SN74LS112 (LX)

Dual JK flip-flop with set and reset; negative-edge trigger

Product Specification

Specification Revision History:

Version	Date	Description
2023-06-A0	2023-06	New
2023-11-A1	2023-11	Parameter modification

Contents

1、General Description

The SN74LS112 is a dual negative-edge triggered JK flip-flop.

Features:

- Supply voltage range: 2~6V
- Temperature range:-40℃ to +125℃
- Packaging information: DIP16/SOP16/TSSOP16

Ordering Information:

Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
SN74LS112AN(LX)	DIP16	SN74LS112N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74LS112DR(LX)	SOP16	LS112	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
SN74LS112PW(LX)	TSSOP16	LS112	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
SN74LS112DR(LX)	SOP16	LS112	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
SN74LS112PW(LX)	TSSOP16	LS112	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

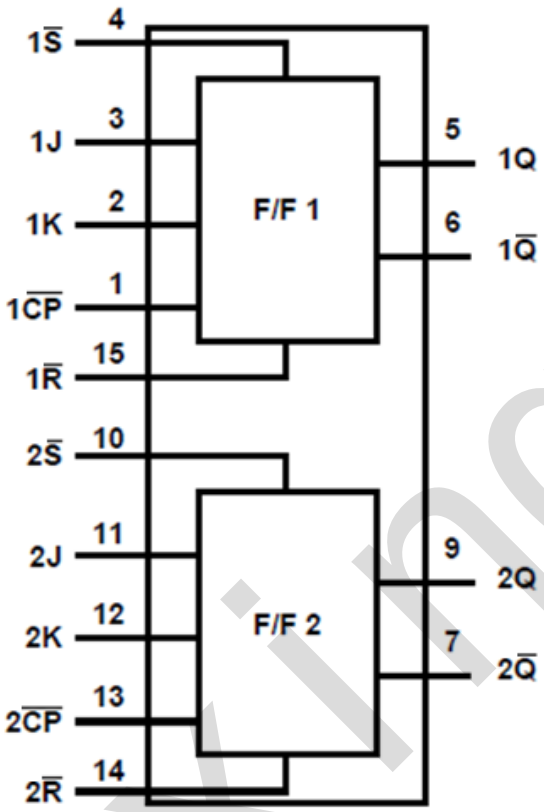
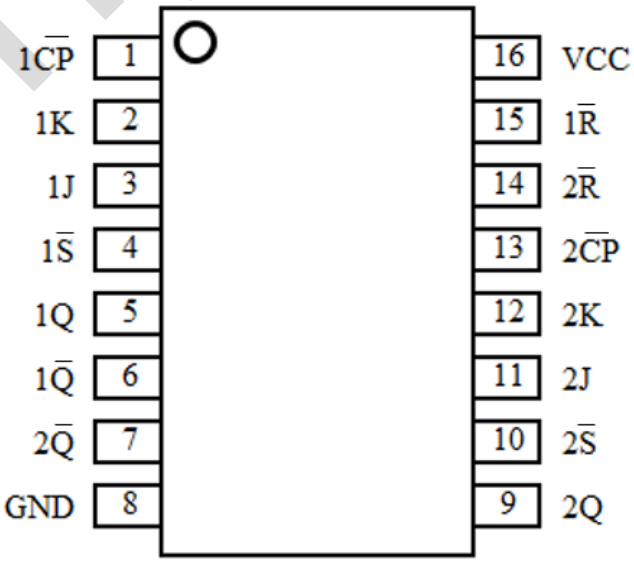


Figure 1. Functional diagram

2.2、Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1	$\overline{1CP}$	clock input (HIGH-to-LOW; edge-triggered)
2	1K	data input
3	1J	data input
4	$\overline{1S}$	set input (active LOW)
5	1Q	true flip-flop output
6	$\overline{1Q}$	complement flip-flop output
7	$\overline{2Q}$	complement flip-flop output
8	GND	ground (0V)
9	2Q	true flip-flop output
10	$\overline{2S}$	set input (active LOW)
11	2J	data input
12	2K	data input
13	$\overline{2CP}$	clock input (HIGH-to-LOW; edge-triggered)
14	$\overline{2R}$	reset input (active LOW)
15	$\overline{1R}$	reset input (active LOW)
16	VCC	supply voltage

