MDHC20-118 is a dual output current sensor with different output ranges for both high current detection and small current accuracy requirements.The MDHC20-118 provides a reliable and cost-effective solution for AC and DC current detection in industrial and automotive applications,and provides effective isolation between the primary and secondary sides.

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Features and Benefits

- Open-loop current sensors applying the HALL inductive principle
- Single 5V power supply
- Channel1 primary measurement current range:±30A
- Channel2 primary measurement current range:±350A
- Sensor operating temperature range: -40 °C to +125 °C
- Output voltage: Equally proportional to power supply (sensitivity and bias)
- Good accuracy, linearity and temperature drift
- Outputs can be clamped

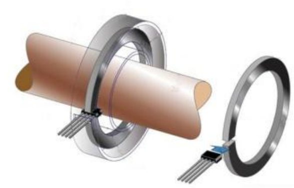
Application

- BMS system

Working Principle

Open-loop current sensors utilize Ampere's law (the magnetic field generated around an energized straight wire is proportional to the current in the wire) to detect the current in the wire by detecting the magnitude of the magnetic field strength, B, generated by the primary current, using the characteristics of hall devices.In the linear interval of hysteresis,the proportionality between B and I is:

$B(I_p) = K * I_p$ (K is a constant)



The Hall voltage can be expressed as:

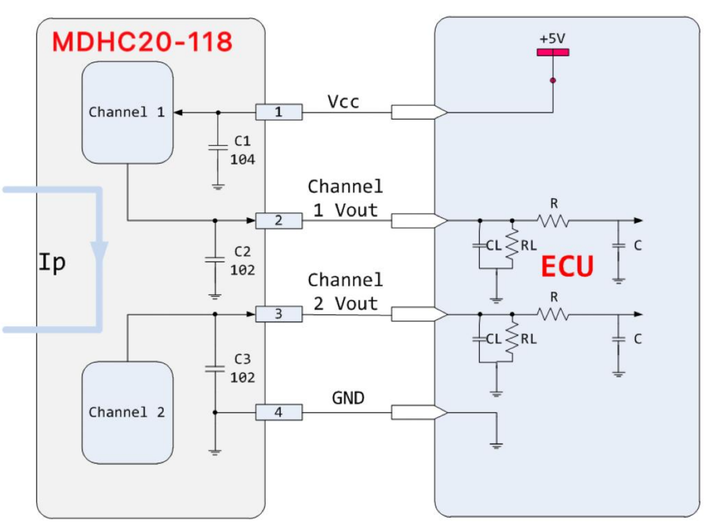
$V_H = (R_H/d) * I * K * I_p$

All are constants except I_p , which is a variable, thus.

$V_H = K_1 * I_p$ (K_1 is a constant)

The particular Hall chip derives the primary side current by amplifying V_H and thus the voltage.

Recommended Circuits



Ordering Information

Model number	V_{QVO}	Channel 1		Channel 2		MPQ	MOQ
		I_P range(A)	Sens.(mV/A)	I_P range(A)	Sens.(mV/A)	(PCS)	(PCS)
MDHC20-118S3	$V_{CC}/2$	±30	66.7	±350	5.7	72	144

Naming convention

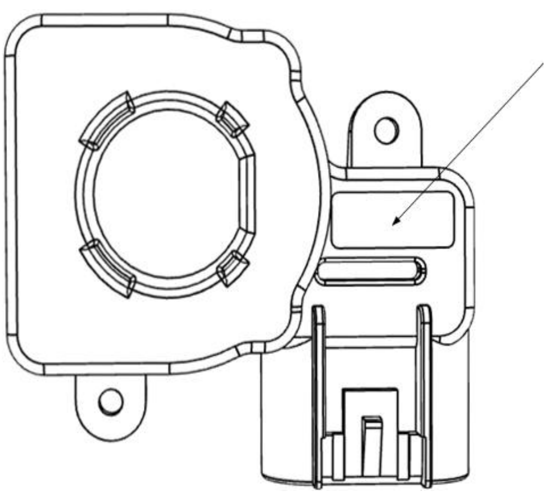
MDHC 20 118 S3
① ② ③ ④

① MDHC Series
② Suitable for copper rods with a diameter of 20mm
③ 118 Configuration: Channel 1=±30A, Channel 2=±350A
④ Chip Version

