



# **AiP74ALVC/ALVCH162374**

## **16-bit Edge-triggered D-type Flip-flop with 3-state outputs and bus hold**

### **Product Specification**

**Specification Revision History:**

<b>Version</b>	<b>Date</b>	<b>Description</b>
2023-06-A1	2023-06	New
2023-08-A2	2023-08	Modifying AC parameters



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## 1、General Description

The AiP74ALVC/ALVCH162374 are 16-bit Edge-triggered D-type Flip-flop with 3-state outputs.

The input can be driven from either 3.3V or 5V devices. This feature allows the use of this device in a mixed 3.3V and 5V environment.

### Features:

- Supply voltage range: 1.2V to 3.6V
- 5 V tolerant inputs/outputs for interfacing with 5 V logic
- High-impedance when  $V_{CC}=0V$
- Temperature range:  $-40^{\circ}C$  to  $+125^{\circ}C$
- Packaging information: TSSOP48

### Ordering Information:

#### Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP74ALVC162374 TA48.TB	TSSOP48	74ALVC162374	38 PCS/tube	100 tube/box	3800 PCS/box	Dimensions of plastic enclosure: 12.5mm×6.1mm Pin spacing: 0.5mm
AiP74ALVCH162374 TA48.TB	TSSOP48	74ALVCH162374	38 PCS/tube	100 tube/box	3800 PCS/box	Dimensions of plastic enclosure: 12.5mm×6.1mm Pin spacing: 0.5mm

#### Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP74ALVC162374 TA48.TR	TSSOP48	74ALVC162374	2000 PCS/reel	2000 PCS/box	Dimensions of plastic enclosure: 12.5mm×6.1mm Pin spacing:0.5mm
AiP74ALVCH162374 TA48.TR	TSSOP48	74ALVCH162374	2000 PCS/reel	2000 PCS/box	Dimensions of plastic enclosure: 12.5mm×6.1mm Pin spacing:0.5mm

