



CD4093

Quad 2-input Nand Schmitt Gate

Product Specification

Specification Revision History:

Version	Date	Description
2019-06-A1	2019-06	New
2023-04-B1	2023-04	Update the template
2023-09-B2	2023-09	Modify parameters



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1、General Description

The CD4093 is a quad two-input NAND gate. Each input has a Schmitt trigger circuit.

The gate switches at different points for positive-going and negative-going signals. The difference between the positive voltage (V_{T+}) and the negative voltage (V_{T-}) is defined as hysteresis voltage (V_H).

It operates over a recommended V_{DD} power supply range of 3V to 15V referenced to V_{SS} (usually ground).

Unused inputs must be connected to V_{DD} , V_{SS} , or another input.

Features:

- Wide supply voltage range from 3V to 15V
- Schmitt trigger input discrimination
- Fully static operation
- 5V, 10V, and 15V parametric ratings
- Standardized symmetrical output characteristics
- Specified from -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
CD4093DA14.TB	DIP14	CD4093	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
CD4093SA14.TB	SOP14	CD4093	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
CD4093TA14.TB	TSSOP14	CD4093	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
CD4093SA14.TR	SOP14	CD4093	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
CD4093TA14.TR	TSSOP14	CD4093	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

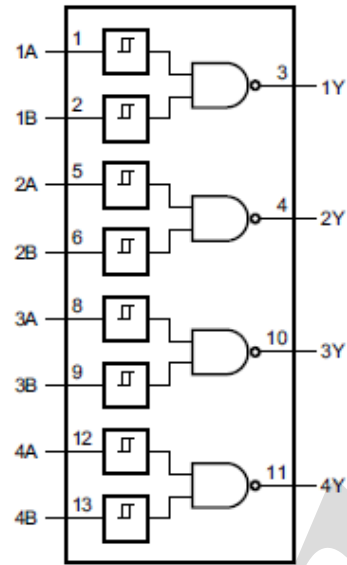


Figure 1. Functional diagram

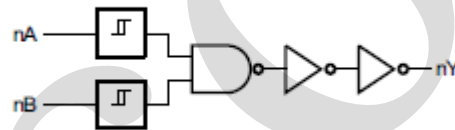
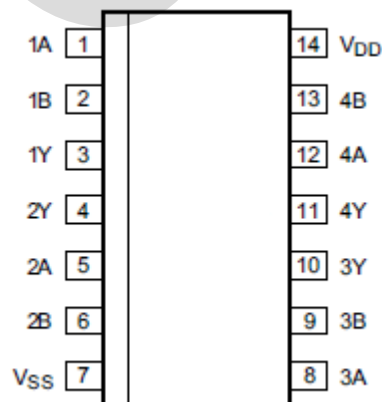


Figure 2. Logic diagram (one gate)

2.2、Pin Configurations





2.3、Pin Description

Pin No.	Pin Name	Description
1	1A	data input
2	1B	data input
3	1Y	data output
4	2Y	data output
5	2A	data input
6	2B	data input
7	V _{SS}	ground (0V)
8	3A	data input
9	3B	data input
10	3Y	data output
11	4Y	data output
12	4A	data input
13	4B	data input
14	V _{DD}	supply voltage

2.4、Function Table

Input		Output
nA	nB	nY
L	L	H
L	H	H
H	L	H
H	H	L

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
DC input current	I _{IK}	any one input	-	±10	mA
input voltage	V _I	all inputs	-0.5	V _{DD} +0.5	V
storage temperature	T _{stg}	-	-65	+150	°C
total power dissipation	P _{tot}	-	-	500	mW
device dissipation	P	per output transistor	-	100	mW
Soldering temperature	T _L	10s	DIP	245	°C
			SOP/TSSOP	260	°C



