



AiP54123

High-Speed Earth Leakage Current Protector

Product Specification

Specification Revision History:

Version	Date	Description
2019-06-A1	2019-06	New
2022-01-A2	2022-01	Modify the ordering information
2023-03-B1	2023-03	Update the template
2024-09-B2	2024-09	Modify the parameters



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**1、General Description**

The AiP54123 is a high-speed earth leakage current protector. In normal operating, the AiP54123 should be connected to the secondary side of the ZCT (zero current transformers). The ZCT detects the leakage signal of the power supply circuit, which is amplified and judged by the leakage protection circuit to control the switch of the external SCR.

Features:

- High input sensitivity : $V_T=6.1\text{mV}$ (Typical)
- Only need low external component count
- High anti-interference and surge-proof
- Low power dissipation: $P_D=5\text{mW}$ (Typical)
- May be used both as 110V and 220V
- Temperature range: -40°C to $+85^{\circ}\text{C}$
- Package information: DIP8/SOP8/SIP8

Ordering Information:**Tube packing specifications:**

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP54123SIP8.TB	SIP8	AiP54123	25 PCS/tube	60 tube/box	1500 PCS/box	Dimensions of plastic enclosure: 19.2mm×6.5mm Pin spacing: 2.54mm
AiP54123DA8.TB	DIP8	AiP54123	50 PCS/tube	40 tube/box	2000 PCS/box	Dimensions of plastic enclosure: 9.2mm×6.4mm Pin spacing: 2.54mm
AiP54123SA8.TB	SOP8	AiP54123	100 PCS/tube	100 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm

Reel packing specifications:

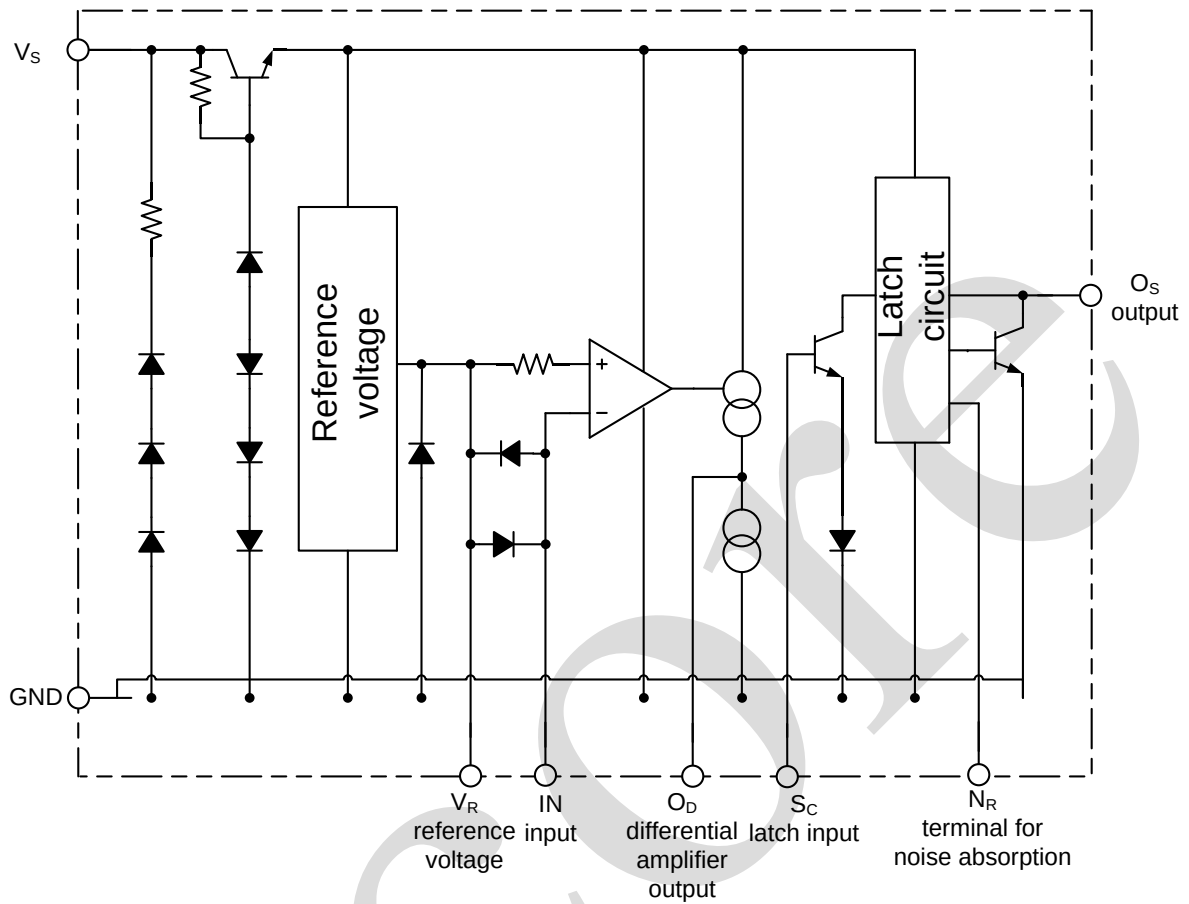
Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP54123SA8.TR	SOP8	AiP54123	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.

