SN74LS175 (LX)
Quad D-type flip-flop with reset; positive-edge trigger

Product Specification

Specification Revision History：

Version	Date	Description
2022-12-A1	2022-12	New

Contents

1、General Description

The SN74LS175 is a quad positive-edge triggered D-type flip-flop with individual data inputs (Dn) and complementary outputs (Qn and $\overline{Qn}$).

Features:

- Four edge-triggered D-type flip-flops
- Asynchronous master reset
- Specified from -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
SN74LS175N (LX)	DIP16	SN74LS175N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74LS175D (LX)	SOP16	LS175	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
SN74LS175PW(LX)	TSSOP16	LS175	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
SN74LS175DR (LX)	SOP16	LS175	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
SN74LS175PW (LX)	TSSOP16	LS175	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

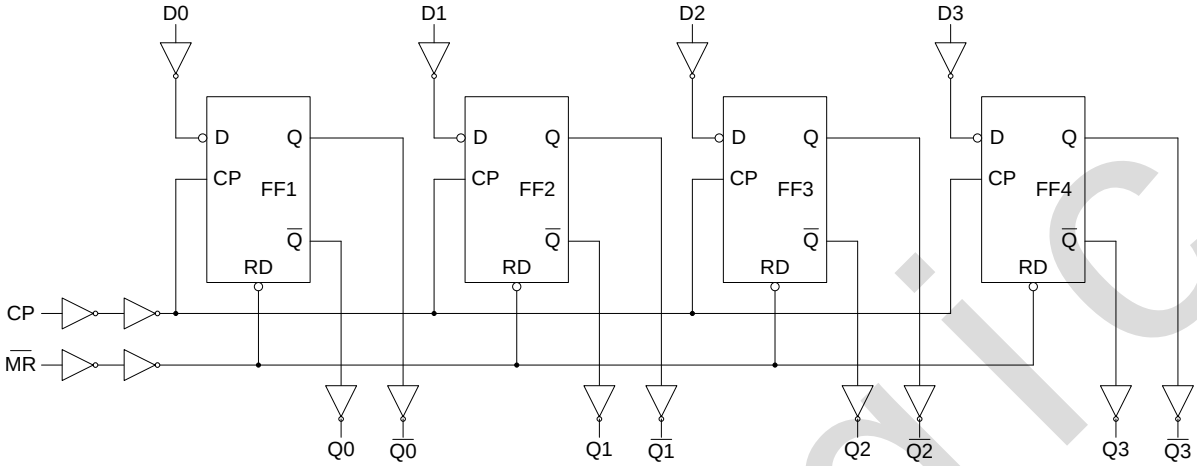
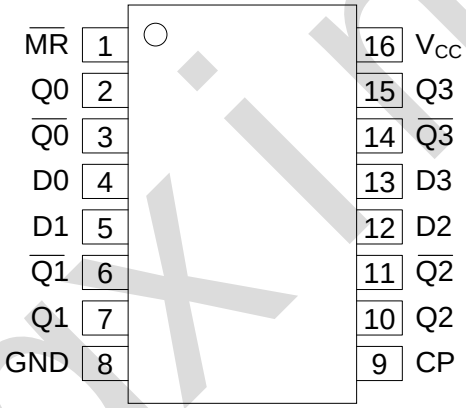


Figure 1. Logic diagram

2.2、Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1		asynchronous master reset input (active LOW)
2	Q0	flip-flop output
3	$\overline{Q0}$	complementary flip-flop output
4	D0	data input
5	D1	data input
6	$\overline{Q1}$	complementary flip-flop output
7	Q1	flip-flop output
8	GND	ground (0V)
9	CP	clock input (LOW-to-HIGH edge-triggered)
10	Q2	flip-flop output
11	$\overline{Q2}$	complementary flip-flop output
12	D2	data input
13	D3	data input
14	$\overline{Q3}$	complementary flip-flop output
15	Q3	flip-flop output
16	V_{CC}	positive supply voltage

2.4、Function table

Operating mode	Inputs			Outputs	
	$\overline{MR}$	CP	Dn	Qn	$\overline{Q}n$
reset (clear)	L	X	X	L	H
load “1”	H	↑	h	H	L
load “0”	H	↑	l	L	H

Note:

H=HIGH voltage level; L=LOW voltage level; X=don’t care;

↑=LOW-to-HIGH clock transition;

h=HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition;

l=LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition.

