



CD4024

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℃ 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
CD4024DA14.TB	DIP14	CD4024	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
CD4024SA14.TB	SOP14	CD4024	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
CD4024TA14.TB	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
CD4024SA14.TR	SOP14	CD4024	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
CD4024TA14.TR	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

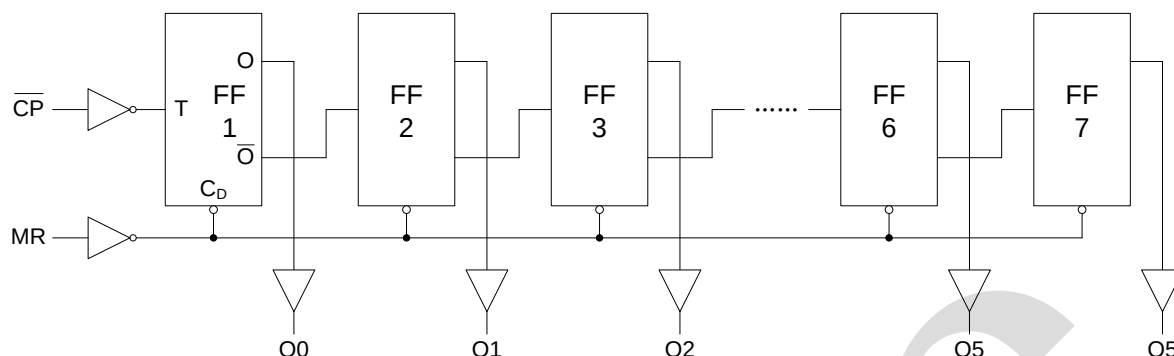
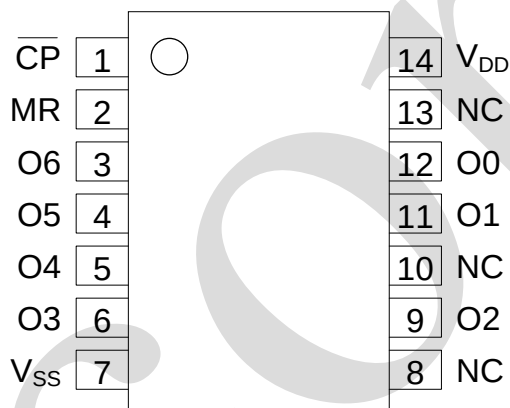


Figure 1. Functional diagram

2.2、Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1	$\overline{CP}$	clock input
2	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 _{SS}	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 _{DD}	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_{OL}	5V	$V_O=0.4V$	0.34	-	-	mA
		10V	$V_O=0.5V$	0.46	-	-	mA
		15V	$V_O=1.5V$	1.4	-	-	mA
input leakage current	I_I	15V	$V_I=15V$ or GND	-	-	± 2	μA
supply current	I_{DD}	5V	$V_I=5V$ or GND; $I_O=0A$	-	-	7.5	μA
		10V	$V_I=10V$ or GND; $I_O=0A$	-	-	15	μA
		15V	$V_I=15V$ or GND; $I_O=0A$	-	-	30	μA

3.3.2、DC Characteristics 2

($T_{amb}=-40^{\circ}C$ to $+125^{\circ}C$, 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 A$	4.95	-	-	V
		10V	$ I_O <1\mu A$	9.95	-	-	V
		15V	$ I_O <1\mu A$	14.95	-	-	V
LOW-level output voltage	V_{OL}	5V	$ I_O <1\mu A$	-	-	0.05	V
		10V	$ I_O <1\mu A$	-	-	0.05	V
		15V	$ I_O <1\mu A$	-	-	0.05	V
HIGH-level output current	I_{OH}	5V	$V_O=4.6V$	-	-	-0.3	mA
		5V	$V_O=2.5V$	-	-	-1.15	mA
		10V	$V_O=9.5V$	-	-	-0.45	mA
		15V	$V_O=13.5V$	-	-	-1.4	mA
LOW-level output current	I_{OL}	5V	$V_O=0.4V$	0.29	-	-	mA
		10V	$V_O=0.5V$	0.38	-	-	mA
		15V	$V_O=1.5V$	1.2	-	-	mA
input leakage current	I_I	15V	$V_I=15V$ or GND	-	-	± 4	μA
supply current	I_{DD}	5V	$V_I=5V$ or GND; $I_O=0A$	-	-	7.5	μA
		10V	$V_I=10V$ or GND; $I_O=0A$	-	-	15	μA
		15V	$V_I=15V$ or GND; $I_O=0A$	-	-	30	μA



