



# SN74LS166 (LX)

## 8-bit parallel-in/serial out shift register

### Product Specification

#### Specification Revision History:

Version	Date	Description
2023-10-A0	2023-10	New
2023-11-A1	2023-11	Parameter modification



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## 1、General Description

The SN74LS166 is an 8-bit serial or parallel-in/serial-out shift register.

### Features:

- Temperature range: -40°C to +125°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
SN74LS166AN(LX)	DIP16	SN74LS166AN	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74LS166AD(LX)	SOP16	LS166A	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
SN74LS166PW(LX)	TSSOP16	LS166	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
SN74LS166ADR(LX)	SOP16	LS166A	2500 PCS/reel	5000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
SN74LS166PW(LX)	TSSOP16	LS166	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

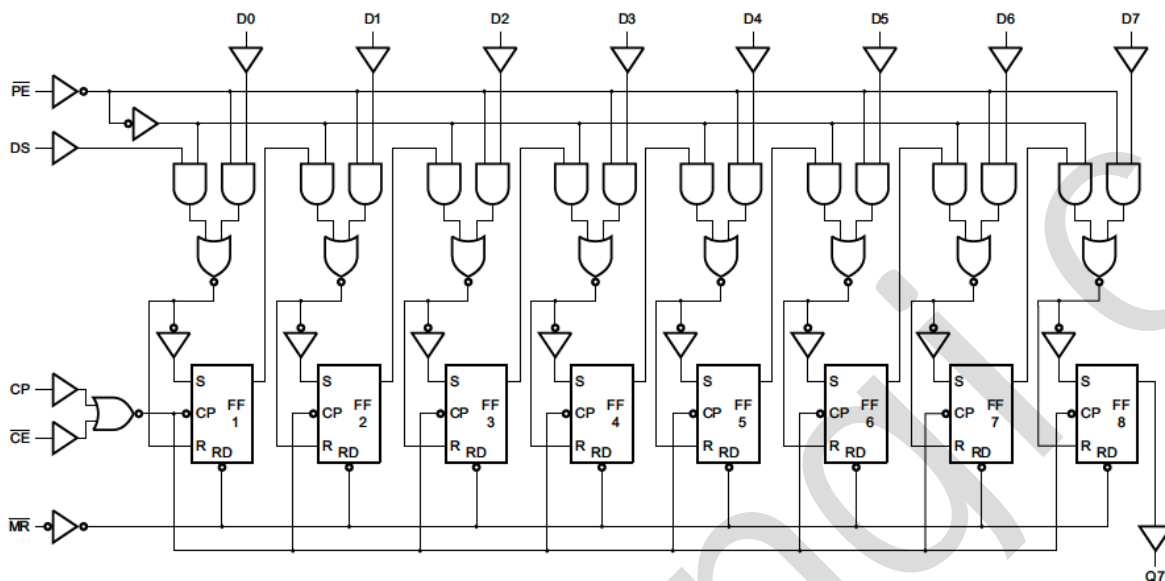
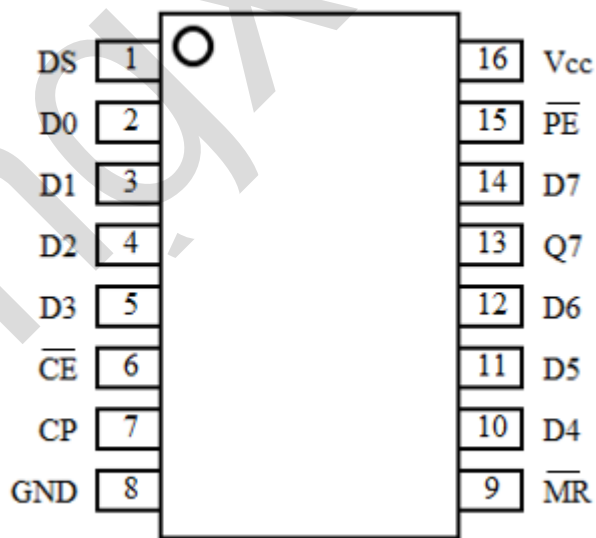