3、Electrical Parameter

3.1、Absolute Maximum Ratings

(T_{amb}=25℃, voltages are referenced to GND (ground=0V), unless otherwise specified)

Characteristic	Symbol	Conditions		Min.	Max.	Unit
supply voltage	V_{CC}	-		-0.5	+7.0	V
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	V_O=-0.5V to (V_{CC}+0.5V)		-	±25	mA
supply current	I_{CC}	-		-	+50	mA
ground current	I_{GND}	-		-50	-	mA
storage temperature	T_{stg}	-		-65	+150	℃
total power dissipation	P_{tot}	-		-	500	mW
soldering temperature	T_L	10s	DIP	245		℃
			SOP/TSSOP	260		℃

3.2、Recommended Operating Conditions

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
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	℃

3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

(T_{amb}=25℃, voltages are referenced to GND (ground=0V), unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH-level input voltage	V_{IH}	V_{CC}=2.0V		1.5	1.2	-	V
		V_{CC}=4.5V		3.15	2.4	-	V
		V_{CC}=6.0V		4.2	3.2	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V		-	0.8	0.5	V
		V_{CC}=4.5V		-	2.1	1.35	V
		V_{CC}=6.0V		-	2.8	1.8	V
HIGH-level output voltage	V_{OH}	V_I=V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	2.0	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	4.5	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	6.0	-	V
			I_O=-4mA; V_{CC}=4.5V	3.98	4.32	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.48	5.81	-	V
LOW-level output voltage	V_{OL}	V_I=V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	0	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	0	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	0	0.1	V
			I_O=4mA; V_{CC}=4.5V	-	0.15	0.26	V
			I_O=5.2mA; V_{CC}=6.0V	-	0.16	0.26	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±1	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V		-	-	1	uA

3.3.2、DC Characteristics 2

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH-level input voltage	V_{IH}	V_{CC}=2.0V		1.5	-	-	V
		V_{CC}=4.5V		3.15	-	-	V
		V_{CC}=6.0V		4.2	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V		-	-	0.5	V
		V_{CC}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	1.8	V
HIGH-level output voltage	V_{OH}	V_I=V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	-	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	-	-	V
			I_O=-4mA; V_{CC}=4.5V	3.84	-	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.34	-	-	V
LOW-level output voltage	V_{OL}	V_I=V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	-	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	-	0.1	V
			I_O=4mA; V_{CC}=4.5V	-	-	0.33	V
			I_O=5.2mA; V_{CC}=6.0V	-	-	0.33	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±2	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V		-	-	2	uA

3.3.3、DC Characteristics 3

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH-level input voltage	V_{IH}	V_{CC}=2.0V		1.5	-	-	V
		V_{CC}=4.5V		3.15	-	-	V
		V_{CC}=6.0V		4.2	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V		-	-	0.5	V
		V_{CC}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	1.8	V
HIGH-level output voltage	V_{OH}	V_I=V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	-	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	-	-	V
			I_O=-4mA; V_{CC}=4.5V	3.7	-	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.2	-	-	V
LOW-level output voltage	V_{OL}	V_I=V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	-	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	-	0.1	V
			I_O=4mA; V_{CC}=4.5V	-	-	0.4	V
			I_O=5.2mA; V_{CC}=6.0V	-	-	0.4	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±4	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V		-	-	4	uA