Packaging Information

Box	Box	Tray
72pcs/box	6-tray/box	12pcs/tray

Product Marking Information



MDHC20-118: Product model
YY: Year(The last two numbers)
M: Month(Month 5 stands for May and A stands for October)
D: Day(9 stands for 9th and K stands for 20th)

Maximum rated parameters

Characteristic	Symbol	Rating	Unit	Condition
Maximum supply voltage (overvoltage)	V_{CC}	14	V	
Maximum supply current (overvoltage)	I_{CC}		mA	
Output voltage	V_{OUT}	0.15 to V_{CC}-0.15	V	
Output Current/Channel	I_{OUT}	40	mA	
Operating temperature	T_A	-40 to 125	℃	
Storage temperature	T_S	-40 to 125	℃	
ESD Rating	V_{ESD}	8	KV	
Isolated Voltage	V_{ISO}	2.5	KV	50Hz, 1 min, ISO 161000.2-2006/IEC 60664.1-2007
Electrical insulation resistance	R_{ISO}	>500M	ohm	500V DC ISO 161000.2-2006/IEC 60664.1-2007
Creepage distance	d_{CP}	61	mm	mm
Electrical gap	d_{CI}	48	mm	mm
CTI value	CTI	600	V	

General Electric Parameters

DC operating parameters at V_{CC} = 5.0 V (unless otherwise noted),T_A within specified temperature range.

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Supply Voltage	V_{CC}		4.5	5	5.5	V
Supply Current	I_{CC}	$R_L \geq 10K\Omega$	6	14	18	mA
Power-up delay	T_{PO}	T_A=25°C			10	ms
QVO follower error (-R)	Er		-0.3		0.3	%
Zero current output	V_{QVO}	T_A= 25°C	V_{CC}/2±0.010			V
Output Voltage Range @I_P	V_{OUT}	T_A= 25°C, I_P=I_{PMAX}	0.5		4.5	V
Load Resistance/Channel	R_L	V_{OUT} to V_{CC} or GND	10			KΩ
Load Capacitance/Channel	C_L	V_{OUT} TO GND			68	nF
Response time	$t_{RESPONSE}$	T_A= 25°C, C_L=1nF, I_P step=50% of $I_{P+;}$ to 90% of output voltage		10		µs
Bandwidths				20		KHz

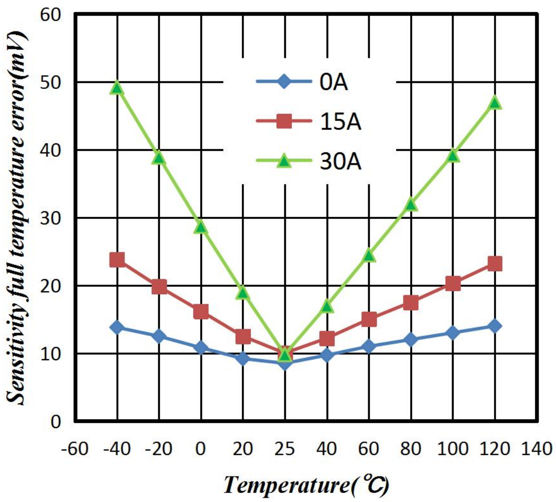
Performance Parameters

DC operating parameters at V_{CC} = 5V (unless otherwise stated),T_A within specified temperature range.

