



AiP74LV1T87

2-input Single Supply Translating Exclusive-nor gate

Product Specification

Specification Revision History:

Version	Date	Description
2023-05-A1	2023-05	New



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1、General Description

The AiP74LV1T87 is a single, level translating 2-input EXCLUSIVE-NOR gate.

The low threshold inputs support 1.8V input logic at $V_{CC}=3.3V$ and can be used in 1.8V to 3.3V level up translation. In addition, the 5V tolerant input pins enable level down translation (3.3V to 2.5V output at $V_{CC}=2.5V$). The output level is referenced to the supply voltage and supports 1.8V, 2.5V, 3.3V and 5.0V CMOS levels.

Features:

- Supply voltage: 1.6V to 5.5V
- Up translation
 - 1.2V to 1.8V at $V_{CC}=1.8V$
 - 1.5V to 2.5V at $V_{CC}=2.5V$
 - 1.8V to 3.3V at $V_{CC}=3.3V$
 - 3.3V to 5.0V at $V_{CC}=5.0V$
- Down translation
 - 3.3V to 1.8V at $V_{CC}=1.8V$
 - 3.3V to 2.5V at $V_{CC}=2.5V$
 - 5.0V to 3.3V at $V_{CC}=3.3V$
- Inputs accept voltages to 5.5 V
- Specified from $-40^{\circ}C$ to $+125^{\circ}C$
- Packaging information: SOT23-5/SOT353/DFN4

Ordering Information:

Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP74LV1T87GB235.TR	SOT23-5	ECXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP74LV1T87GC353.TR	SOT353	ECXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.1mm×1.3mm Pin spacing: 0.65mm
AiP74LV1T87XD4.TR	DFN4	ECXX	12000 PCS/reel	120000 PCS/box	Dimensions of plastic enclosure: 0.8mm×0.8mm Pin spacing: 0.5mm

Note 1: “XX” refers to variable content, meaning year and package batch serial number.

Note 2: 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

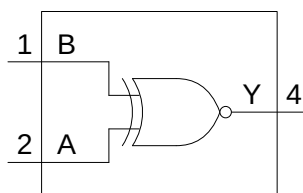


Figure 1. Logic symbol

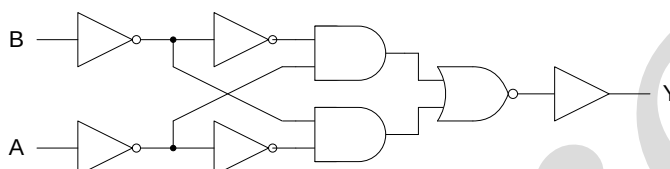
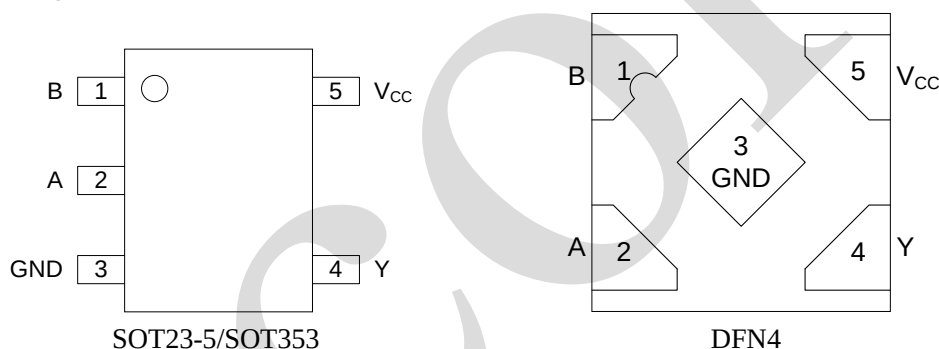


Figure 2. Logic diagram

2.2、Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1	B	data input
2	A	data input
3	GND	ground (0V)
4	Y	data output
5	V _{CC}	supply voltage

2.4、Function Table

Input		Output
A	B	Y
L	L	H
L	H	L
H	L	L
H	H	H

Note: H=HIGH voltage level; L=LOW voltage level;



