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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Contents

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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℃ 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
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	Markingcode	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.

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2、Block Diagram And Pin Description

2.1、Block Diagram

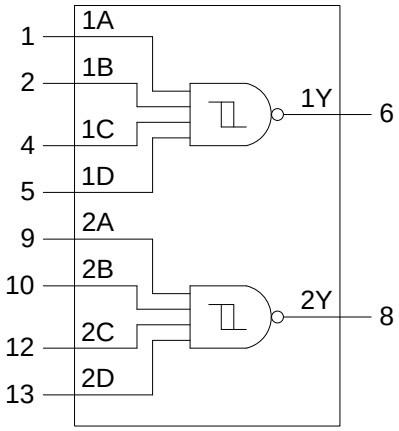

Figure 1. Logic symbol

2.2、Pin Configurations

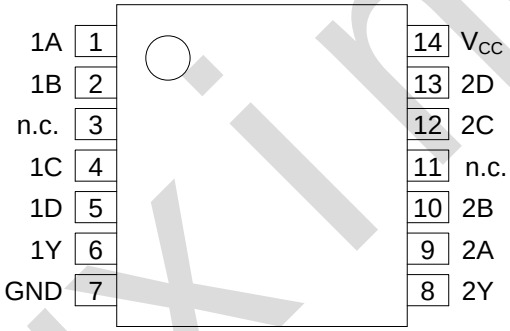

Figure 2. Pin Configurations

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_{CC}	supply voltage

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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 $V_I > V_{CC}+0.5V$		-	±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	℃
soldering temperature	T_L	10s	DIP	245		℃
			SOP/TSSOP	260		

3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
SN74HC13						
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	℃
SN74HCT13						
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	℃

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3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

(T_{amb}=-40℃ to +85℃, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	V_{CC}	Conditions	Min.	Typ.	Max.	Unit
SN74HC13							
positive-going threshold voltage	V_{T+}	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_{T-}	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_H	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_{OH}	2.0V	I_O=-20uA	1.9	2.0	-	V
		4.5V	I_O=-20uA	4.4	4.5	-	V
		6.0V	I_O=-20uA	5.9	6.0	-	V
		4.5V	I_O=-4.0mA	3.84	4.32	-	V
		6.0V	I_O=-5.2mA	5.34	5.81	-	V
LOW-level output voltage	V_{OL}	2.0V	I_O=20uA	-	0	0.1	V
		4.5V	I_O=20uA	-	0	0.1	V
		6.0V	I_O=20uA	-	0	0.1	V
		4.5V	I_O=4.0mA	-	0.15	0.33	V
		6.0V	I_O=5.2mA	-	0.16	0.33	V
input leakage current	I_I	6.0V	V_I=V_{CC} or GND	-	-	±1.0	uA
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND; I_O=0A	-	-	20	uA
SN74HCT13							
positive-going threshold voltage	V_{T+}	4.5V	-	1.2	1.41	1.9	V
		5.5V	-	1.4	1.59	2.1	V
negative-going threshold voltage	V_{T-}	4.5V	-	0.5	0.85	1.2	V
		5.5V	-	0.6	0.99	1.4	V
hysteresis voltage	V_H	4.5V	-	0.4	0.56	-	V
		5.5V	-	0.4	0.6	-	V
HIGH-level output voltage	V_{OH}	4.5V	I_O=-20uA	4.4	4.5	-	V
			I_O=-4.0mA	3.84	4.32	-	V
LOW-level output voltage	V_{OL}	4.5V	I_O=20uA	-	0	0.1	V
			I_O=4.0mA	-	0.15	0.33	V
input leakage current	I_I	5.5V	V_I=V_{CC} or GND	-	-	±1.0	uA
supply current	I_{CC}	5.5V	V_I=V_{CC} or GND; I_O=0A	-	-	20	uA
additional supply current	ΔI_{CC}	4.5~ 5.5V	One input at V_I=V_{CC}-2.1V; Other inputs at V_{CC} or GND; I_O=0A	-	-	135	uA