2.4、Function Table

Inputs					Outputs	
$\overline{S}$	$\overline{R}$	$\overline{CP}$	J	K	Q	$\overline{Q}$
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H(Note 1)	H(Note 1)
H	H	↓	L	L	No Change	
H	H	↓	H	L	H	L
H	H	↓	L	H	L	H
H	H	↓	H	H	Toggle	
H	H	H	X	X	No Change	

H= High Level (Steady State)

L= Low Level (Steady State)

X= Don't Care

↓ = High-to-Low Transition

NOTE 1： Output states unpredictable if both S and R go High simultaneously after both being low at the same time

3、Electrical Parameter

3.1、Absolute Maximum Ratings

(T_{amb}=25℃, All voltage referenced to Vss, 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、Electrical Characteristics

3.2.1、DC Characteristics 1

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

Parameter	Symbol	V_{CC}	Conditions	Min.	Typ.	Max.	Unit
HIGH-level input voltage	V_{IH}	2.0V	-	1.5	1.2	-	V
		4.5V	-	3.15	2.4	-	V
		6.0V	-	4.2	3.2	-	V
LOW-level input voltage	V_{IL}	2.0V	-	-	0.8	0.5	V
		4.5V	-	-	2.1	1.35	V
		6.0V	-	-	2.8	1.8	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	uA
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND;I_O=0A	-	-	80	uA

3.2.2、DC Characteristics 2

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

Parameter	Symbol	V_{CC}	Conditions	Min.	Typ.	Max.	Unit
HIGH-level input voltage	V_{IH}	2.0V	-	1.5	-	-	V
		4.5V	-	3.15	-	-	V
		6.0V	-	4.2	-	-	V
LOW-level input voltage	V_{IL}	2.0V	-	-	-	0.5	V
		4.5V	-	-	-	1.35	V
		6.0V	-	-	-	1.8	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	uA
supply current	I_{CC}	6.0V	V_I=V_{CC} or GND;I_O=0A	-	-	160	uA

3.3.3、AC Characteristics 1

(T_{amb}=-40℃ to +85℃, V_{SS}=0V, unless otherwise specified.)

Parameter	Symbol	V_{CC}	Conditions		Min.	Typ.	Max.	Unit
$n\overline{CP}$ to nQ propagation delay	t_{PLH}, t_{PHL}	2.0V	C_L=50pF	see Figure 5	-	55	220	ns
		4.5V	C_L=50pF		-	20	44	ns
		5.0V	C_L=15pF		-	17	-	ns
		6.0V	C_L=50pF		-	16	37	ns
$n\overline{CP}$ to $n\overline{Q}$ propagation delay		2.0V	C_L=50pF	see Figure 5	-	55	220	ns
		4.5V	C_L=50pF		-	20	44	ns
		5.0V	C_L=15pF		-	17	-	ns
		6.0V	C_L=50pF		-	16	37	ns
$n\overline{R}$ to $n\overline{Q}$、nQ propagation delay		2.0V	C_L=50pF	see Figure 6	-	58	225	ns
		4.5V	C_L=50pF		-	21	45	ns
		5.0V	C_L=15pF		-	18	-	ns
		6.0V	C_L=50pF		-	17	38	ns
$n\overline{S}$ to $n\overline{Q}$、nQ propagation delay		2.0V	C_L=50pF	see Figure 6	-	50	295	ns
		4.5V	C_L=50pF		-	18	39	ns
		5.0V	C_L=15pF		-	15	-	ns
		6.0V	C_L=50pF		-	14	33	ns
transition time	t_{THL}, t_{TLH}	2.0V	C_L=50pF	see Figure 5	-	19	95	ns
		4.5V	C_L=50pF		-	7	19	ns
		6.0V	C_L=50pF		-	6	16	ns
$n\overline{CP}$ HIGH or LOW pulse width	tw	2.0V	C_L=50pF	see Figure 5	100	22	-	ns
		4.5V	C_L=50pF		20	8	-	ns
		6.0V	C_L=50pF		17	6	-	ns
$n\overline{S}$,$n\overline{R}$ LOW pulse width		2.0V	C_L=50pF	see Figure 6	100	22	-	ns
		4.5V	C_L=50pF		20	8	-	ns
		6.0V	C_L=50pF		17	6	-	ns
$n\overline{R}$ to $n\overline{CP}$ recovery time	trec	2.0V	C_L=50pF	see Figure 6	125	22	-	ns
		4.5V	C_L=50pF		25	8	-	ns
		6.0V	C_L=50pF		21	6	-	ns
$n\overline{S}$ to $n\overline{CP}$ recovery time		2.0V	C_L=50pF	see Figure 6	100	-19	-	ns
		4.5V	C_L=50pF		20	-7	-	ns
		6.0V	C_L=50pF		17	-6	-	ns
nJ and nK to n$\overline{CP}$ set-up time	tsu	2.0V	C_L=50pF	see Figure 5	100	19	-	ns
		4.5V	C_L=50pF		20	7	-	ns
		6.0V	C_L=50pF		17	6	-	ns
nJ and nK to n$\overline{CP}$ hold time	th	2.0V	C_L=50pF	see Figure 5	0	-11	-	ns
		4.5V	C_L=50pF		0	-4	-	ns
		6.0V	C_L=50pF		0	-3	-	ns
maxiumum frequency	fmax	2.0V	C_L=50pF	see Figure 5	4.8	20	-	MHz
		4.5V	C_L=50pF		24	60	-	MHz
		5.0V	C_L=15pF		-	66	-	MHz
		6.0V	C_L=50pF		28	71	-	MHz