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	see Figure 5	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

($T_{amb} = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{SS} = 0\text{V}$, 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	-	-	144	ns
		10V		-	-	60	ns
		15V		-	-	48	ns
On to O_{n+1} LOW to HIGH propagation delay time	t_{PLH}	5V		-	-	120	ns
		10V		-	-	48	ns
		15V		-	-	36	ns
$\overline{CP}$ to $O0$ HIGH to LOW propagation delay time	t_{PHL}	5V		-	-	240	ns
		10V		-	-	90	ns
		15V		-	-	60	ns
$\overline{CP}$ to $O0$ LOW to HIGH propagation delay time	t_{PLH}	5V		-	-	252	ns
		10V		-	-	102	ns
		15V		-	-	72	ns
MR to Q_n HIGH to LOW propagation delay time	t_{PHL}	5V		-	-	288	ns
		10V		-	-	108	ns
		15V		-	-	72	ns
transition time	t_{THL}, t_{TLH}	5V		-	-	144	ns
		10V		-	-	72	ns
		15V		-	-	48	ns
Minimum clock pulse width;HIGH	t_{WCPH}	5V	see Figure5	72	-	-	ns
		10V		36	-	-	ns
		15V		24	-	-	ns
Minimum MR pulse width;HIGH	t_{WMRH}	5V		96	-	-	ns
		10V		42	-	-	ns
		15V		30	-	-	ns
Recovery time for MR	t_{RMR}	5V		36	-	-	ns
		10V		18	-	-	ns
		15V		18	-	-	ns
Maximum clock pulse frequency	f_{max}	5V	-	4	-	-	MHZ
		10V	-	12	-	-	MHZ
		15V	-	17	-	-	MHZ



