Product Model: BMS500
Measurement Range: DC±500A
Accuracy: 0.5%

BMS500 Automotive Current Transducer

BMS500 fluxgate transducer is made of an excitation magnetic ring and a control circuit. Under normal conditions, the control circuit generates a fixed excitation current frequency to alternately place the magnetic core at the maximum saturation point. When the measured current flows, the primary current is measured by detecting the symmetry of the saturation point.

The multi-point zero-flux technology system secures the high accuracy by utilizing the technology combination of exciting magnetic flux closed-loop control, self-excited magnetic flux gate and multi-closed-loop control that realizes the closed-loop control between excitation magnetic flux and AC/DC magnetic flux generated by primary current, while the high-frequency ripple sensing channel allows the sensor to have the high performance over the full bandwidth range.

Product photo

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Introduction

The BMS series is suitable for battery monitoring systems that require high accuracy and low offset. It can realize the isolation measurement between the primary current (high voltage) and the secondary current (12V system).

Key Technologies

◇ Excitation closed-loop control technology
◇ Self-excitation demagnetization technology
◇ Temperature control compensation technology
◇ Unipolar + 12V battery power supply
◇ Output signal: CAN (500kbps)

Features

◇ Using fluxgate technology
◇ Unlimited over-current capability
◇ Panel mounting
◇ Optional internal digital low-pass frequency filter
◇ Optional CAN speed and model

Special features

◇ Connector type: Tyco AMP 1473672-1
◇ Full galvanic isolation

Advantage

◇ The error is compensated below 10mA
◇ High accuracy
- 0.1% error at room temperature (nominal)
- 0.5% error within the temperature range (±3σ)

Application Domain

◇ Hybrid and electric vehicle battery pack
◇ Accurate current measurement for battery management applications (SOC, SOH, SOF etc.)
◇ Conventional lead-acid batteries

Electrical Performance

Parameter	Symbol	Measuring Conditions	Min	Typ	Max	Unit
Load dump over-voltage	U_C	400ms	—	32	—	V
Over-voltage	U_C	1 minute	—	24	—	V
Reverse polarity	U_C	1 minute	—	-16	—	V
Minimum supply voltage	U_C	Continuous	—	6	—	V
Maximum supply voltage	U_C	Continuous	—	18	—	V
Creepage distance	d_{CP}		—	7.2	—	mm
Clearance	d_{Cl}		—	6.95	—	mm
RMS voltage for AC insulation test	U_d	50Hz, 1 minute	—	2.5	—	KV
Insulation resistance	R_{is}	500V-ISO 16750-2	—	500	—	MΩ
IP grade				IP42		

Operating characteristics in nominal range

Parameter	Symbol	Measuring Conditions	Min	Typ	Max	Unit
Electrical Data						
Supply voltage	U_C	—	8	13.5	16	V
Current consumption @ I_P=0A	I_C	@Uc=13.5V@25℃		40	45	mA
Current consumption @ I_P=500A	I_C	@Uc=13.5V@25℃		140	160	mA
Performance Data						
Primary current, measuring range	I_{PN}		-500		500	A
Current clamping value			-530		530	A
Voltage clamping value max		When Uc increases/When Uc decreases	—	17.2/16.9	—	V
Voltage clamping value min		When U_C increase/When Uc decreases	—	7.0/6.8	—	V
Linearity error	ε_L	At room temperature	—	0.1	—	%
Output noise		—	—	±10	—	mA
Frequency bandwidth[1)]	BW	Depends on the filter implemented	—	100	—	Hz
Start-up time			—	150	—	ms
Setting time after over load			—	20	—	ms

Note: 1)Bandwidth depends on emission period of the frame without digital filter.

General Characteristics

Parameter	Symbol	Measuring Conditions	Min	Typ	Max	Unit
Ambient operating temperature	T_A	Guaranteed accuracy ±3σ temperature range	-40	—	+85	ºC
Mass	M	—		67		g

Accuracy – Enhanced performances in typical application

PHEV and EV system may use different technologies of batteries. One very important parameter that may influence the stability of the SOC is the temperature.

The battery temperature affects vehicle performance, reliability, safety and lift-cycle cost.

The BMS500 series is qualified between -40℃ to 85℃ but the transducer shows a better accuracy in a restricted temperature range in order to deliver a very accuracy current measurement.

