



# CD4024 (LX) 7-stage binary counter

## Product Specification

### Specification Revision History:

Version	Date	Description
2023-04-A1	2023-04	New



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## 1、General Description

The CD4024 is a 7-stage binary ripple counter。

### Features:

- Supply voltage range: 3V to 15V
- 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
CD4024BE (LX)	DIP14	CD4024BE	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
CD4024BM (LX)	SOP14	CD4024BM	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
CD4024BPW(LX)	TSSOP14	CD4024	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
CD4024BM(LX)	SOP14(1)	CD4024BM	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
CD4024BM(LX)	SOP14(2)	CD4024BM	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
CD4024BPW(LX)	TSSOP14	CD4024	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

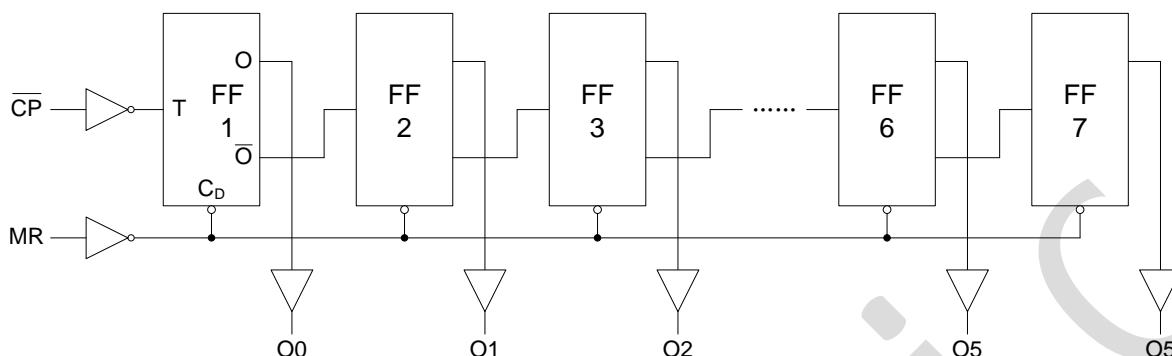
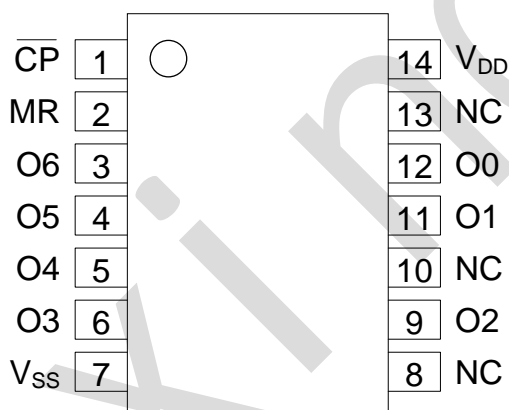


Figure 1. Functional diagram

### 2.2、Pin Configurations



### 2.3、Pin Description

Pin No.	Pin Name	Description
1	$\overline{CP}$	clock input
2	$\overline{MR}$	master reset output
3	O6	buffered parallel output
4	O5	buffered parallel output
5	O4	buffered parallel output
6	O3	buffered parallel output
7	V <sub>SS</sub>	ground supply voltage
8	NC	not connected
9	O2	buffered parallel output
10	NC	not connected
11	O1	buffered parallel output
12	O0	buffered parallel output
13	NC	not connected
14	V <sub>DD</sub>	supply voltage



## 2.4、Function Table

Input		Output
$\overline{CP}$	MR	On
X	H	L
↑	L	No Change
↓	L	Advance to Next State

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

## 3、Electrical Parameter

### 3.1、Absolute Maximum Ratings

(Voltages are referenced to  $V_{SS}$  (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Max.	Unit
supply voltage	$V_{DD}$	-	-0.5	+18	V
input voltage	$V_I$	all inputs	-0.5	$V_{DD}+0.5$	V
DC input current	$I_{IK}$	any one input	-	±10	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	$V_{DD}$	-	3	-	15	V
ambient temperature	$T_{amb}$	in free air	-40	-	+125	°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  $V_{SS}$  (ground=0V), unless otherwise specified.)