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

($T_{amb}=25^{\circ}\text{C}$, voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions (V)			$T_{amb}=25^{\circ}\text{C}$			Unit
		V_O	V_{IN}	V_{DD}	Min.	Typ.	Max.	
supply current	I_{DD}	-	0, 5	5	-	-	1	uA
		-	0, 10	10	-	-	2	uA
		-	0, 15	15	-	-	4	uA
LOW-level output current	I_{OL}	0.4	0, 5	5	0.51	1	-	mA
		0.5	0, 10	10	1.3	2.6	-	mA
		1.5	0, 15	15	3.4	6.8	-	mA
HIGH-level output current	I_{OH}	4.6	0, 5	5	-0.51	-1	-	mA
		2.5	0, 5	5	-1.6	-3.2	-	mA
		9.5	0, 10	10	-1.3	-2.6	-	mA
		13.5	0, 15	15	-3.4	-6.8	-	mA
LOW-level output voltage	V_{OL}	-	0, 5	5	-	0	0.05	V
		-	0, 10	10	-	0	0.05	V
		-	0, 15	15	-	0	0.05	V
HIGH-level output voltage	V_{OH}	-	0, 5	5	4.95	5	-	V
		-	0, 10	10	9.95	10	-	V
		-	0, 15	15	14.95	15	-	V
input leakage current	I_I	-	0, 15	15	-	-	± 1	uA



3.3.2、DC Characteristics 2

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

Parameter	Symbol	Conditions (V)			$T_{amb}=-40^{\circ}\text{C}$		$T_{amb}=+85^{\circ}\text{C}$		$T_{amb}=+125^{\circ}\text{C}$		Unit
		V_O	V_{IN}	V_{DD}	Min.	Max.	Min.	Max.	Min.	Max.	
supply current	I_{DD}	-	0, 5	5	-	1	-	30	-	30	μA
		-	0, 10	10	-	2	-	60	-	60	μA
		-	0, 15	15	-	4	-	120	-	120	μA
LOW-level output current	I_{OL}	0.4	0, 5	5	0.61	-	0.42	-	0.36	-	mA
		0.5	0, 10	10	1.5	-	1.1	-	0.9	-	mA
		1.5	0, 15	15	4	-	2.8	-	2.4	-	mA
HIGH-level output current	I_{OH}	4.6	0, 5	5	-0.61	-	-0.42	-	-0.36	-	mA
		2.5	0, 5	5	-1.8	-	-1.3	-	-1.15	-	mA
		9.5	0, 10	10	-1.5	-	-1.1	-	-0.9	-	mA
		13.5	0, 15	15	-4	-	-2.8	-	-2.4	-	mA
LOW-level output voltage	V_{OL}	-	0, 5	5	-	0.05	-	0.05	-	0.05	V
		-	0, 10	10	-	0.05	-	0.05	-	0.05	V
		-	0, 15	15	-	0.05	-	0.05	-	0.05	V
HIGH-level output voltage	V_{OH}	-	0, 5	5	4.95	-	4.95	-	4.95	-	V
		-	0, 10	10	9.95	-	9.95	-	9.95	-	V
		-	0, 15	15	14.95	-	14.95	-	14.95	-	V
input leakage current	I_I	-	0, 15	15	-	± 1	-	± 1	-	± 1	μA

3.3.3、AC Characteristics

($T_{amb}=25^{\circ}\text{C}$, $V_{SS}=0\text{V}$, $t_r, t_f=20\text{ns}$, $C_L=50\text{pF}$, $R_L=200\text{k}\Omega$, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay time	t_{PHL}, t_{PLH}	see Figure 4	$V_{DD}=5\text{V}$	-	45	100	ns
			$V_{DD}=10\text{V}$	-	25	60	ns
			$V_{DD}=15\text{V}$	-	20	50	ns
transition time	t_{THL}, t_{TLH}	see Figure 4	$V_{DD}=5\text{V}$	-	30	70	ns
			$V_{DD}=10\text{V}$	-	25	60	ns
			$V_{DD}=15\text{V}$	-	20	50	ns
input capacitance	C_I	any input		-	5	7.5	pF