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

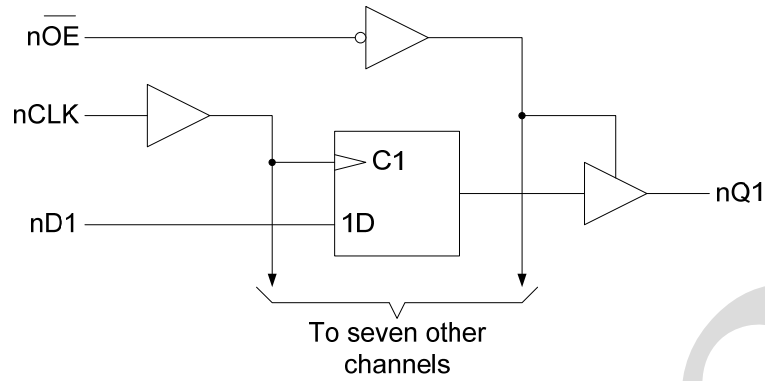


Figure 1. Logic diagram

### 2.2、Pin Configurations

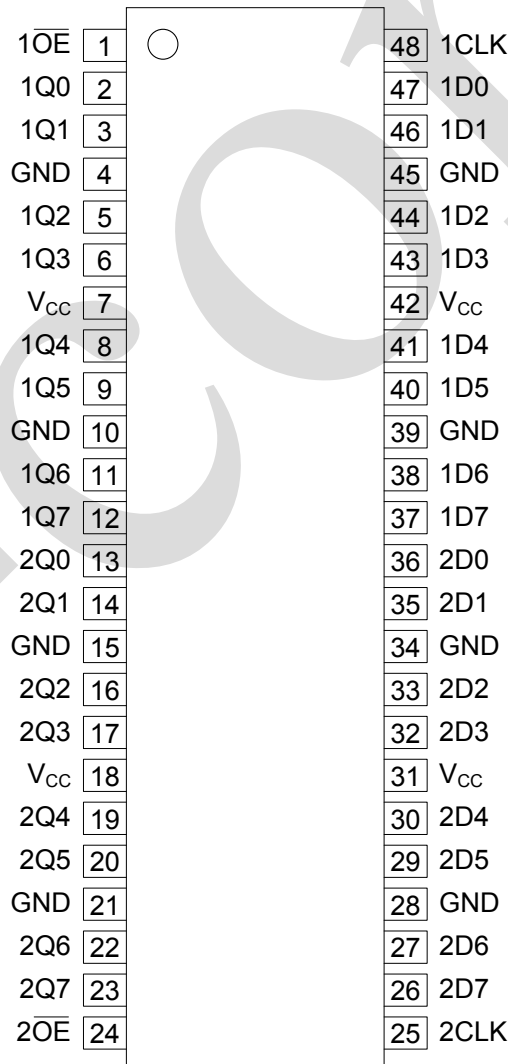


Figure 2. Pin configurations



## 2.3、Pin Description

Pin No.	Pin Name	Description
1	1 $\overline{OE}$	output enable input (active LOW)
24	2 $\overline{OE}$	output enable input (active LOW)
48	1CP	clock input
25	2CP	clock input
4, 10, 15, 21, 28, 34, 39, 45	GND	ground (0V)
7, 18, 31, 42	V <sub>CC</sub>	supply voltage
2, 3, 5, 6, 8, 9, 11, 12	1Q0 to 1Q7	data output
13, 14, 16, 17, 19, 20, 22, 23	2Q0 to 2Q7	data output
47, 46, 44, 43, 41, 40, 38, 37	1D0 to 1D7	data input
36, 35, 33, 32, 30, 29, 27, 26	2D0 to 2D7	data input

## 2.4、Function Table

Inputs			Output
$\overline{nOE}$	CLK	nDn	nQn
L	↑	H	H
L	↑	L	L
L	H or L	X	Q0
H	X	X	Z

Note:

H=HIGH voltage level

L=LOW voltage level

↑=positive-going transition

Z=high-impedance OFF-state

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 <sub>CC</sub>	-	-0.5	+6.5	V
input voltage	V <sub>I</sub>	-	-0.5	+6.5	V
output voltage	V <sub>O</sub>	Active mode	-0.5	V <sub>CC</sub> +0.5	V
		Power-down mode; V <sub>CC</sub> =0V	-0.5	+6.5	V
		output 3-state	-0.5	+6.5	V
supply current	I <sub>CC</sub>	-	-	100	mA
ground current	I <sub>GND</sub>	-	-100	-	mA
input clamping current	I <sub>IK</sub>	V <sub>I</sub> < 0V	-50	-	mA
output current	I <sub>O</sub>	V <sub>O</sub> =0V to V <sub>CC</sub>	-	±50	mA
output clamping current	I <sub>OK</sub>	V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0V	-	±50	mA
storage temperature	T <sub>stg</sub>	-	-65	+150	°C
soldering temperature	T <sub>L</sub>	10s	260		°C



### 3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	$V_{CC}$	-	1.2	-	3.6	V
input voltage	$V_I$	-	0	-	5.5	V
output voltage	$V_O$	Active mode	0	-	$V_{CC}$	V
		Power-down mode; $V_{CC}=0V$	0	-	5.5	V
		output 3-state	0	-	5.5	V
ambient temperature	$T_{amb}$	-	-40	-	+125	°C