3.3.4、AC Characteristics 2

(T_{amb}=-40℃ to +125℃, V_{SS}=0V, unless otherwise specified.)

Parameter	Symbol	V_{CC}	Conditions		Min.	Typ.	Max.	Unit
$n\overline{CP}$ to nQ propagation delay	t_{PLH}, t_{PHL}	2.0V	C_L=50pF	see Figure 3	-	-	265	ns
		4.5V	C_L=50pF		-	-	53	ns
		6.0V	C_L=50pF		-	-	45	ns
$n\overline{CP}$ to $n\overline{Q}$ propagation delay		2.0V	C_L=50pF	see Figure 3	-	-	265	ns
		4.5V	C_L=50pF		-	-	53	ns
		6.0V	C_L=50pF		-	-	45	ns
$n\overline{R}$ to $n\overline{Q}$、nQ propagation delay		2.0V	C_L=50pF	see Figure 4	-	-	270	ns
		4.5V	C_L=50pF		-	-	54	ns
		6.0V	C_L=50pF		-	-	46	ns
$n\overline{S}$ to $n\overline{Q}$、nQ propagation delay		2.0V	C_L=50pF	see Figure 4	-	-	235	ns
		4.5V	C_L=50pF		-	-	47	ns
		6.0V	C_L=50pF		-	-	40	ns
transition time	t_{THL}, t_{TLH}	2.0V	C_L=50pF	see Figure 3	-	-	110	ns
		4.5V	C_L=50pF		-	-	22	ns
		6.0V	C_L=50pF		-	-	19	ns
$n\overline{CP}$ HIGH or LOW pulse width	tw	2.0V	C_L=50pF	see Figure 3	120	-	-	ns
		4.5V	C_L=50pF		24	-	-	ns
		6.0V	C_L=50pF		20	-	-	ns
$n\overline{S}$,$n\overline{R}$ LOW pulse width		2.0V	C_L=50pF	see Figure 4	120	-	-	ns
		4.5V	C_L=50pF		24	-	-	ns
		6.0V	C_L=50pF		20	-	-	ns
$n\overline{R}$ to $n\overline{CP}$ recovery time	trec	2.0V	C_L=50pF	see Figure 4	150	-	-	ns
		4.5V	C_L=50pF		30	-	-	ns
		6.0V	C_L=50pF		26	-	-	ns
$n\overline{S}$ to $n\overline{CP}$ recovery time		2.0V	C_L=50pF	see Figure 4	120	-	-	ns
		4.5V	C_L=50pF		24	-	-	ns
		6.0V	C_L=50pF		20	-	-	ns
nJ and nK to n$\overline{CP}$ set-up time	tsu	2.0V	C_L=50pF	see Figure 3	120	-	-	ns
		4.5V	C_L=50pF		24	-	-	ns
		6.0V	C_L=50pF		20	-	-	ns
nJ and nK to n$\overline{CP}$ hold time	th	2.0V	C_L=50pF	see Figure 3	0	-	-	ns
		4.5V	C_L=50pF		0	-	-	ns
		6.0V	C_L=50pF		0	-	-	ns
maxiumum frequency	fmax	2.0V	C_L=50pF	see Figure 3	4.0	-	-	MHZ
		4.5V	C_L=50pF		20	-	-	MHZ
		6.0V	C_L=50pF		24	-	-	NHZ