3.3.4、Transfer Characteristics 1

($T_{amb}=25^{\circ}\text{C}$, voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions (V)			$T_{amb}=25^{\circ}\text{C}$			Unit
		V_O	V_{IN}	V_{DD}	Min.	Typ.	Max.	
positive-going threshold voltage	V_{T+}	-	[1]	5	2.2	2.9	3.6	V
		-	[1]	10	4.6	5.9	7.1	V
		-	[1]	15	6.8	8.8	10.8	V
		-	[2]	5	2.6	3.3	4	V
		-	[2]	10	5.6	7	8.2	V
		-	[2]	15	6.3	9.4	12.7	V
negative-going threshold voltage	V_{T-}	-	[1]	5	0.9	1.9	2.8	V
		-	[1]	10	2.5	3.9	5.2	V
		-	[1]	15	4	5.8	7.4	V
		-	[2]	5	1.4	2.3	3.2	V
		-	[2]	10	3.4	5.1	6.6	V
		-	[2]	15	4.8	7.3	9.6	V
hysteresis voltage	V_H	-	[1]	5	0.3	0.9	1.6	V
		-	[1]	10	1.2	2.3	3.4	V
		-	[1]	15	1.6	3.5	5	V
		-	[2]	5	0.3	0.9	1.6	V
		-	[2]	10	1.2	2.3	3.4	V
		-	[2]	15	1.6	3.5	5	V

Note:

[1] Input on terminals 1, 5, 8, 12 or 2, 6, 9, 13; other inputs to V_{DD} .

[2] Input on terminals 1 and 2, 5 and 6, 8 and 9 or 12 and 13; other inputs to V_{DD} .

[3] See Figure 5 and Figure 6.



3.3.5、Transfer 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	Conditions (V)			$T_{amb} = -40^{\circ}\text{C}$		$T_{amb} = +85^{\circ}\text{C}$		$T_{amb} = +125^{\circ}\text{C}$		Unit
		V_O	V_{IN}	V_{DD}	Min.	Max.	Min.	Max.	Min.	Max.	
positive-going threshold voltage	V_{T+}	-	[1]	5	2.2	3.6	2.2	3.6	2.2	3.6	V
		-	[1]	10	4.6	7.1	4.6	7.1	4.6	7.1	V
		-	[1]	15	6.8	10.8	6.8	10.8	6.8	10.8	V
		-	[2]	5	2.6	4	2.6	4	2.6	4	V
		-	[2]	10	5.6	8.2	5.6	8.2	5.6	8.2	V
		-	[2]	15	6.3	12.7	6.3	12.7	6.3	12.7	V
negative-going threshold voltage	V_{T-}	-	[1]	5	0.9	2.8	0.9	2.8	0.9	2.8	V
		-	[1]	10	2.5	5.2	2.5	5.2	2.5	5.2	V
		-	[1]	15	4	7.4	4	7.4	4	7.4	V
		-	[2]	5	1.4	3.2	1.4	3.2	1.4	3.2	V
		-	[2]	10	3.4	6.6	3.4	6.6	3.4	6.6	V
		-	[2]	15	4.8	9.6	4.8	9.6	4.8	9.6	V
hysteresis voltage	V_H	-	[1]	5	0.3	1.6	0.3	1.6	0.3	1.6	V
		-	[1]	10	1.2	3.4	1.2	3.4	1.2	3.4	V
		-	[1]	15	1.6	5	1.6	5	1.6	5	V
		-	[2]	5	0.3	1.6	0.3	1.6	0.3	1.6	V
		-	[2]	10	1.2	3.4	1.2	3.4	1.2	3.4	V
		-	[2]	15	1.6	5	1.6	5	1.6	5	V

Note:

[1] Input on terminals 1, 5, 8, 12 or 2, 6, 9, 13; other inputs to V_{DD} .