3.3.4、AC Characteristics 1

(T_{amb}=25℃, GND=0V, C_L=50pF, unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{PLH}/t_{PHL}	CP to Qn, ; see Figure 4	V_{CC}=2.0V	-	55	175	ns
			V_{CC}=4.5V	-	50	35	ns
			V_{CC}=5.0V C_L=15pF	-	17	-	ns
			V_{CC}=6.0V	-	16	30	ns
HIGH to LOW propagation delay	t_{PHL}	to Qn, ; see Figure 6	V_{CC}=2.0V	-	50	150	ns
			V_{CC}=4.5V	-	18	30	ns
			V_{CC}=5.0V C_L=15pF	-	15	-	ns
			V_{CC}=6.0V	-	14	26	ns
transition time	t_t	Qn output; see Figure 4	V_{CC}=2.0V	-	19	75	ns
			V_{CC}=4.5V	-	7	15	ns
			V_{CC}=6.0V	-	6	13	ns
pulse width	t_W	CP input HIGH or LOW; see Figure 4	V_{CC}=2.0V	80	22	-	ns
			V_{CC}=4.5V	16	8	-	ns
			V_{CC}=6.0V	14	6	-	ns
		input LOW; see Figure 6	V_{CC}=2.0V	80	19	-	ns
			V_{CC}=4.5V	16	7	-	ns
			V_{CC}=6.0V	14	6	-	ns
recovery time	t_{rec}	$\overline{MR}$ to CP; see Figure 6	V_{CC}=2.0V	5	-33	-	ns
			V_{CC}=4.5V	5	-12	-	ns
			V_{CC}=6.0V	5	-10	-	ns
set-up time	t_{su}	Dn to CP; see Figure 4	V_{CC}=2.0V	80	3	-	ns
			V_{CC}=4.5V	16	1	-	ns
			V_{CC}=6.0V	14	1	-	ns
hold time	t_h	Dn to CP; see Figure 4	V_{CC}=2.0V	25	2	-	ns
			V_{CC}=4.5V	5	0	-	ns
			V_{CC}=6.0V	4	0	-	ns
maximum frequency	f_{max}	CP input; see Figure 4	V_{CC}=2.0V	6	25	-	ns
			V_{CC}=4.5V	30	75	-	ns
			V_{CC}=5.0V C_L=15pF	-	83	-	ns
			V_{CC}=6.0V	35	89	-	ns

3.3.5、AC Characteristics 2

(T_{amb}=-40℃ to +85℃, GND=0V, C_L=50pF, unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{PLH}/t_{PHL}	CP to Qn, ; see Figure 4	V_{CC}=2.0V	-	-	220	ns
			V_{CC}=4.5V	-	-	44	ns
			V_{CC}=6.0V	-	-	37	ns
HIGH to LOW propagation delay	t_{PHL}	$\overline{MR}$ to Qn, Qn; see Figure 6	V_{CC}=2.0V	-	-	190	ns
			V_{CC}=4.5V	-	-	38	ns
			V_{CC}=6.0V	-	-	33	ns
transition time	t_t	Qn output; see Figure 4	V_{CC}=2.0V	-	-	95	ns
			V_{CC}=4.5V	-	-	19	ns
			V_{CC}=6.0V	-	-	16	ns
pulse width	t_W	CP input HIGH or LOW; see Figure 4	V_{CC}=2.0V	100	-	-	ns
			V_{CC}=4.5V	20	-	-	ns
			V_{CC}=6.0V	17	-	-	ns
		$\overline{MR}$ input LOW; see Figure 6	V_{CC}=2.0V	100	-	-	ns
			V_{CC}=4.5V	20	-	-	ns
			V_{CC}=6.0V	17	-	-	ns
recovery time	t_{rec}	$\overline{MR}$ to CP; see Figure 6	V_{CC}=2.0V	5	-	-	ns
			V_{CC}=4.5V	5	-	-	ns
			V_{CC}=6.0V	5	-	-	ns
set-up time	t_{su}	Dn to CP; see Figure 4	V_{CC}=2.0V	100	-	-	ns
			V_{CC}=4.5V	20	-	-	ns
			V_{CC}=6.0V	17	-	-	ns
hold time	t_h	Dn to CP; see Figure 4	V_{CC}=2.0V	30	-	-	ns
			V_{CC}=4.5V	6	-	-	ns
			V_{CC}=6.0V	5	-	-	ns
maximum frequency	f_{max}	CP input; see Figure 4	V_{CC}=2.0V	4.8	-	-	ns
			V_{CC}=4.5V	24	-	-	ns
			V_{CC}=6.0V	28	-	-	ns

