



# 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



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## 1、 General Description

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

### Features:

- Four edge-triggered D-type flip-flops
- Asynchronous master reset
- Specified from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- 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



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**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

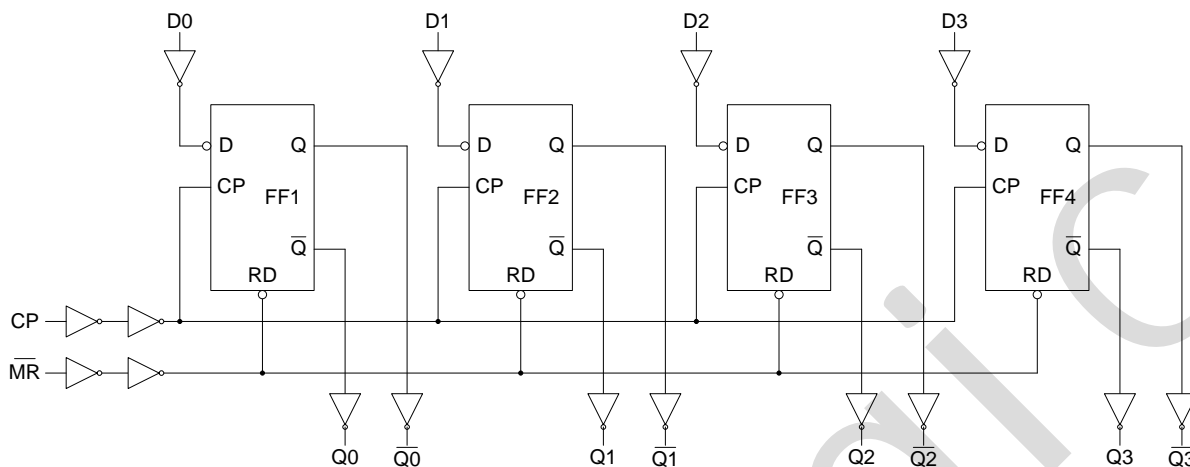
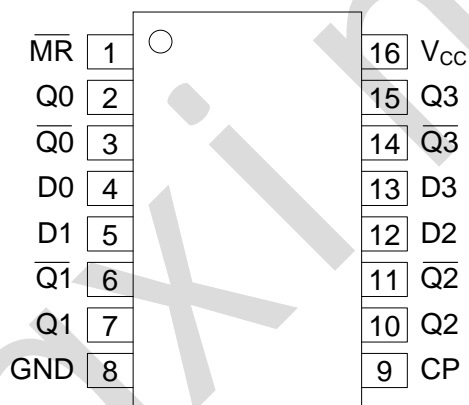


Figure 1. Logic diagram

### 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 <sub>cc</sub>	positive supply voltage

### 2.4、Function table

Operating mode	Inputs			Outputs	
	$\overline{MR}$	CP	D <sub>n</sub>	Q <sub>n</sub>	$\overline{Q_n}$
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

( $T_{amb}=25^{\circ}\text{C}$ , 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	$I_{IK}$	$V_I < -0.5\text{V}$ or $V_I > V_{CC} + 0.5\text{V}$	-	+20	mA
output clamping current	$I_{OK}$	$V_O < -0.5\text{V}$ or $V_O > V_{CC} + 0.5\text{V}$	-	$\pm 20$	mA
output current	$I_O$	$V_O = -0.5\text{V}$ to $(V_{CC} + 0.5\text{V})$	-	$\pm 25$	mA
supply current	$I_{CC}$	-	-	+50	mA
ground current	$I_{GND}$	-	-50	-	mA
storage temperature	$T_{stg}$	-	-65	+150	$^{\circ}\text{C}$
total power dissipation	$P_{tot}$	-	-	500	mW
soldering temperature	$T_L$	10s	DIP	245	$^{\circ}\text{C}$
			SOP/TSSOP	260	$^{\circ}\text{C}$

#### 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	$^{\circ}\text{C}$



### 3.3、Electrical Characteristics

#### 3.3.1、DC Characteristics 1

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

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



### 3.3.2、DC Characteristics 2

( $T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , voltages are referenced to GND (ground=0V), unless otherwise specified)