### 3.3、Electrical Characteristics

#### 3.3.1、DC Characteristics 1

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
HIGH-level input voltage	$V_{IH}$	$V_{CC}=1.65V$ to $1.95V$	$0.65 \times V_{CC}$	-	3.6	V	
		$V_{CC}=2.3V$ to $2.7V$	1.7	-	-	V	
		$V_{CC}=2.7V$ to $3.6V$	2	-	-	V	
LOW-level input voltage	$V_{IL}$	$V_{CC}=1.65V$ to $1.95V$	-	-	$0.35 \times V_{CC}$	V	
		$V_{CC}=2.3V$ to $2.7V$	-	-	0.7	V	
		$V_{CC}=2.7V$ to $3.6V$	-	-	0.8	V	
HIGH-level output voltage	$V_{OH}$	$V_I=V_{IH}$ or $V_{IL}$	$I_O=-100\mu A$ ; $V_{CC}=1.65V$ to $3.6V$	$V_{CC}-0.2$	-	-	V
			$I_O=-2mA$ ; $V_{CC}=1.65V$	1.2	-	-	V
			$I_O=-4mA$ ; $V_{CC}=2.3V$	1.9	-	-	V
			$I_O=-6mA$ ; $V_{CC}=2.7V$	1.7	-	-	V
			$I_O=-6mA$ ; $V_{CC}=3.0V$	2.4	-	-	V
			$I_O=-8mA$ ; $V_{CC}=2.7V$	2	-	-	V
			$I_O=-12mA$ ; $V_{CC}=3.0V$	2	-	-	V
LOW-level output voltage	$V_{OL}$	$V_I=V_{IH}$ or $V_{IL}$	$I_O=100\mu A$ ; $V_{CC}=1.65V$ to $3.6V$	-	-	0.2	V
			$I_O=2mA$ ; $V_{CC}=1.65V$	-	-	0.45	V
			$I_O=4mA$ ; $V_{CC}=2.3V$	-	-	0.4	V
			$I_O=6mA$ ; $V_{CC}=2.7V$	-	-	0.55	V
			$I_O=6mA$ ; $V_{CC}=3.0V$	-	-	0.55	V
			$I_O=8mA$ ; $V_{CC}=2.7V$	-	-	0.6	V
			$I_O=12mA$ ; $V_{CC}=3.0V$	-	-	0.8	V
input leakage current	$I_I$	$V_{CC}=3.6V$ ; $V_I=V_{CC}$ or GND	-	-	$\pm 5$	$\mu A$	
OFF-state output current	$I_{OZ}$	$V_{CC}=3.6V$ ; $V_I=V_{IH}$ or $V_{IL}$ ; $V_O=V_{CC}$ or GND	-	-	$\pm 10$	$\mu A$	
supply current	$I_{CC}$	$V_{CC}=3.6V$ ; $V_I=V_{CC}$ or GND; $I_O=0A$	-	-	40	$\mu A$	
additional supply current	$\Delta I_{CC}$	per input pin; $V_{CC}=3V$ to $3.6V$ ; $V_I=V_{CC}-0.6V$ ; $I_O=0A$	-	-	750	$\mu A$	
bus hold current	$I_{I(HOLD)}$	$V_{CC}=1.65V$ ; $V_I=0.58V$	25	-	-	$\mu A$	
		$V_{CC}=1.65V$ ; $V_I=1.07V$	-25	-	-	$\mu A$	
		$V_{CC}=2.3V$ ; $V_I=0.7V$	45	-	-	$\mu A$	



		$V_{CC}=2.3V; V_I=1.7V$	-45	-	-	uA
		$V_{CC}=3V; V_I=0.8V$	75	-	-	uA
		$V_{CC}=3V; V_I=2V$	-75	-	-	uA
		$V_{CC}=3V; V_I=0 \text{ to } 3.6V$	-	-	$\pm 500$	uA