3、Electrical Parameter

3.1、Absolute Maximum Ratings

(Voltage 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 voltage	V_I	-	-0.5	+7.0	V
output voltage	V_O	output HIGH or LOW state	-0.5	$V_{CC}+0.5$	V
		output in power-off state	-0.5	+4.6	V
supply current	I_{CC}	-	-	50	mA
ground current	I_{GND}	-	-50	-	mA
input clamping current	I_{IK}	$V_I < 0V$	-20	-	mA
output current	I_O	$V_O = 0V$ to V_{CC}	-	± 25	mA
output clamping current	I_{OK}	$V_O < 0V$ or $V_O > V_{CC}$	-	± 20	mA
storage temperature	T_{stg}	-	-65	+150	°C
soldering temperature	T_L	10s	260		°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}	-	1.6	5.0	5.5	V
input voltage	V_I	-	0	-	5.5	V
output voltage	V_O	output HIGH or LOW state	0	-	V_{CC}	V
ambient temperature	T_{amb}	-	-40	-	+125	°C

3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

($T_{amb}=25^{\circ}C$, 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 $1.8V$	0.94	-	-	V
		$V_{CC}=2.0V$	0.99	-	-	V
		$V_{CC}=2.25V$ to $2.5V$	1.135	-	-	V
		$V_{CC}=2.75V$	1.21	-	-	V
		$V_{CC}=3.0V$ to $3.3V$	1.35	-	-	V
		$V_{CC}=3.6V$	1.47	-	-	V
		$V_{CC}=4.5V$ to $5.0V$	2.02	-	-	V
		$V_{CC}=5.5V$	2.10	-	-	V
LOW-level input voltage	V_{IL}	$V_{CC}=1.65V$ to $2.0V$	-	-	0.58	V
		$V_{CC}=2.25V$ to $2.75V$	-	-	0.75	V
		$V_{CC}=3.0V$ to $3.6V$	-	-	0.80	V
		$V_{CC}=4.5V$ to $5.5V$	-	-	0.80	V
HIGH-level output voltage	V_{OH}	$V_I = V_{IH}$ or V_{IL}	$V_{CC}=1.65V$ to $5.5V$; $I_O = -20\mu A$	$V_{CC}-0.1$	-	V
			$V_{CC}=1.65V$; $I_O = -2mA$	1.28	-	V
			$V_{CC}=1.8V$; $I_O = -2mA$	1.5	-	V
			$V_{CC}=2.3V$; $I_O = -2.3mA$	2.0	-	V



			$V_{CC}=2.3V; I_O=-3mA$	2.0	-	-	V
			$V_{CC}=2.5V; I_O=-3mA$	2.25	-	-	V
			$V_{CC}=3.0V; I_O=-3mA$	2.78	-	-	V
			$V_{CC}=3.0V; I_O=-5.5mA$	2.6	-	-	V
			$V_{CC}=3.3V; I_O=-5.5mA$	2.9	-	-	V
			$V_{CC}=4.5V; I_O=-4mA$	4.2	-	-	V
			$V_{CC}=4.5V; I_O=-8mA$	4.1	-	-	V
			$V_{CC}=5.0V; I_O=-8mA$	4.6	-	-	V
LOW-level output voltage	V_{OL}	$V_I=V_{IH}$ or V_{IL}	$V_{CC}=1.65V$ to $5.5V$; $I_O=20\mu A$	-	-	0.1	V
			$V_{CC}=1.65V; I_O=2mA$	-	-	0.2	V
			$V_{CC}=2.3V; I_O=2.3mA$	-	-	0.1	V
			$V_{CC}=2.3V; I_O=3mA$	-	-	0.15	V
			$V_{CC}=3.0V; I_O=3mA$	-	-	0.1	V
			$V_{CC}=3.0V; I_O=5.5mA$	-	-	0.2	V
			$V_{CC}=4.5V; I_O=4mA$	-	-	0.15	V
			$V_{CC}=4.5V; I_O=8mA$	-	-	0.3	V
input leakage current	I_I	$V_I=V_{CC}$ or GND; $V_{CC}=0V$ to $5.5V$		-	-	± 1	μA
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0A$; $V_{CC}=1.8V, 2.5V, 3.3V, 5.0V$		-	-	1	μA
additional supply current	ΔI_{CC}	per input pin; $V_{CC}=1.8V$; $V_I=0.3V$ or $1.1V$; $I_O=0A$; other pins at V_{CC} or GND		-	-	10	μA
		per input pin; $V_{CC}=5.5V$; $V_I=0.3V$ or $3.4V$; $I_O=0A$; other pins at V_{CC} or GND		-	-	1.35	mA