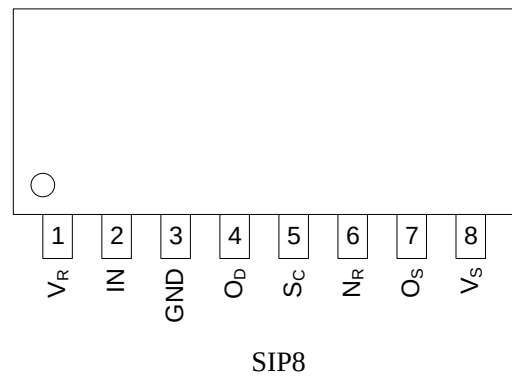
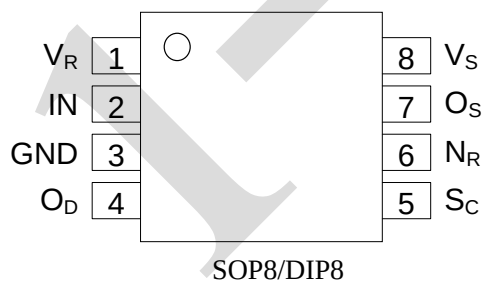


2、Block Diagram And Pin Description

2.1、Block Diagram



2.2、Pin Configurations





2.3、Pin Description

Pin No.	Pin Name	Description
1	V _R	reference voltage
2	IN	input
3	GND	ground
4	O _D	differential amplifier output
5	S _C	latch input
6	N _R	noise absorption
7	O _S	output
8	V _S	supply voltage

3、Electrical Parameter

3.1、Absolute Maximum Ratings

(T_{amb}=25℃, unless otherwise specified)

Characteristic		Symbol	Conditions		Value	Unit
supply current		I _S	-		8	mA
V _R pin current	Between V _R and IN ^[2]	I _{VR}	-		250	mA
	Between V _R and GND		-		30	mA
	Between IN and V _R ^[2]		-		-250	mA
IN pin current	Between IN and V _R ^[2]	I _{IN}	-		250	mA
	Between IN and GND		-		30	mA
	Between V _R and IN ^[2]		-		-250	mA
S _C pin current		I _{SC}	-		5	mA
Power dissipation		P _D	-		200	mW
storage temperature		T _{stg}	-		-65 to 150	°C
thermal resistance	SOP8	θ _{JA}	-		160	°C/W
	DIP8		-		110	
	SIP8		-		110	
soldering temperature		T _L	10s	SIP	245	°C
				DIP	250	
				SOP	260	

Note:

[1] Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

[2] Current value between V_R and IN, and between IN and V_R is less than 1ms in the pulse width, and duty cycle is less than 12%, in applying AC current continuously, it is 100 mA in the off-state.