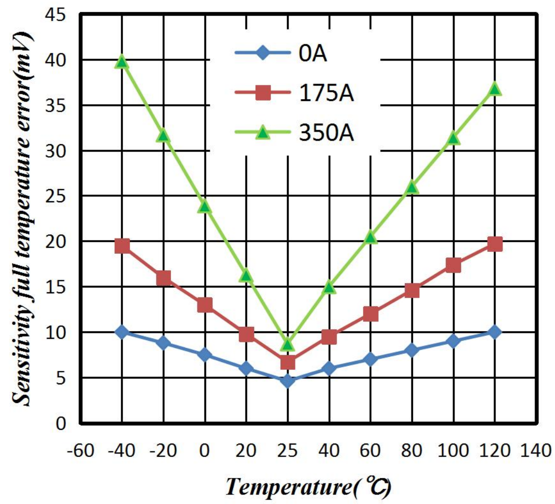
Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Channel 1						
Measuring range of primary side current	I_P		-30		30	A
Sensor Sensitivity	S_{ensTA}			66.7		mV/A
Resolution ratio				2.5		mV
Sensitivity error	E_{Sens}	@T_A=25°C;V_{CC}=5V	-1		1	%
Zero-point electrical misalignment voltage	V_{OE}	I_P=0A, T_A=25°C		±2		mV
Zero magnetic misalignment voltage	V_{OM}	I_P=0A, T_A=25°C, after excursion of I_{PM}		±4		mV
Zero Out-of-Set Voltage	V_{OFFSET}	T_A=25°C		±10		mV
output noise	$V_{NO\ PP}$			10		mV
Zero point full temperature error		@-40~125℃	-15		15	mV
Sensitivity full temperature error		@-40~125℃	-50		50	mV
Channel 2						
Measuring range of primary side current	I_P		-350		350	A
Sensor Sensitivity	S_{ensTA}			5.7		mV/A
Resolution ratio				2.5		mV
Sensitivity error	E_{Sens}	@T_A=25°C;V_{CC}=5V	-1.2		1.2	%
Zero-point electrical misalignment voltage	V_{OE}	I_P=0A, T_A=25°C		±2		mV
Zero magnetic misalignment voltage	V_{OM}	I_P=0A, T_A=25°C, after excursion of I_{PM}		±2		mV
Zero Out-of-Set Voltage	V_{OFFSET}	T_A=25°C		±5		mV
output noise	$V_{NO\ PP}$			10		mV
Zero point full temperature error		@-40~125℃	-10		10	mV
Sensitivity full temperature error		@-40~125℃	-40		40	mV

Performance Graph

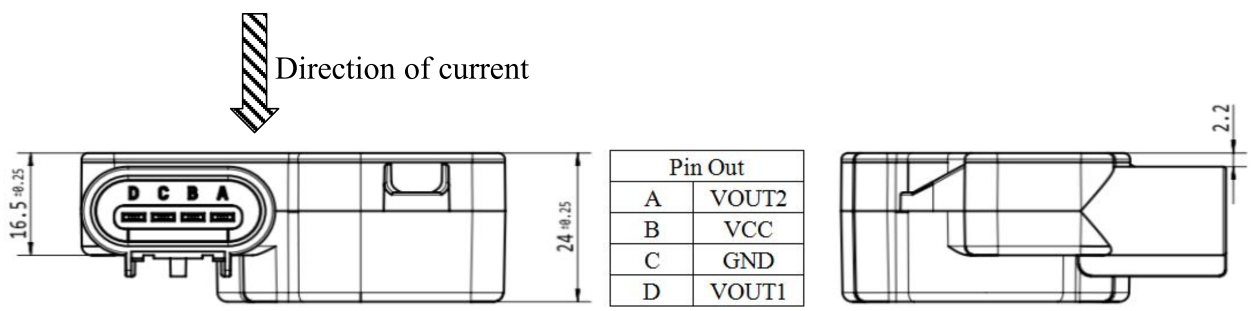
Typical Temperature (TA) Versus Sensitivity full temperature error（Channel 1）