3.3.6、AC Characteristics 3

(T_{amb}=-40℃ to +125℃, GND=0V, C_L=50pF, unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{PLH}/t_{PHL}	CP to Qn, $\overline{Qn}$; see Figure 4	V_{CC}=2.0V	-	-	265	ns
			V_{CC}=4.5V	-	-	53	ns
			V_{CC}=6.0V	-	-	45	ns
HIGH to LOW propagation delay	t_{PHL}	$\overline{MR}$ to Qn, $\overline{Qn}$; see Figure 6	V_{CC}=2.0V	-	-	225	ns
			V_{CC}=4.5V	-	-	45	ns
			V_{CC}=6.0V	-	-	38	ns
transition time	t_t	Qn output; see Figure 4	V_{CC}=2.0V	-	-	110	ns
			V_{CC}=4.5V	-	-	22	ns
			V_{CC}=6.0V	-	-	19	ns
pulse width	t_W	CP input HIGH or LOW; see Figure 4	V_{CC}=2.0V	120	-	-	ns
			V_{CC}=4.5V	24	-	-	ns
			V_{CC}=6.0V	20	-	-	ns
		$\overline{MR}$ input LOW; see Figure 6	V_{CC}=2.0V	120	-	-	ns
			V_{CC}=4.5V	24	-	-	ns
			V_{CC}=6.0V	20	-	-	ns
recovery time	t_{rec}	$\overline{MR}$ to CP; see Figure 6	V_{CC}=2.0V	5	-	-	ns
			V_{CC}=4.5V	5	-	-	ns
			V_{CC}=6.0V	5	-	-	ns
set-up time	t_{su}	Dn to CP; see Figure 4	V_{CC}=2.0V	120	-	-	ns
			V_{CC}=4.5V	24	-	-	ns
			V_{CC}=6.0V	20	-	-	ns
hold time	t_h	Dn to CP; see Figure 4	V_{CC}=2.0V	40	-	-	ns
			V_{CC}=4.5V	8	-	-	ns
			V_{CC}=6.0V	7	-	-	ns
maximum frequency	f_{max}	CP input; see Figure 4	V_{CC}=2.0V	4	-	-	ns
			V_{CC}=4.5V	20	-	-	ns
			V_{CC}=6.0V	24	-	-	ns

4、Testing Circuit

4.1、AC Testing Circuit

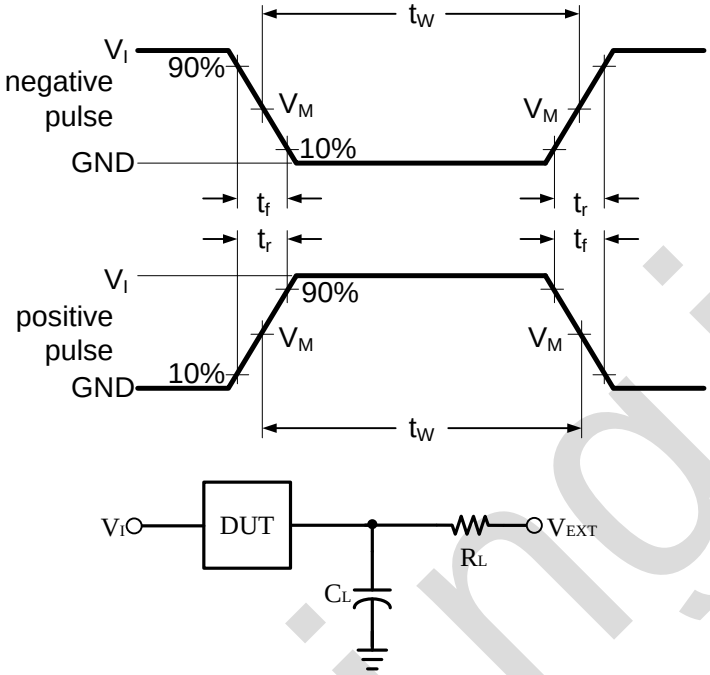


Figure 3. Test circuit for measuring switching times

Definitions for test circuit:

C_L includes probe and jig capacitance.

4.2、AC Testing Waveforms

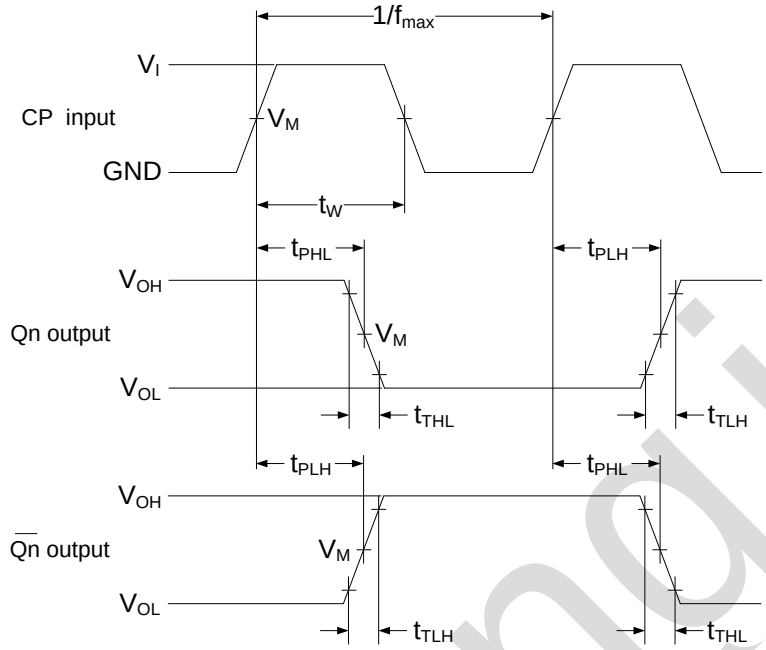


Figure 4. Input to output propagation delay, output transition time, clock input pulse width and maximum frequency