[2] Input on terminals 1 and 2, 5 and 6, 8 and 9 or 12 and 13; other inputs to V_{DD} .

[3] See Figure 5 and Figure 6.

4、Testing Circuit

4.1、AC Testing Circuit

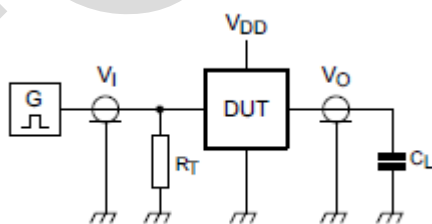


Figure 3. Test circuit for switching times

Definitions for test circuit:

DUT=Device Under Test.

C_L =Load capacitance including jig and probe capacitance.

R_T =Termination resistance should be equal to the output impedance Z_o of the pulse generator.



4.2、AC Testing Waveforms

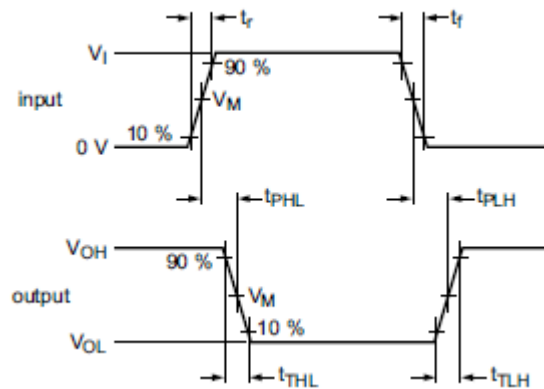


Figure 4. Propagation delay and output transition time

4.3、Transfer Characteristics Waveforms

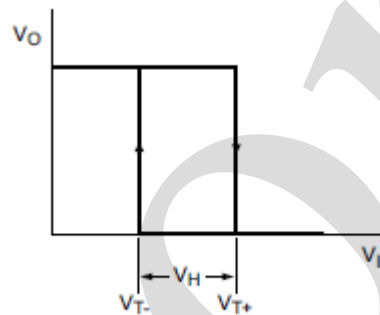


Figure 5. Transfer characteristic

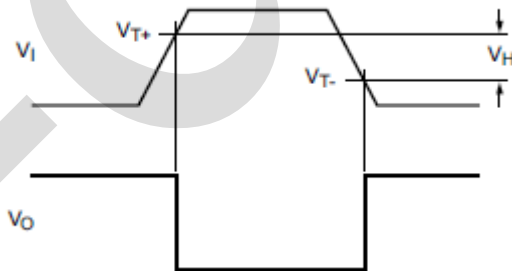


Figure 6. Waveforms showing definition of V_{T+} and V_{T-} (between limits at 30% and 70%) and V_H

