



AiP8181/8180

Zero-Drift, Bidirectional Current Detection Amplifier

Product Specification

Specification Revision History:

Version	Date	Description
2023-08-A0	2023-08	New
2024-08-A1	2024-08	Modify parameters



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1、General Description

The AiP8181/AiP8180 is a wide-band, zero-drift, bidirectional current detection amplifier, mainly used in battery monitoring, power management, overcurrent detection, etc. The circuit can sense the voltage drop on the shunt resistor at -0.2V to 30V common-mode voltage, The AiP8181/AiP8180 integrates a matching resistor gain network with four fixed gain options: 20V/V, 50V/V, 100V/V and 200V/V.

The AiP8181/AiP8180 is powered by a single supply from 2.7V to 5.5V, with a maximum supply current of 260 μ A.

Features:

- Rail-to-rail output
- Offset voltage:
 $\pm 150 \mu\text{V}$ (Max.), $V_{\text{CM}}=0\text{V}$
 $\pm 500 \mu\text{V}$ (Max.), $V_{\text{CM}}=12\text{V}$
- Precision and zero drift characteristics:
Gain error: $\pm 1\%$ (Max.)
Offset drift: $1 \mu\text{V}/^\circ\text{C}$ (Max.)
Gain drift: $20 \text{ppm}/^\circ\text{C}$ (Max.)
- Output voltage gain:
20V/V (AiP8181 A1, AiP8180 A1, B1)
50V/V (AiP8181 A2, AiP8180 A2, B2)
100V/V (AiP8181 A3, AiP8180 A3, B3)
200V/V (AiP8181 A4, AiP8180 A4, B4)
- High bandwidth: 350kHz (AiP8181 A1, AiP8180 A1, B1)
- Package form:
AiP8181: SOT23-6
AiP8180: SOT23-5

**Ordering Information:****Reel packing specifications:**

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP8181A1GB236.TR	SOT23-6	FMXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8181A2GB236.TR	SOT23-6	FNXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8181A3GB236.TR	SOT23-6	FPXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8181A4GB236.TR	SOT23-6	FQXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8180A1GB235.TR	SOT23-5	FRXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8180A2GB235.TR	SOT23-5	FSXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8180A3GB235.TR	SOT23-5	FTXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8180A4GB235.TR	SOT23-5	FUXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8180B1GB235.TR	SOT23-5	FWXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8180B2GB235.TR	SOT23-5	FXXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing:



					0.95mm
AiP8180B3GB235.TR	SOT23-5	FYXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP8180B4GB235.TR	SOT23-5	FZXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm

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

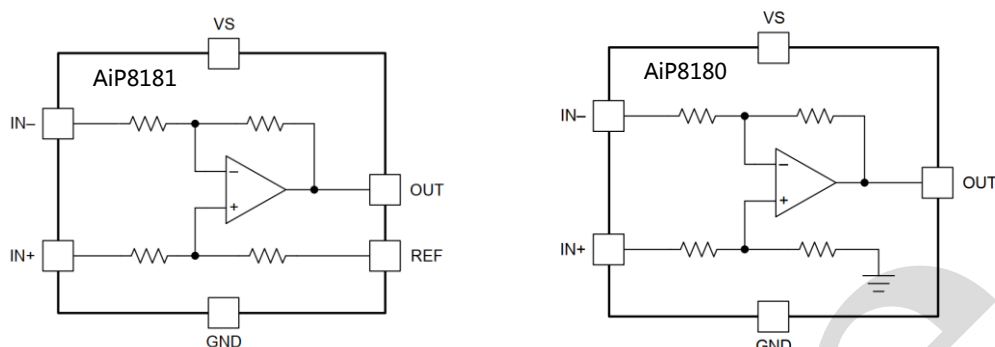


Figure 1. block diagram

2.2、Pin Configurations

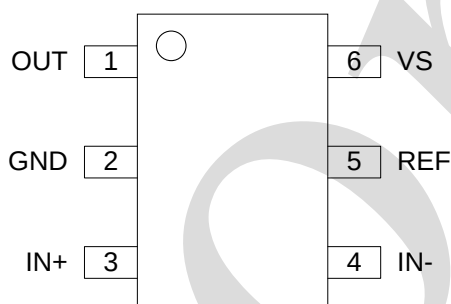


Figure 2. AiP8181 pin configuration

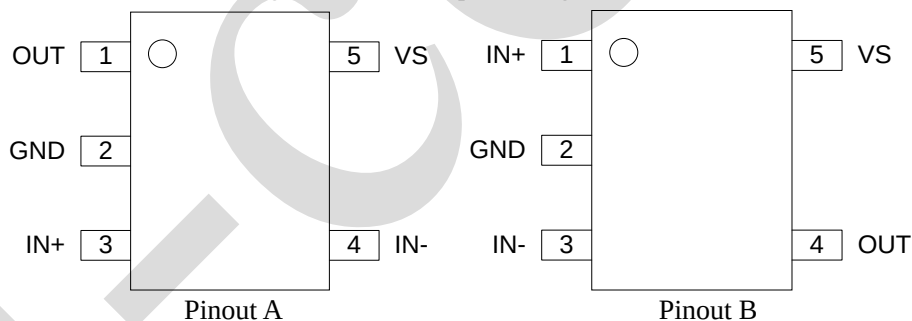


Figure 3. AiP8180 pin configuration

2.3、Pin Description

Pin No.			Pin Name	I/O	Description
AiP8181	AiP8180 Pinout A	AiP8180 Pinout B			
1	1	4	OUT	O	Ouput voltage
2	2	2	GND	GND	Negative voltage or ground
3	3	1	IN+	I	Current-sense amplifier positive input
4	4	3	IN-	I	Current-sense amplifier negative input.
5	-	-	REF	I	Reference voltage
6	5	5	VS	VCC	Positive voltage



3、Electrical Parameter

3.1、Absolute Maximum Ratings

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

Characteristic	Symbol	Conditions	Min.	Max.	Unit
Power supply voltage	VS	-	-	6	V
Input voltage IN+, IN-	Difference (IN+)-(IN-)	-	-30	30	V
	Common mode (VCM)	-	GND-0.2	35	V
Output current	I _{OUT}	-	-	8	mA
Maximum junction temperature	T _J	-	-	150	°C
Storage temperature	T _{stg}	-	-65	150	°C
Soldering temperature	T _L	10s	260		°C

3.2、ESD

Parameter	Symbol	Conditions	Value	Unit
ESD	HBM	ANSI/ESDA/JEDEC JS-001	±3	kV

3.3、Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Common mode input voltage	V _{CM}	-0.2	12	30	V
Power supply voltage	VS	2.7	5	5.5	V
Ambient temperature	T _{amb}	-40	25	125	°C

3.3、Electrical Characteristics

($T_{amb}=25^{\circ}\text{C}$, $V_{SENSE}=(V_{IN+})-(V_{IN-})$, $VS=5V$, $V_{IN+}=12V$, $V_{REF}=VS/2$, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input						
Input offset voltage	VOS	V _{SENSE} =0mV	-	±100	±500	μV
		V _{SENSE} =0mV, V _{IN+} =0V	-	±25	±150	μV
Input offset voltage temperature drift	VOS TC	V _{SENSE} =0mV, -40°C to 125°C	-	0.2	1	μV/°C
Common mode input voltage	VCM	-40°C to 125°C	-0.2	-	30	V
Common mode rejection ratio	CMRR	V _{IN+} =0V to 30V, V _{SENSE} =0mV, -40°C to 125°C	84	100	-	dB
Input bias current	IB	V _{SENSE} =0mV, V _{IN+} = 0 V	-	-6	-	μA
		V _{SENSE} =0mV	-	75	-	μA
Input offset current	IOS	V _{SENSE} =0mV	-	0.05	-	μA
Power supply rejection ratio	PSRR	VS=+2.7V to 18V, V _{IN+} =18V, V _{SENSE} =0mV	-	±8	±40	μV/V
NOISE RTI (referred to input)						
Input voltage	en	f =1kHz	-	40	-	nV /√Hz