3.3.2、DC Characteristics 2

($T_{amb}=-40^{\circ}C$ 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 1.8V		1.0	-	-	V
		V _{CC} =2.0V		1.03	-	-	V
		V _{CC} =2.25V to 2.5V		1.18	-	-	V
		V _{CC} =2.75V		1.23	-	-	V
		V _{CC} =3.0V to 3.3V		1.37	-	-	V
		V _{CC} =3.6V		1.48	-	-	V
		V _{CC} =4.5V to 5.0V		2.03	-	-	V
		V _{CC} =5.5V		2.11	-	-	V
LOW-level input voltage	V _{IL}	V _{CC} =1.65V to 2.0V		-	-	0.55	V
		V _{CC} =2.25V to 2.75V		-	-	0.71	V
		V _{CC} =3.0V to 3.6V		-	-	0.65	V
		V _{CC} =4.5V to 5.5V		-	-	0.80	V
HIGH-level output voltage	V _{OH}	V _I =V _{IH} or V _{IL}	V _{CC} =1.65V to 5.5V; I _O =-20uA	V _{CC} -0.1	-	-	V
			V _{CC} =1.65V; I _O =-2mA	1.21	-	-	V



			$V_{CC}=1.8V; I_O=-2mA$	1.45	-	-	V
			$V_{CC}=2.3V; I_O=-2.3mA$	2.0	-	-	V
			$V_{CC}=2.3V; I_O=-3mA$	1.93	-	-	V
			$V_{CC}=2.5V; I_O=-3mA$	2.15	-	-	V
			$V_{CC}=3.0V; I_O=-3mA$	2.7	-	-	V
			$V_{CC}=3.0V; I_O=-5.5mA$	2.49	-	-	V
			$V_{CC}=3.3V; I_O=-5.5mA$	2.8	-	-	V
			$V_{CC}=4.5V; I_O=-4mA$	4.1	-	-	V
			$V_{CC}=4.5V; I_O=-8mA$	3.95	-	-	V
			$V_{CC}=5.0V; I_O=-8mA$	4.5	-	-	V
LOW-level output voltage	V_{OL}	$V_I=V_{IH}$ or V_{IL}	$V_{CC}=1.65V$ to $5.5V$; $I_O=20\mu A$	-	-	0.1	V
			$V_{CC}=1.65V; I_O=2mA$	-	-	0.25	V
			$V_{CC}=2.3V; I_O=2.3mA$	-	-	0.15	V
			$V_{CC}=2.3V; I_O=3mA$	-	-	0.2	V
			$V_{CC}=3.0V; I_O=3mA$	-	-	0.15	V
			$V_{CC}=3.0V; I_O=5.5mA$	-	-	0.252	V
			$V_{CC}=4.5V; I_O=4mA$	-	-	0.2	V
			$V_{CC}=4.5V; I_O=8mA$	-	-	0.35	V
input leakage current	I_I	$V_I=V_{CC}$ or GND; $V_{CC}=0V$ to $5.5V$		-	-	± 2	μA
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0A$; $V_{CC}=1.8V, 2.5V, 3.3V, 5.0V$		-	-	2	μA
additional supply current	ΔI_{CC}	per input pin; $V_{CC}=1.8V$; $V_I=0.3V$ or $1.1V$; $I_O=0A$; other pins at V_{CC} or GND		-	-	10	μA
		per input pin; $V_{CC}=5.5V$; $V_I=0.3V$ or $3.4V$; $I_O=0A$; other pins at V_{CC} or GND		-	-	1.5	mA

3.3.3、DC Characteristics 3

($T_{amb}=-40^{\circ}C$ 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 $1.8V$	1.0	-	-	V
		$V_{CC}=2.0V$	1.03	-	-	V
		$V_{CC}=2.25V$ to $2.5V$	1.18	-	-	V
		$V_{CC}=2.75V$	1.23	-	-	V
		$V_{CC}=3.0V$ to $3.3V$	1.37	-	-	V
		$V_{CC}=3.6V$	1.48	-	-	V
		$V_{CC}=4.5V$ to $5.0V$	2.03	-	-	V
		$V_{CC}=5.5V$	2.11	-	-	V
LOW-level input voltage	V_{IL}	$V_{CC}=1.65V$ to $2.0V$	-	-	0.55	V
		$V_{CC}=2.25V$ to $2.75V$	-	-	0.71	V
		$V_{CC}=3.0V$ to $3.6V$	-	-	0.65	V
		$V_{CC}=4.5V$ to $5.5V$	-	-	0.80	V



