HSCWxxx-Tx series Current Sensor

HSCWxxx-Tx series current sensors provide a reliable and cost-effective solution for AC and DC current detection in industrial and automotive applications. It provides effective isolation between the primary side and the secondary side. The same enclosure can provide a variety of different current measurement specifications from ±200A to ±900A.

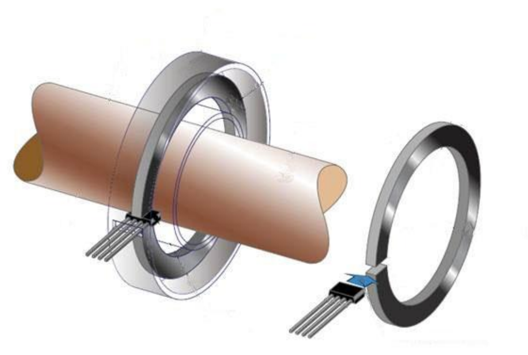
FEATURES AND BENEFITS:

- Open-loop current sensor
- Single power supply + 5V (3.3V please contact factory)
- Analog signal output
- Primary current measuring range：±200A to ±900A
- Operating temperature range: -40 °C to +125 °C
- Output voltage:
- -TR: $V_{QVO}=V_{CC}/2$, gain fixed
- -TF: V_{QVO}=2.5V, gain fixed
- Good accuracy, linearity and temperature drift

Applications:

- inverter
- Power supply and DC-DC converter

Principle



The open-loop current sensor uses Ampere's law (the magnetic field generated around an energized straight wire is proportional to the current in the wire), and the characteristics of the hall device to detect the magnitude of the magnetic field strength B generated by the primary current to detect the current in the wire. Within the linear range of the hysteresis cycle, the proportional relationship between B and I is:

$B(I_P) = K * I_P$ （K is constant）

The Hall voltage is expressed by:

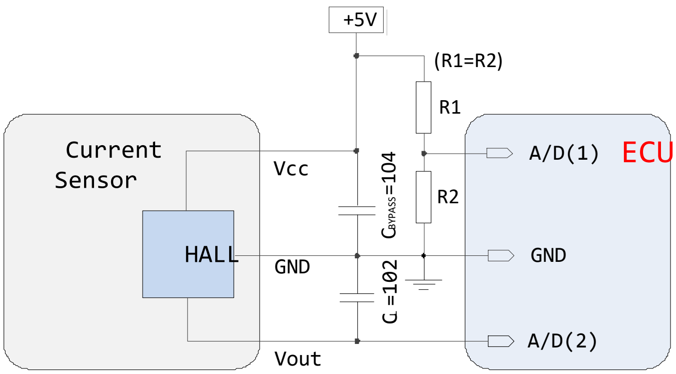
$V_H=(R_H/d) * I * K * I_P$

Except for I_P all terms of this equation are constant. Therefore:

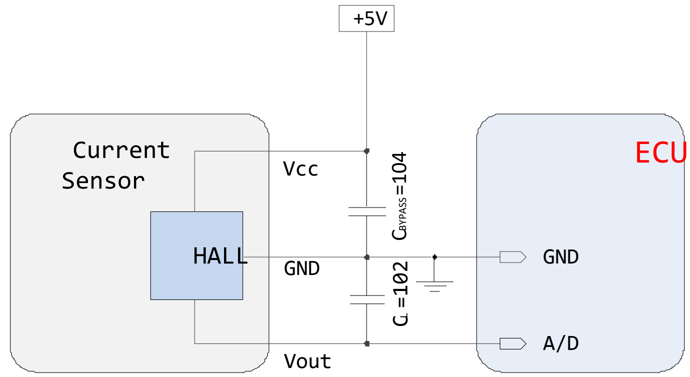
$V_H=K_1 * I_P$（K_1 is constant）

The specific Hall chip calculates the primary current by amplifying the V_H to obtain the voltage.

Recommended Application Diagrams:



-TR :QVO ratiometric with V_{CC}, Gain is fixed



-TF : QVO is fixed @2.5V， Gain is fixed

C_{BYPASS} should be placed close to V_{CC}

Ordering Information:

P/N	V_{QVO}	Primary Current I_P (A)	Sensitivity (Typ.) (mV/A)	MPQ (PCS)	MOQ (PCS)
HSCW200-TR	$V_{CC}/2$	±200	10	486	486
HSCW200-TF	2.50	±200	10	486	486
HSCW300-TR	$V_{CC}/2$	±300	6.67	486	486
HSCW300-TF	2.50	±300	6.67	486	486
HSCW400-TR	$V_{CC}/2$	±400	5	486	486
HSCW400-TR	2.50	±400	5	486	486
HSCW500-TR	$V_{CC}/2$	±500	4	486	486
HSCW500-TF	2.50	±500	4	486	486
HSCW600-TR	$V_{CC}/2$	±600	3.33	486	486
HSCW600-TF	2.50	±600	3.33	486	486
HSCW700-TR	$V_{CC}/2$	±700	2.86	486	486
HSCW700-TF	2.50	±700	2.86	486	486
HSCW800-TR	$V_{CC}/2$	±800	2.5	486	486
HSCW800-TF	2.50	±800	2.5	486	486
HSCW900-TR	$V_{CC}/2$	±900	2.22	486	486
HSCW900-TF	2.50	±900	2.22	486	486