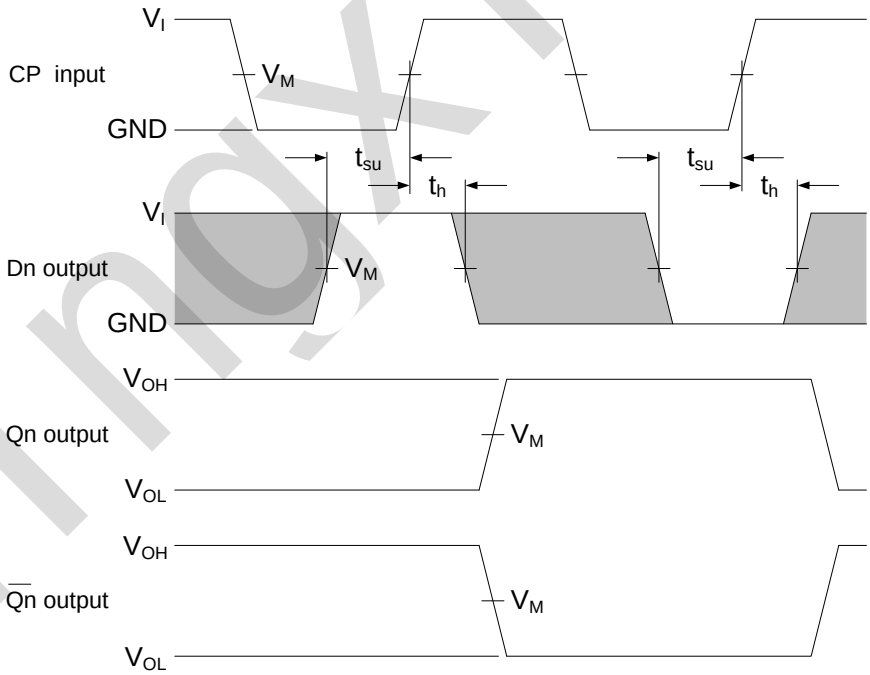


Figure 5. Data set-up and hold times for data input

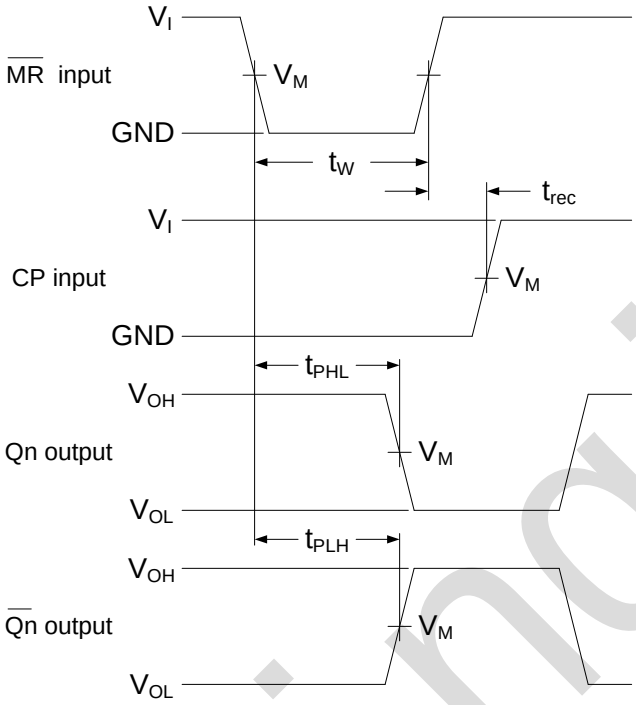


Figure 6. Master reset to output propagation delays, master reset pulse width and master reset to clock recovery time