Figure 1. Logic symbol

### 2.2、Pin Configurations





### 2.3、Pin Description

Pin No.	Pin Name	Description
1	DS	serial data input
2	D0	parallel data input
3	D1	parallel data input
4	D2	parallel data input
5	D3	parallel data input
6	$\overline{\text{CE}}$	clock enable input (active LOW)
7	CP	clock input (LOW-to-HIGH edge-triggered)
8	GND	ground (0V)
9	$\overline{\text{MR}}$	asynchronous master reset (active LOW)
10	D4	parallel data input
11	D5	parallel data input
12	D6	parallel data input
13	Q7	serial output from the last stage
14	D7	parallel data input
15	$\overline{\text{PE}}$	parallel enable input (active LOW)
16	V <sub>CC</sub>	supply voltage

### 2.4、Function Table

Operating modes	Inputs					Qn registers		Output
	$\overline{\text{PE}}$	$\overline{\text{CE}}$	CP	DS	D0 to D7	Q0	Q1 to Q6	Q7
parallel load	l	l	↑	X	l	L	L to L	L
	l	l	↑	X	h	H	H to H	H
serial shift	h	l	↑	l	X	L	q0 to q5	q6
	h	l	↑	h	X	H	q0 to q5	q6
hold “do nothing”	X	H	X	X	X	q0	q1 to q6	q7

Note:

H = HIGH voltage level;

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

L = LOW voltage level;

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

q = state of the referenced output one set-up time prior to the LOW-to-HIGH clock transition;

X = don't care;

↑ = LOW-to-HIGH clock transition.



### 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	245	$^{\circ}C$
			SOP/TSSOP	260	

#### 3.2、Recommended Operating Conditions

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	$^{\circ}C$





### 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
HIGH-level input voltage	V <sub>IH</sub>	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 <sub>IL</sub>	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 <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	uA
supply current	I <sub>CC</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	80	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
HIGH-level input voltage	V <sub>IH</sub>	2.0V	-	1.5	-	-	V
		4.5V	-	3.15	-	-	V
		6.0V	-	4.2	-	-	V
LOW-level input voltage	V <sub>IL</sub>	2.0V	-	-	-	0.5	V
		4.5V	-	-	-	1.35	V
		6.0V	-	-	-	1.8	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	uA
supply current	I <sub>CC</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	160	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	
CP to Q7 propagation delay	$t_{PLH}, t_{PHL}$	2.0V	$C_L=50\text{pF}$	see Figure 4	-	50	190	ns
		4.5V	$C_L=50\text{pF}$		-	18	38	ns
		5.0V	$C_L=15\text{pF}$		-	15	-	ns
		6.0V	$C_L=50\text{pF}$		-	14	33	ns
$\overline{\text{MR}}$ to Q7 propagation delay	$t_{PLH}, t_{PHL}$	2.0V	$C_L=50\text{pF}$	see Figure 5	-	47	200	ns
		4.5V	$C_L=50\text{pF}$		-	17	40	ns
		5.0V	$C_L=15\text{pF}$		-	14	-	ns
		6.0V	$C_L=50\text{pF}$		-	14	34	ns
transition time	$t_{THL}, t_{TLH}$	2.0V	$C_L=50\text{pF}$	see Figure 4	-	19	95	ns
		4.5V	$C_L=50\text{pF}$		-	7	19	ns
		6.0V	$C_L=50\text{pF}$		-	6	16	ns
CP input HIGH or LOW pulse width	$t_w$	2.0V	$C_L=50\text{pF}$	see Figure 4	100	17	-	ns
		4.5V	$C_L=50\text{pF}$		20	6	-	ns
		6.0V	$C_L=50\text{pF}$		17	5	-	ns
$\overline{\text{MR}}$ input LOW pulse width	$t_w$	2.0V	$C_L=50\text{pF}$	see Figure 5	125	25	-	ns
		4.5V	$C_L=50\text{pF}$		25	9	-	ns
		6.0V	$C_L=50\text{pF}$		21	7	-	ns
$\overline{\text{MR}}$ to CP recovery time	$t_{rec}$	2.0V	$C_L=50\text{pF}$	see Figure 5	0	-19	-	ns
		4.5V	$C_L=50\text{pF}$		0	-7	-	ns
		6.0V	$C_L=50\text{pF}$		0	-6	-	ns
Dn, $\overline{\text{CE}}$ to CP set_up time	$t_{su}$	2.0V	$C_L=50\text{pF}$	see Figure 6	100	14	-	ns
		4.5V	$C_L=50\text{pF}$		20	5	-	ns
		6.0V	$C_L=50\text{pF}$		17	4	-	ns
$\overline{\text{PE}}$ to CP set_up time	$t_{su}$	2.0V	$C_L=50\text{pF}$	see Figure 6	125	33	-	ns
		4.5V	$C_L=50\text{pF}$		25	12	-	ns
		6.0V	$C_L=50\text{pF}$		21	10	-	ns
Dn, $\overline{\text{CE}}$ to CP hold time	$t_h$	2.0V	$C_L=50\text{pF}$	see Figure 6	2	-8	-	ns
		4.5V	$C_L=50\text{pF}$		2	-3	-	ns
		6.0V	$C_L=50\text{pF}$		2	-2	-	ns
$\overline{\text{PE}}$ to CP hold time	$t_h$	2.0V	$C_L=50\text{pF}$	see Figure 6	0	-28	-	ns
		4.5V	$C_L=50\text{pF}$		0	-10	-	ns
		6.0V	$C_L=50\text{pF}$		0	-8	-	ns
maximum frequency	$f_{max}$	2.0V	$C_L=50\text{pF}$	see Figure 4	4.8	19	-	MHZ
		4.5V	$C_L=50\text{pF}$		24	57	-	MHZ
		5.0V	$C_L=15\text{pF}$		-	63	-	MHZ
		6.0V	$C_L=50\text{pF}$		28	68	-	MHZ