3.2、Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
supply voltage (latch circuit is off-state)	V_S	12	-	-	V
external capacitor between V_S and GND	C_{VS}	1	-	-	μF
external capacitor between O_S and GND	C_{OS}	-	-	1	μF
ambient temperature	T_{amb}	-40	-	+85	$^{\circ}\text{C}$

3.3、Electrical Characteristics

3.3.1、DC Characteristics

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
supply current 1	I _{S1}	V _S =12V, V _R -V _I =30mV, see test circuit 1	T _{amb} =-40℃	-	-	580	uA
			T _{amb} =25℃	-	400	530	uA
			T _{amb} =85℃	-	-	480	uA
trip voltage	V _T	V _S =16V, V _R -V _I , T _{amb} =-40～85℃ ^[2] , see test circuit 2		4	6.1	9	mVrms
timed current 1	I _{TD1}	V _S =16V, V _R -V _I =30mV, V _{OD} =1.2V, T _{amb} =25℃, see test circuit 3		-12	-	-30	uA
timed current 2	I _{TD2}	V _S =16V, short circuit between V _R and V _I , V _{OD} =0.8V, T _{amb} =25℃, see test circuit 4		17	-	37	uA
output current	I _O	V _{SC} =1.4V, V _{OS} =0.8V, see test circuit 5	I _{S1} =530uA, T _{amb} =-40℃	-200	-	-	uA
			I _{S1} =530uA, T _{amb} =25℃	-100	-	-	uA
			I _{S1} =530uA T _{amb} =85℃	-75	-	-	uA
S _C “ON” voltage ^[3]	V _{SC“ON”}	V _S =16V, T _{amb} =25℃, see test circuit 6		0.7	-	1.4	V
S _C input current	I _{SC“ON”}	V _S =12V, T _{amb} =25℃, see test circuit 7		-	-	5	uA
output low-level current	I _{OSL}	V _S =12V, V _{OSL} =0.2V, T _{amb} =-40℃ to 85℃, see test circuit 8		200	-	-	uA
input clamp voltage	V _{IC}	V _S =12V, I _{IC} =20mA, T _{amb} =-40℃ to 85℃, see test circuit 9		4.3	-	6.7	V
differential input clamp voltage	V _{IDC}	I _{IDC} =100mA, T _{amb} =-40℃ to 85℃, see test circuit 10		0.4	-	2	V
maximum current voltage	V _{SM}	I _{SM} =7mA, T _{amb} =25℃, 测试图 11		20	-	28	V
supply current 2 ^[4]	I _{S2}	V _R -V _I , V _{OS} =0.6V, T _{amb} =-40℃ to 85℃ ^[5] , see test circuit 12		-	-	1200	uA
supply voltage (latch circuit is off-state) ^[6]	V _{S“ON”}	T _{amb} =25℃, see test circuit 13		0.5	-	-	V



operating time ^[7]	T_{ON}	$V_S=16V$, $V_R-V_I=0.3V$, $T_{amb}=25^{\circ}C$, see test circuit 14	2	-	4	ms
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Note:

[1] Typical values are at $T_{amb}=25^{\circ}C$.

[2] When standard value of voltage (60Hz) between V_R and V_I is minimum, and output O_S is low-level, or when standard value of voltage (60Hz) between V_R and V_I is maximum, and output O_S is high-level, it is considered as a good one.

[3] When standard value of voltage $V_{SC(ON)}$ is minimum, and output O_S is low-level, or when standard value of voltage $V_{SC(ON)}$ is maximum, and output O_S is high-level, it is considered as a good one.

