



# SN74HC/HCT13 (LX) Dual 4-Input Nand Schmitt Trigger

## Product Specification

### Specification Revision History:

Version	Date	Description
2023-12-A0	2023-12	New
2024-01-A1	2024-01	Parameter modification



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## 1、General Description

The SN74HC/HCT13 provides two 4-input NAND gates with Schmitt-trigger inputs.

### Features:

- Supply voltage range:  
SN74HC13: 2~6V  
SN74HCT13: 4.5~5.5V
- Input levels:  
SN74HC13: CMOS level  
SN74HCT13: 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
SN74HC13N(LX)	DIP14	SN74HC13N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74HCT13N(LX)	DIP14	SN74HCT13N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm

#### Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
SN74HC13DR(LX)	SOP14	HC13	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HCT13DR(LX)	SOP14	HCT13	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
SN74HC13P(LX)	TSSOP14	HC13	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
SN74HCT13P(LX)	TSSOP14	HCT13	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

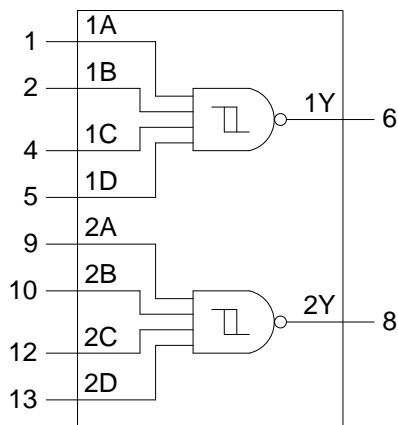


Figure 1. Logic symbol

### 2.2、Pin Configurations

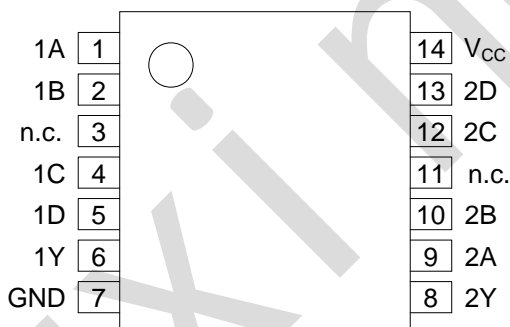


Figure 2. Pin Configurations

### 2.3、Pin Description

Pin No.	Pin Name	Description
1	1A	data input
2	1B	data input
3	n.c.	not connect
4	1C	data input
5	1D	data input
6	1Y	data output
7	GND	ground (0V)
8	2Y	data output
9	2A	data input
10	2B	data input
11	n.c.	not connect
12	2C	data input
13	2D	data input
14	V <sub>CC</sub>	supply voltage



### 2.3、Function Table

Input				Output
nA	nB	nC	nD	nY
L	X	X	X	H
X	L	X	X	H
X	X	L	X	H
X	X	X	L	H
H	H	H	H	L

Note: H=HIGH voltage level; L=LOW voltage level; X=don't care.