### 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			
CP to Q7 propagation delay	t <sub>PLH</sub> , t <sub>PHL</sub>	2.0V	C <sub>L</sub> =50pF	see Figure 4	-	-	225	ns		
		4.5V	C <sub>L</sub> =50pF		-	-	45	ns		
		6.0V	C <sub>L</sub> =50pF		-	-	38	ns		
MR to Q7 propagation delay		t <sub>PLH</sub> , t <sub>PHL</sub>	2.0V	C <sub>L</sub> =50pF	see Figure 5	-	-	240	ns	
			4.5V	C <sub>L</sub> =50pF		-	-	48	ns	
			6.0V	C <sub>L</sub> =50pF		-	-	41	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	
CP input HIGH or LOW pulse width		t <sub>w</sub>	2.0V	C <sub>L</sub> =50pF	see Figure 4	120	-	-	ns	
			4.5V	C <sub>L</sub> =50pF		24	-	-	ns	
			6.0V	C <sub>L</sub> =50pF		20	-	-	ns	
MR input LOW pulse width	t <sub>w</sub>		2.0V	C <sub>L</sub> =50pF	see Figure 5	150	-	-	ns	
			4.5V	C <sub>L</sub> =50pF		30	-	-	ns	
			6.0V	C <sub>L</sub> =50pF		26	-	-	ns	
MR to CP recovery time		t <sub>rec</sub>	2.0V	C <sub>L</sub> =50pF	see Figure 5	0	-	-	ns	
			4.5V	C <sub>L</sub> =50pF		0	-	-	ns	
			6.0V	C <sub>L</sub> =50pF		0	-	-	ns	
Dn, CE to CP set_up time	t <sub>su</sub>		2.0V	C <sub>L</sub> =50pF	see Figure 6	120	-	-	ns	
			4.5V	C <sub>L</sub> =50pF		24	-	-	ns	
			6.0V	C <sub>L</sub> =50pF		20	-	-	ns	
PE to CP set_up time		t <sub>su</sub>	2.0V	C <sub>L</sub> =50pF		see Figure 6	150	-	-	ns
			4.5V	C <sub>L</sub> =50pF			30	-	-	ns
			6.0V	C <sub>L</sub> =50pF			26	-	-	ns
Dn, CE to CP hold time	t <sub>h</sub>		2.0V	C <sub>L</sub> =50pF	see Figure 6		2	-	-	ns
			4.5V	C <sub>L</sub> =50pF			2	-	-	ns
			6.0V	C <sub>L</sub> =50pF			2	-	-	ns
PE to CP hold time		t <sub>h</sub>	2.0V	C <sub>L</sub> =50pF		see Figure 6	0	-	-	ns
			4.5V	C <sub>L</sub> =50pF			0	-	-	ns
			6.0V	C <sub>L</sub> =50pF			0	-	-	ns
maximum frequency	f <sub>max</sub>		2.0V	C <sub>L</sub> =50pF	see Figure 4		4	-	-	MHZ
			4.5V	C <sub>L</sub> =50pF			20	-	-	MHZ
			6.0V	C <sub>L</sub> =50pF			24	-	-	MHZ



