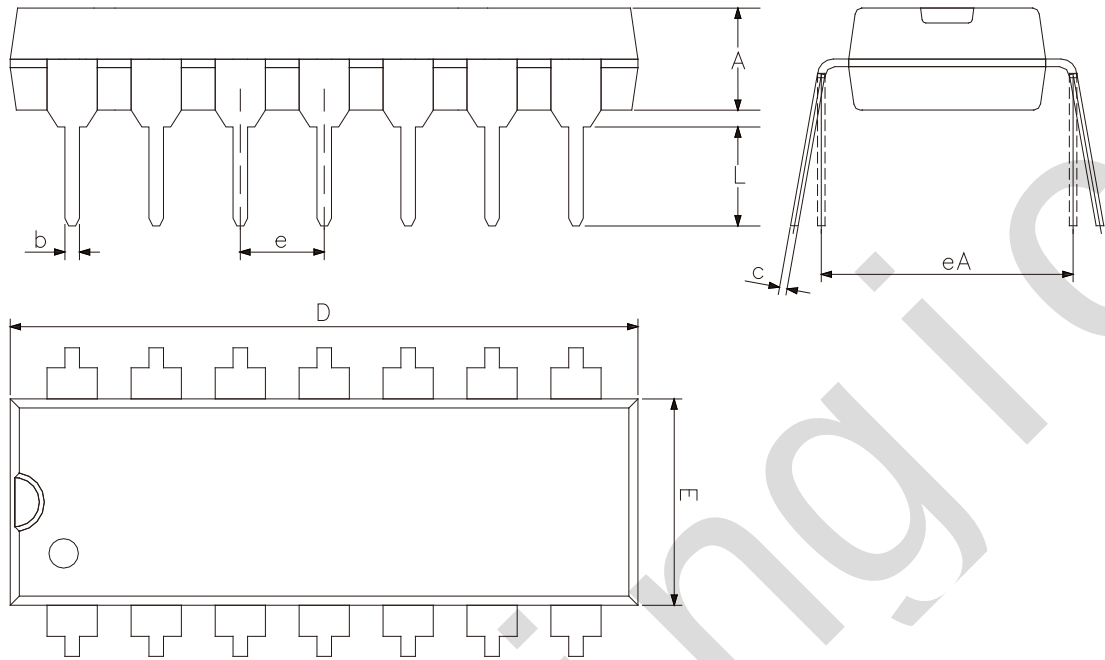
4.4、Measurement Points

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



5、Package Information

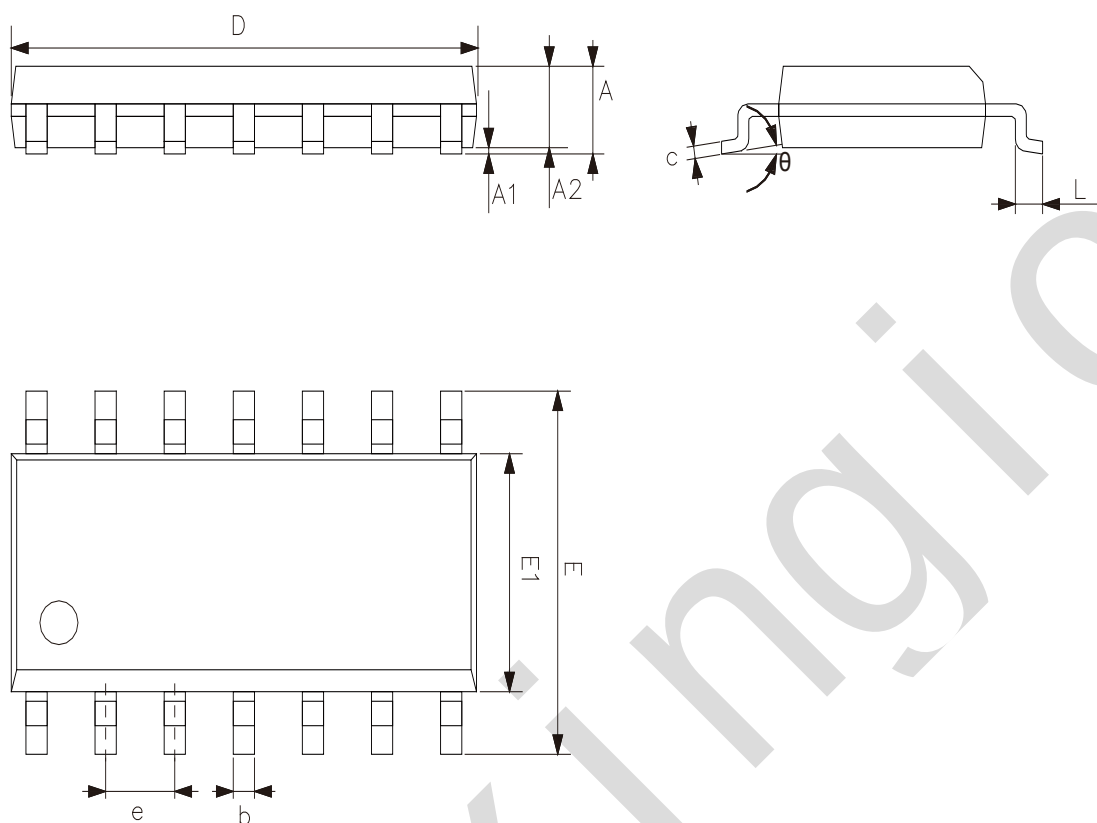
5.1、DIP14



