PCBS8518A050P1SC00, Automotive Operation Temperature -40 °C~+125 °C Shunt Based Current Sensing Module

1、Characteristics

- Continuous Operating Range: -350A~+350A
- Connector: Horizontal 4 PIN
- High Accuracy Current Measurement
- Real-Time Temperature Measurement
- Applicable to High Pulse Current
- Low TCR, Low Inductance, Low Thermal EMF
- Excellent Long-Term Stability
- Operating Temperature Range：-40℃~125℃

2、Applications

- BMS Current Measurement
- BDU/PDU Current Measurement

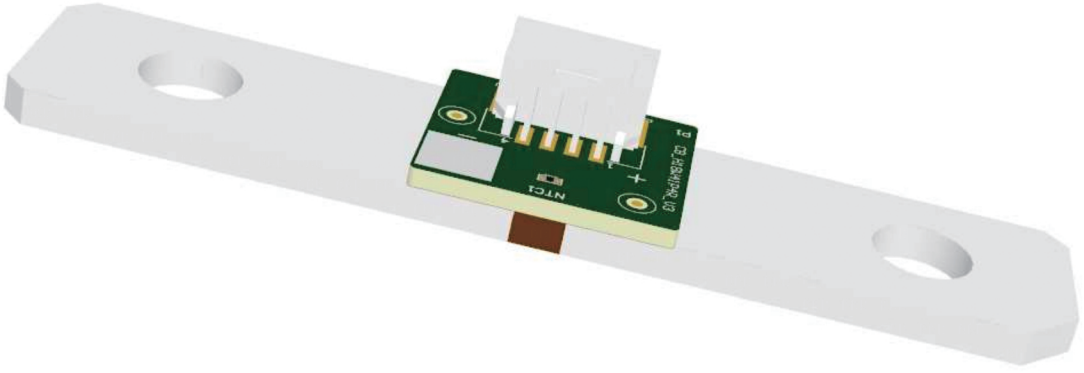
3、Introduction

PCBS8518A050P1SC00 is an automotive current sensing module used to assist in measuring bidirectional DC current. It has high accuracy, low TCR, low inductance, low thermal EMF, and excellent long-term stability and anti-interference ability.

This module is designed based on a low-TCR shunt, which is welded with PCBA and can be installed on the circuit through bolts. It is used to collect bus current and shunt temperature, and send the measured signal to the signal processing side of the user defined module. It can be customized according to the specific technical requirements.

Module Information

Shunt Size	Hole Diameter	Connector
85mm×18mm	8.3mm	5023520400



Content

4、Revision

Date	Note	Revised Content
2023.02	/	A0
2023.04.10	Revise the copper bar connection diagram.	A1
2023.09.20	Revise the derating curve	A2
2023.12.05	Revise the layout of datasheet	A3

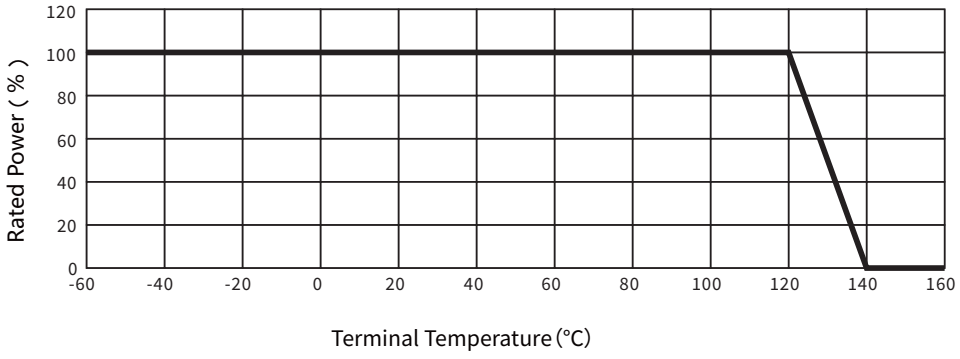
5、Specifications

5.1 Limit Parameters

Note: Product will affect its reliability and cause unexpected permanent damage if operating under limit parameters for long time.

Parameter	Condition	Min.	Typical	Max.	Unit
Current Measurement Range	±1000A			5	s
Operating Temperature		-40		125	°C
Storage Temperature		-40		125	°C
Humidity				95	%RH

[1] When operating temperature＞120°C, derating power is needed. The specific derating range refers to the figure below.