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



### 3.3.3、DC Characteristics 3

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

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



### 3.3.4、AC Characteristics 1

( $T_{amb}=25^{\circ}C$ ,  $GND=0V$ ,  $C_L=50pF$ , 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

( $T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $GND = 0\text{V}$ ,  $C_L = 50\text{pF}$ , unless otherwise specified)

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



### 3.3.6、AC Characteristics 3

( $T_{amb} = -40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $GND = 0\text{V}$ ,  $C_L = 50\text{pF}$ , unless otherwise specified)

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

## 4、Testing Circuit

### 4.1、AC Testing Circuit

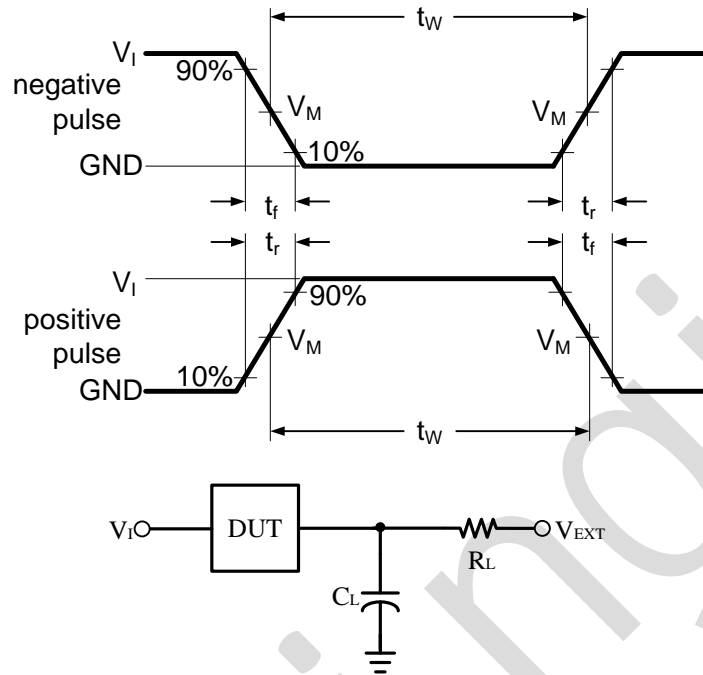


Figure 3. Test circuit for measuring switching times

Definitions for test circuit:

$C_L$  includes probe and jig capacitance.



### 4.2、AC Testing Waveforms

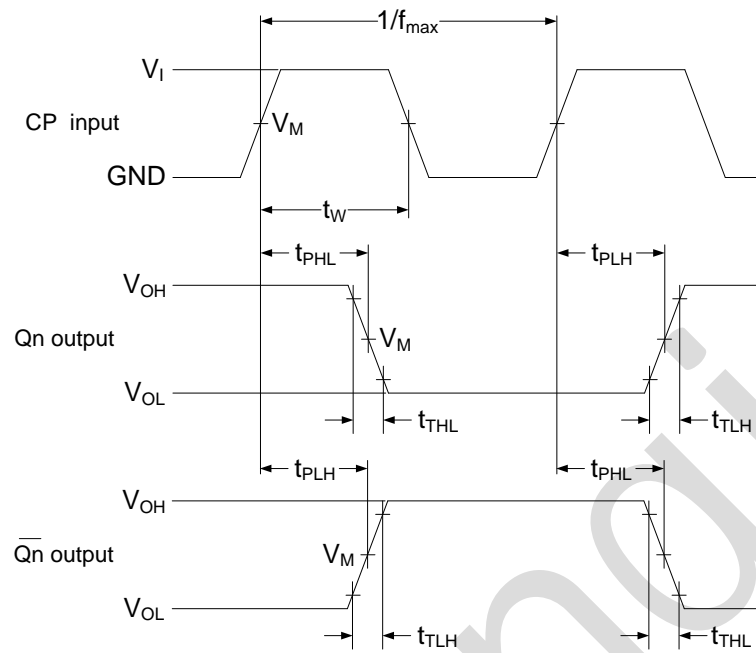


Figure 4. Input to output propagation delay, output transition time, clock input pulse width and maximum frequency