noise density						
Output						
Gain	G	AiP8181A1/ AiP8180A1, B1	-	20	-	V/V
		AiP8181A2/ AiP8180A2, B2	-	50	-	V/V
		AiP8181A3/ AiP8180A3, B3	-	100	-	V/V
		AiP8181A4/ AiP8180A4, B4	-	200	-	V/V
Gain error	EG	VOUT=0.5V to VS-0.5V, -40°C to 125°C	-	±0.1%	±1%	-
Gain error temperature drift	EG TC	-40°C to 125°C	-	1.5	20	ppm
Nonlinear error	—	VOUT=0.5V to VS-0.5V	-	±0.01%	-	-
Maximum load capacitance	CLOAD	No sustained oscillation	-	1	-	nF
Swing to VS power-supply rail	VOH	RLOAD=10kΩ to GND, -40°C to 125°C	VS-0.03	VS-0.02	-	V
Swing to GND	VOL	RLOAD=10kΩ to GND, -40°C to 125°C	-	VGND+0.0005	VGND+0.005	V
Frequency response						
Bandwidth	BW	CLOAD=10pF, AiP8181A1, AiP8180A1, B1	-	350	-	kHz
		CLOAD=10pF, AiP8181A2, AiP8180A2, B2	-	210	-	kHz
		CLOAD=10pF, AiP8181A3, AiP8180A3, B3	-	150	-	kHz
		CLOAD=10pF, AiP8181A4, AiP8180A4, B4	-	105	-	kHz
Slew rate	SR	AiP8181A1, AiP8180A1, B1	-	2	-	V/μs
		AiP8181A2, AiP8180A2, B2	-	4	-	V/μs
		AiP8181A3, AiP8180A3, B3	-	6	-	V/μs
		AiP8181A4, AiP8180A4, B4	-	8	-	V/μs
Power supply						
Supply voltage	VS	-	2.7	-	5.5	V
Quiescent current	IQ	AiP8181, AiP8180, VSENSE=0mV	-	175	260	μA
		AiP8181, AiP8180, VSENSE=0mV, -40°C to 125°C	-	-	300	μA



4、Characteristic Curve

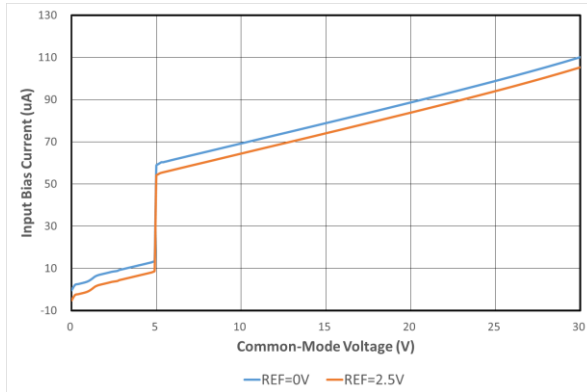


Figure 4. Input bias current vs Input common-mode voltage (VS=5V)

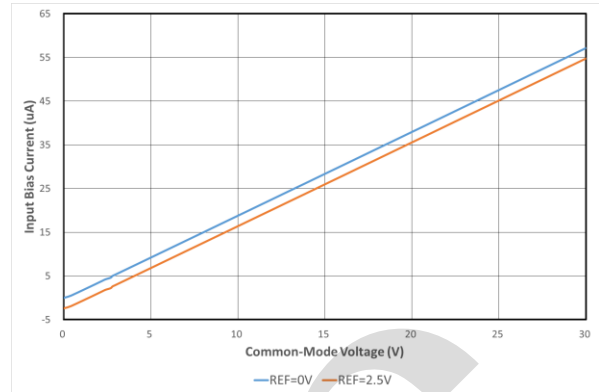


Figure 5. Input bias current vs Input common-mode voltage (VS=0V)