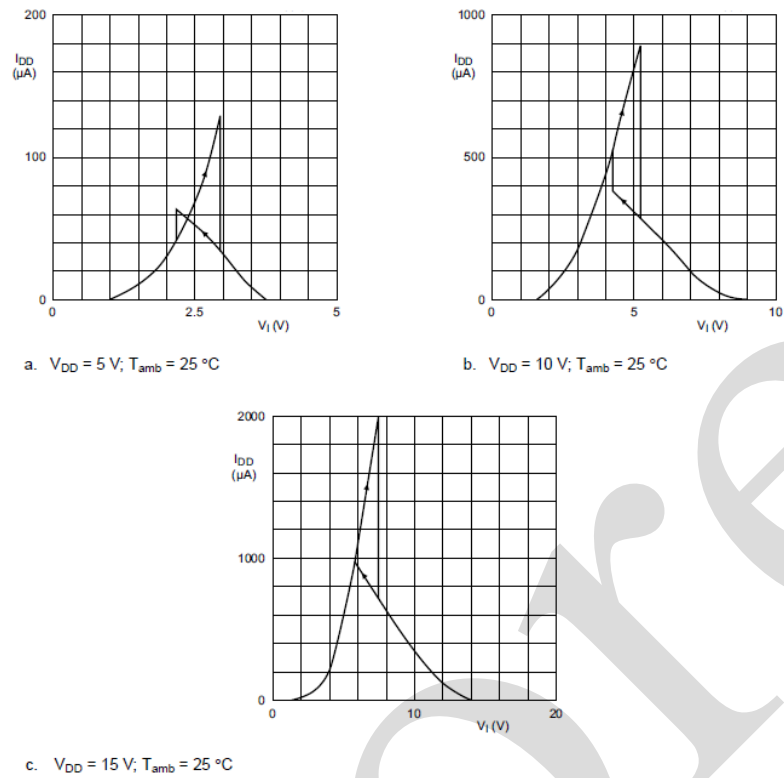


Figure 7. Typical drain current as a function of input

4.4、Measurement Points

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

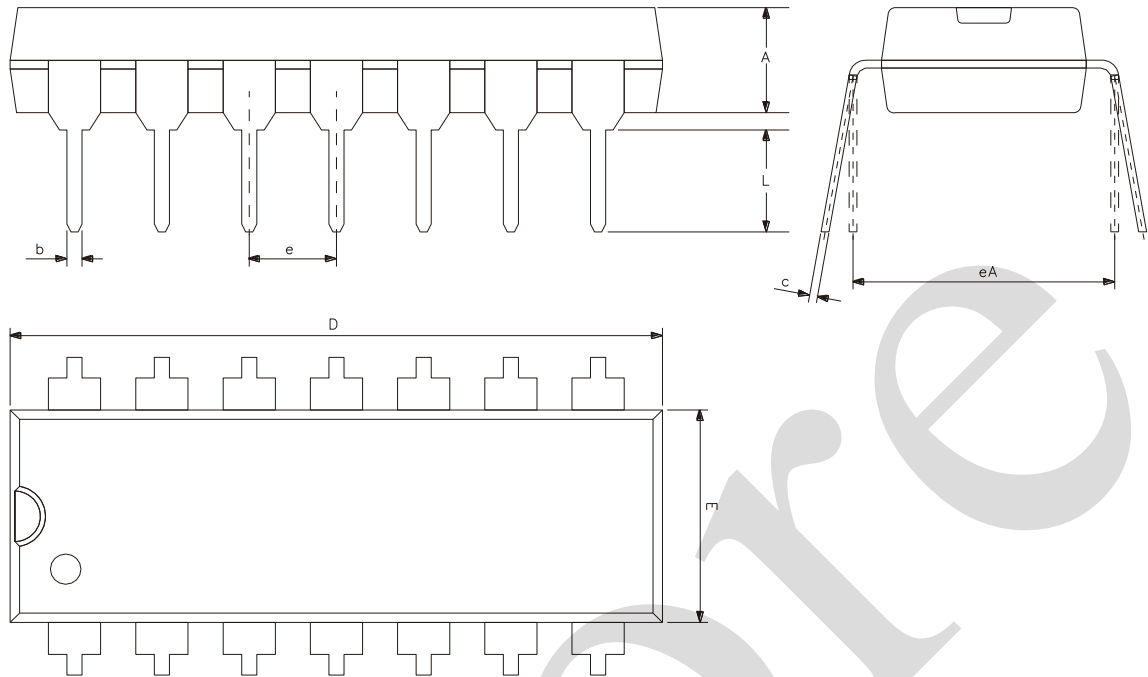
4.5、Test Data

Supply voltage	Input		Load
V_{DD}	V_I	t_r, t_f	C_L
5V to 15V	V_{SS} or V_{DD}	$\leq 20\text{ ns}$	50pF