## 4、Testing Circuit

### 4.1、AC Testing Circuit

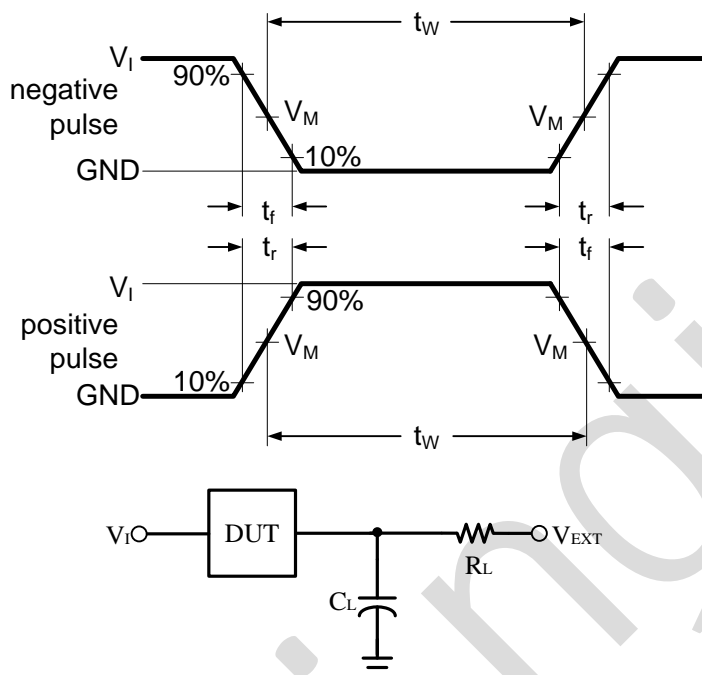


Figure 3. Test circuit for measuring switching times

$C_L$  includes probe and jig capacitance.

### 4.2、Test Data

Input		Load		$V_{EXT}$		
$V_I$	$t_r = t_f$	$C_L$	$R_L$	$t_{PLH}/t_{PHL}$	$t_{PLZ}/t_{PZL}$	$t_{PHZ}/t_{PZH}$
$V_{CC}$	3.0ns	15pF, 50pF	1K $\Omega$	Open	$V_{CC}$	GND