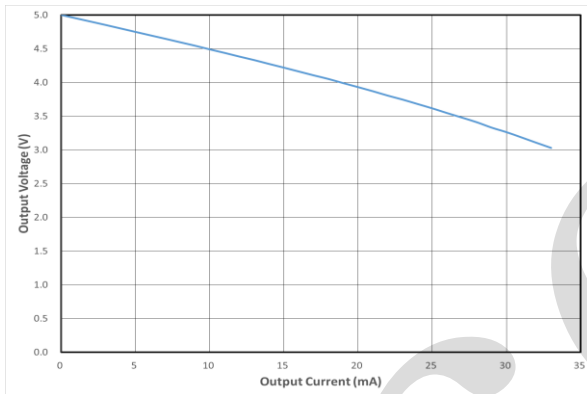


Figure 6. Output High-level drive

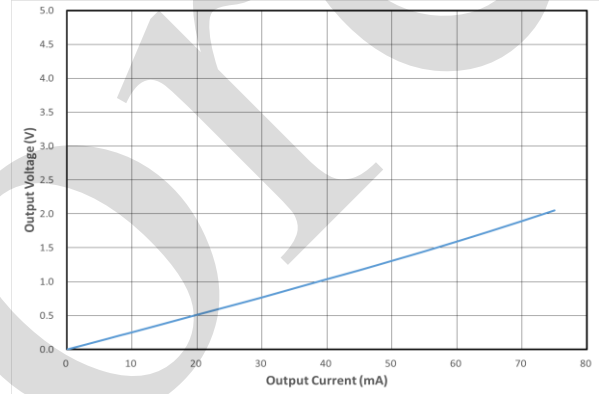


Figure 7. Output Low-level drive

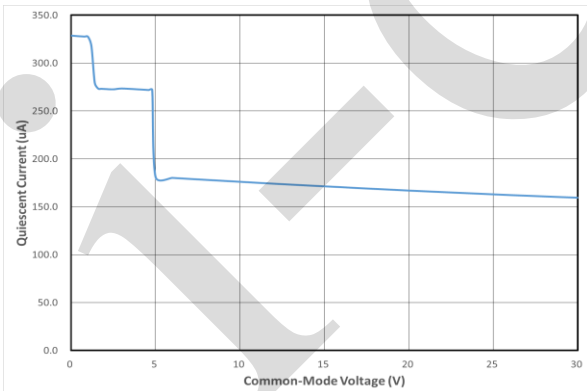


Figure 8. Input common-mode voltage vs Quiescent current (VS=5V)