3.3.2、DC Characteristics 2

(T_{amb}=-40℃ to +125℃, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	V_{CC}	Conditions	Min.	Typ.	Max.	Unit
SN74HC13							
positive-going threshold voltage	V_{T+}	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_{T-}	2.0V	-	0.3	-	0.9	V
		4.5V	-	0.9	-	2.0	V
		6.0V	-	1.2	-	2.6	V
hysteresis voltage	V_H	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_{OH}	2.0V	I_O=-20uA	1.9	-	-	V
		4.5V	I_O=-20uA	4.4	-	-	V
		6.0V	I_O=-20uA	5.9	-	-	V
		4.5V	I_O=-4.0mA	3.7	-	-	V
		6.0V	I_O=-5.2mA	5.2	-	-	V
LOW-level output voltage	V_{OL}	2.0V	I_O=20uA	-	-	0.1	V
		4.5V	I_O=20uA	-	-	0.1	V
		6.0V	I_O=20uA	-	-	0.1	V
		4.5V	I_O=4.0mA	-	-	0.4	V
		6.0V	I_O=5.2mA	-	-	0.4	V
input leakage current	I_I	6.0V	V_I=V_{CC} or GND	-	-	±1.0	uA
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND; I_O=0A	-	-	40	uA
SN74HCT13							
positive-going threshold voltage	V_{T+}	4.5V	-	1.2	-	1.9	V
		5.5V	-	1.4	-	2.1	V
negative-going threshold voltage	V_{T-}	4.5V	-	0.5	-	1.2	V
		5.5V	-	0.6	-	1.4	V
hysteresis voltage	V_H	4.5V	-	0.4	-	-	V
		5.5V	-	0.4	-	-	V
HIGH-level output voltage	V_{OH}	4.5V	I_O=-20uA	4.4	-	-	V
			I_O=-4.0mA	3.7	-	-	V
LOW-level output voltage	V_{OL}	4.5V	I_O=20uA	-	-	0.1	V
			I_O=4.0mA	-	-	0.4	V
input leakage current	I_I	5.5V	V_I=V_{CC} or GND	-	-	±1.0	uA
supply current	I_{CC}	5.5V	V_I=V_{CC} or GND; I_O=0A	-	-	40	uA
additional supply current	ΔI_{CC}	4.5~ 5.5V	One input at V_I=V_{CC}-2.1V; Other inputs at V_{CC} or GND; I_O=0A	-	-	147	uA

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3.3.3、AC Characteristics 1

(T_{amb}=-40℃ to +85℃, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	V_{CC}	Conditions		Min.	Typ.	Max.	Unit
SN74HC13								
propagation delay	t_{PLH}, t_{PHL}	2.0V	C_L=50pF	see Figure 4	-	41	155	ns
		4.5V	C_L=50pF		-	15	31	ns
		5.0V	C_L=15pF		-	12	-	ns
		6.0V	C_L=50pF		-	12	26	ns
transition time	t_{THL}, t_{TLH}	2.0V	C_L=50pF	see Figure 4	-	19	95	ns
		4.5V	C_L=50pF		-	7	19	ns
		6.0V	C_L=50pF		-	6	15	ns
SN74HCT13								
propagation delay	t_{PLH}, t_{PHL}	4.5V	C_L=50pF	see Figure 4	-	20	43	ns
		5.0V	C_L=15pF		-	17	-	ns
transition time	t_{THL}, t_{TLH}	4.5V	C_L=50pF	see Figure 4	-	7	19	ns

3.3.4、AC Characteristics 2

(T_{amb}=-40℃ to +125℃, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	V_{CC}	Conditions		Min.	Typ.	Max.	Unit
SN74HC13								
propagation delay	t_{PLH}, t_{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
transition time	t_{THL}, t_{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
SN74HCT13								
propagation delay	t_{PLH}, t_{PHL}	4.5V	C_L=50pF	see Figure 4	-	-	51	ns
transition time	t_{THL}, t_{TLH}	4.5V	C_L=50pF	see Figure 4	-	-	22	ns