4.3、Measurement Points

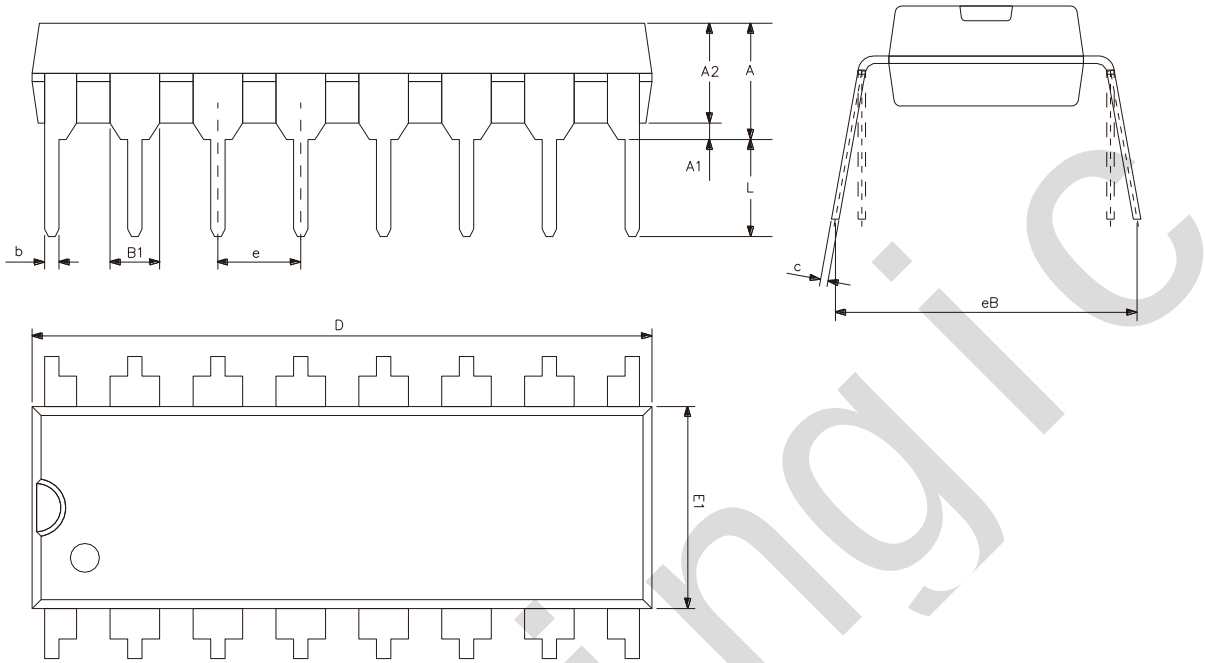
Input		Output
V_I	**V_M**	**V_M**
V_{CC}	$0.5\times V_{CC}$	$0.5\times V_{CC}$

4.4、Test Data

Input		Load		Test
V_I	**t_r , t_f**	**C_L**	**R_L**	
V_{CC}	3.0ns	15pF, 50pF	1kΩ	t_{PLH}, t_{PHL}