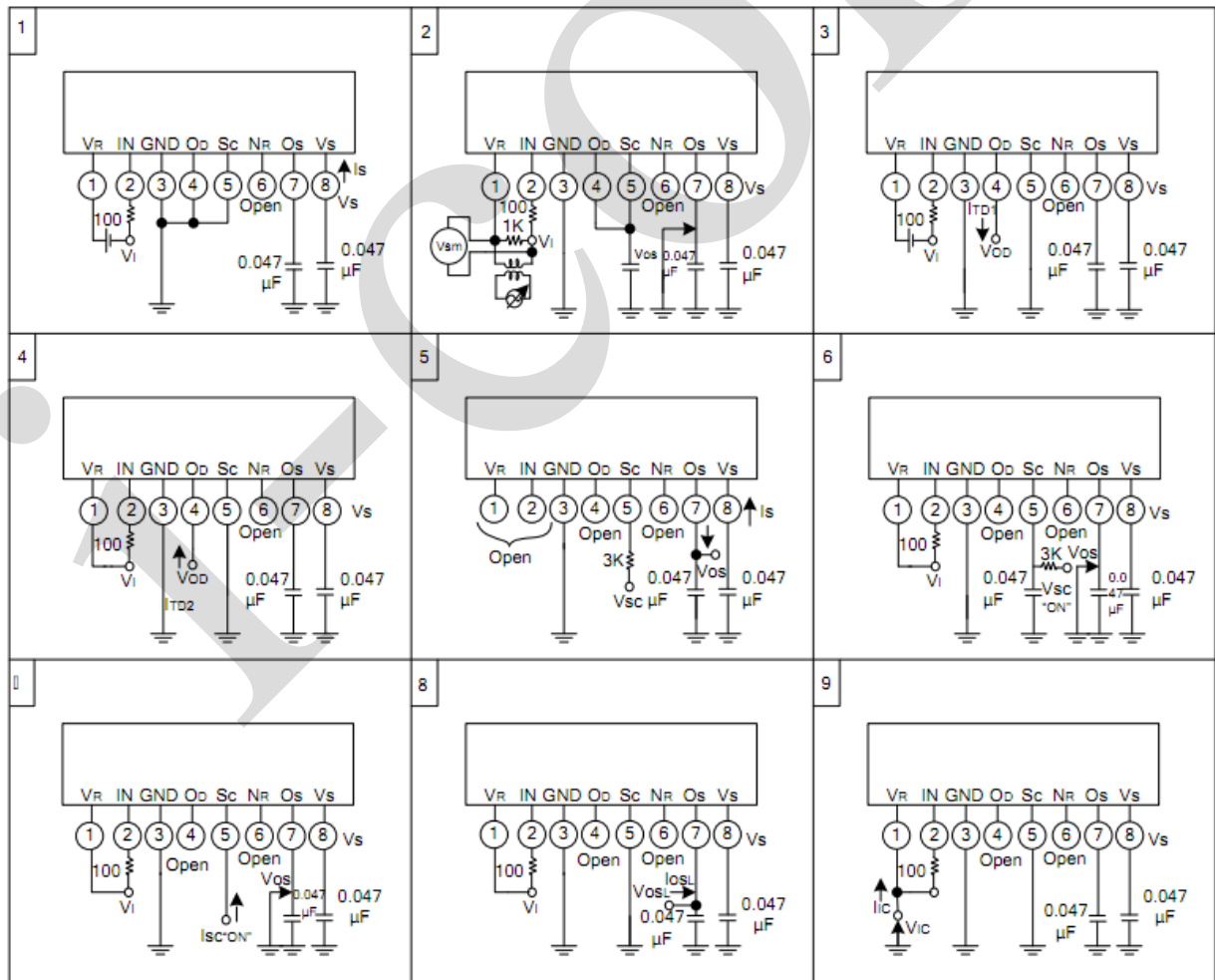
[4] Supply current 2 is necessary to keep high in output O_S .