5.2 General Parameters

Test Conditions: Ambient Temperature 25°C (Unless Otherwise Noted)

Parameter	Condition	Min.	Typical	Max.	Unit
Shunt					
Resistance			50		μΩ
Tolerance			±5		%
TCR	-40°C~+125°C		±100		ppm/°C
Continuous Operating Current			±350		A
Thermal EMF				3	μV/°C
Inductance				5	nH
Operating Temperature Range			-55~+175		°C
NTC					
Resistance			10		kΩ
Tolerance			±1		%
TCR	25/85°C		3435		K
Operating Temperature Range			-50~+150		°C

6、Test Standards

Test No.	Test Standards	Test Items
General inspection		
1	/	Appearance
2	/	Dimension
3	/	Weight
4	/	Flatness of installation
Electrical loads		
5	VW 80000-2021 5.4.20	E-18 Insulation resistance
6	VW 80000-2021 5.4.22	E-20 Dielectric strength
7	GB/T 6148-2005	Drift of temperature
Climatic loads		
8	GB/T 2423.2-2008	High temperature aging
9	GBT 2423.1-2008	Low-temperature operation
10	VW 80000：2021 5.6.5	K-05 Thermal shock (component)
11	GB/T2423.50-2012 MIL-STD-202 Method 103	Damp heat, constant
12	VW 80000：2021 5.8.3	L-03 Service life test – Temperature cycle durability testing
13	GB/T 10125-2021	Salt spray
Mechanical loads		
14	VW 80000-2021 5.5.1	M-01 Free fall
15	VW 80000-2021 5.5.4	M-04 Vibration test
16	VW 80000-2021 5.5.5	M-05 Mechanical shock
Regulation Validation		
17	RoHS	Pb, Cd, Hg, Cr(V), PBBs, PBDEs
18	REACH	CMR,PBT,vPvB...

7、Current Data

7.1 Temperature Compensation

PCBS8518A050P1SC00 applies temperature compensation to weaken the impact of ambient temperature changes on the shunt resistance. A fitting algorithm is used to compute a curve of the shunt resistance change with temperature , as shown in Figure 7-1.

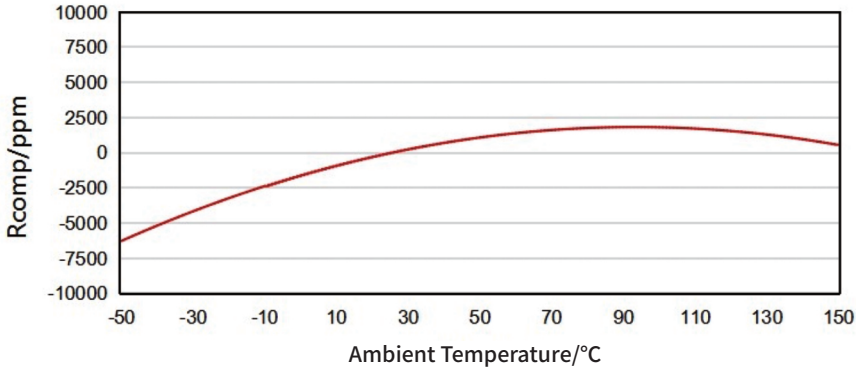


Figure 7-1. R_{COMP} Temperature Characteristic Curve

As shown in Figure 7-1, the compensation factor R_{COMP} temperature characteristic curve is:

$$R_{COMP}=A*T^2+B*T+C$$

Demonstration:

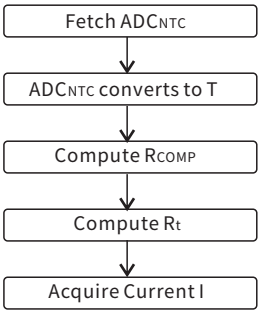
R_{COMP} : The drift of the shunt resistance relative to the change from initial temperature to present temperature, in ppm.
T : Present Temperature of Shunt
A : Coefficient of Quadratic Term T^2
B : Coefficient of Primary Term T
C : Constant Term

Shunt resistance R_t at present temperature t, through temperature compensation:

$$R_t=R_0*(1+R_{COMP}/10^6)\ [1]$$

[1] R_0 is the initial resistance of shunt at lab environment, usually at +25°C±2°C
[2] Figure 7-1 is only for illustration of this product. It is not the temperature characteristic curve for all products.