Parameter	Symbol	$V_{DD}$	Conditions	Min.	Typ.	Max.	Unit
HIGH-level input voltage	$V_{IH}$	5V	-	3.5	-	-	V
		10V	-	7	-	-	V
		15V	-	11	-	-	V
LOW-level input voltage	$V_{IL}$	5V	-	-	-	1.5	V
		10V	-	-	-	3	V
		15V	-	-	-	4	V
HIGH-level output voltage	$V_{OH}$	5V	$ I_O <1\mu\text{A}$	4.95	-	-	V
		10V	$ I_O <1\mu\text{A}$	9.95	-	-	V
		15V	$ I_O <1\mu\text{A}$	14.95	-	-	V
LOW-level output voltage	$V_{OL}$	5V	$ I_O <1\mu\text{A}$	-	-	0.05	V
		10V	$ I_O <1\mu\text{A}$	-	-	0.05	V
		15V	$ I_O <1\mu\text{A}$	-	-	0.05	V
HIGH-level output current	$I_{OH}$	5V	$V_O=4.6\text{V}$	-	-	-0.34	mA
		5V	$V_O=2.5\text{V}$	-	-	-1.3	mA
		10V	$V_O=9.5\text{V}$	-	-	-0.55	mA
		15V	$V_O=13.5\text{V}$	-	-	-1.65	mA



LOW-level output current	I <sub>OL</sub>	5V	V <sub>O</sub> =0.4V	0.34	-	-	mA
		10V	V <sub>O</sub> =0.5V	0.46	-	-	mA
		15V	V <sub>O</sub> =1.5V	1.4	-	-	mA
input leakage current	I <sub>I</sub>	15V	V <sub>I</sub> =15V or GND	-	-	±2	uA
supply current	I <sub>DD</sub>	5V	V <sub>I</sub> =5V or GND; I <sub>O</sub> =0A	-	-	7.5	uA
		10V	V <sub>I</sub> =10V or GND; I <sub>O</sub> =0A	-	-	15	uA
		15V	V <sub>I</sub> =15V or GND; I <sub>O</sub> =0A	-	-	30	uA

### 3.3.2、DC Characteristics 2

(T<sub>amb</sub>=-40°C to +125°C, voltages are referenced to V<sub>SS</sub> (ground=0V), unless otherwise specified.)

Parameter	Symbol	V <sub>DD</sub>	Conditions	Min.	Typ.	Max.	Unit
HIGH-level input voltage	V <sub>IH</sub>	5V	-	3.5	-	-	V
		10V	-	7	-	-	V
		15V	-	11	-	-	V
LOW-level input voltage	V <sub>IL</sub>	5V	-	-	-	1.5	V
		10V	-	-	-	3	V
		15V	-	-	-	4	V
HIGH-level output voltage	V <sub>OH</sub>	5V	I <sub>O</sub>  <1uA	4.95	-	-	V
		10V	I <sub>O</sub>  <1uA	9.95	-	-	V
		15V	I <sub>O</sub>  <1uA	14.95	-	-	V
LOW-level output voltage	V <sub>OL</sub>	5V	I <sub>O</sub>  <1uA	-	-	0.05	V
		10V	I <sub>O</sub>  <1uA	-	-	0.05	V
		15V	I <sub>O</sub>  <1uA	-	-	0.05	V
HIGH-level output current	I <sub>OH</sub>	5V	V <sub>O</sub> =4.6V	-	-	-0.3	mA
		5V	V <sub>O</sub> =2.5V	-	-	-1.15	mA
		10V	V <sub>O</sub> =9.5V	-	-	-0.45	mA
		15V	V <sub>O</sub> =13.5V	-	-	-1.4	mA
LOW-level output current	I <sub>OL</sub>	5V	V <sub>O</sub> =0.4V	0.29	-	-	mA
		10V	V <sub>O</sub> =0.5V	0.38	-	-	mA
		15V	V <sub>O</sub> =1.5V	1.2	-	-	mA
input leakage current	I <sub>I</sub>	15V	V <sub>I</sub> =15V or GND	-	-	±4	uA
supply current	I <sub>DD</sub>	5V	V <sub>I</sub> =5V or GND; I <sub>O</sub> =0A	-	-	7.5	uA
		10V	V <sub>I</sub> =10V or GND; I <sub>O</sub> =0A	-	-	15	uA
		15V	V <sub>I</sub> =15V or GND; I <sub>O</sub> =0A	-	-	30	uA



### 3.3.3、AC Characteristics 1

( $T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{SS} = 0\text{V}$ , unless otherwise specified.)