Absolute Accuracy Table

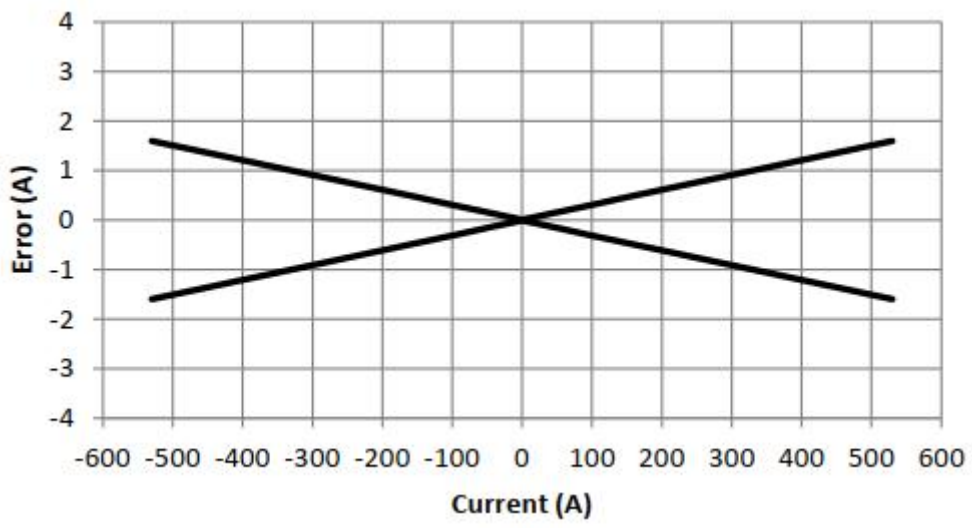
Operating parameters are valid for TA=-40 to 85℃ and VCC between 11V and 15V

Primary Current	Symbol	Unit	Temperature					
			-40℃	0℃	15℃	25℃	55℃	85℃
100A	X_G	%	0.5	0.4	0.3		0.4	0.5
350A								
450A								
500A								

Table 1-Accuracy table

Note: All the parameters expressed in the table are determined during initial characterization and given at ±3σ

Global Accuracy Graph



Global Accuracy at Ambient Temperature and Operating Voltage 13.5V

External Magnetic Field Influences

The BMS500 series uses a very accurate technology and offers to the customer the current measurement needed to the application.

In order to respect this accuracy, some conditions must be respected during the design of the environment of the transducer:

◇ Primary bus-bar centering
◇ Bus-bar shape
◇ Contactors position

CAN Output Specification

CAN Interface characteristics:

◇ CAN protocol 2.0B Version
◇ Bit order: big endian (Motorola)
◇ CAN oscillator tolerance: 0.27%
◇ No sleep mode capacity
◇ 120Ω termination resistor to be added externally, internal CAN impedance = 4.8kΩ

Message Description	CAN ID	Name	Data Length (Nb byte)	Type of frame	Message launch type	Message launch type	Signal Description	Start bit	End bit
Return Current I_P (mA)	View selection table	BMS500_I_P	8	Standard	Cyclic message every 10 ±1ms	I_P Value: 80000000H=0mA 7FFFFFFFH=1mA 80000001H=1mA	IP_Value	24	32
						Error Info 0=Normal，1=Faild	Error_Indication	32	1
						CSM-FAIL	Error_Info	33	7
						sensor information	SW_Revision	56	24

CAN frame content								
	BIT7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
BYTE 0	IP_VALUE							
	MSB 7	6	5	4	3	2	1	0
BYTE 1	IP_VALUE							
	15	14	13	12	11	10	9	8
BYTE 2	IP_VALUE							
	23	22	21	20	19	18	17	16
BYTE 3	IP_VALUE							
	31	30	29	28	27	26	25	LSB 24
BYTE 4	ERROR_INFO							ERROR_INDICATION
	MSB 39	38	37	36	35	34	LSB 33	32
BYTE 5	SENSOR_INFO							
	MSB 47	46	45	44	43	42	41	40
BYTE 6	SENSOR_INFO							
	55	54	53	52	51	50	49	48
BYTE 7	SENSOR_INFO							
	63	62	61	60	59	58	57	LSB 56

Error Management

Failure Mode	I_P Value	Error Indicatoin	Error Information
Memory Error	0*FFFF FFFF	1	0*40
Overcurrent Detection IP>580A	0*FFFF FFFF	1	0*41
Fluxgate has no oscillation for more than 20ms	0*FFFF FFFF	1	0*42
Clock derivation	0*FFFF FFFF	1	0*44
Supply voltage is out of range	0*FFFF FFFF	1	0*46
Hardware default ADC channel	0*FFFF FFFF	1	0*47
New Data not available	0*FFFF FFFF	1	0*49
Hardware default DAC Threshold	0*FFFF FFFF	1	0*4A
Hardware default Reference voltage	0*FFFF FFFF	1	0*4B