4、Testing Circuit

4.1、DC Testing Circuit

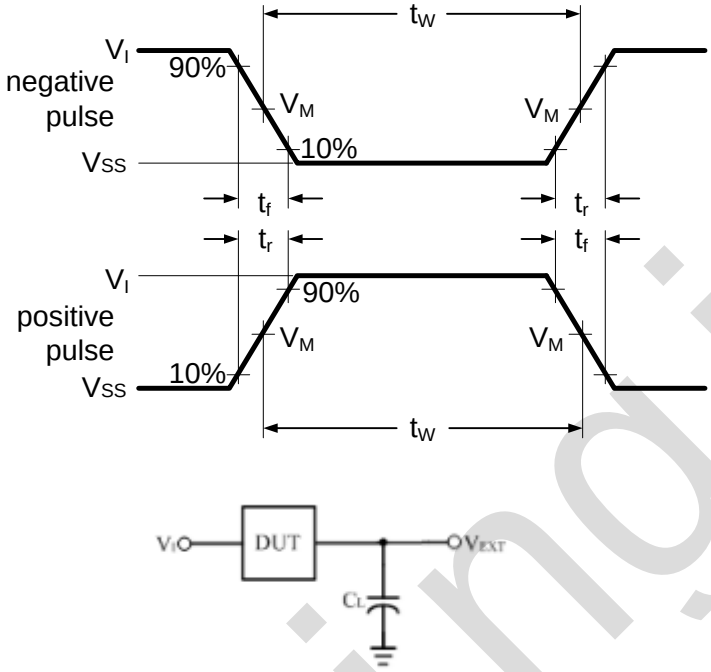


Figure 2 Load circuit

C_L includes probe and jig capacitance.

4.2、AC Testing Circuit

Input		Load	V_{EXT}		
V_I	$t_r = t_f$	C_L	t_{PLH}/t_{PHL}	t_{PLZ}/t_{PZL}	t_{PHZ}/t_{PZH}
V_{CC}	6.0ns	50pF	Open	V_{CC}	GND