HIGH-level output voltage	V_{OH}	$V_I = V_{IH} \text{ or } V_{IL}$	$V_{CC}=1.65V \text{ to } 5.5V;$ $I_O=-20\mu A$	V_{CC} -0.1	-	-	V
			$V_{CC}=1.65V; I_O=-2mA$	1.21	-	-	V
			$V_{CC}=1.8V; I_O=-2mA$	1.45	-	-	V
			$V_{CC}=2.3V; I_O=-2.3mA$	2.0	-	-	V
			$V_{CC}=2.3V; I_O=-3mA$	1.93	-	-	V
			$V_{CC}=2.5V; I_O=-3mA$	2.15	-	-	V
			$V_{CC}=3.0V; I_O=-3mA$	2.7	-	-	V
			$V_{CC}=3.0V; I_O=-5.5mA$	2.49	-	-	V
			$V_{CC}=3.3V; I_O=-5.5mA$	2.8	-	-	V
			$V_{CC}=4.5V; I_O=-4mA$	4.1	-	-	V
			$V_{CC}=4.5V; I_O=-8mA$	3.95	-	-	V
			$V_{CC}=5.0V; I_O=-8mA$	4.5	-	-	V
LOW-level output voltage	V_{OL}	$V_I = V_{IH} \text{ or } V_{IL}$	$V_{CC}=1.65V \text{ to } 5.5V;$ $I_O=20\mu A$	-	-	0.1	V
			$V_{CC}=1.65V; I_O=2mA$	-	-	0.25	V
			$V_{CC}=2.3V; I_O=2.3mA$	-	-	0.15	V
			$V_{CC}=2.3V; I_O=3mA$	-	-	0.2	V
			$V_{CC}=3.0V; I_O=3mA$	-	-	0.15	V
			$V_{CC}=3.0V; I_O=5.5mA$	-	-	0.252	V
			$V_{CC}=4.5V; I_O=4mA$	-	-	0.2	V
			$V_{CC}=4.5V; I_O=8mA$	-	-	0.35	V
input leakage current	I_I	$V_I = V_{CC} \text{ or } GND;$ $V_{CC}=0V \text{ to } 5.5V$		-	-	± 4	μA
supply current	I_{CC}	$V_I = V_{CC} \text{ or } GND; I_O=0A;$ $V_{CC}=1.8V, 2.5V, 3.3V, 5.0V$		-	-	4	μA
additional supply current	ΔI_{CC}	per input pin; $V_{CC}=1.8V;$ $V_I=0.3V \text{ or } 1.1V; I_O=0A;$ other pins at $V_{CC} \text{ or } GND$		-	-	10	μA
		per input pin; $V_{CC}=5.5V;$ $V_I=0.3V \text{ or } 3.4V; I_O=0A;$ other pins at $V_{CC} \text{ or } GND$		-	-	1.5	mA

3.3.4、AC Characteristics 1

($T_{amb}=25^{\circ}C$, $GND=0V$, unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{PLH}, t_{PHL}	A, B to Y; see Figure 4	$V_{CC}=1.8V; C_L=15pF$	-	7.3	11.6	ns
			$V_{CC}=1.8V; C_L=30pF$	-	8.4	12.9	ns
			$V_{CC}=2.5V; C_L=15pF$	-	5.1	7.8	ns
			$V_{CC}=2.5V; C_L=30pF$	-	5.8	8.6	ns
			$V_{CC}=3.3V; C_L=15pF$	-	4.2	6.2	ns
			$V_{CC}=3.3V; C_L=30pF$	-	4.7	6.9	ns
			$V_{CC}=5.0V; C_L=15pF$	-	3.4	4.6	ns
			$V_{CC}=5.0V; C_L=30pF$	-	3.9	5.1	ns