### 4.3、AC Testing Waveforms

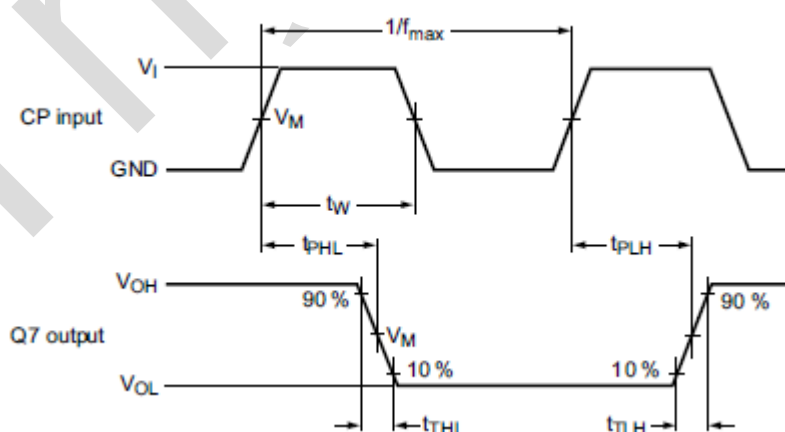


Figure 4. Clock (CP) to output (Q7) propagation delays, pulse width, output transition times and maximum frequency

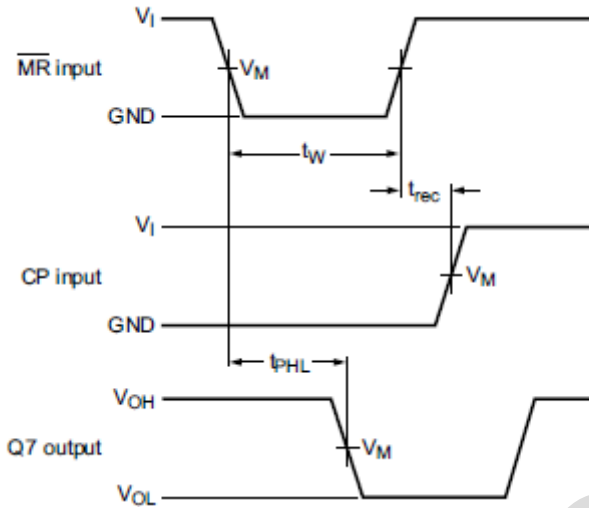


Figure 5. Master reset ( $\overline{MR}$ ) pulse width,  $\overline{MR}$  to output (Q7) propagation delay and  $\overline{MR}$  to clock (CP) recovery time