4.3、AC Testing Waveforms

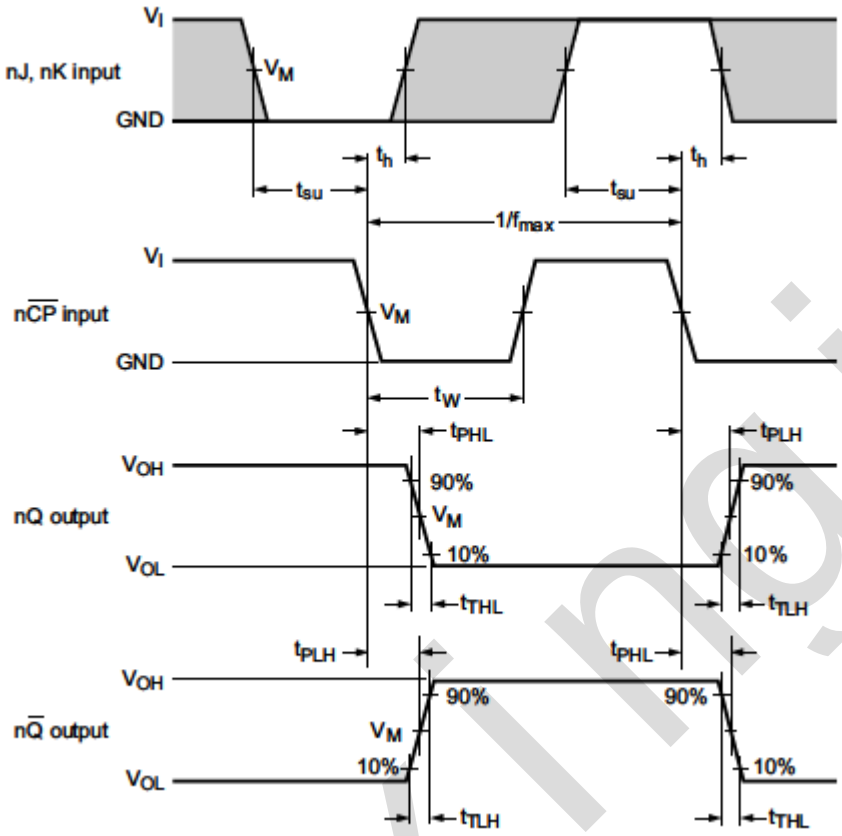


Figure 3 Clock propagation delays, output transition time, pulse width, set-up, hold times, and maximum frequency