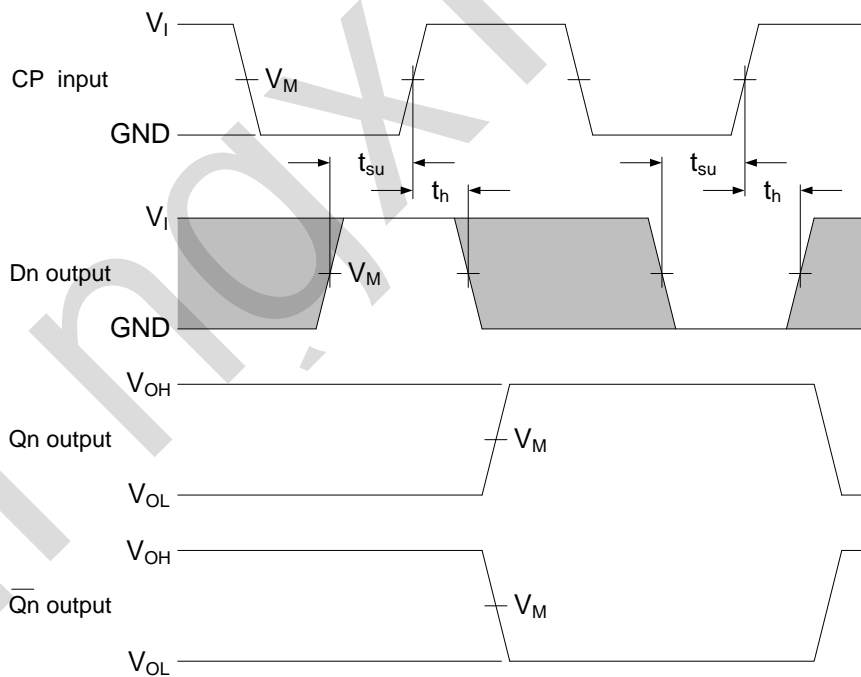


Figure 5. Data set-up and hold times for data input

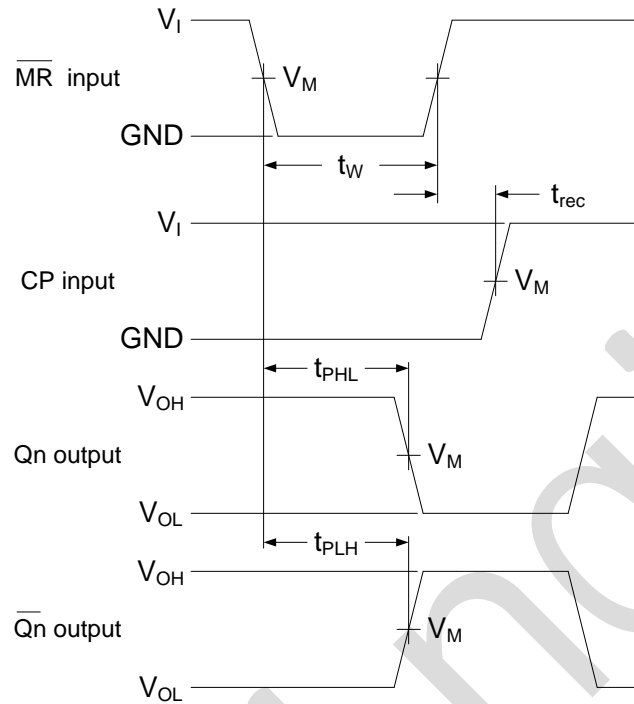


Figure 6. Master reset to output propagation delays, master reset pulse width and master reset to clock recovery time