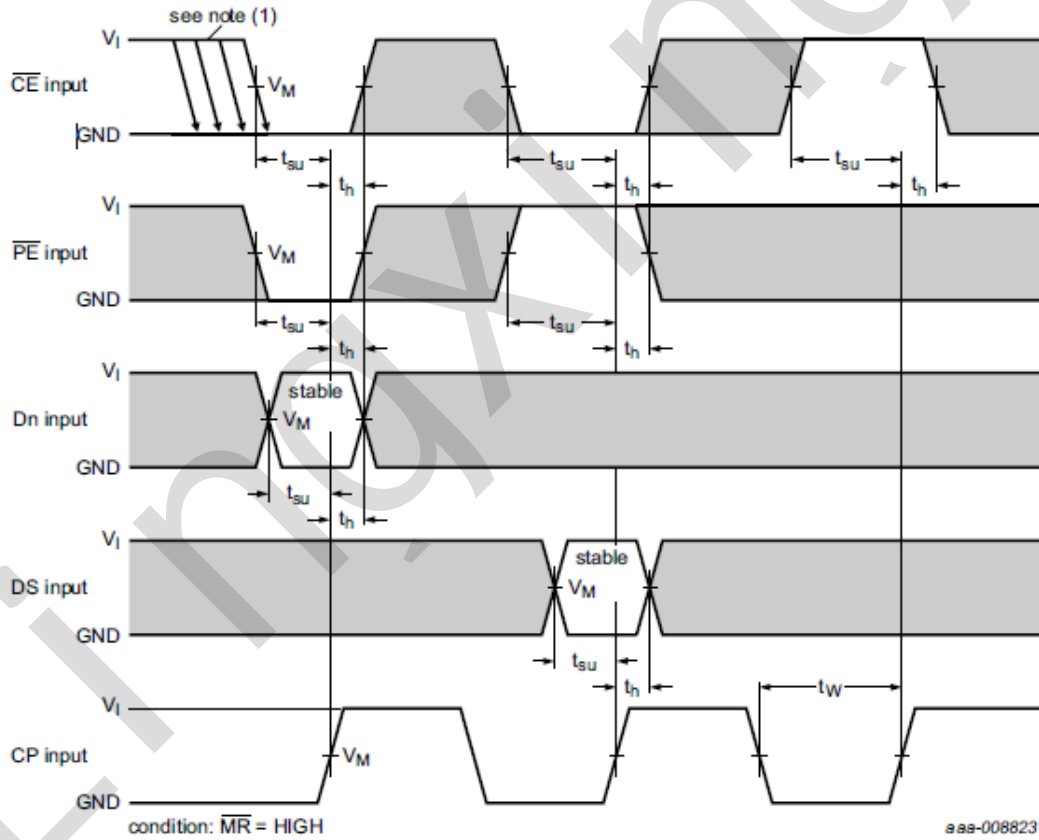


Figure 6. Set-up and hold times



#### 4.4、Measurement Points

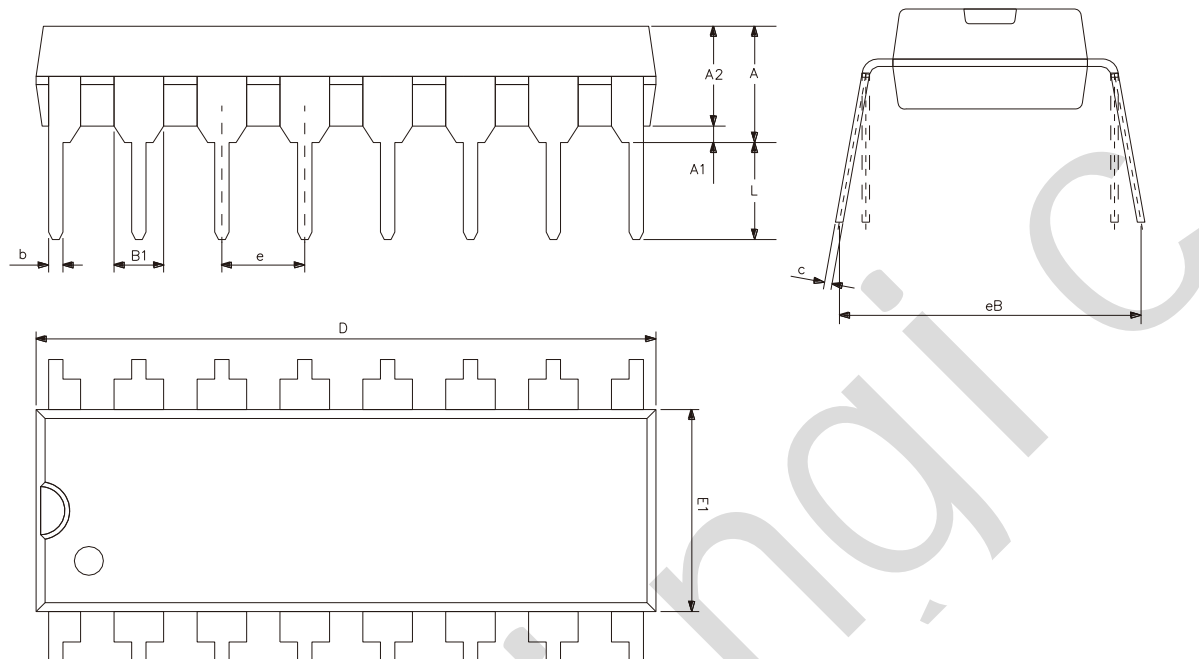
Input	Output
$V_M$	$V_M$
$0.5 \times V_{CC}$	$0.5 \times V_{CC}$