## 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 $V_I > V_{CC}+0.5V$	-	$\pm 20$	mA
output clamping current	$I_{OK}$	$V_O < -0.5V$ or $V_O > V_{CC}+0.5V$	-	$\pm 20$	mA
output current	$I_O$	$-0.5V < V_O < V_{CC}+0.5V$	-	$\pm 25$	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
<b>SN74HC13</b>						
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	$^{\circ}C$
<b>SN74HCT13</b>						
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 <sub>CC</sub>	Conditions	Min.	Typ.	Max.	Unit
<b>SN74HC13</b>							
positive-going threshold voltage	V <sub>T+</sub>	2.0V	-	0.7	1.18	1.5	V
		4.5V	-	1.7	2.38	3.15	V
		6.0V	-	2.1	3.14	4.2	V
negative-going threshold voltage	V <sub>T-</sub>	2.0V	-	0.3	0.52	0.9	V
		4.5V	-	0.9	1.4	2.0	V
		6.0V	-	1.2	1.89	2.6	V
hysteresis voltage	V <sub>H</sub>	2.0V	-	0.2	0.66	1.0	V
		4.5V	-	0.4	0.98	1.4	V
		6.0V	-	0.6	1.25	1.6	V
HIGH-level output voltage	V <sub>OH</sub>	2.0V	I <sub>O</sub> =-20uA	1.9	2.0	-	V
		4.5V	I <sub>O</sub> =-20uA	4.4	4.5	-	V
		6.0V	I <sub>O</sub> =-20uA	5.9	6.0	-	V
		4.5V	I <sub>O</sub> =-4.0mA	3.84	4.32	-	V
		6.0V	I <sub>O</sub> =-5.2mA	5.34	5.81	-	V
LOW-level output voltage	V <sub>OL</sub>	2.0V	I <sub>O</sub> =20uA	-	0	0.1	V
		4.5V	I <sub>O</sub> =20uA	-	0	0.1	V
		6.0V	I <sub>O</sub> =20uA	-	0	0.1	V
		4.5V	I <sub>O</sub> =4.0mA	-	0.15	0.33	V
		6.0V	I <sub>O</sub> =5.2mA	-	0.16	0.33	V
input leakage current	I <sub>I</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND	-	-	±1.0	uA
supply current	I <sub>CC</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	20	uA
<b>SN74HCT13</b>							
positive-going threshold voltage	V <sub>T+</sub>	4.5V	-	1.2	1.41	1.9	V
		5.5V	-	1.4	1.59	2.1	V
negative-going threshold voltage	V <sub>T-</sub>	4.5V	-	0.5	0.85	1.2	V
		5.5V	-	0.6	0.99	1.4	V
hysteresis voltage	V <sub>H</sub>	4.5V	-	0.4	0.56	-	V
		5.5V	-	0.4	0.6	-	V
HIGH-level output voltage	V <sub>OH</sub>	4.5V	I <sub>O</sub> =-20uA	4.4	4.5	-	V
			I <sub>O</sub> =-4.0mA	3.84	4.32	-	V
LOW-level output voltage	V <sub>OL</sub>	4.5V	I <sub>O</sub> =20uA	-	0	0.1	V
			I <sub>O</sub> =4.0mA	-	0.15	0.33	V
input leakage current	I <sub>I</sub>	5.5V	V <sub>I</sub> =V <sub>CC</sub> or GND	-	-	±1.0	uA
supply current	I <sub>CC</sub>	5.5V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	20	uA
additional supply current	ΔI <sub>CC</sub>	4.5~5.5V	One input at V <sub>I</sub> =V <sub>CC</sub> -2.1V; Other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> =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 <sub>CC</sub>	Conditions	Min.	Typ.	Max.	Unit
<b>SN74HC13</b>							
positive-going threshold voltage	V <sub>T+</sub>	2.0V	-	0.7	-	1.5	V