### 3.3.2、DC Characteristics 2

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
HIGH-level input voltage	$V_{IH}$	$V_{CC}=1.65V$ to $1.95V$	$0.65 \times V_{CC}$	-	3.6	V	
		$V_{CC}=2.3V$ to $2.7V$	1.7	-	-	V	
		$V_{CC}=2.7V$ to $3.6V$	2	-	-	V	
LOW-level input voltage	$V_{IL}$	$V_{CC}=1.65V$ to $1.95V$	-	-	$0.35 \times V_{CC}$	V	
		$V_{CC}=2.3V$ to $2.7V$	-	-	0.7	V	
		$V_{CC}=2.7V$ to $3.6V$	-	-	0.8	V	
HIGH-level output voltage	$V_{OH}$	$V_I=V_{IH}$ or $V_{IL}$	$I_O=-100\mu A; V_{CC}=1.65V$ to $3.6V$	$V_{CC}-0.2$	-	-	V
			$I_O=-2mA; V_{CC}=1.65V$	1.2	-	-	V
			$I_O=-4mA; V_{CC}=2.3V$	1.9	-	-	V
			$I_O=-6mA; V_{CC}=2.7V$	1.7	-	-	V
			$I_O=-6mA; V_{CC}=3.0V$	2.4	-	-	V
			$I_O=-8mA; V_{CC}=2.7V$	2	-	-	V
			$I_O=-12mA; V_{CC}=3.0V$	2	-	-	V
LOW-level output voltage	$V_{OL}$	$V_I=V_{IH}$ or $V_{IL}$	$I_O=100\mu A; V_{CC}=1.65V$ to $3.6V$	-	-	0.2	V
			$I_O=2mA; V_{CC}=1.65V$	-	-	0.45	V
			$I_O=4mA; V_{CC}=2.3V$	-	-	0.4	V
			$I_O=6mA; V_{CC}=2.7V$	-	-	0.55	V
			$I_O=6mA; V_{CC}=3.0V$	-	-	0.55	V
			$I_O=8mA; V_{CC}=2.7V$	-	-	0.6	V
			$I_O=12mA; V_{CC}=3.0V$	-	-	0.8	V
input leakage current	$I_I$	$V_{CC}=3.6V; V_I=V_{CC}$ or GND	-	-	$\pm 5$	uA	
OFF-state output current	$I_{OZ}$	$V_{CC}=3.6V; V_I=V_{IH}$ or $V_{IL}; V_O=V_{CC}$ or GND	-	-	$\pm 10$	uA	
supply current	$I_{CC}$	$V_{CC}=3.6V; V_I=V_{CC}$ or GND; $I_O=0A$	-	-	40	uA	
additional supply current	$\Delta I_{CC}$	per input pin; $V_{CC}=3V$ to $3.6V; V_I=V_{CC}-0.6V; I_O=0A$	-	-	750	uA	
bus hold current	$I_{I(HOLD)}$	$V_{CC}=1.65V; V_I=0.58V$	25	-	-	uA	
		$V_{CC}=1.65V; V_I=1.07V$	-25	-	-	uA	
		$V_{CC}=2.3V; V_I=0.7V$	45	-	-	uA	
		$V_{CC}=2.3V; V_I=1.7V$	-45	-	-	uA	
		$V_{CC}=3V; V_I=0.8V$	75	-	-	uA	
		$V_{CC}=3V; V_I=2V$	-75	-	-	uA	
		$V_{CC}=3V; V_I=0 \text{ to } 3.6V$	-	-	$\pm 500$	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	Conditions	Min.	Typ.	Max.	Unit	
nCP to nQn propagation delay	$t_{PLH}, t_{PHL}$	see Figure 4	$V_{CC}=2.3\text{V to }2.7\text{V}$	-	-	7.6	ns
			$V_{CC}=2.7\text{V}$	-	-	7.6	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	-	-	6.4	ns
nOE to nQn enable time	$t_{PZH}, t_{PZL}$	see Figure 5	$V_{CC}=2.3\text{V to }2.7\text{V}$	-	-	9.1	ns
			$V_{CC}=2.7\text{V}$	-	-	9.0	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	-	-	7.2	ns
nOE to nQn disable time	$t_{PLZ}, t_{PHZ}$	see Figure 5	$V_{CC}=2.3\text{V to }2.7\text{V}$	-	-	7.8	ns
			$V_{CC}=2.7\text{V}$	-	-	7.0	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	-	-	6.3	ns
CLK HIGH or LOW pulse width	$t_w$	see Figure 5	$V_{CC}=2.3\text{V to }2.7\text{V}$	4.6	-	-	ns
			$V_{CC}=2.7\text{V}$	4.6	-	-	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	4.6	-	-	ns
nDn to CLK set_up time	tsu	see Figure 6	$V_{CC}=2.3\text{V to }2.7\text{V}$	2.9	-	-	ns
			$V_{CC}=2.7\text{V}$	3.1	-	-	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	2.7	-	-	ns
nDn to CLK hold time	th	see Figure 6	$V_{CC}=2.3\text{V to }2.7\text{V}$	0.8	-	-	ns
			$V_{CC}=2.7\text{V}$	0.7	-	-	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	0.7	-	-	ns