Parameter	Symbol	$V_{DD}$	Conditions	Min.	Typ.	Max.	Unit
On to $O_{n+1}$ HIGH to LOW propagation delay time	$t_{PHL}$	5V	$C_L = 50\text{pF}$ see Figure 4	-	60	120	ns
		10V		-	25	50	ns
		15V		-	20	40	ns
On to $O_{n+1}$ LOW to HIGH propagation delay time	$t_{PLH}$	5V		-	50	100	ns
		10V		-	20	40	ns
		15V		-	15	30	ns
$\overline{CP}$ to $O0$ HIGH to LOW propagation delay time	$t_{PHL}$	5V		-	100	200	ns
		10V		-	40	75	ns
		15V		-	25	50	ns
$\overline{CP}$ to $O0$ LOW to HIGH propagation delay time	$t_{PLH}$	5V		-	105	210	ns
		10V		-	45	85	ns
		15V		-	30	60	ns
MR to $Q_n$ HIGH to LOW propagation delay time	$t_{PHL}$	5V	-	120	240	ns	
		10V	-	45	90	ns	
		15V	-	30	60	ns	
transition time	$t_{THL}, t_{TLH}$	5V	-	60	120	ns	
		10V	-	30	60	ns	
		15V	-	20	40	ns	
Minimum clock pulse width;HIGH	$t_{WCPH}$	5V	60	120	-	ns	
		10V	30	60	-	ns	
		15V	20	40	-	ns	
Minimum MR pulse width;HIGH	$t_{WMRH}$	5V	80	40	-	ns	
		10V	35	20	-	ns	
		15V	25	15	-	ns	
Recovery time for MR	$t_{RMR}$	5V	20	10	-	ns	
		10V	15	5	-	ns	
		15V	15	5	-	ns	
Maximum clock pulse frequency	$f_{max}$	5V	-	5	10	-	MHZ
		10V	-	13	25	-	MHZ
		15V	-	18	35	-	MHZ



### 3.3.4、AC Characteristics 2

( $T_{amb} = -40^{\circ}C$  to  $+125^{\circ}C$ ,  $V_{SS} = 0V$ , unless otherwise specified.)

Parameter	Symbol	V <sub>DD</sub>	Conditions	Min.	Typ.	Max.	Unit	
On to O <sub>n+1</sub> HIGH to LOW propagation delay time	t <sub>PHL</sub>	5V	C <sub>L</sub> =50pF, see Figure 4	-	-	144	ns	
		10V		-	-	60	ns	
		15V		-	-	48	ns	
On to O <sub>n+1</sub> LOW to HIGH propagation delay time	t <sub>PLH</sub>	5V		-	-	120	ns	
		10V		-	-	48	ns	
		15V		-	-	36	ns	
CP to O0 HIGH to LOW propagation delay time	t <sub>PHL</sub>	5V		see Figure 5	-	-	240	ns
		10V			-	-	90	ns
		15V			-	-	60	ns
CP to O0 LOW to HIGH propagation delay time	t <sub>PLH</sub>	5V			-	-	252	ns
		10V			-	-	102	ns
		15V			-	-	72	ns
MR to Qn HIGH to LOW propagation delay time	t <sub>PHL</sub>	5V	-		-	288	ns	
		10V	-		-	108	ns	
		15V	-		-	72	ns	
transition time	t <sub>THL</sub> , t <sub>TLH</sub>	5V	-		-	144	ns	
		10V	-		-	72	ns	
		15V	-		-	48	ns	
Minimum clock pulse width;HIGH	t <sub>WCPH</sub>	5V	72	-	-	ns		
		10V	36	-	-	ns		
		15V	24	-	-	ns		
Minimum MR pulse width;HIGH	t <sub>WMRH</sub>	5V	96	-	-	ns		
		10V	42	-	-	ns		
		15V	30	-	-	ns		
Recovery time for MR	t <sub>RMR</sub>	5V	36	-	-	ns		
		10V	18	-	-	ns		
		15V	18	-	-	ns		
Maximum clock pulse frequency	f <sub>max</sub>	5V	-	4	-	-	MHZ	
		10V	-	12	-	-	MHZ	
		15V	-	17	-	-	MHZ	