		4.5V	-	1.7	-	3.15	V
		6.0V	-	2.1	-	4.2	V
negative-going threshold voltage	V <sub>T-</sub>	2.0V	-	0.3	-	0.9	V
		4.5V	-	0.9	-	2.0	V
		6.0V	-	1.2	-	2.6	V
hysteresis voltage	V <sub>H</sub>	2.0V	-	0.2	-	1.0	V
		4.5V	-	0.4	-	1.4	V
		6.0V	-	0.6	-	1.6	V
HIGH-level output voltage	V <sub>OH</sub>	2.0V	I <sub>O</sub> =-20uA	1.9	-	-	V
		4.5V	I <sub>O</sub> =-20uA	4.4	-	-	V
		6.0V	I <sub>O</sub> =-20uA	5.9	-	-	V
		4.5V	I <sub>O</sub> =-4.0mA	3.7	-	-	V
		6.0V	I <sub>O</sub> =-5.2mA	5.2	-	-	V
LOW-level output voltage	V <sub>OL</sub>	2.0V	I <sub>O</sub> =20uA	-	-	0.1	V
		4.5V	I <sub>O</sub> =20uA	-	-	0.1	V
		6.0V	I <sub>O</sub> =20uA	-	-	0.1	V
		4.5V	I <sub>O</sub> =4.0mA	-	-	0.4	V
		6.0V	I <sub>O</sub> =5.2mA	-	-	0.4	V
input leakage current	I <sub>I</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND	-	-	±1.0	uA
supply current	I <sub>CC</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	40	uA
<b>SN74HCT13</b>							
positive-going threshold voltage	V <sub>T+</sub>	4.5V	-	1.2	-	1.9	V
		5.5V	-	1.4	-	2.1	V
negative-going threshold voltage	V <sub>T-</sub>	4.5V	-	0.5	-	1.2	V
		5.5V	-	0.6	-	1.4	V
hysteresis voltage	V <sub>H</sub>	4.5V	-	0.4	-	-	V
		5.5V	-	0.4	-	-	V
HIGH-level output voltage	V <sub>OH</sub>	4.5V	I <sub>O</sub> =-20uA	4.4	-	-	V
			I <sub>O</sub> =-4.0mA	3.7	-	-	V
LOW-level output voltage	V <sub>OL</sub>	4.5V	I <sub>O</sub> =20uA	-	-	0.1	V
			I <sub>O</sub> =4.0mA	-	-	0.4	V
input leakage current	I <sub>I</sub>	5.5V	V <sub>I</sub> =V <sub>CC</sub> or GND	-	-	±1.0	uA
supply current	I <sub>CC</sub>	5.5V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	40	uA
additional supply current	ΔI <sub>CC</sub>	4.5~5.5V	One input at V <sub>I</sub> =V <sub>CC</sub> -2.1V; Other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> =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 <sub>CC</sub>	Conditions	Min.	Typ.	Max.	Unit	
<b>SN74HC13</b>								
propagation delay	t <sub>PLH</sub> , t <sub>PHL</sub>	2.0V	C <sub>L</sub> =50pF	see Figure 4	-	41	155	ns
		4.5V	C <sub>L</sub> =50pF		-	15	31	ns
		5.0V	C <sub>L</sub> =15pF		-	12	-	ns
		6.0V	C <sub>L</sub> =50pF		-	12	26	ns
transition time	t <sub>THL</sub> , t <sub>TLH</sub>	2.0V	C <sub>L</sub> =50pF	see Figure 4	-	19	95	ns
		4.5V	C <sub>L</sub> =50pF		-	7	19	ns
		6.0V	C <sub>L</sub> =50pF		-	6	15	ns
<b>SN74HCT13</b>								
propagation delay	t <sub>PLH</sub> , t <sub>PHL</sub>	4.5V	C <sub>L</sub> =50pF	see Figure 4	-	20	43	ns
		5.0V	C <sub>L</sub> =15pF		-	17	-	ns
transition time	t <sub>THL</sub> , t <sub>TLH</sub>	4.5V	C <sub>L</sub> =50pF	see Figure 4	-	7	19	ns