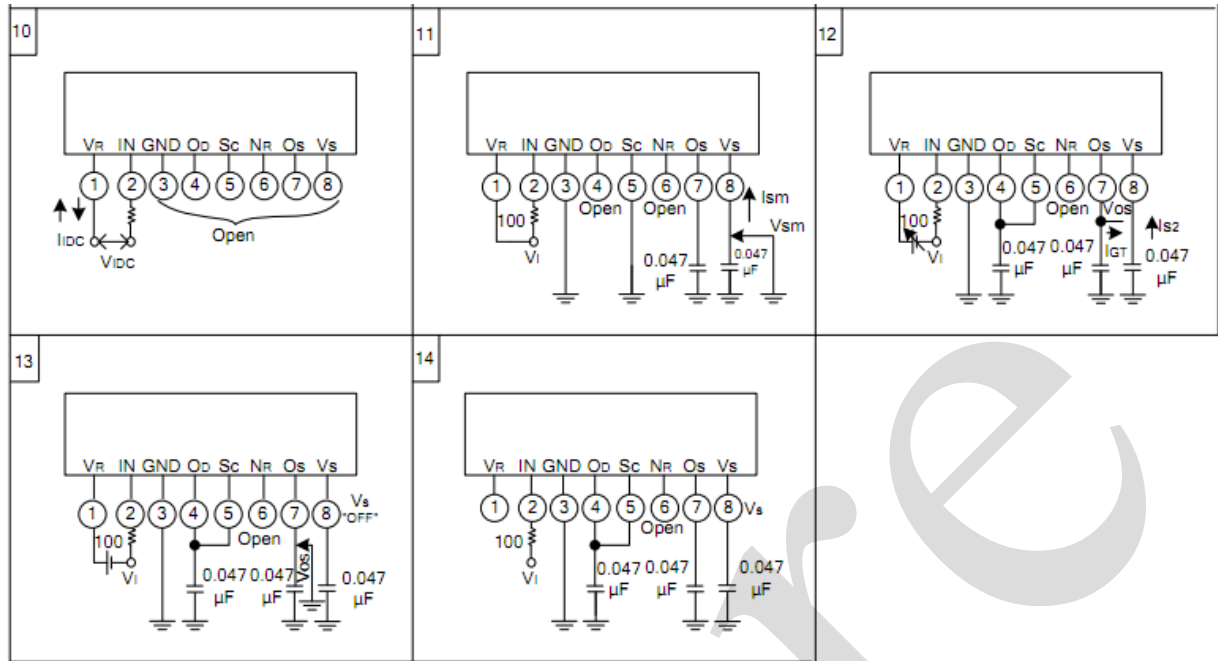
[5] After applying 30mV between V_R and V_I and shorting between them, it is considered as a good one if standard value of IGT flows out of output O_S .

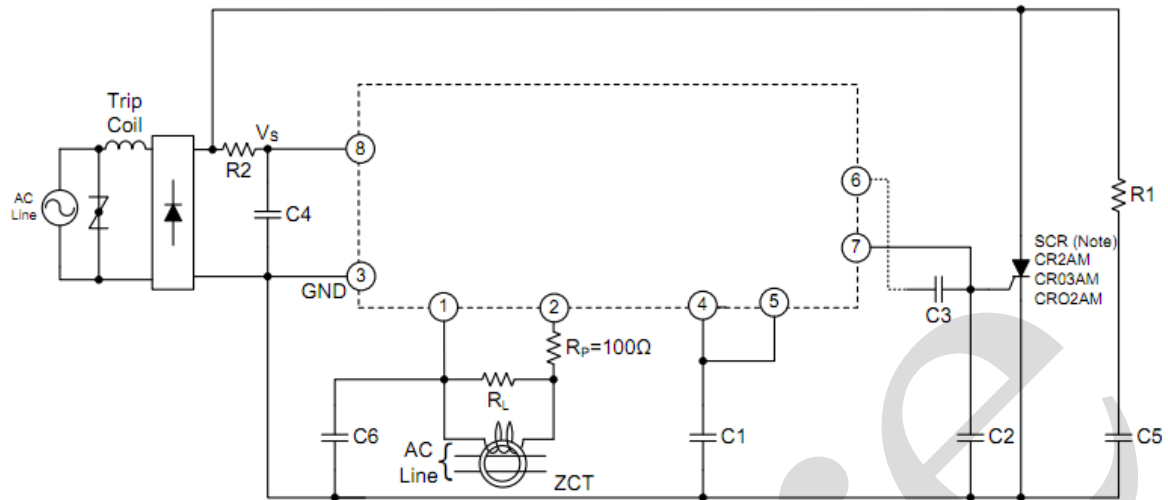
[6] After supply voltage applies 12V and output O_S is high-level, it is considered as a good one in the standard value of supply voltage and in the low-level of output O_S .

[7] Operating time is a time from applying fixed input till operating latch circuit in $0.047\mu F$ between O_D and GND.

4、Testing Circuit





**5、Typical Application Circuit And Application Note****High-speed leakage circuit breaker****Note:**

The value of R1, R2, C4, and C5 should be chosen in order to keep at least 12V in V_S .

Please connect C4 ($>1\mu\text{F}$) and C2 ($<1\mu\text{F}$).