4、Testing Circuit

4.1、AC Testing Circuit

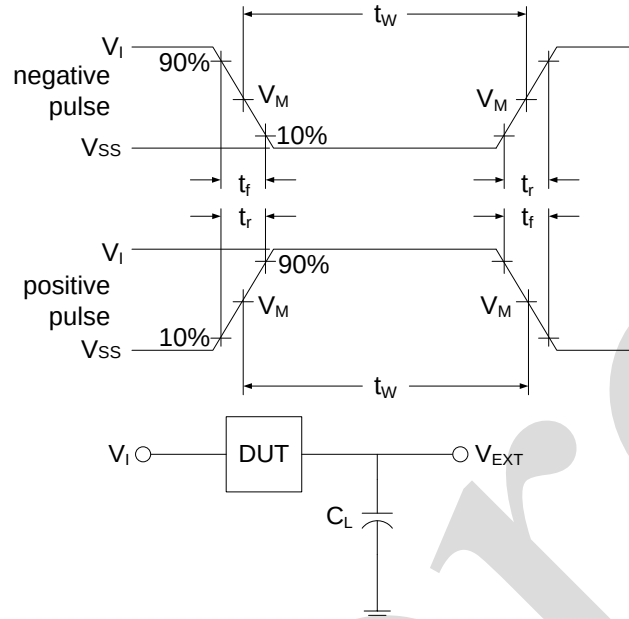


Figure 3. Load circuit

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

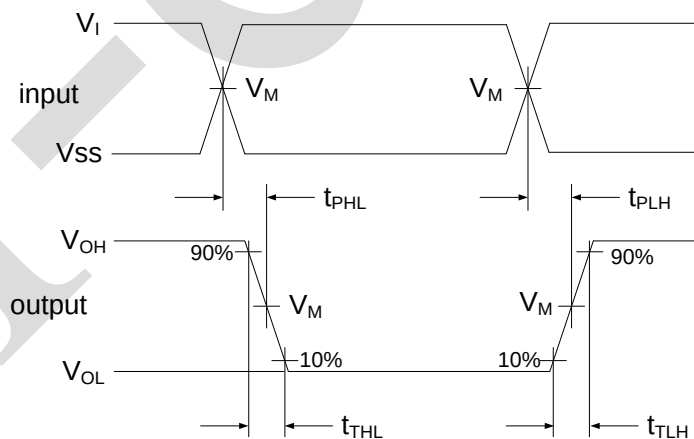


Figure 4. Propagation delay, output transition time

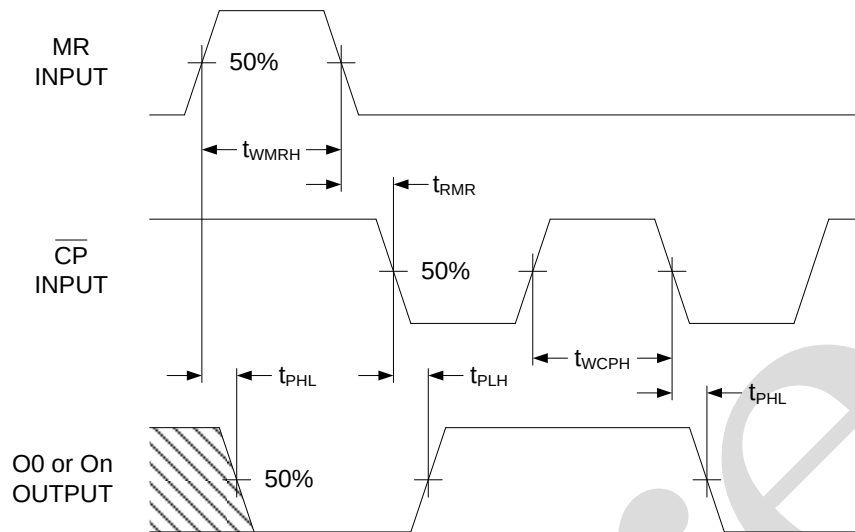


Figure 5. Waveforms showing minimum MR and $\overline{CP}$ pulse widths and recovery time for MR.