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	—

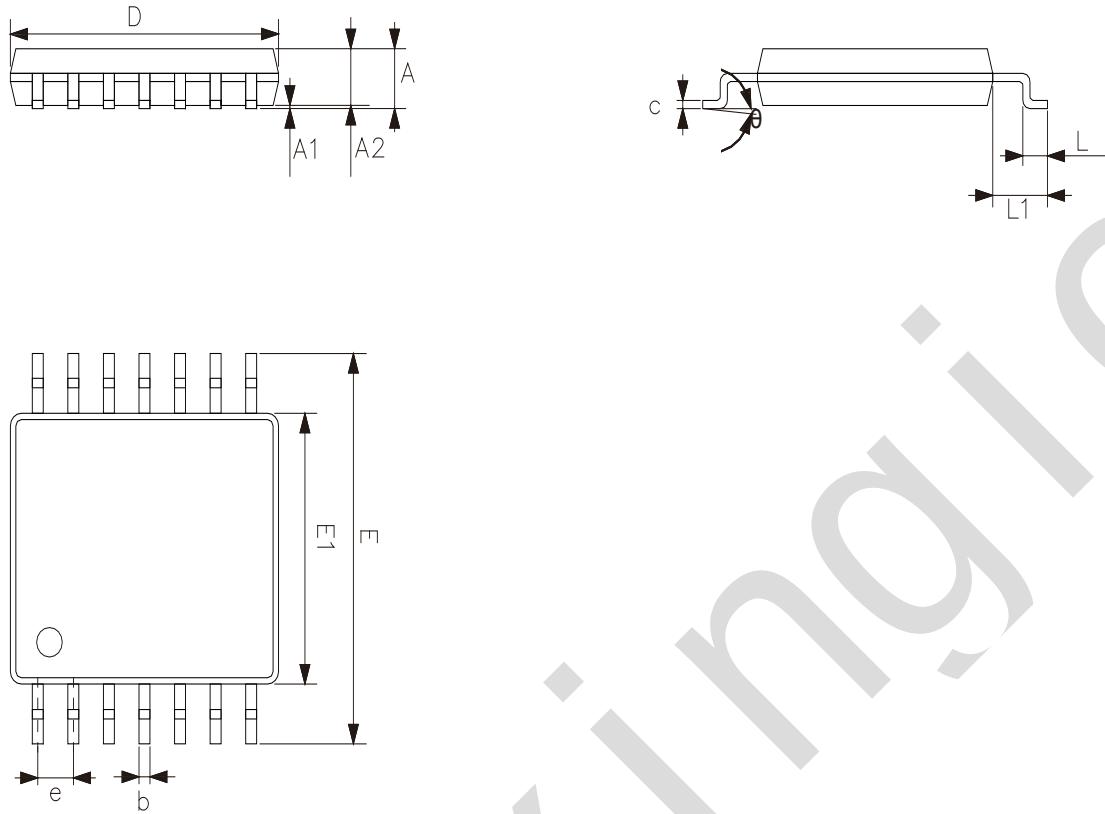


5.2、SOP14



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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