5、Package Information

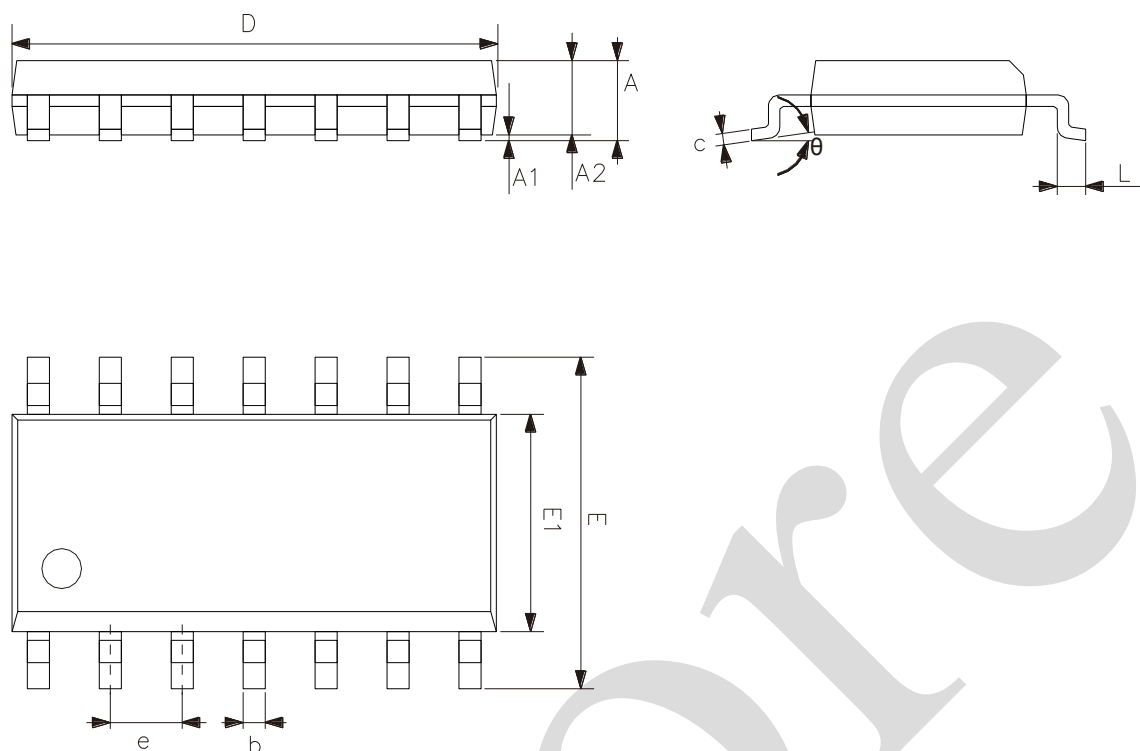
5.1、DIP14



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	-



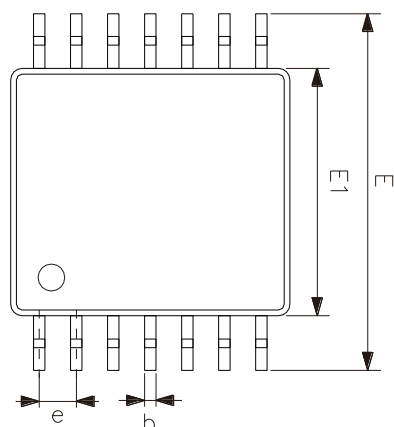
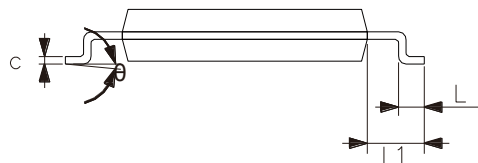
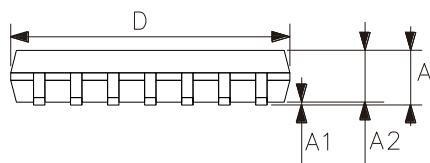
5.2、SOP14



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

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

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