5、Typical Application Circuit And Application Note

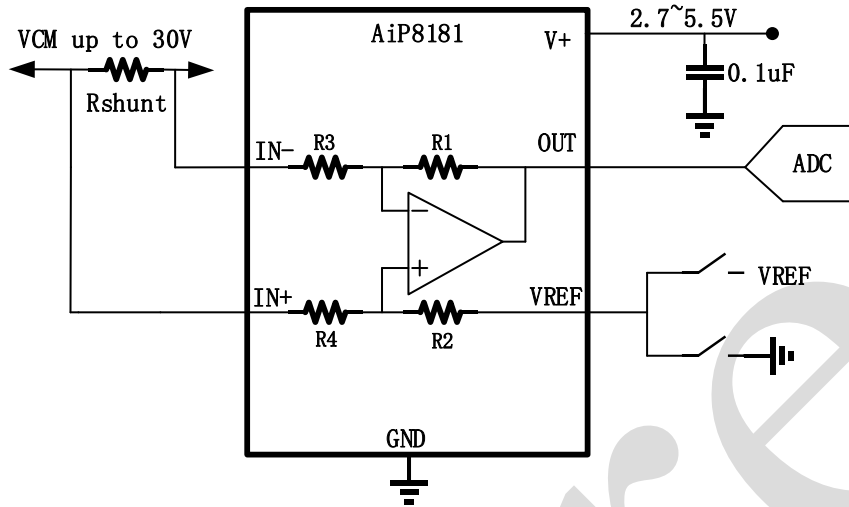


Figure 9. AiP8181 typical application circuit

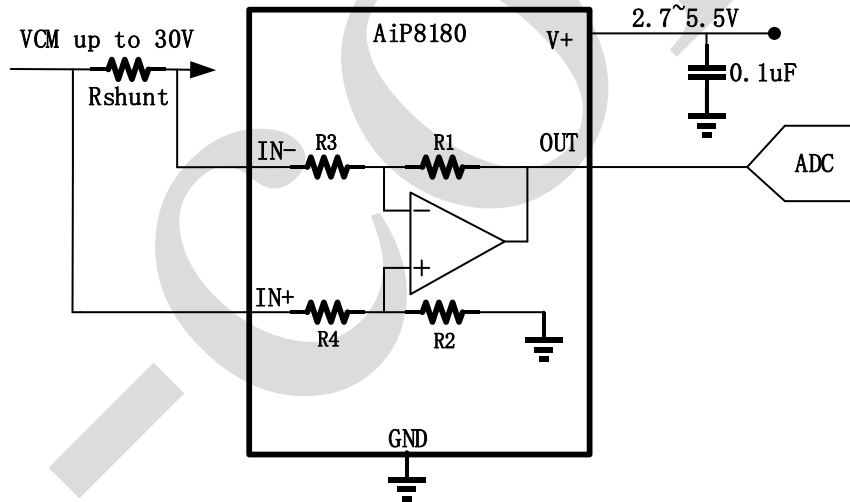
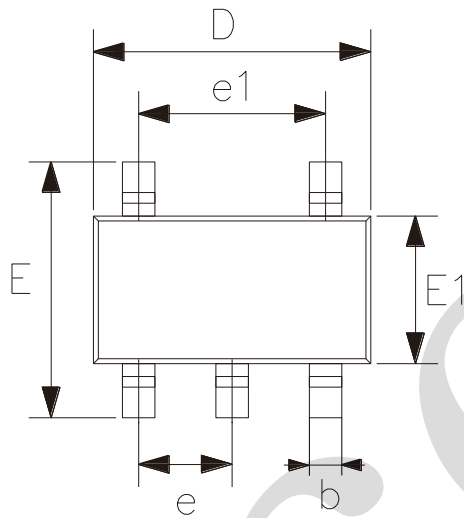
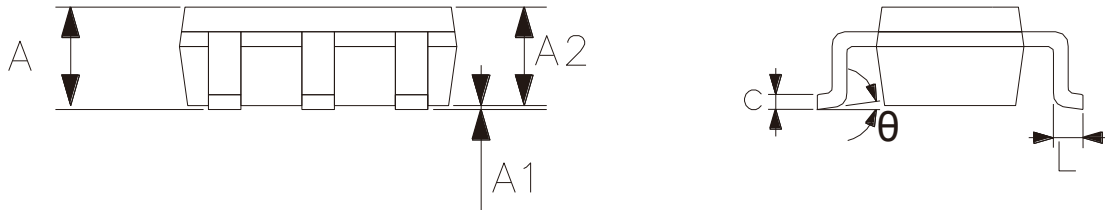


Figure 10. AiP8180 typical application circuit

The above figures show the basic connections of the AiP8181/AiP8180. Connect the input pins (IN+ and IN-) as closely as possible to the shunt resistor to minimize any resistance in series with the shunt resistor. To ensure stability, connect bypass capacitors close to the device pins.

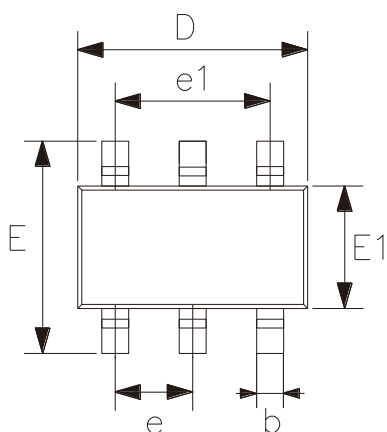
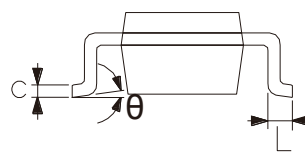
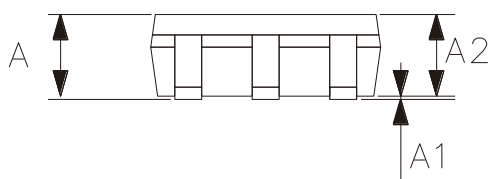
**6、Package Information****6.1、SOT23-5**

2023/12/A	Dimensions In Millimeters	
Symbol	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°

Note: The package dimensions do not include flash and burrs, and the dimensions of flash and burrs shall not exceed 0.15mm.



6.2、SOT23-6



2023/12/A	Dimensions In Millimeters	
Symbol	Min.	Max.
A	—	1.25
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°

Note: The package dimensions do not include flash and burrs, and the dimensions of flash and burrs shall not exceed 0.15mm.



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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