#### 4.3. Measurement Points

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

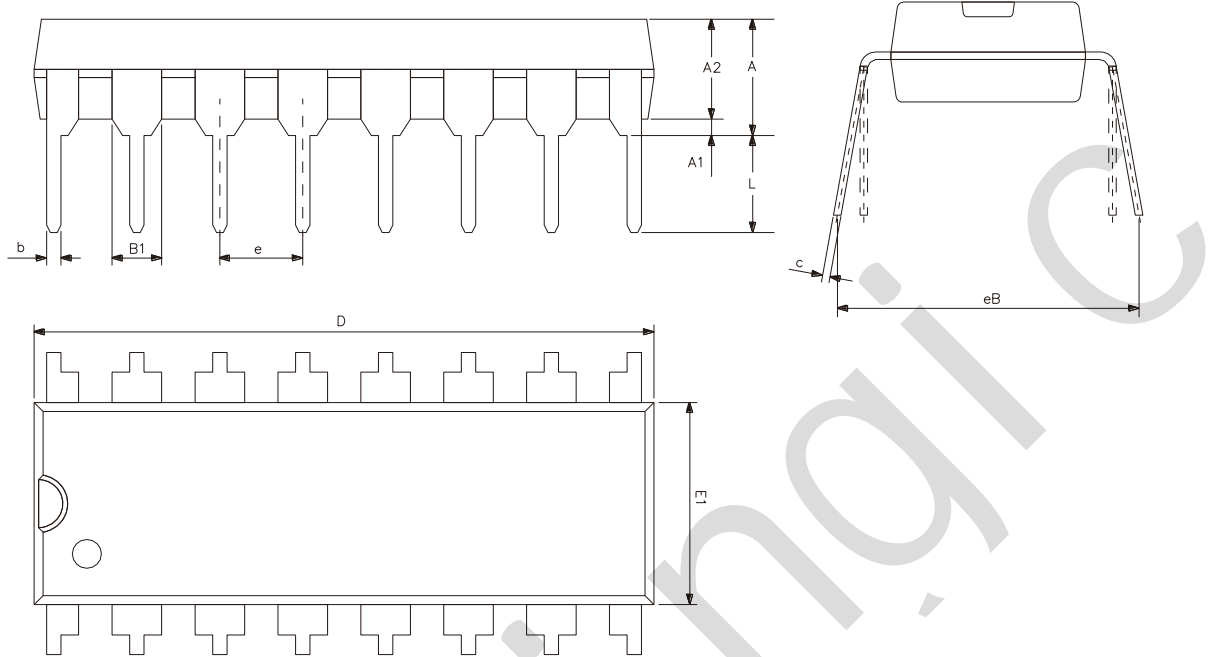
#### 4.4. Test Data

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

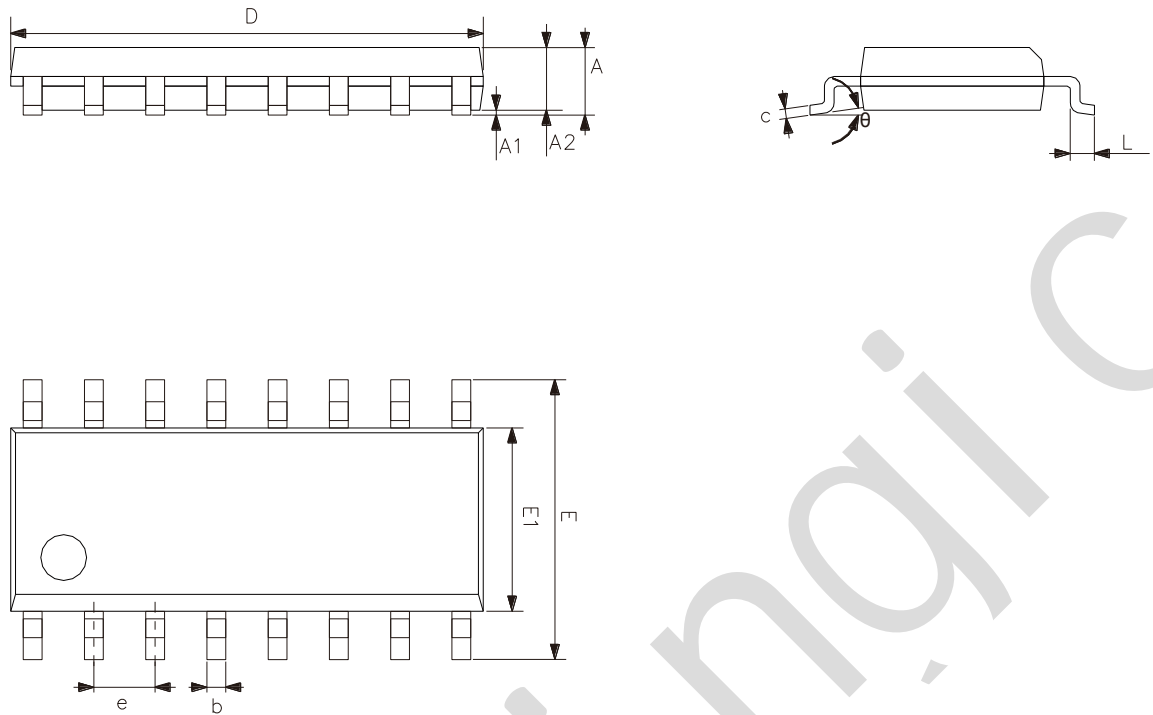
### 5.1、DIP16



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