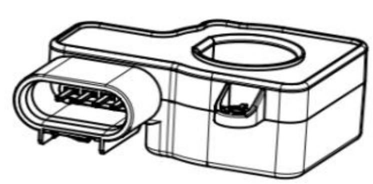
Typical Temperature (TA) Versus Sensitivity full temperature error（Channel 2）

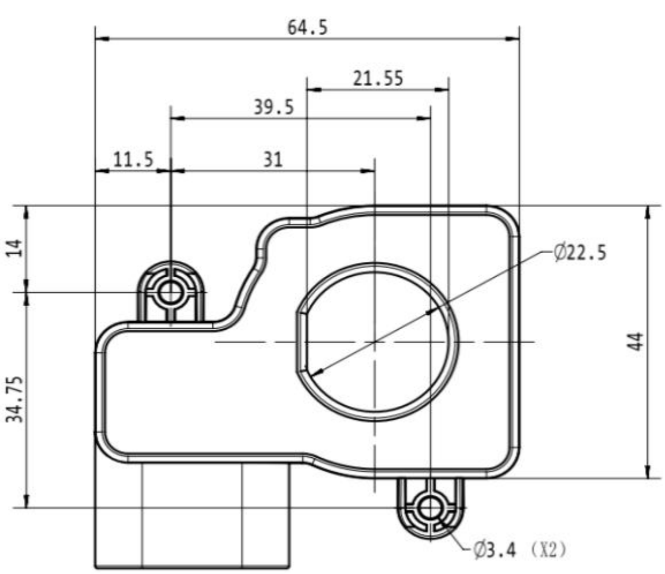


Package Drawing



Pin Out	
A	VOUT2
B	VCC
C	GND
D	VOUT1





Technical requirements:

1. Shell material PA66+GF25 HB flame retardant grade.
2. Magnetic core material:
   channel 1: iron-nickel alloy.
   channel 2: silicon steel.
3. Electrical output end coating: with tin plating.
4. Recommended connector: Delphi gt150 p/n 15326815.
5. You are advised to use two M4 screws with a torque of 2.5N.m±5%.
6. Product weight 96g.

Definition of performance parameters

- **Static Output Voltage (QVO)** :Sensor output voltage V_{QVO} in the state of no obvious magnetic field B =0G