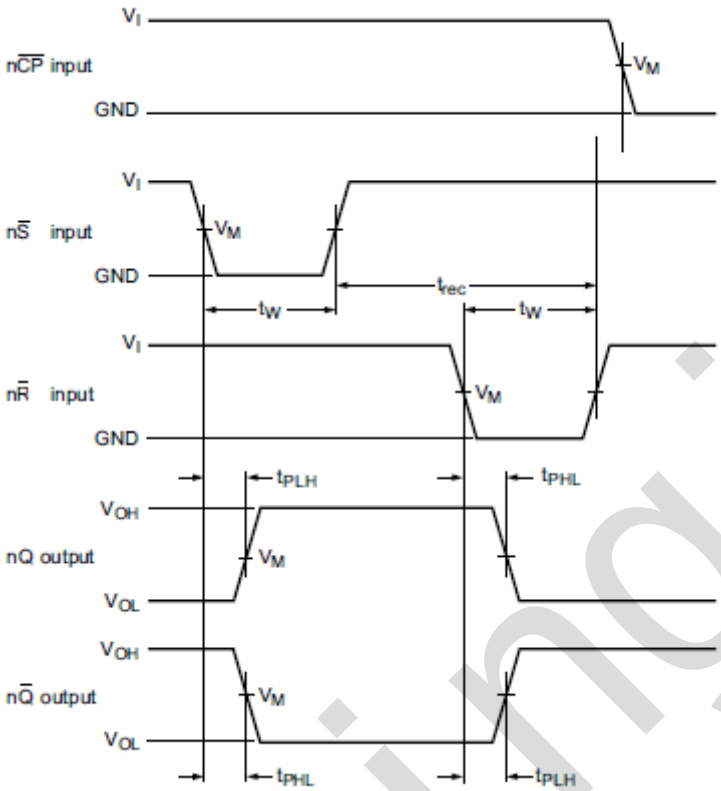


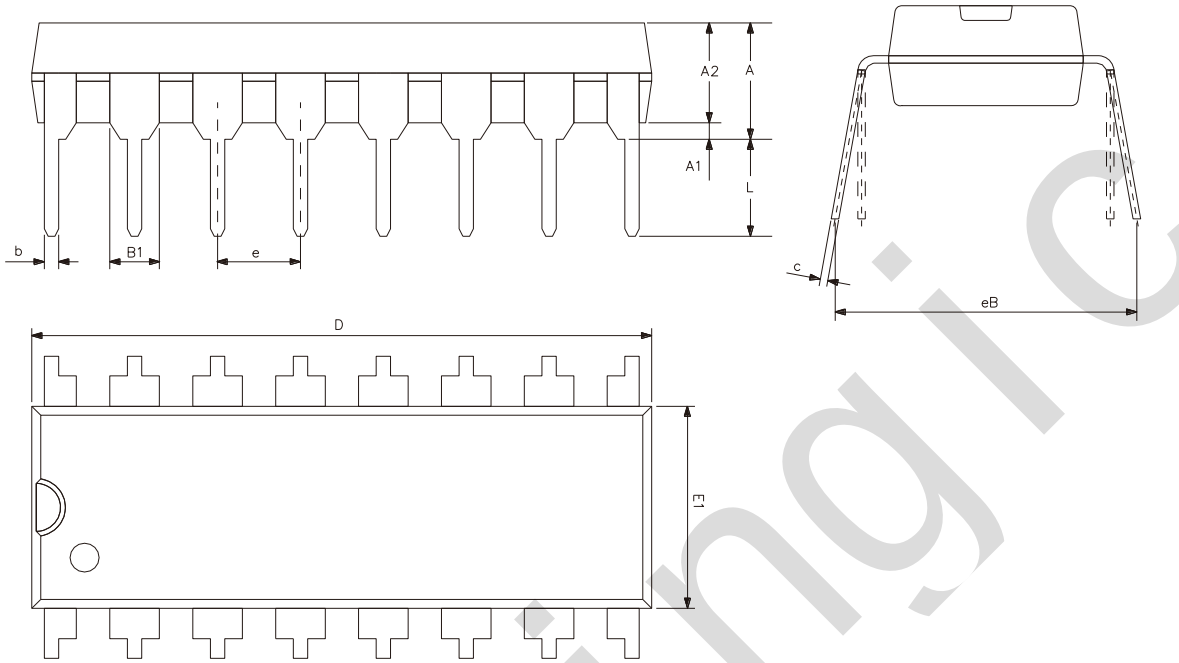
Figure 4 Set and reset propagation delays, pulse widths and recovery time

4.4、Measurement Points

Input	Output		
V_M	V_M	V_X	V_Y
$0.5\times V_{CC}$	$0.5\times V_{CC}$	$0.1\times V_{CC}$	$0.9\times V_{CC}$