3.3.5、AC Characteristics 2

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{PLH}, t_{PHL}	A, B to Y; see Figure 4	$V_{CC}=1.8V; C_L=15pF$	-	-	13.3	ns
			$V_{CC}=1.8V; C_L=30pF$	-	-	14.7	ns
			$V_{CC}=2.5V; C_L=15pF$	-	-	8.8	ns
			$V_{CC}=2.5V; C_L=30pF$	-	-	9.8	ns
			$V_{CC}=3.3V; C_L=15pF$	-	-	7.0	ns
			$V_{CC}=3.3V; C_L=30pF$	-	-	7.8	ns
			$V_{CC}=5.0V; C_L=15pF$	-	-	5.1	ns
			$V_{CC}=5.0V; C_L=30pF$	-	-	5.8	ns

3.3.6、AC Characteristics 3

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{PLH}, t_{PHL}	A, B to Y; see Figure 4	$V_{CC}=1.8V; C_L=15pF$	-	-	14.2	ns
			$V_{CC}=1.8V; C_L=30pF$	-	-	15.8	ns
			$V_{CC}=2.5V; C_L=15pF$	-	-	9.5	ns
			$V_{CC}=2.5V; C_L=30pF$	-	-	10.6	ns
			$V_{CC}=3.3V; C_L=15pF$	-	-	7.5	ns
			$V_{CC}=3.3V; C_L=30pF$	-	-	8.4	ns
			$V_{CC}=5.0V; C_L=15pF$	-	-	5.4	ns
			$V_{CC}=5.0V; C_L=30pF$	-	-	6.1	ns

4、Testing Circuit

4.1、AC Testing Circuit

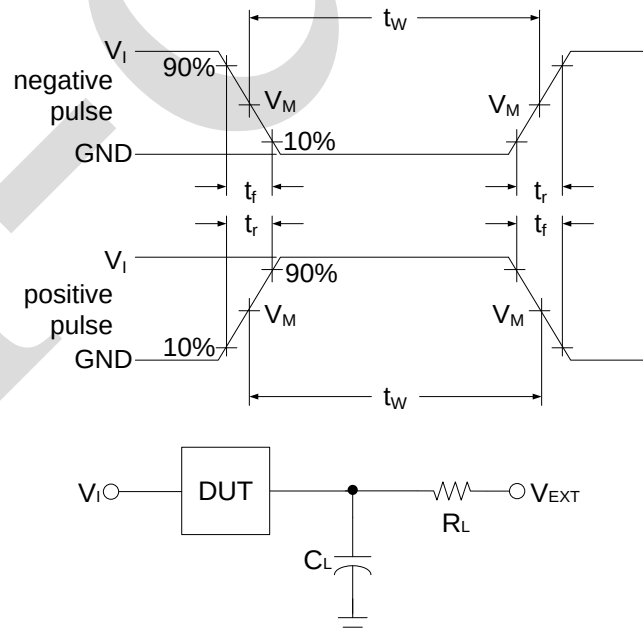


Figure 3. Test circuit for measuring switching time

C_L includes probe and jig capacitance.



4.2、Test Data

Supply voltage	Input		Load		V _{EXT}		
V _{CC}	V _I	t _r = t _f	C _L	R _L	t _{PLH} , t _{PHL}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}
1.8V	V _{CC}	3.0ns	15pF, 30pF	1KΩ	Open	GND	V _{CC}
2.5V	V _{CC}	3.0ns	15pF, 30pF	1KΩ	Open	GND	V _{CC}
3.3V	3V	3.0ns	15pF, 30pF	1KΩ	Open	GND	V _{CC}
5.0V	3V	3.0ns	15pF, 30pF	1KΩ	Open	GND	V _{CC}