### 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 <sub>CC</sub>	Conditions	Min.	Typ.	Max.	Unit	
<b>SN74HC13</b>								
propagation delay	t <sub>PLH</sub> , t <sub>PHL</sub>	2.0V	C <sub>L</sub> =50pF	see Figure 4	-	-	190	ns
		4.5V	C <sub>L</sub> =50pF		-	-	38	ns
		6.0V	C <sub>L</sub> =50pF		-	-	32	ns
transition time	t <sub>THL</sub> , t <sub>TLH</sub>	2.0V	C <sub>L</sub> =50pF	see Figure 4	-	-	110	ns
		4.5V	C <sub>L</sub> =50pF		-	-	22	ns
		6.0V	C <sub>L</sub> =50pF		-	-	19	ns
<b>SN74HCT13</b>								
propagation delay	t <sub>PLH</sub> , t <sub>PHL</sub>	4.5V	C <sub>L</sub> =50pF	see Figure 4	-	-	51	ns
transition time	t <sub>THL</sub> , t <sub>TLH</sub>	4.5V	C <sub>L</sub> =50pF	see Figure 4	-	-	22	ns



## 4、Testing Circuit

### 4.1、AC Testing Circuit

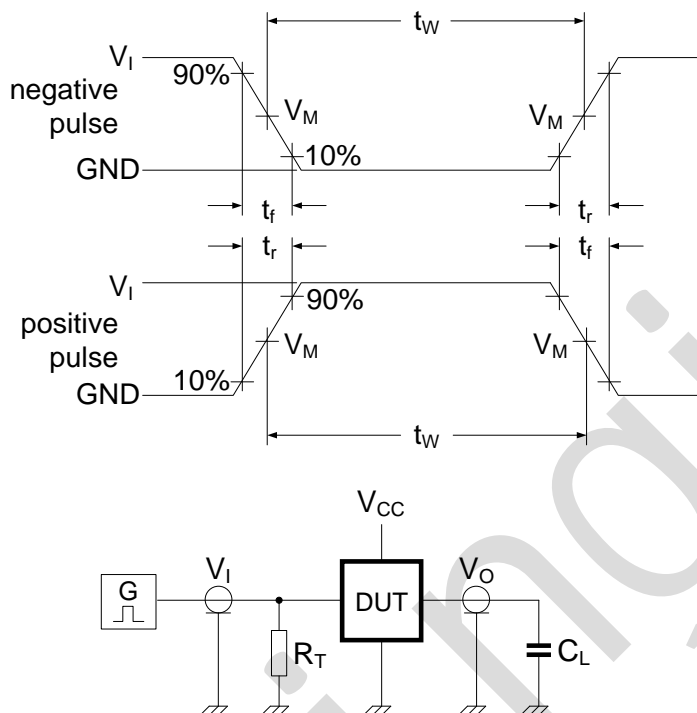


Figure 3. Test circuit for measuring switching times

$C_L$  includes probe and jig capacitance.

### 4.2、Test Data

Type	Input		Load	Test
	$V_I$	$t_r = t_f$	$C_L$	
SN74HC13	$V_{CC}$	6.0ns	15pF, 50pF	$t_{PLH}/t_{PHL}$
SN74HCT13	3.0V	6.0ns	15pF, 50pF	$t_{PLH}/t_{PHL}$