## 4、Testing Circuit

### 4.1、AC Testing Circuit

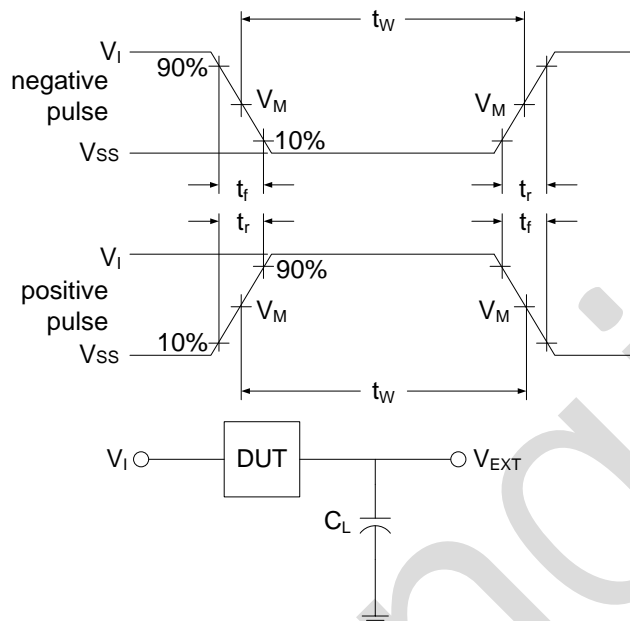


Figure 3. Load circuit

$C_L$  includes probe and jig capacitance.

### 4.2、Test Data

Supply voltage	Input		Load	$V_{EXT}$		
$V_{DD}$	$V_I$	$t_r = t_f$	$C_L$	$t_{PLH}/t_{PHL}$	$t_{PLZ}/t_{PZL}$	$t_{PHZ}/t_{PZH}$
5V to 15V	$V_{DD}$	$\leq 20\text{ns}$	50pF	Open	$V_{DD}$	$V_{SS}$

### 4.3、AC Testing Waveforms

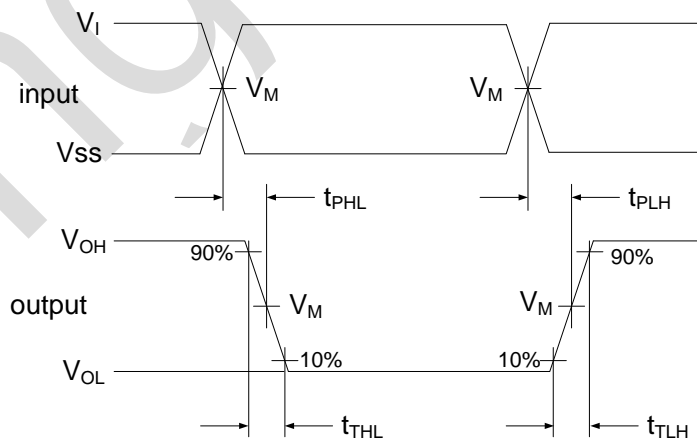


Figure 4. Propagation delay, output transition time

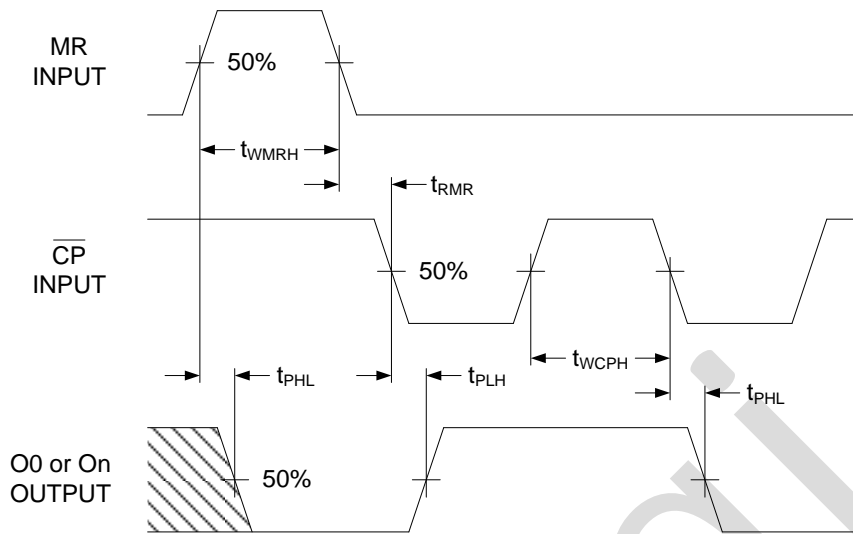


Figure 5. Waveforms showing minimum MR and  $\overline{CP}$  pulse widths and recovery time for MR.