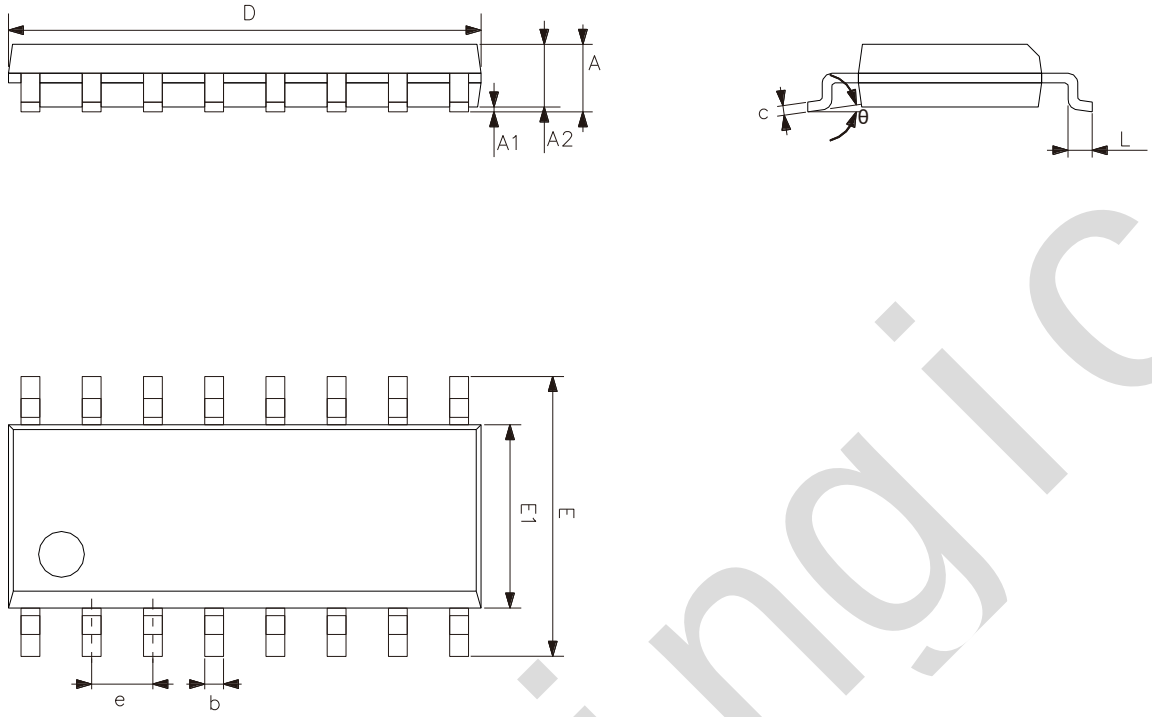
5、Package Information

5.1、DIP16



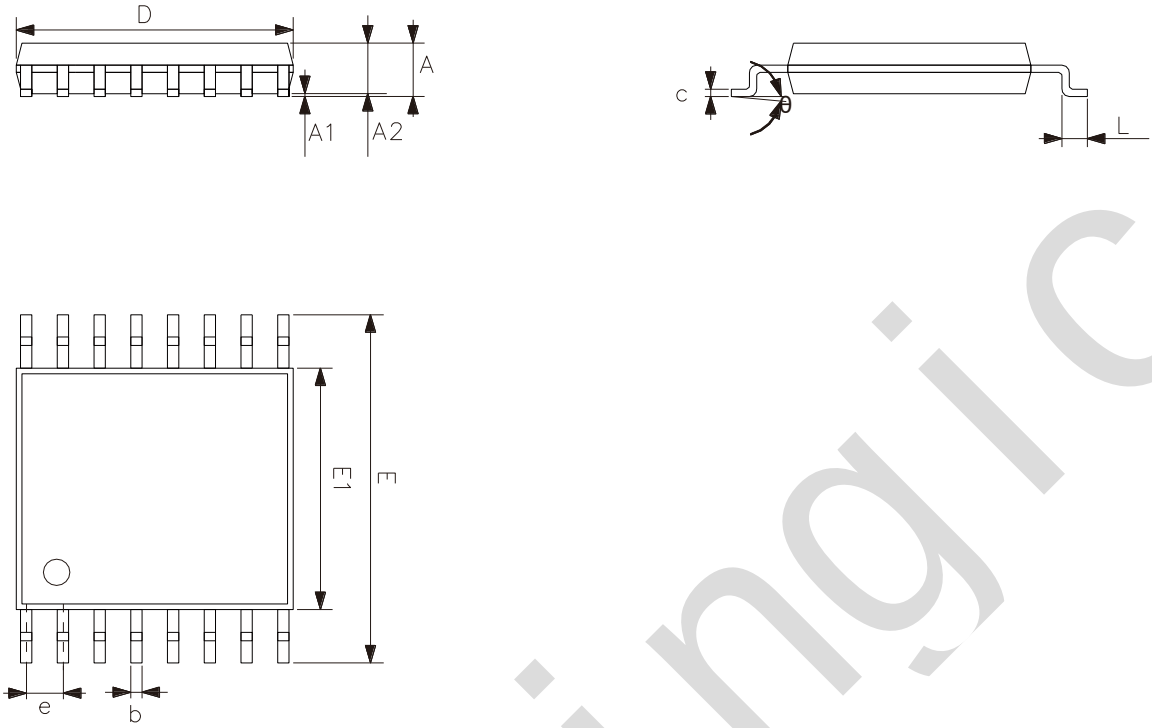
Symbol	Dimensions (mm)	
	Min.	Max.
A2	3.20	3.60
A1	0.51	-
A	3.60	5.33
L	3.00	3.60
b	0.36	0.56
B1	1.52	
D	18.80	19.94
E1	6.20	6.60
e	2.54	
c	0.20	0.36
eB	7.62	9.30

5.2、SOP16



Symbol	Dimensions (mm)	
	Min.	Max.
A	1.35	1.80
A1	0.10	0.25
A2	1.25	1.55
b	0.33	0.51
c	0.19	0.25
D	9.50	10.10
E	5.80	6.30
E1	3.70	4.10
e	1.27	
L	0.35	0.89
θ	0°	8°

5.3、TSSOP16



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
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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