ZCT and load resistance R_L of ZCT are connected between input pin 1 and 2.

Protective resistance ($R_P=100\Omega$) must be insured.

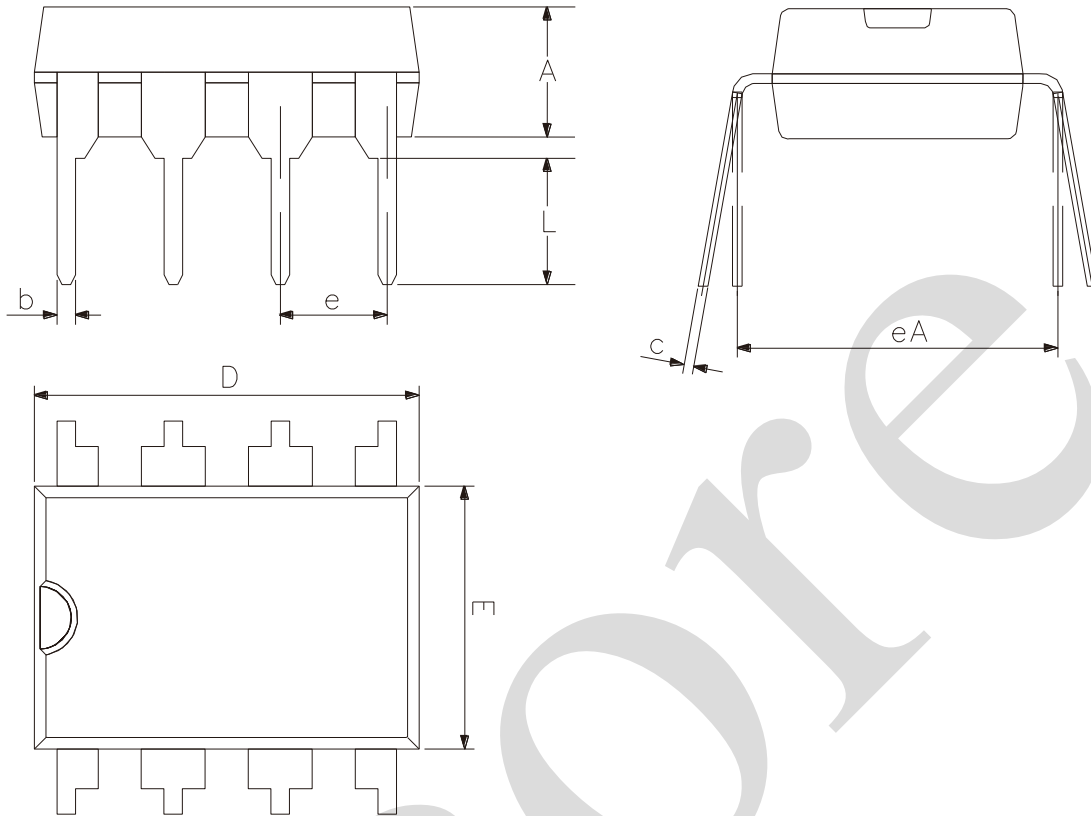
R_L and amplifier's output (in Pin 4) regulates sensitivity current

External capacitor C1 between pin 4 and GND is used for noise removal.

Please connect a varistor or a diode (2 pcs.) to ZCT in parallel, because of when large current is grounded in the primary side (AC line) of ZCT, the following situation can be abandoned: The wave form in the secondary side of ZCT is distorted and some signals do not appear in the output of amplifier.

Please connect capacitor (about $0.047\mu\text{F}$) between pin 6 and pin 7.