  -BR:V_{QVO} varies with power supply voltage V_{CC}; and $V_{QVO} = V_{CC}/2$

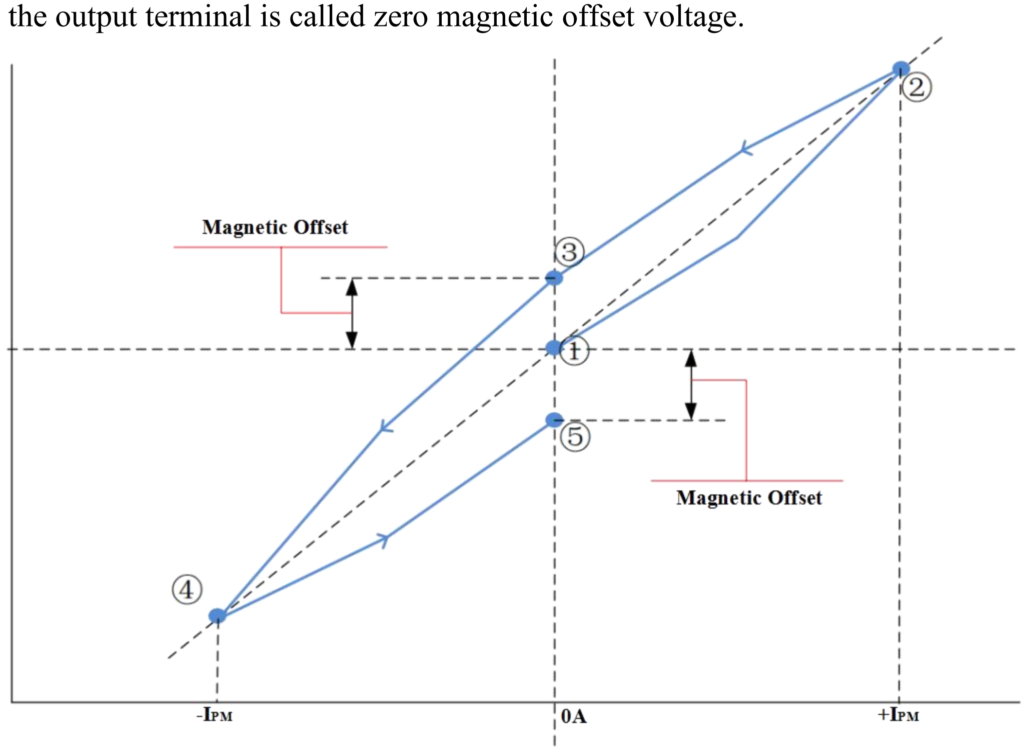
- **Sens(Sensitivity)**:Sens is the reference output straight line (-BR model: $V_{OUT} = V_{CC}/5 \times (2.5 + 2 \times I_P/I_{P\_MAX})$) is the slope of the output,which refers to the change in output as the current changes,and its relation to the current is.$\mathbf{Sens} = V_{CC}/5 \times 2/I_{P\_MAX}$.

- **Offset With Temperature**:The zero point may shift at operating temperature due to internal component tolerances,stresses,and heat dissipation.

- **Sensitivity With Temperature**:Due to the effect of the internal temperature compensation coefficient,the sensitivity will change throughout the operating temperature compared to the expected value at room temperature.

- **Electrical Offset Voltage**:The error caused by the noise of the HALL components and the internal operational amplifier amplification itself is called the offset voltage.

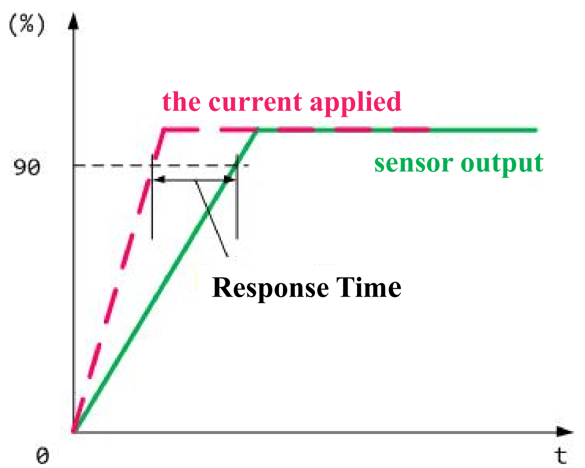
- **Magnetic Offset**:In the primary current from the maximum value of I_P -> 0,due to the hysteresis phenomenon caused by the sensor's magnetic core material,the error generated in the output terminal is called zero magnetic offset voltage.

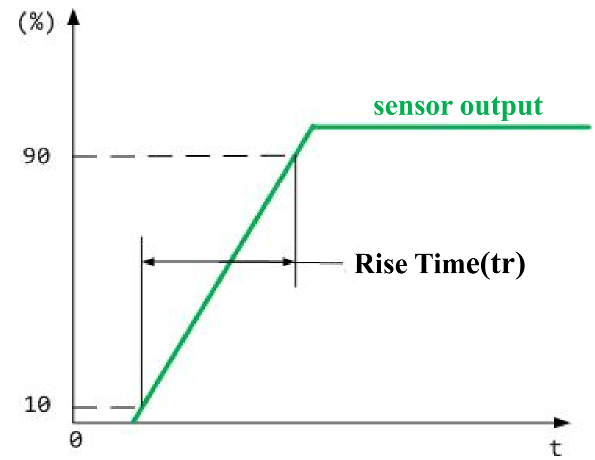


- **Offset Voltage**:Zero-point offset voltage is the output voltage when the primary current is zero, the value is $V_{QVO} = V_{CC}/2$;therefore the difference between V_{QVO} and the value is referred to as the total zero misalignment voltage error.This offset error can be attributed to the zero-point electrical misalignment voltage (due to the resolution of the ASIC's internal QVO),magnetic offset, temperature drift,and temperature-induced hysteresis.