### 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	Conditions	Min.	Typ.	Max.	Unit	
nDn to nQn propagation delay	$t_{PLH}, t_{PHL}$	see Figure 4	$V_{CC}=2.3\text{V to }2.7\text{V}$	-	-	9.0	ns
			$V_{CC}=2.7\text{V}$	-	-	9.0	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	-	-	7.7	ns
nOE to nQn enable time	$t_{PZH}, t_{PZL}$	see Figure 5	$V_{CC}=2.3\text{V to }2.7\text{V}$	-	-	10.9	ns
			$V_{CC}=2.7\text{V}$	-	-	10.8	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	-	-	8.7	ns
nOE to nQn disable time	$t_{PLZ}, t_{PHZ}$	see Figure 5	$V_{CC}=2.3\text{V to }2.7\text{V}$	-	-	9.4	ns
			$V_{CC}=2.7\text{V}$	-	-	8.4	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	-	-	7.6	ns
CLK HIGH or LOW pulse width	$t_w$	see Figure 5	$V_{CC}=2.3\text{V to }2.7\text{V}$	5.6	-	-	ns
			$V_{CC}=2.7\text{V}$	5.6	-	-	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	5.6	-	-	ns
nDn to CLK set_up time	tsu	see Figure 6	$V_{CC}=2.3\text{V to }2.7\text{V}$	3.4	-	-	ns
			$V_{CC}=2.7\text{V}$	3.6	-	-	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	3.2	-	-	ns
nDn to CLK hold time	th	see Figure 6	$V_{CC}=2.3\text{V to }2.7\text{V}$	1.0	-	-	ns
			$V_{CC}=2.7\text{V}$	0.8	-	-	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	0.8	-	-	ns



## 4、Testing Circuit

### 4.1、AC Testing Circuit

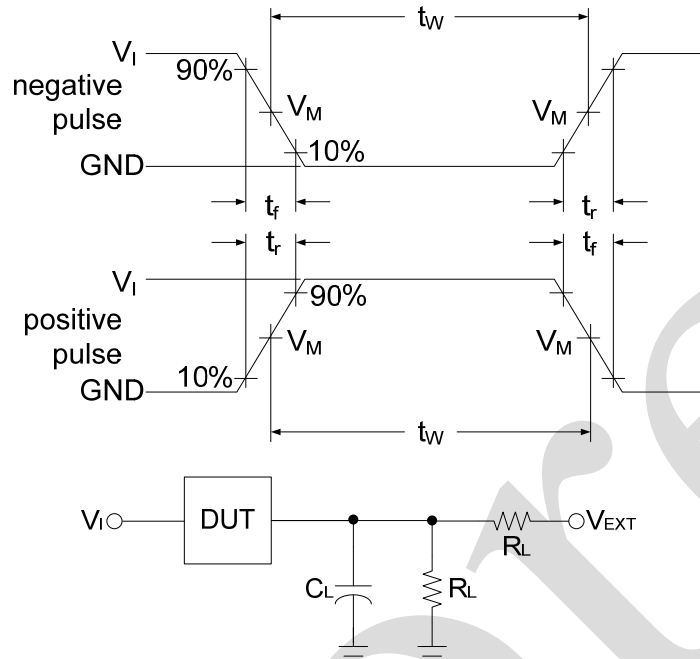


Figure 3. Load circuit

$C_L$  includes probe and jig capacitance.

$R_L$ =Load resistance.

### 4.2、Test Data

Supply voltage	Input		Load		$V_{EXT}$		
	$V_I$	$t_r = t_f$	$C_L$	$R_L$	$t_{PLH}/t_{PHL}$	$t_{PLZ}/t_{PZL}$	$t_{PHZ}/t_{PZH}$
1.2V	$V_{CC}$	$\leq 3ns$	30pF	1k $\Omega$	Open	$2 \times V_{CC}$	GND
1.65V to 1.95V	$V_{CC}$	$\leq 3ns$	30pF	1k $\Omega$	Open	$2 \times V_{CC}$	GND
2.3V to 2.7V	$V_{CC}$	$\leq 3ns$	30pF	500 $\Omega$	Open	$2 \times V_{CC}$	GND
2.7V	$V_{CC}$	$\leq 3ns$	50pF	500 $\Omega$	Open	$2 \times V_{CC}$	GND
3.0V to 3.6V	$V_{CC}$	$\leq 3ns$	50pF	500 $\Omega$	Open	$2 \times V_{CC}$	GND