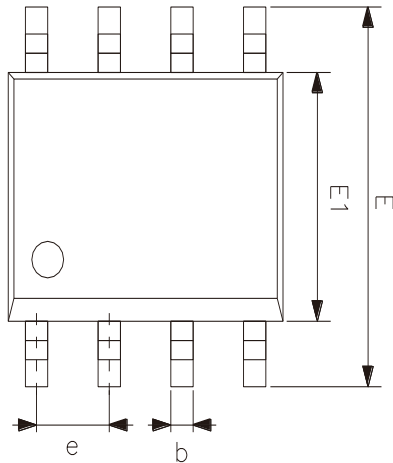
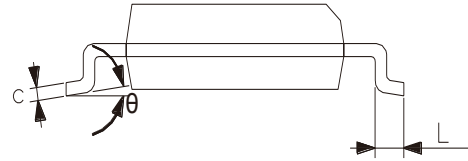
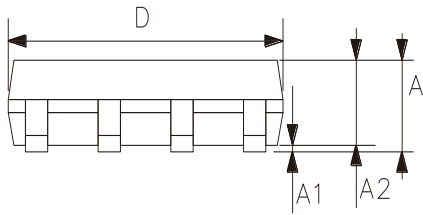
Capacitor C6 between pin 1 and GND is about $0.047\mu\text{F}$ for removing noise.

**6、Package Information****6.1、DIP8**

2023/12/A	Dimensions In Millimeters	
Symbol	Min	Max
A	3.00	3.60
b	0.36	0.56
c	0.20	0.36
D	9.00	9.45
E	6.15	6.60
e	2.54	
eA	7.62	9.30
L	3.00	—



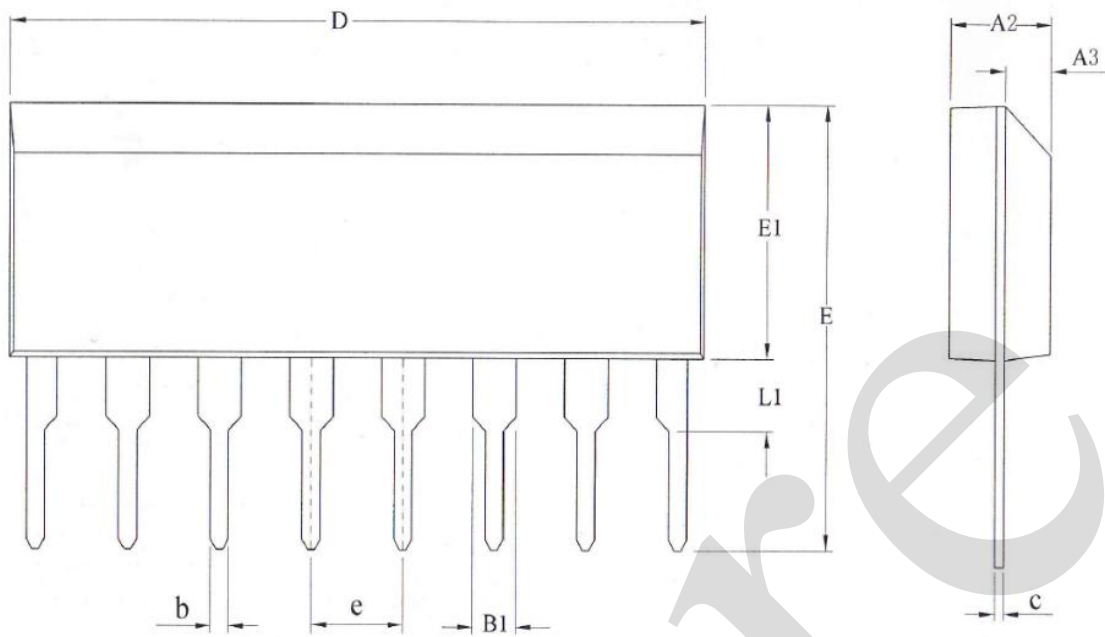
6.2、SOP8



2023/12/A	Dimensions In Millimeters	
Symbol	Min.	Max.
A	1.35	1.80
A1	0.05	0.25
A2	1.25	1.55
D	4.70	5.10
E	5.80	6.30
E1	3.70	4.10
b	0.306	0.51
c	0.19	0.25
e	1.27	
L	0.40	0.89
θ	0°	8°



6.3、SIP8



2023/12/A	Dimensions In Millimeters	
Symbol	Min	Max
A2	2.70	2.90
A3	1.35	1.45
b	0.48	0.56
B1	1.20	
c	0.25	0.29
D	19.10	19.30
e	2.54	
E	11.20	11.60
E1	6.40	6.60
L1	1.30	1.70



7、Statements And Notes

7.1、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.									

7.2、Notes

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