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4、Testing Circuit

4.1、AC Testing Circuit

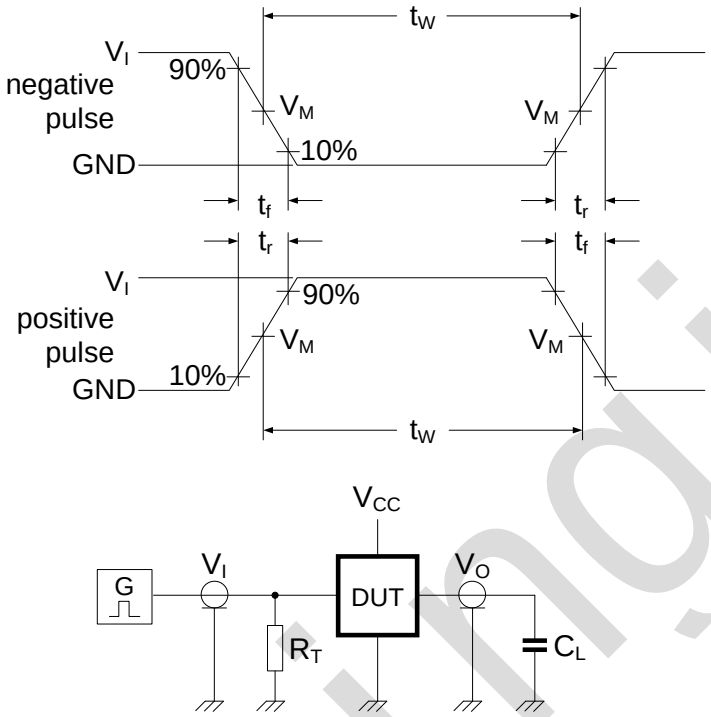

Figure 3. Test circuit for measuring switching times

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}

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4.3、AC Testing Waveforms

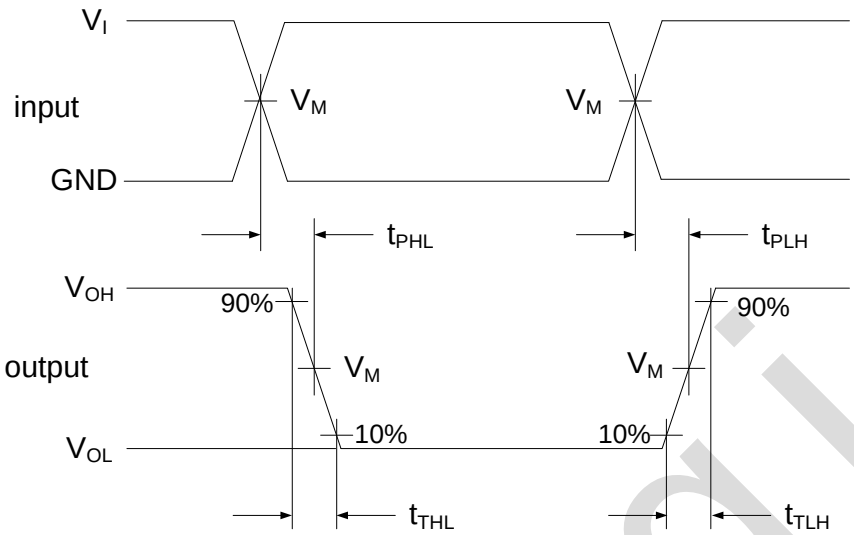

Figure 4. Propagation delay, output transition time

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	$0.1\times V_{CC}$	$0.9\times V_{CC}$

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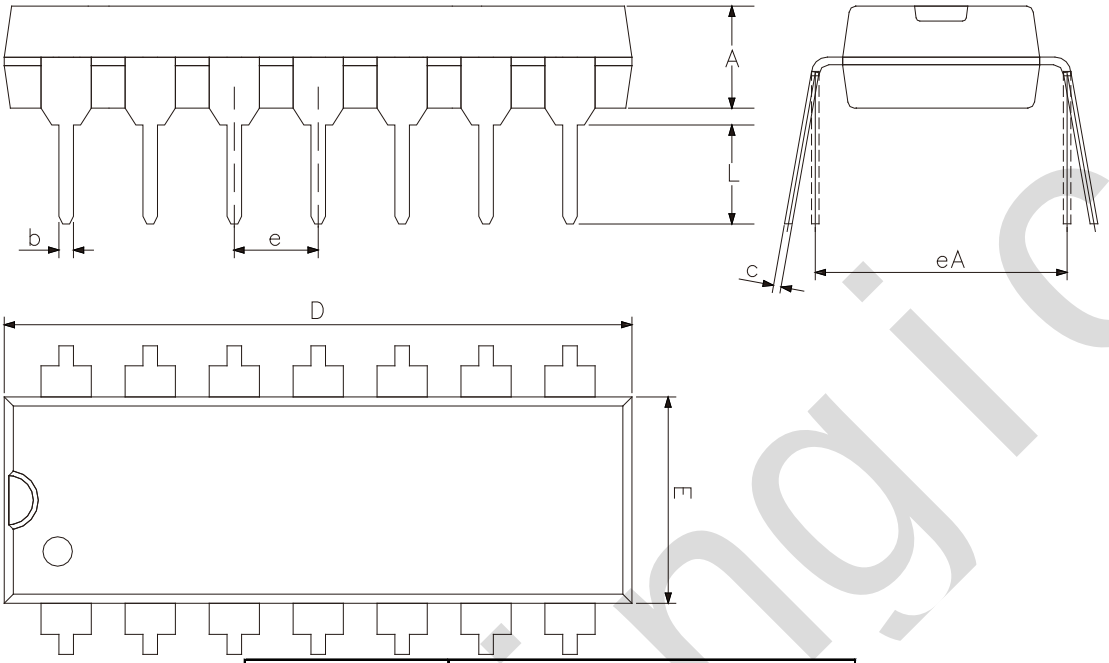
5、Package Information