Selection table

product name	MCU brand	CAN ID	CAN SPEED(kbps)
BMS500A	AutoChips	0x03C2	500
BMS500X	AutoChips	0x03C4	500
BMS500Y	AutoChips	0x03C3	500
BMS500Z	AutoChips	0x03C1	500
BMS500N	NXP	0x03C2	500

BMS500 Test table

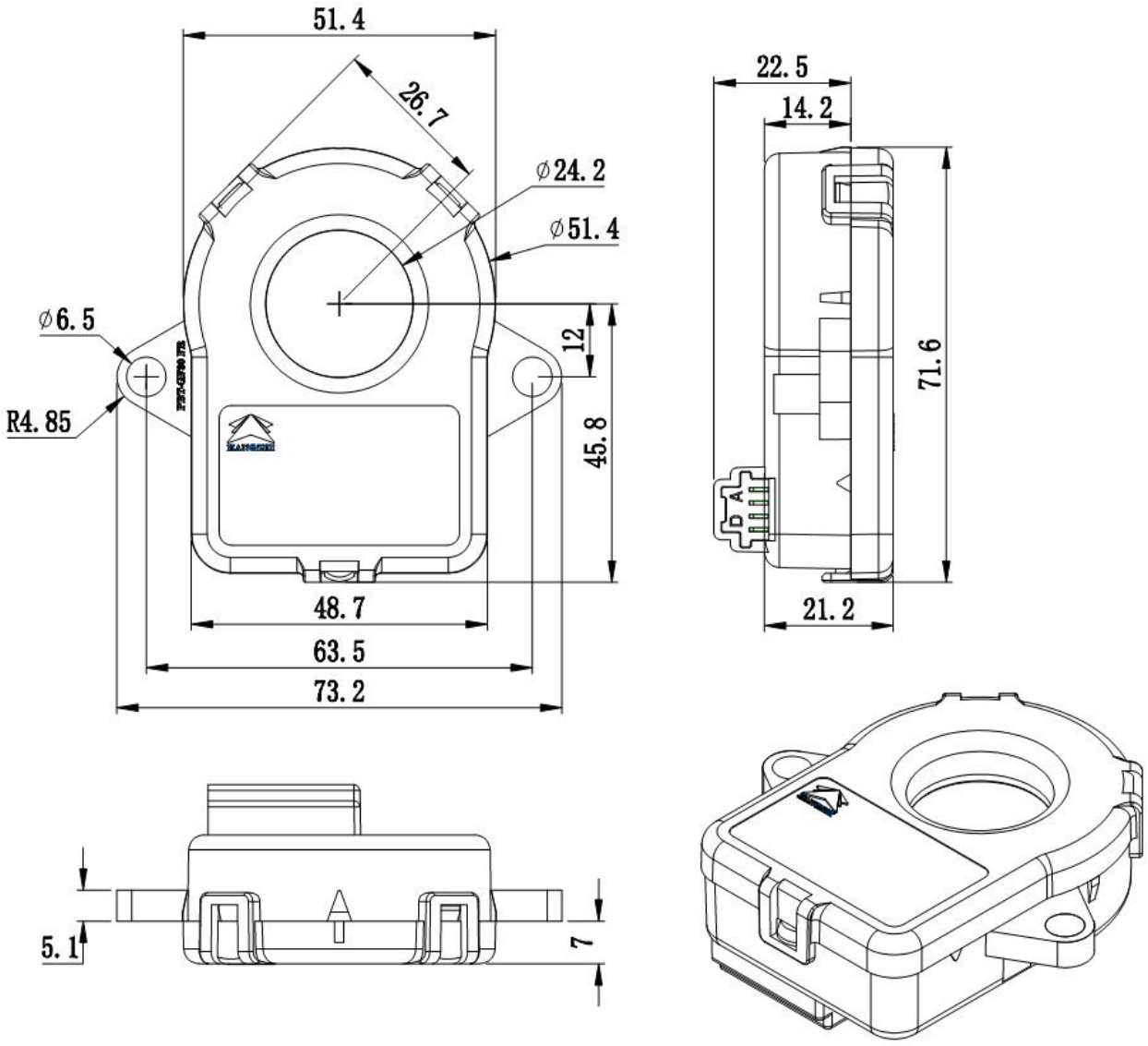
Test	Test standard	Procedure
Environmental Test		
Low temperature operating endurance	ISO16750-4	120hours，-40℃，power on
High temperature operating endurance		120hours，85℃，power on。
Powered thermal cycle endurance	ISO16750-4	540cycles（936hours），-40℃（20 min），+85℃（20 min），slope 4℃/min
Thermal shock	ISO 16750-4	-40℃（20 min soak）/85℃（20 min soak），1000 cycles, with connectors => 667 h（28 days）
Thermal humidity cycle	ISO 16750-4	240 hours，-10℃/+65℃，humidity 93%，Not powered on
High temperature and humidity endurance	JESD 22-A101	85℃，humidity 85%，1000 hours
Vibration	ISO 16750-3	Test IV, -40°C/+85C, 8 hours (Figure 1), rotation speed and acceleration 27.1 m/s2, 20 h/axis, 3 axes+, power on and monitor output
Mechanical shock	ISO16750-3	500m/s2, 10 times in each direction (60 in total), half-sine pulse
Handling drop	ISO16750-3	There are 2 landing points in each direction, 3 axes, a total of 6 landing points, 1 meter away from the concrete floor
Dust（and other solid intrusion）	ISO20653	IP category：4
Water intrusion	DIN 40050-9	IP category：2
Mixed flowing gas	IEC60068-2-60	Method 4 in Table 1. H2S, NO2, Cl2, SO2, 25±1°C, RH 75±3%, 21 days
Salt fog	ISO16750-4	Concentration 50 g/L. Cycle: salt spray for 4 hours, 60°C < 30% RH, dry for 2 hours, wet at 50°C 95% RH for 2 hours, 110 cycles