4.3、AC Testing Waveforms

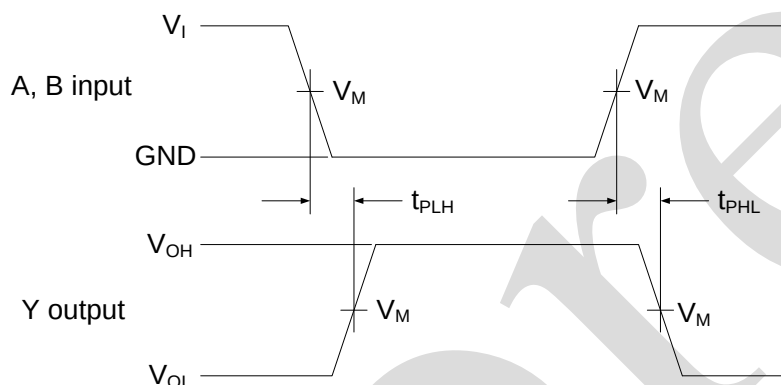


Figure 4. The data input (A, B) to output (Y) propagation delays

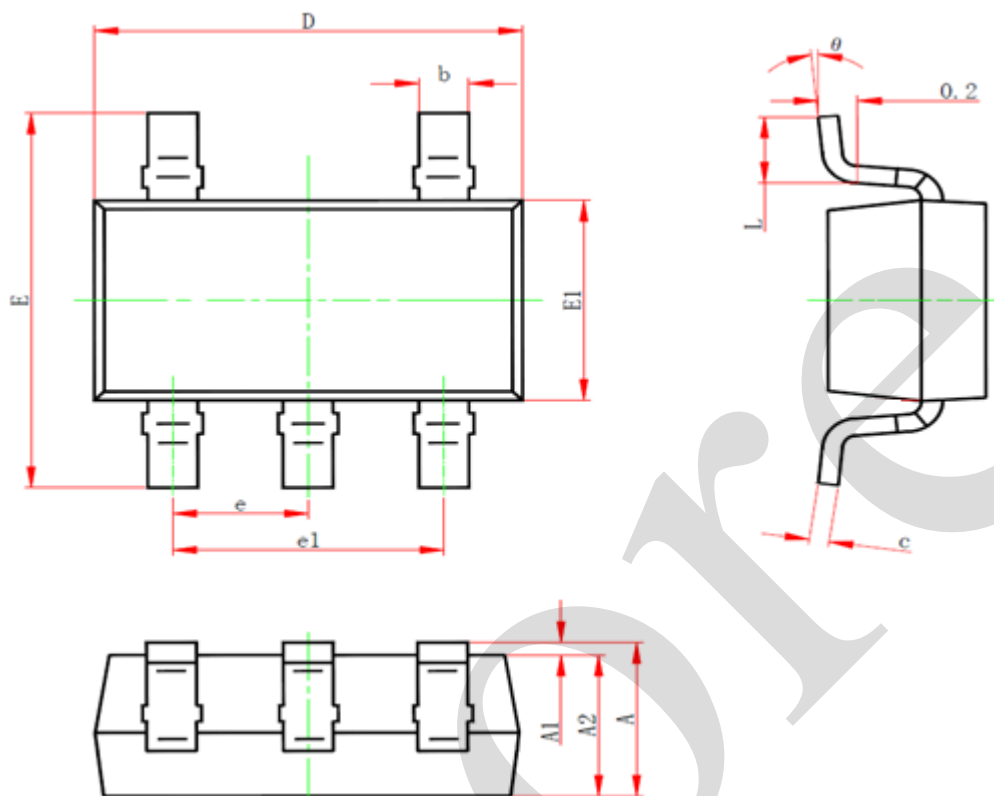
4.4、Measurement Points

Input	Output		
V _M	V _M	V _X	V _Y
0.5V _I	0.5×V _{CC}	V _{OL} +0.3V	V _{OH} -0.3V



5、Package Information

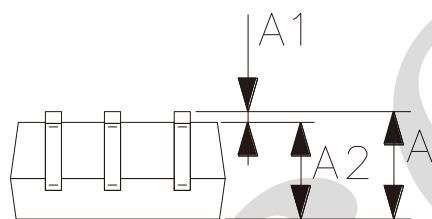
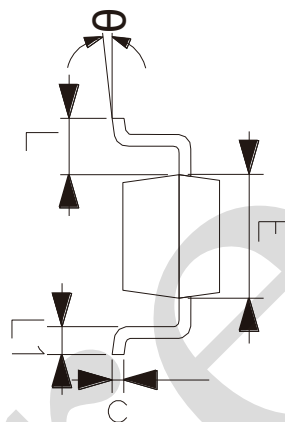
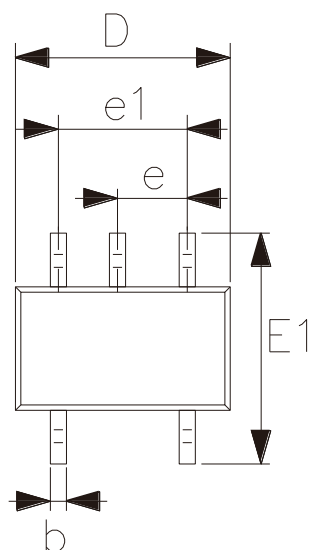
5.1、SOT23-5