7.2 Current Data Acquisition



ADC_{NTC}: ADC of NTC

T: NTC Temperature (°C)

R_{COMP}: $R_{COMP}=A*T^2+B*T+C$

$R_t=R_0*(1+R_{COMP}/10^6)$

$I=V_{SHUNT}/R_t$
V_{SHUNT}: Voltage of Shunt

8、Mechanical Structure

8.1 Dimensions

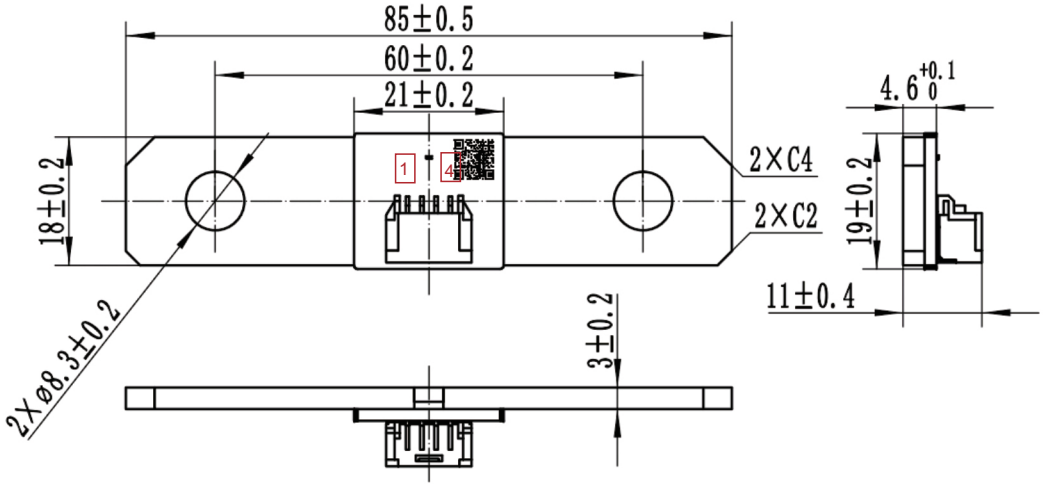


Figure 8. 1 Structure Diagram

8.2 Laser QR Code

8.2.1 Code Size

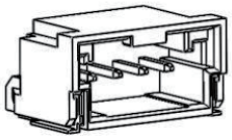
No.	Materials	Size L*W(mm)
1	PCB Cover Size	6*6
2	Data Matrix Size	5*5

8.2.2 Data Matrix

Content	Year	Month	Day	Module ID	R_0 [1]	Coefficient A[2]	Coefficient B[3]	Constant Term C[4]
Format	YYYY	MM	DD	XXXXX	RXXX.XXXX	±X.XXXXXXXX	±XXX.XXXXX	±XXXX.XXX
Example	2023	02	13	00001	R051.4912	-0.45837105	+130.48848	-2975.730
	20230213000001R051.4912-0.45837105+130.48848-2975.730[5]							

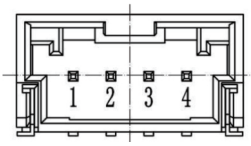
[1]R_0, the initial resistance of shunt at lab environment, usually at 25°C±2°C, rounded to 4 decimal places, in μΩ.
[2]Coefficient A of Quadratic Term T^2, rounded to 8 decimal places.
[3]Coefficient B of Primary Term T, rounded to 5 decimal places.
[4]Constant Term C, rounded to 3 decimal places.
[5]The total number of characters is 52.

8.3 Connector

Manufacturer	Pin Count	Part #	Structural Diagram
Molex	4	5023520400	

[1] 推荐对插母头型号:5023510400 。

8.4 Connector Definition

No.	Pin No.	Code	Description	Structural Diagram
1	Pin 1	T1	Temperature Sensor Pin 1	
2	Pin 2	S+	Current Signal Positive	
3	Pin 3	S-	Current Signal Negative	
4	Pin 4	T2	Temperature Sensor Pin 2	

[1] Refer to the recommended current direction in the PCB Structural Diagram.
[2] Recommend Pin1 and Pin4 as twisted pair. Pin2 and Pin3 as twisted pair.