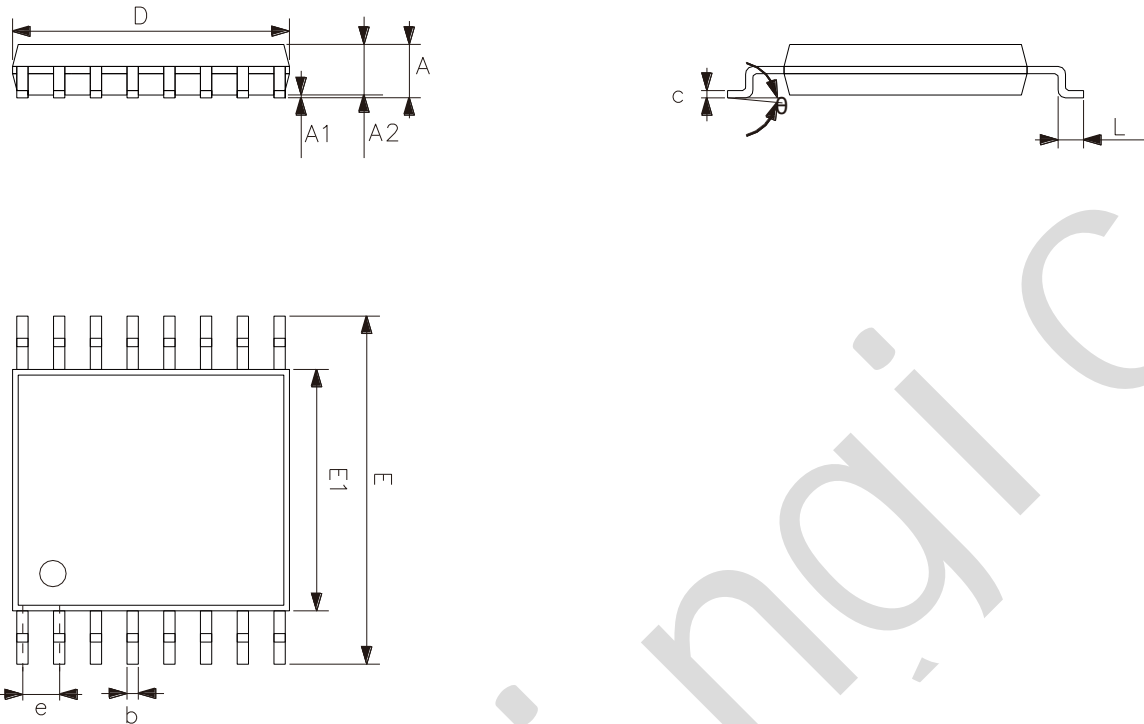
### 5.2、SOP16



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
$\theta$	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
$\theta$	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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