Symbol	Dimensions (mm)	
	Min.	Max.
A	-	1.26
A1	0.00	0.12
A2	1.00	1.20
b	0.30	0.50
c	0.10	0.20
D	2.82	3.02
E	2.60	3.00
E1	1.50	1.70
e	0.95	
e1	1.80	2.00
L	0.30	0.60
θ	0°	8°



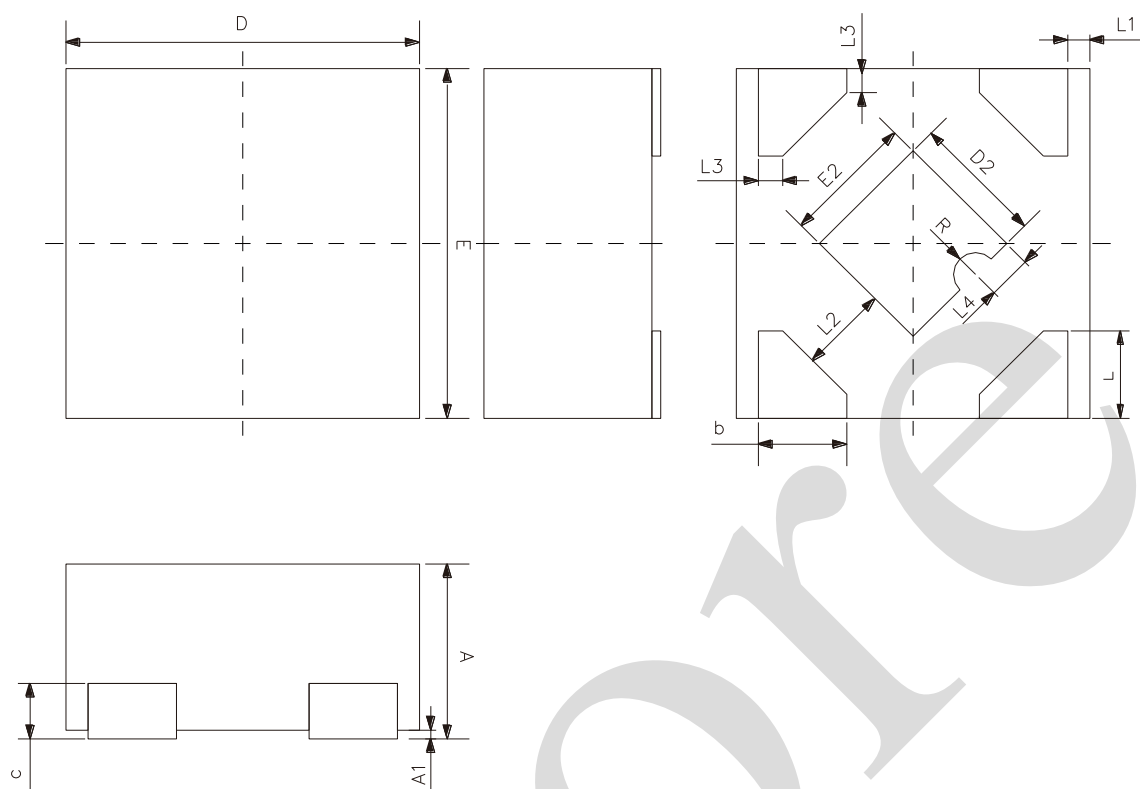
5.2、SOT353



Symbol	Dimensions (mm)	
	Min.	Max.
A	0.90	1.10
A1	0.00	0.10
A2	0.90	1.00
b	0.15	0.35
c	0.11	0.175
D	2.00	2.20
E	1.15	1.35
E1	2.15	2.45
e	0.65	
e1	1.20	1.40
L	0.525	
L1	0.26	0.46
θ	0°	8°



5.3、DFN4



Symbol	Dimensions (mm)	
	Min.	Max.
A	0.37	0.43
A1	0.00	0.05
b	0.15	0.25
c	0.127	
D	0.75	0.85
D2	0.20	0.40
E	0.75	0.85
E2	0.20	0.40
e	0.50	
L	0.15	0.25
L1	0.05	
L2	0.20	
L3	0.055	
L4	0.10	
R	0.05	



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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