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	—

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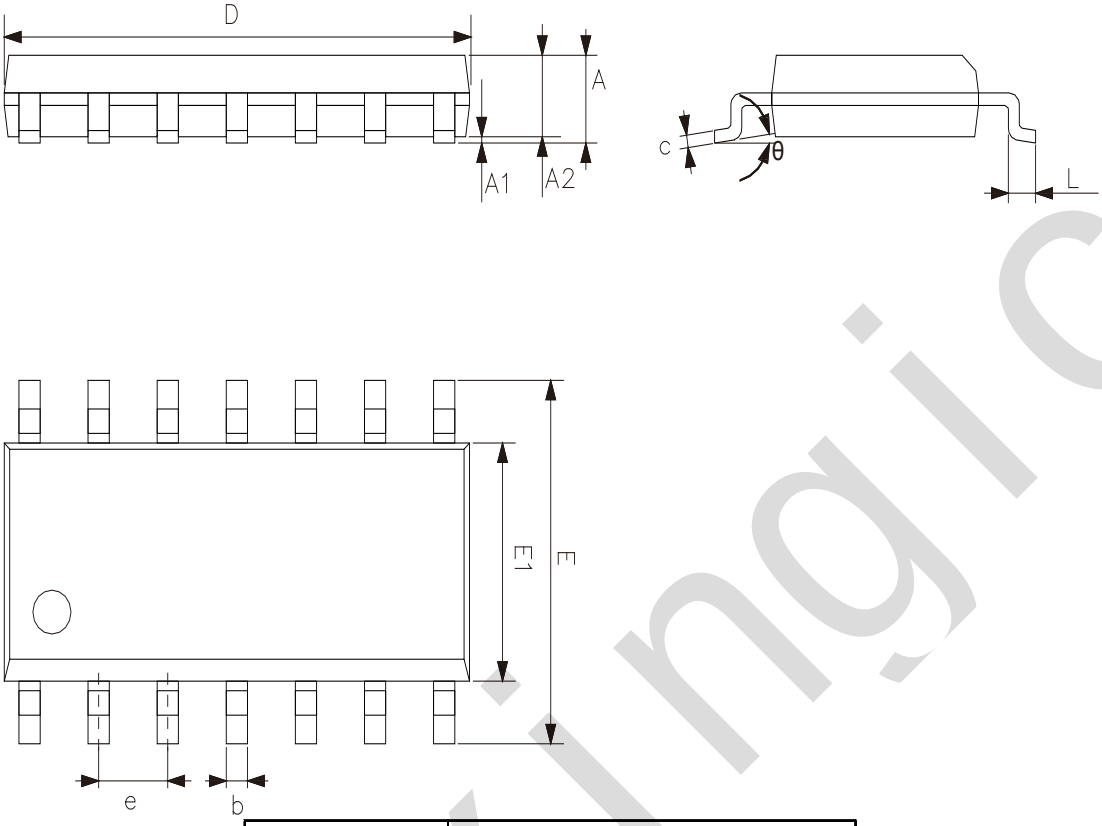
5.2、SOP14



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°

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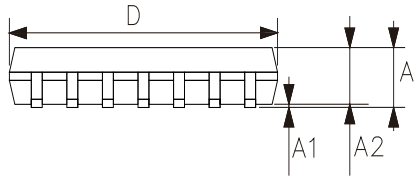
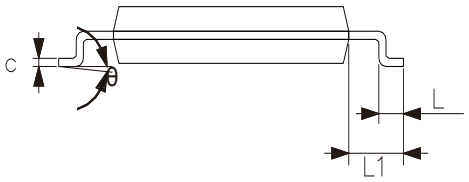
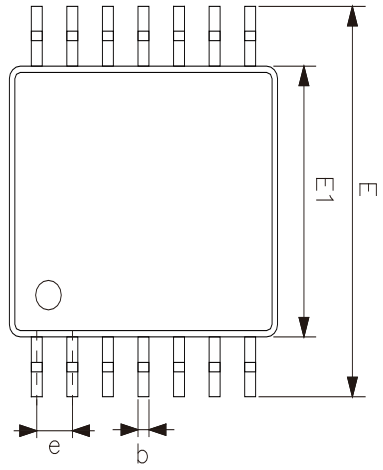
5.3、TSSOP14







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°

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6、Statements And Notes

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