- **Response Time**:The response time of the sensor is the time interval between when the applied current reaches the final 90% and when the sensor output reaches the corresponding value of the applied current.

- **Rise Time**:The rise time of the sensor is the time between the sensor outputting 10% and reaching the final 90%.





- **QVO Ratiometricity Error**:The deviation of the sensor zero output from the theoretical value when the supply voltage V_{CC} changes from 5V to $4.75<V_{CC1}<5.25V$, defined by the following formula.

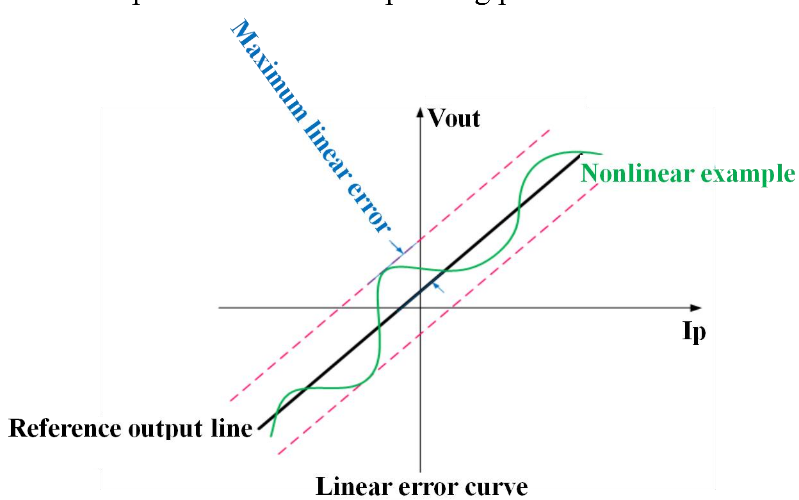
$$E_r = \left(1 - \frac{\frac{V_{QVO(V_{CC1})}}{V_{QVO(5V)}}}{V_{CC1}/5}\right) \times 100\%$$

- **Linearity Error**:Non-linearity is a measure of the linearity of the sensor IC over the full current measurement range,where the end-base straight line is used as a reference working line.

$$\mathrm{Lin_{ERR}} = \frac{\Delta L_{max}}{Y_{FS}} \times 100\%$$

Where:Lin_{ERR} - end-base linearity error of the sensor

ΔLMAX - the absolute value of the maximum difference between the arithmetic mean of the output values of multiple measurements of positive and negative strokes at the same calibration point and the corresponding point on the reference line.



Notes

1. Incorrect wiring may cause damage to the sensor.After the sensor is connected to the 5V power supply,the current to be measured passes through the sensor in the direction of the arrow,and the corresponding voltage value can be measured at the output terminal.
2. -BR:Zero output voltage V_{QVO}=V_{CC}/2,gain is 2V_{CC}/5,output curve is. $\boldsymbol{V_{OUT} = V_{CC}/5\times(2.5 + 2 \times I_P/I_{P\_MAX})}$;a change in the supply voltage within a certain range will cause a change in V_{OUT} .

   For example:V_{CC} range 4.75V ~ 5.25V;corresponding to 0A under the static output voltage V_{QVO} output range of 2.375V ~ 2.625V and the gain varies with V_{CC},so the output range of full range $V_{OUT(IPMAX)}$ is 4.275V~4.725V.