### 4.3、AC Testing Waveforms

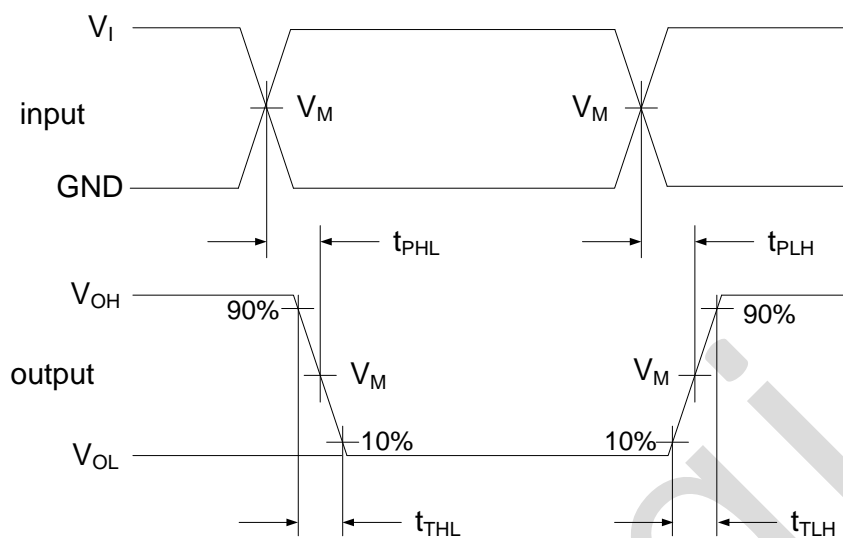


Figure 4. Propagation delay, output transition time

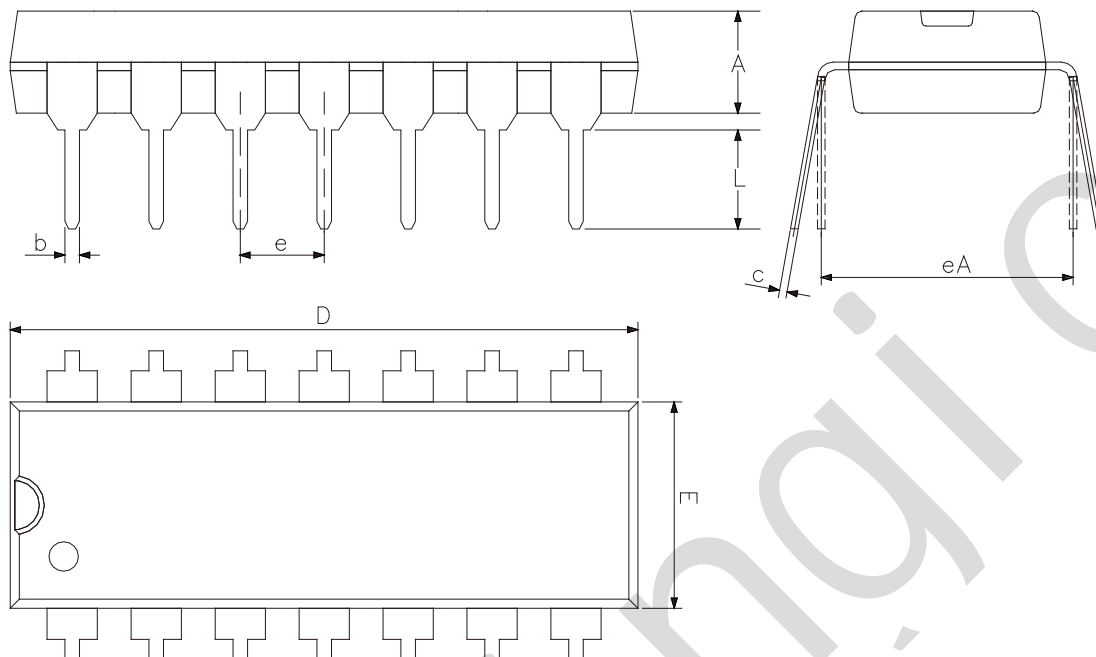
### 4.4、Measurement Points

Type	Input	Output		
	$V_M$	$V_M$	$V_X$	$V_Y$
SN74HC13	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$0.1 \times V_{CC}$	$0.9 \times V_{CC}$
SN74HCT13	1.3V	1.3V	$0.1 \times V_{CC}$	$0.9 \times V_{CC}$