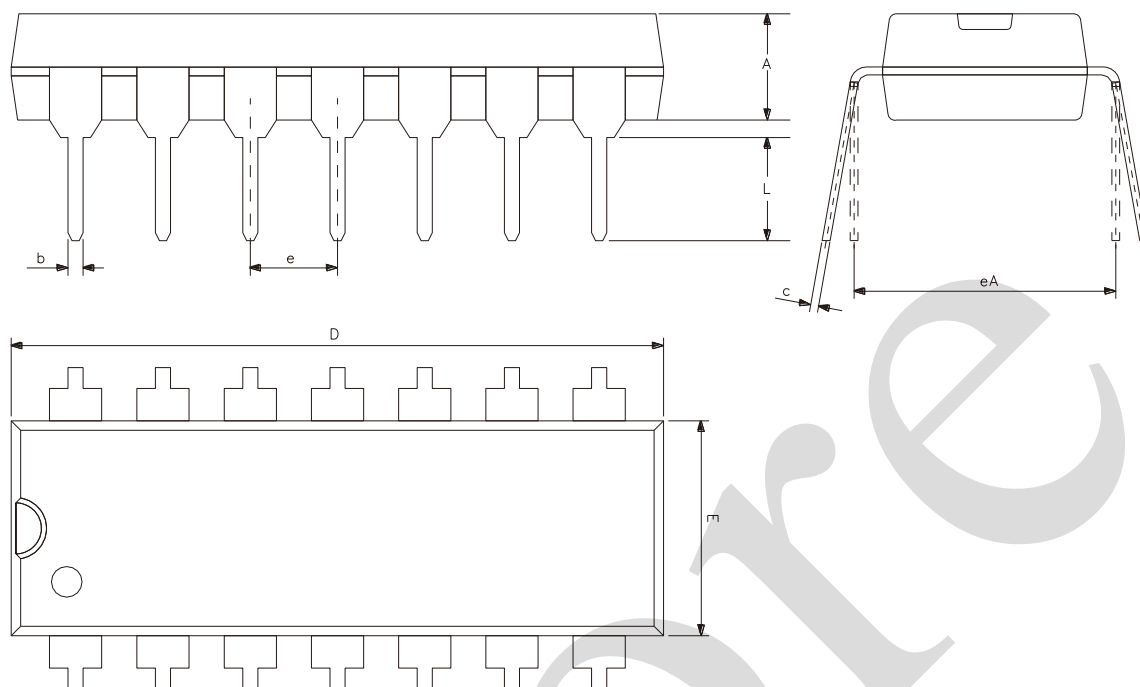
4.4、Measurement Points

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

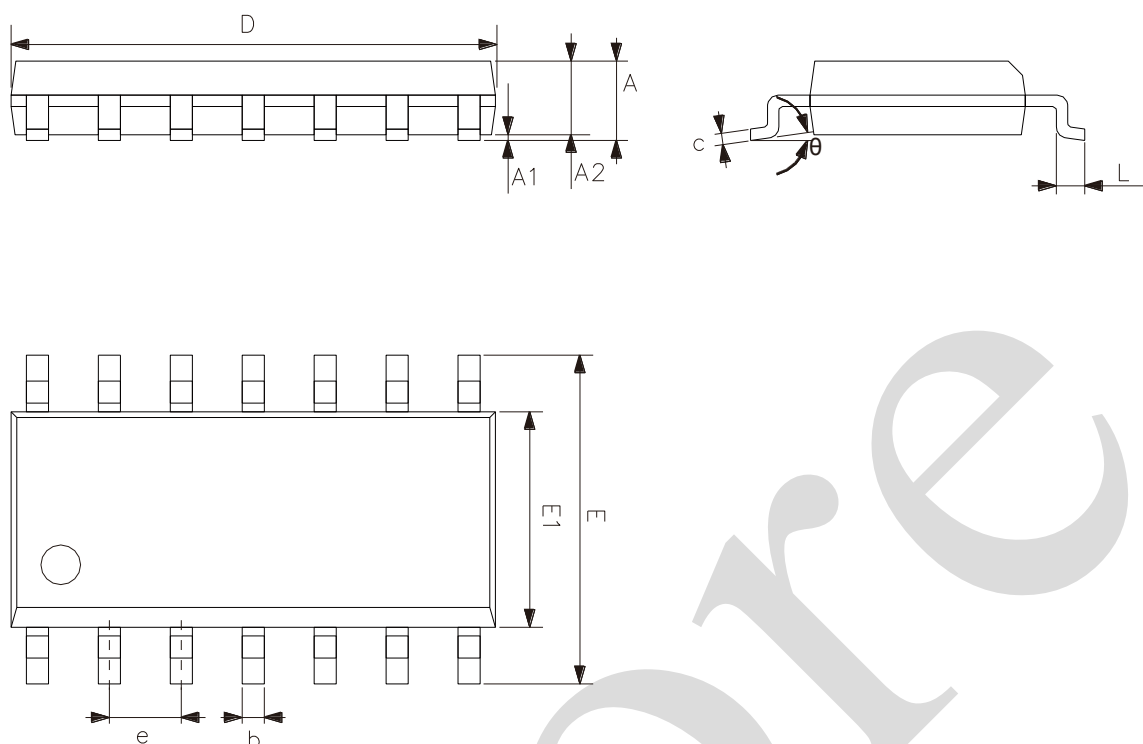
5.1、DIP14



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	-



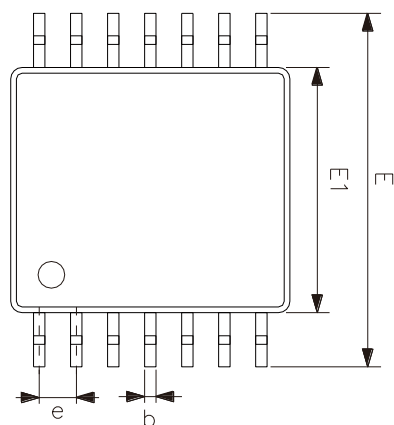
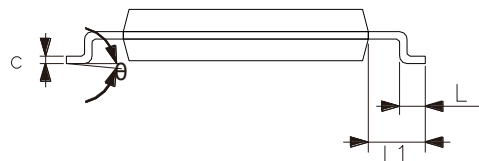
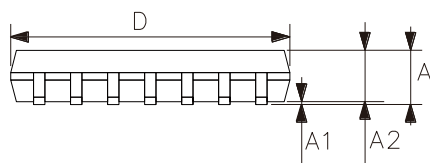
5.2、SOP14



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
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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