## 4.3、AC Testing Waveforms

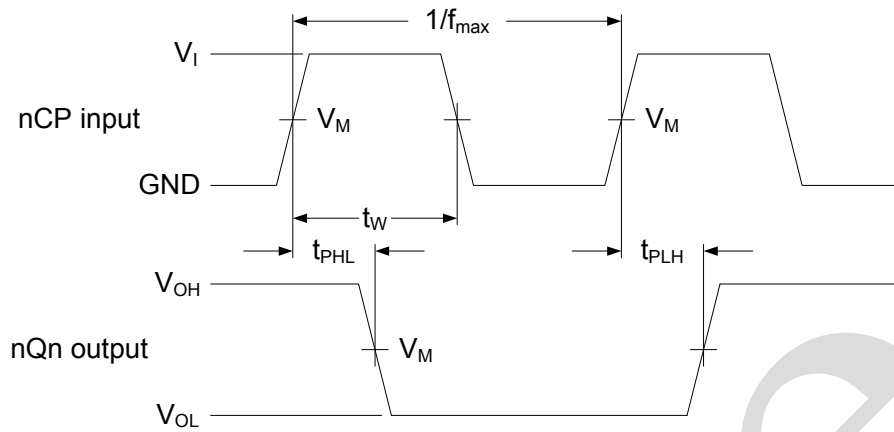


Figure 4. Clock (nCP) to output (nQn) propagation delays, clock pulse width

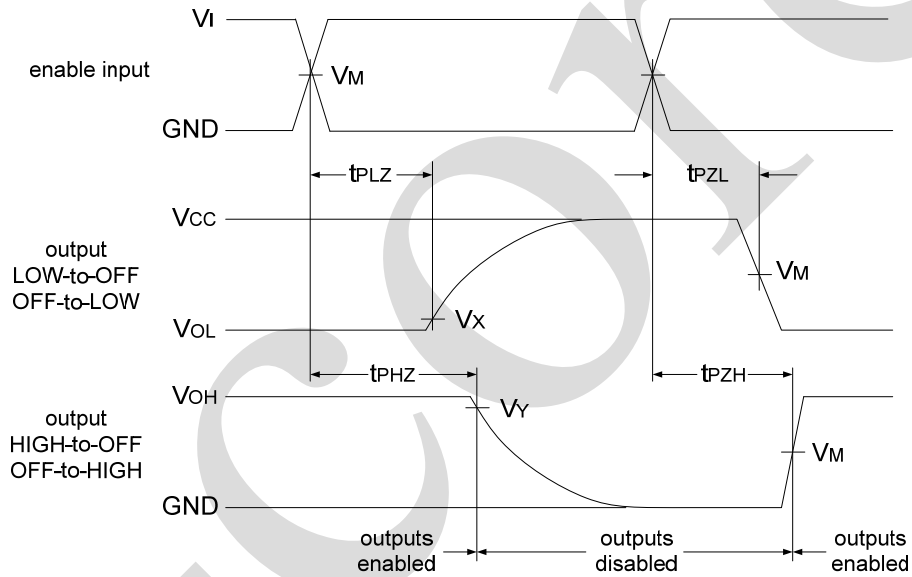


Figure 5. 3-state enable and disable times

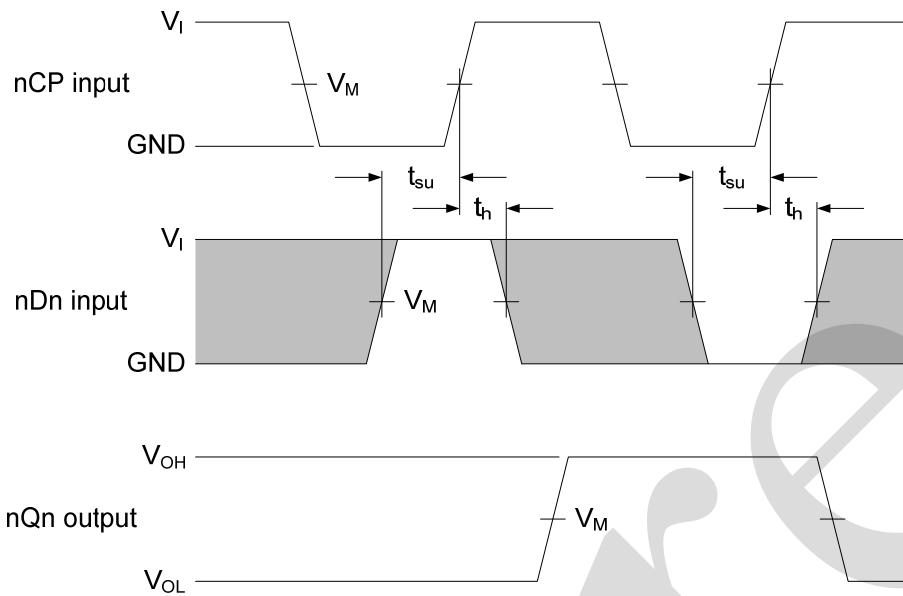


Figure 6. Data set-up and hold times for the nDn input to the nCP input

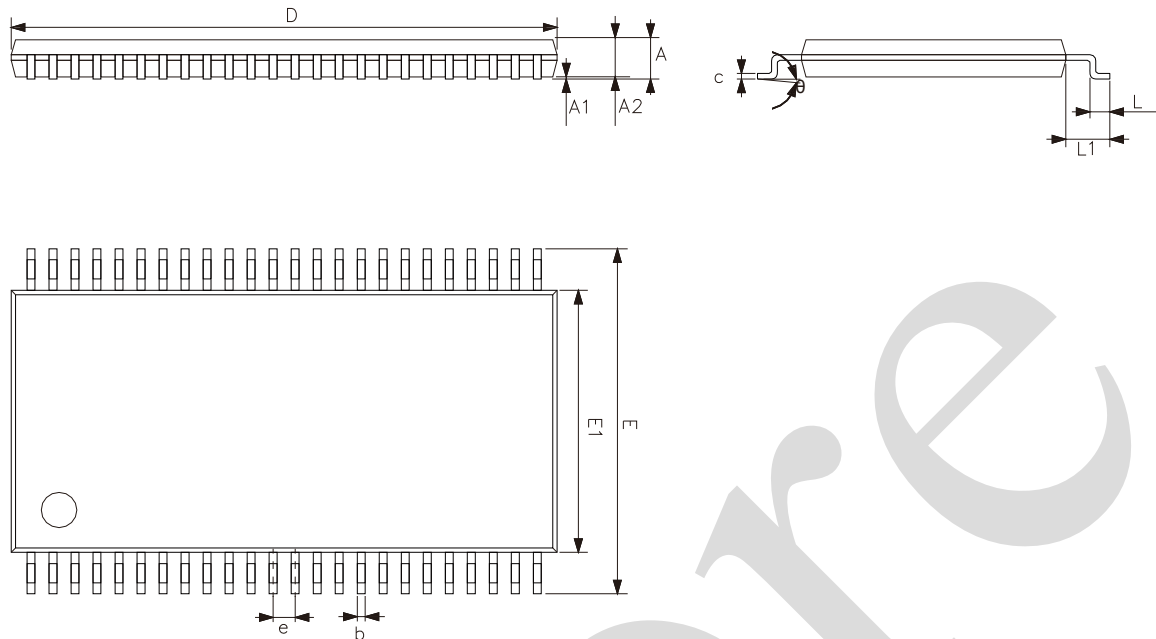
#### 4.4. Measurement Points

Supply voltage	Input	Output		
		$V_M$	$V_X$	$V_Y$
$V_{CC}$	$V_M$	$V_M$	$V_{OL}+0.15V$	$V_{OH}-0.15V$
1.2V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL}+0.15V$	$V_{OH}-0.15V$
1.65V to 1.95V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL}+0.15V$	$V_{OH}-0.15V$
2.3V to 2.7V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL}+0.15V$	$V_{OH}-0.15V$
2.7V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL}+0.3V$	$V_{OH}-0.3V$
3.0V to 3.6V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL}+0.3V$	$V_{OH}-0.3V$



## 5、Package Information

### 5.1、TSSOP48



Symbol	Dimensions (mm)	
	Min.	Max.
A	-	1.20
A1	0.03	0.15
A2	0.82	1.05
b	0.17	0.27
c	0.12	0.22
D	12.40	12.60
E	7.90	8.30
E1	6.00	6.20
e	0.50	
L	0.35	0.75
L1	1.00	
$\theta$	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

We recommend you to read this chapter carefully before using this product.

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