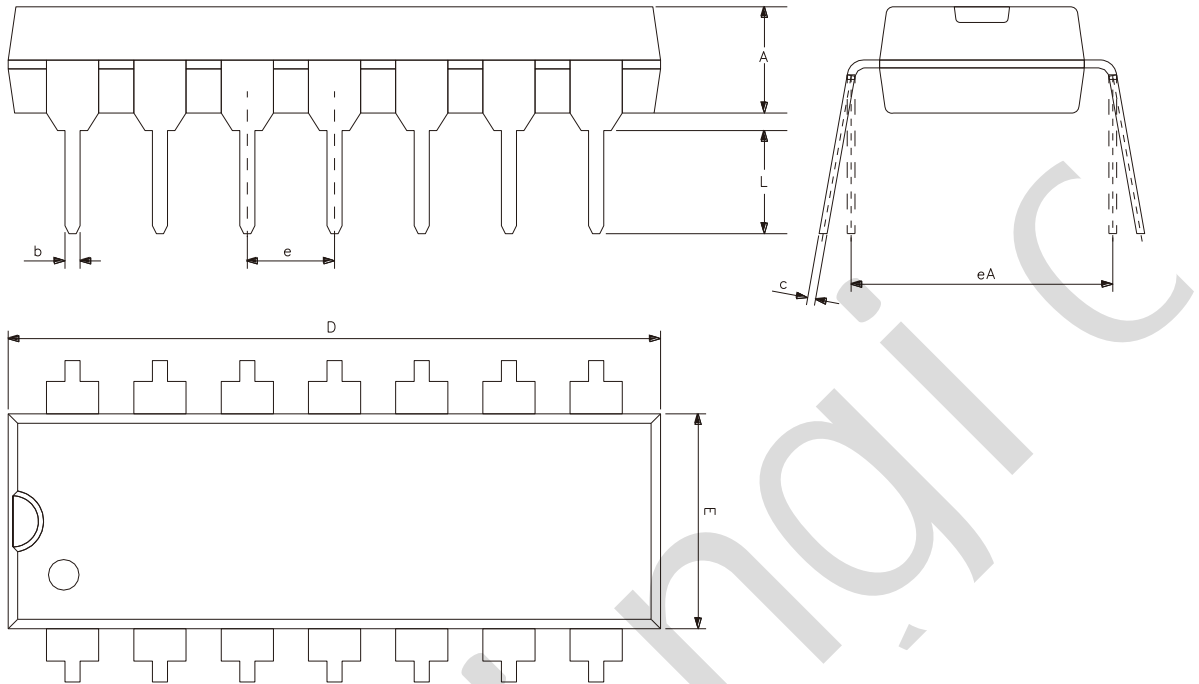
#### 4.4. Measurement Points

Supply voltage	Input	Output		
$V_{DD}$	$V_M$	$V_M$	$V_X$	$V_Y$
5V to 15V	$0.5 \times V_{DD}$	$0.5 \times V_{DD}$	$0.1 \times V_{DD}$	$0.9 \times V_{DD}$