8.5 PCB Structural Diagram

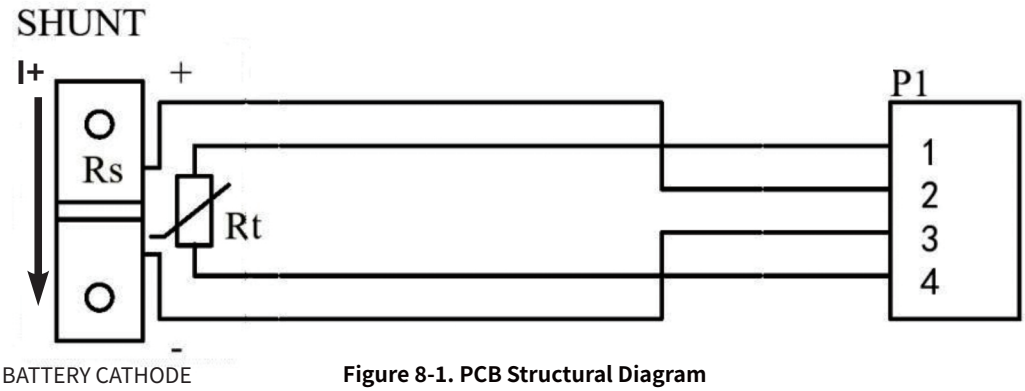


Figure 8-1. PCB Structural Diagram

[1] The direction of current is related to the installation position of the PCBS product in the BDU, and is not related to the PCBS itself.
[2] The positive and negative electrode of the PIN is determined by the direction of the current in the diagram.
[3] Generally, battery discharge is considered positive and charging is considered negative.

8.6 Copper Bar Connection

- Recommended Bolts: M8
- Recommended Torque: 15-20Nm
- Recommended Width * Thickness of Copper Bar: 24mm*3mm
- Recommended Length of Overlap between Shunt and Copper Bar: 20mm
- Do not use a flat washer between the copper bar and the shunt
- Keep the surface of shunt and copper bar clean and free of scratches

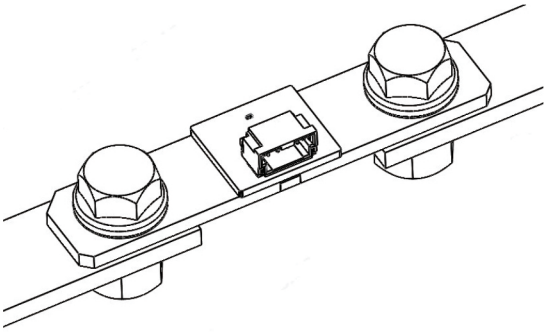


Figure 8-2. Shunt Connection Diagram

9.Storage & Packaging

9.1 Storage

- Recommended storage at room temperature.
- The storage environment shall be clean, tidy, dry and free of harmful gases.
  The packaging case shall be protected from direct sunlight.
- Anti-static bracelet or gloves shall be worn during installation, storage and handling.

9.2 Packaging

9.2.1 General Information

Packaging Element	Specifications	
SNP[1]	150	
Container	Carton	
Container Size	509*342*240	mm

[1] SNP, Standard Number of Package

9.2.2 Auxiliary Materials Information

No.	Materials	Size L*W*H(mm)	Quantity	Recycle
1	50-Grid EPE Tray	496*328*61	3	No
2	EPE Tray Cover	495*325*5	4	No
3	Anti-Static PE Bag	900*510	1	No

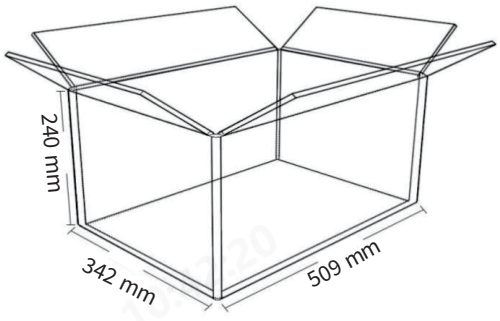


Figure 9-1. Carton Diagram

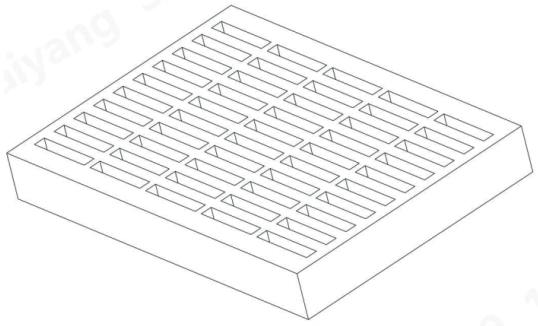


Figure 9-2.Structure Diagram of EPE

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