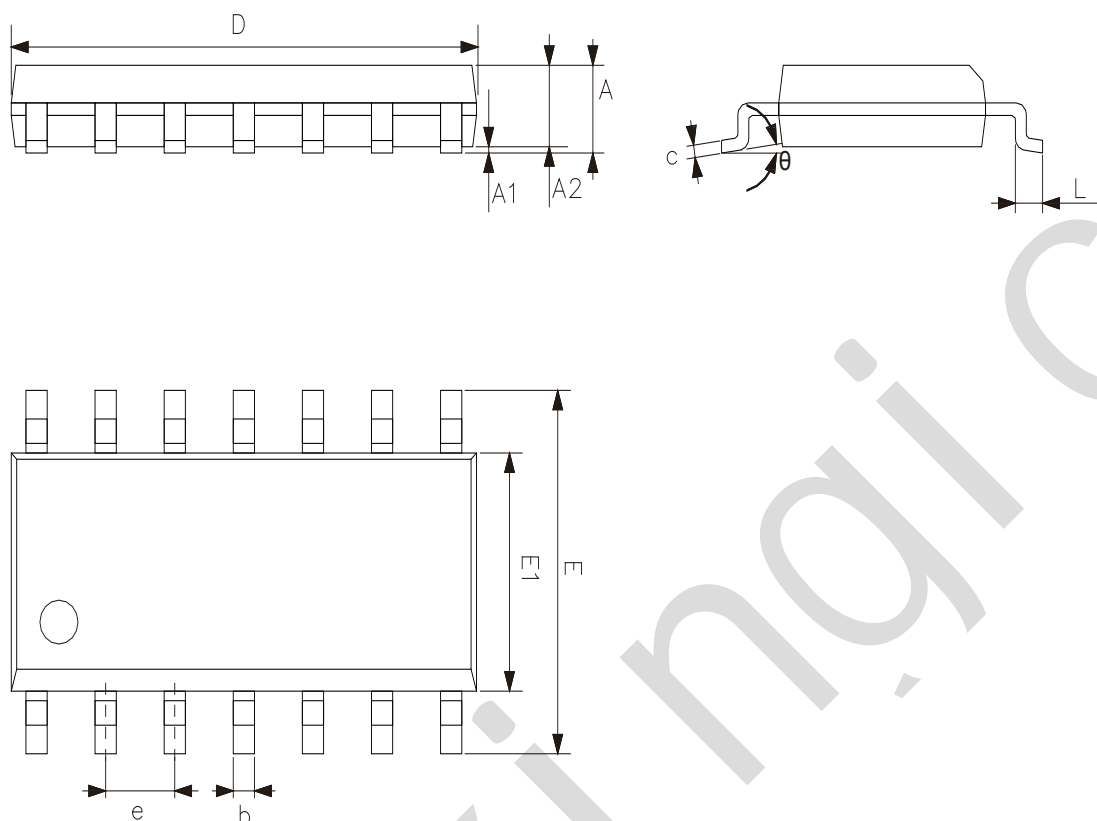
## 5、Package Information

### 5.1、DIP14



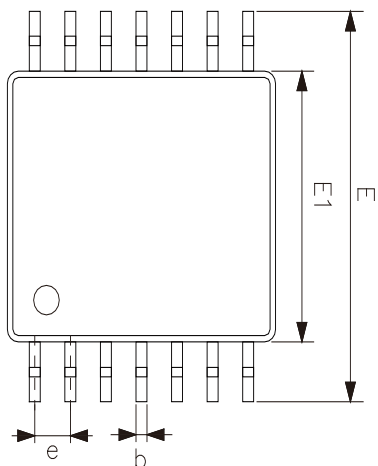
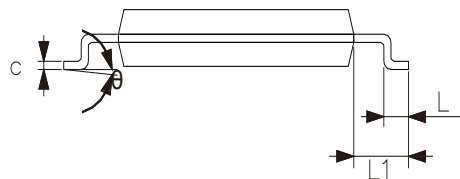
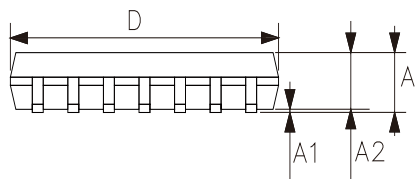
2023/12/A	Dimensions In Millimeters		
	Symbol	Min	Max
	A	3.05	3.60
	b	0.33	0.56
	c	0.20	0.36
	D	18.80	19.40
	E	6.20	6.60
	e	2.54	
	eA	7.62	10.90
	L	2.92	—

## 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
$\theta$	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	
$\theta$	0°	8°



## 6、Statements And Notes

Recommended carefully reading this information before the use of this product;

The information in this document are subject to change without notice;

This information is using to the reference only, the company is not responsible for any loss;

The company is not responsible for the any infringement of the third party patents or other rights of the responsibility.

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