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## 5、Package Information

### 5.1、DIP16

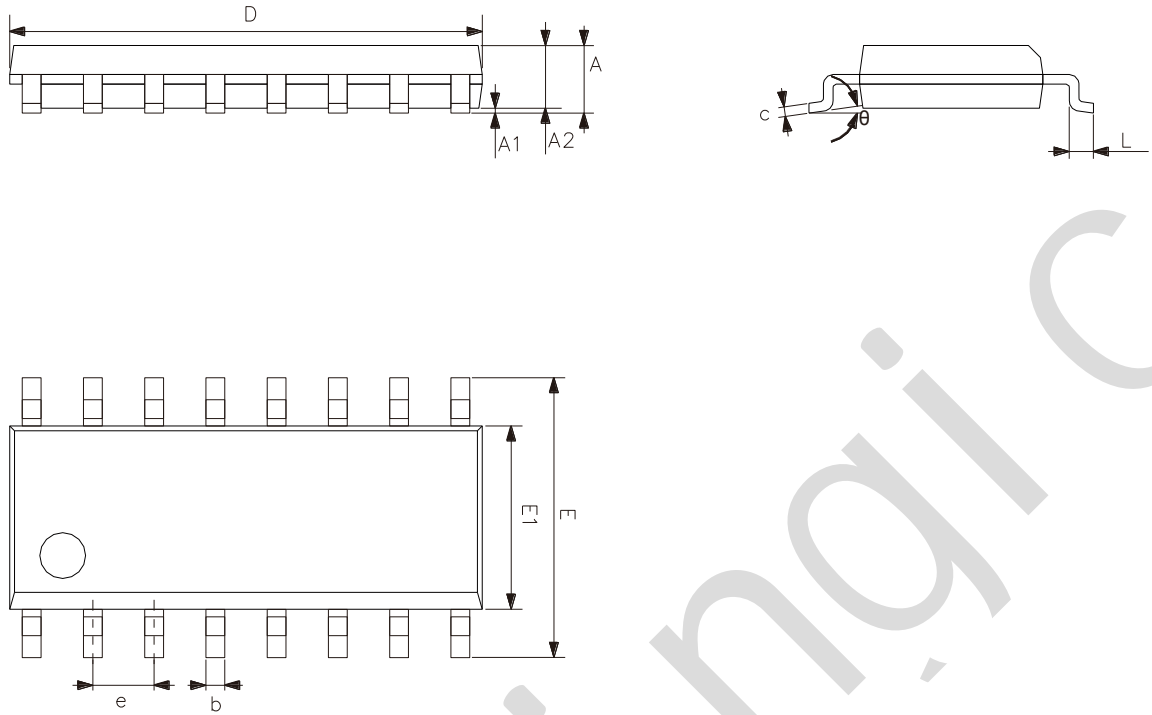


Symbol	Dimensions (mm)	
	Min.	Max.
A2	3.20	3.60
A1	0.51	-
A	3.60	5.33
L	3.00	3.60
b	0.36	0.56
B1	1.52	
D	18.80	19.94
E1	6.20	6.60
e	2.54	
c	0.20	0.36
eB	7.62	9.30





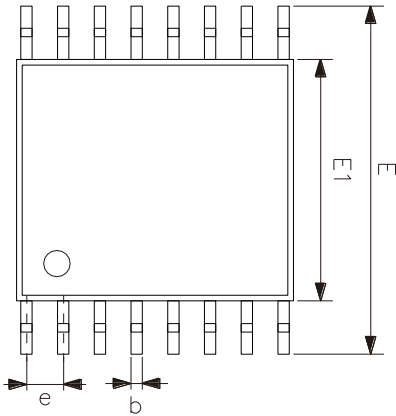
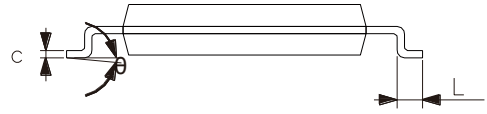
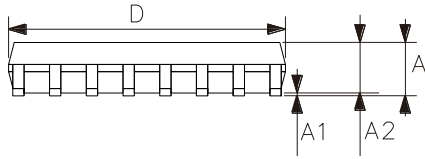
### 5.2、SOP16



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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