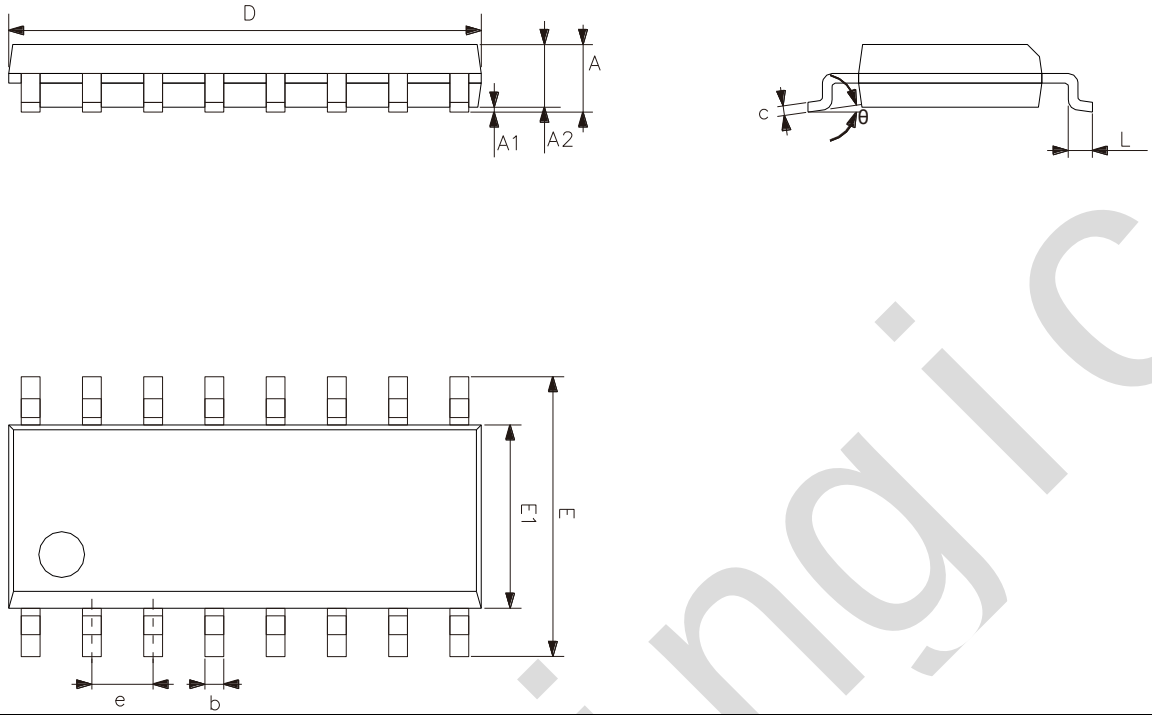
5、Package Information

5.1、DIP16



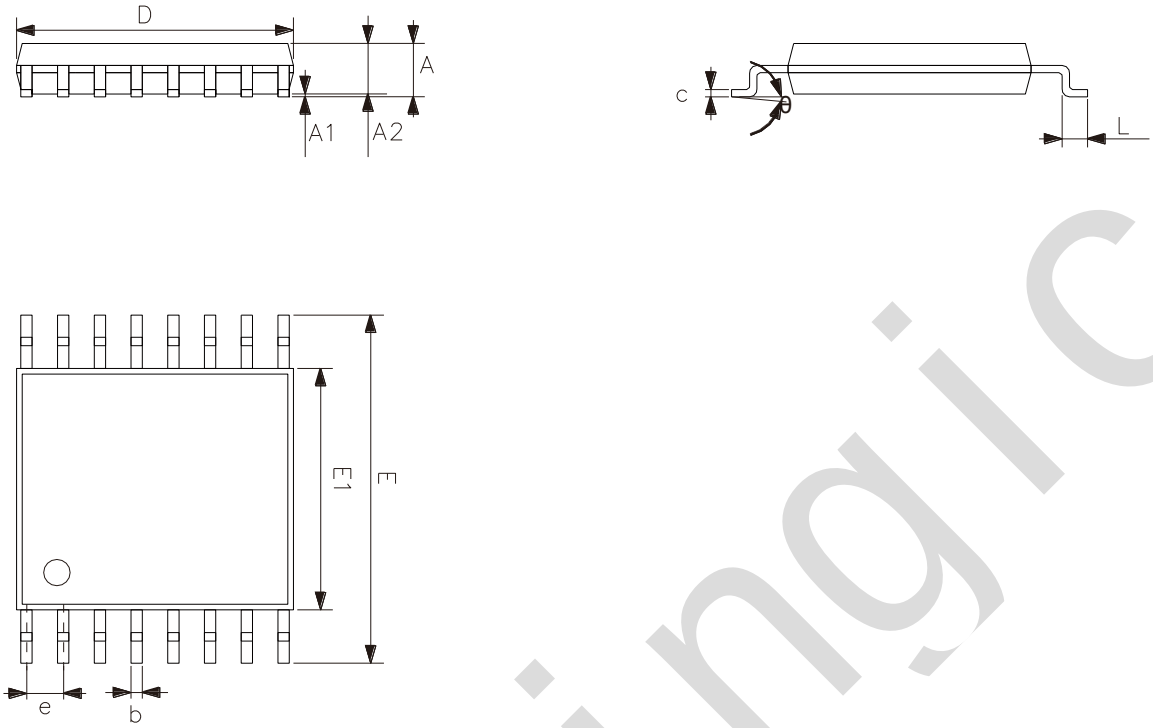
Symbol	Dimensions (mm)	
	Min.	Max.
A2	3.20	3.60
A1	0.51	-
A	3.60	5.33
L	3.00	3.60
b	0.36	0.56
B1	1.52	
D	18.80	19.94
E1	6.20	6.60
e	2.54	
c	0.20	0.36
eB	7.62	9.30

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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