Test	Test standard	Procedure
EMC Test		
Conducted radiation-voltage method	CISPR25	9kHz to 108MHz, level 3
Conducted Radiation-Current Method	CISPR25	20kHz to 108MHz,level 3
Emitting radiation (ALSE)	CISPR25	0.1 MHz to 5 GHz,level 3
Current Injection Crane Interference (BCI)	ISO11452-4	Test Level II and Test Level IV
Transient disturbances along the power supply	ISO7637-2	The basis is ISO7637-2
Anti-radiation field - dark acoustic chamber (ALSE)	ISO 11452-2	Test frequency: 80 MHz-3.2 GHz, test level: 100 V/m 200 V/m
Transient disturbance along I/O	ISO7637-3	Fast Level a: cc - 150v 10 minutes; Fixed b: CCC +100 V 10 minutes, Slow pulse positive: ICC +20 V 20 min; Slow pulse negative: icc - 20v 20 minutes
Anti-static test	ISO10605	Not powered, pin: ±4kv, case: ±8kv, air: ±15 kV and ±30 kV
Electrostatic discharge operation test	ISO10605	Power on, indirect contact discharge: +4 kV ±8 kV ±15 kV ± 25 kV, air: ±8 kV ±20 kV
Electrical Test		
DC supply voltage	ISO 16750-2	Follow Code B
Overvoltage	ISO 16750-2	18V, 1 hour, @65°C; 24V, 1 minute, @25°C
Alternating voltage superposition	ISO 16750-2	Severity Level 2: Upp= 4 V; Severity Level 4: Upp= 2 V
Supply voltage rises and falls slowly	ISO 16750-2	Umin= 8 V, 0.5 V/min, running time 10 minutes
Power supply Momentary drop in power	ISO 16750-2	Room temperature, Usmin is 4.5 V
Power supply voltage drop reset	ISO 16750-2	Usmin = 8 V
Reverse voltage	ISO 16750-2	Case 2
Open circuit	ISO 16750-2	Single line/multi-line open circuit
Short circuit protection	ISO 16750-2	Test signal circuit, short circuit voltage Usmax=16V and GND, duration 60 seconds

Product Model: BMS500
Measurement Range: DC±500A
Accuracy: 0.5%

Dimensions

Unit：mm



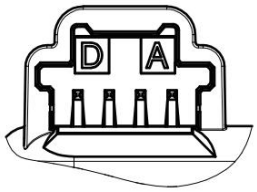
Mechanical characteristics

Plastic case: PBT GF 30
Magnetic core: Nanocrystalline
Electrical terminal coating: Tin plated

Installation recommendations

Connector type: Tyco-AMP P/N: 1 473672-1

Connection

No.	Pin	Definition	Interface
1	A	CAN-L	
2	B	CAN-H	
3	C	GND	
4	D	Uc	