## 5、Package Information

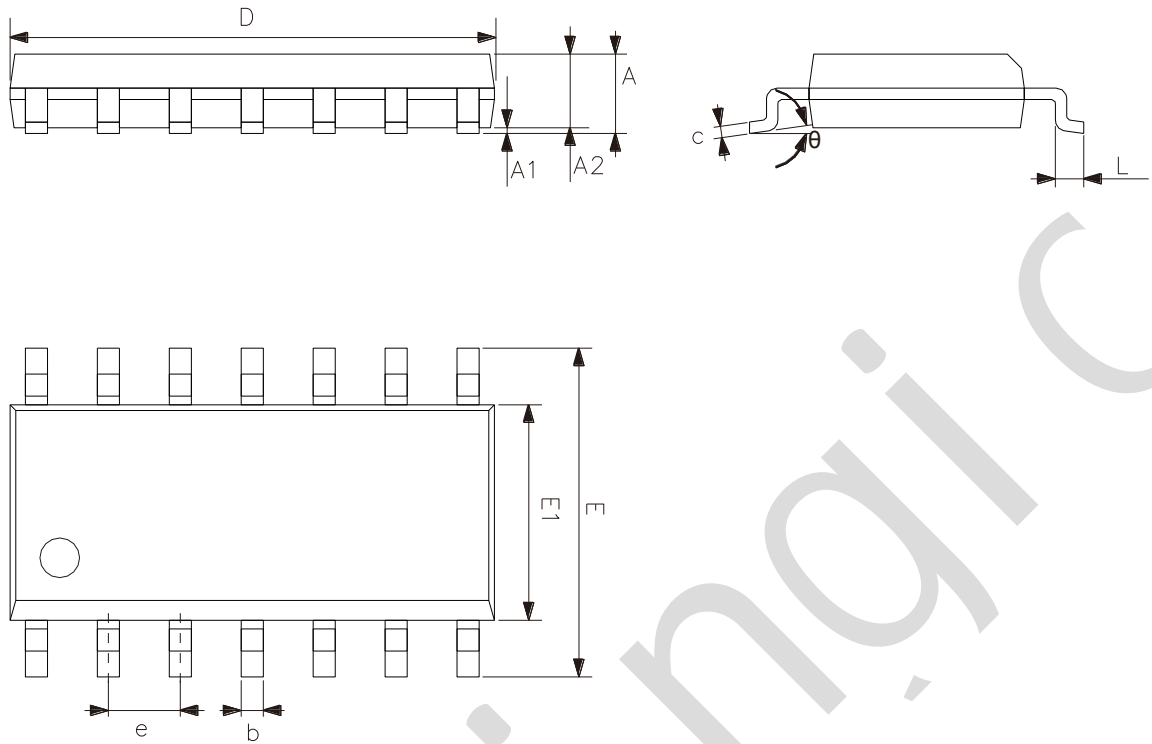
### 5.1、DIP14



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	-



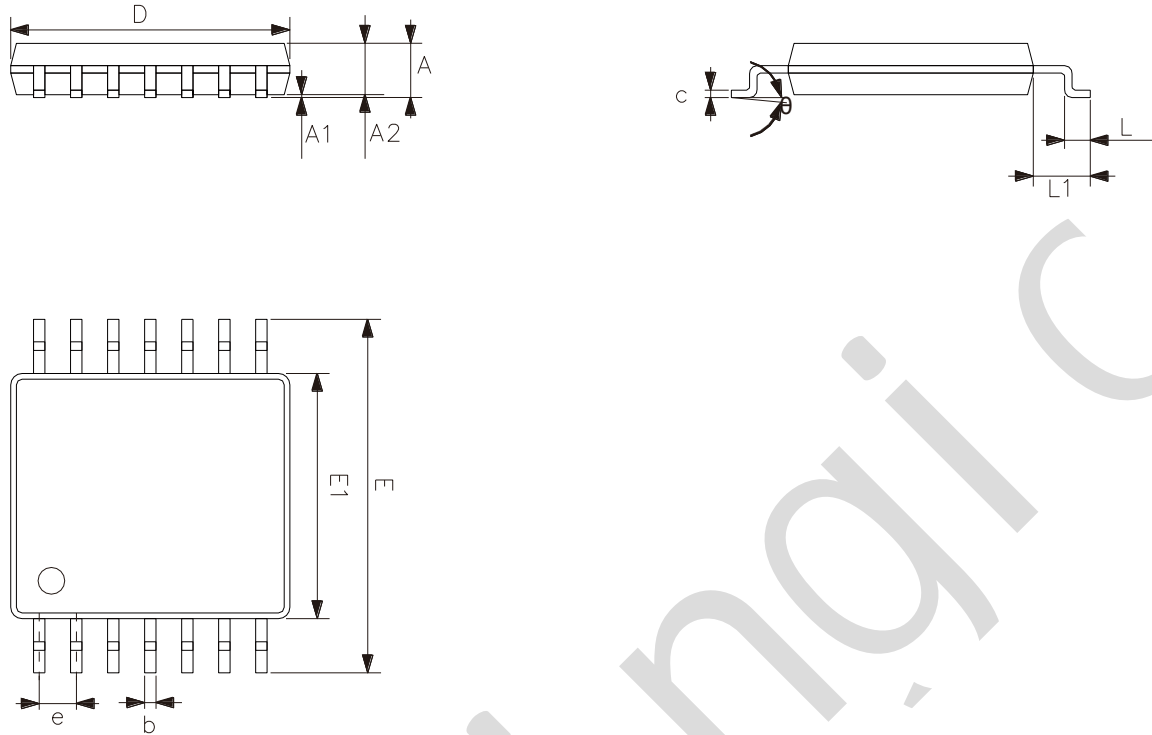
### 5.2、SOP14



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
$\theta$	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	
$\theta$	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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