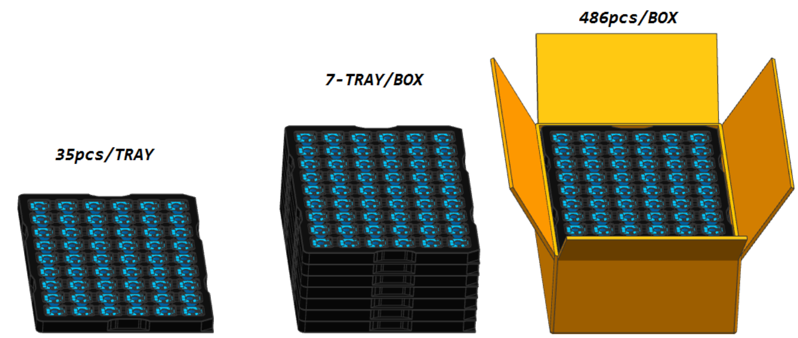
**Please contact factory for special measuring current.*

Part Numbering Specification:

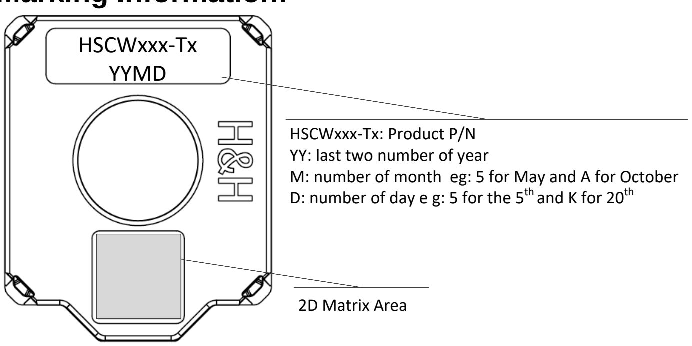
HSCW xxx - T x
① ② ③ ④

① HSCW series
② I_{PM}
③ Tray packaging
④ R=ratiometric QVO, Gain fixed
F=fixed QVO, Gain fixed

Package Information:



Marking Information:



Absolute ratings

Characteristic	Symbol	Rating	Unit
Maximum supply voltage	V_{CC}	-0.3 to 6.5	V
Supply Current	I_{CC}	18	mA
Output Voltage	V_{OUT}	0.15 to V_{CC}-0.15	V
Output Current	I_{OUT}	±40	mA
Operating Temperature Range	T_A	-40 to 125	℃
Storage Temperature Range	T_S	-40 to 125	℃
ESD Sensitivity(Human Body Model)	V_{HBM}	4	KV
RMS voltage for AC insulation test, 50 Hz, 1 min	V_{ISO}	2.5	KV
Creepage distance	d_{CP}	5.98	mm
Clearance	d_{CI}	2.95	mm

Electrical characteristics in nominal range (I_{PN})

Operating Characteristics, VCC = 5V, TA = -40°C to 125°C (unless otherwise specified)

Parameter	Symbol	Condition		Min	Typ.	Max	Unit
supply voltage	V_{CC}			4.5	5	5.5	V
supply current	I_{CC}	$R_L \geq 10K\Omega$			13	18	mA
Power-On Time	T_{PO}	T_A=25°C			80		µs
Ratiometry Quiescent Voltage Output Error	E_r			-0.3		0.3	%
Quiescent Voltage Output	V_{QVO}	HSCWxxx-TR	T_A = 25°C	V_{CC}/2+0.010			V
		HSCWxxx-TF		2.50±0.010			
Output Voltage @IP	V_{OUT}-V_{QVO}	T_A = 25°C, I_P=I_{PMAX}		±2±0.020			
Output Load Resistance	R_L	V_{OUT} to V_{CC} or GND		2			KΩ
Output Load Capacitance	C_L	V_{OUT} TO GND		6		100	nF
Response time	$t_{RESPONSE}$	T_A=25°C, C_L=1nF, I_P step=50% of I_{P+}, 90% input to 90% output			4		µs
Band Width	BW	Small signal -3dB, C_L=1nF, T_A=25°C		120	150		KHz
Output internal resistance	R_{OUT}	T_A = 25°C		–	3	–	Ω

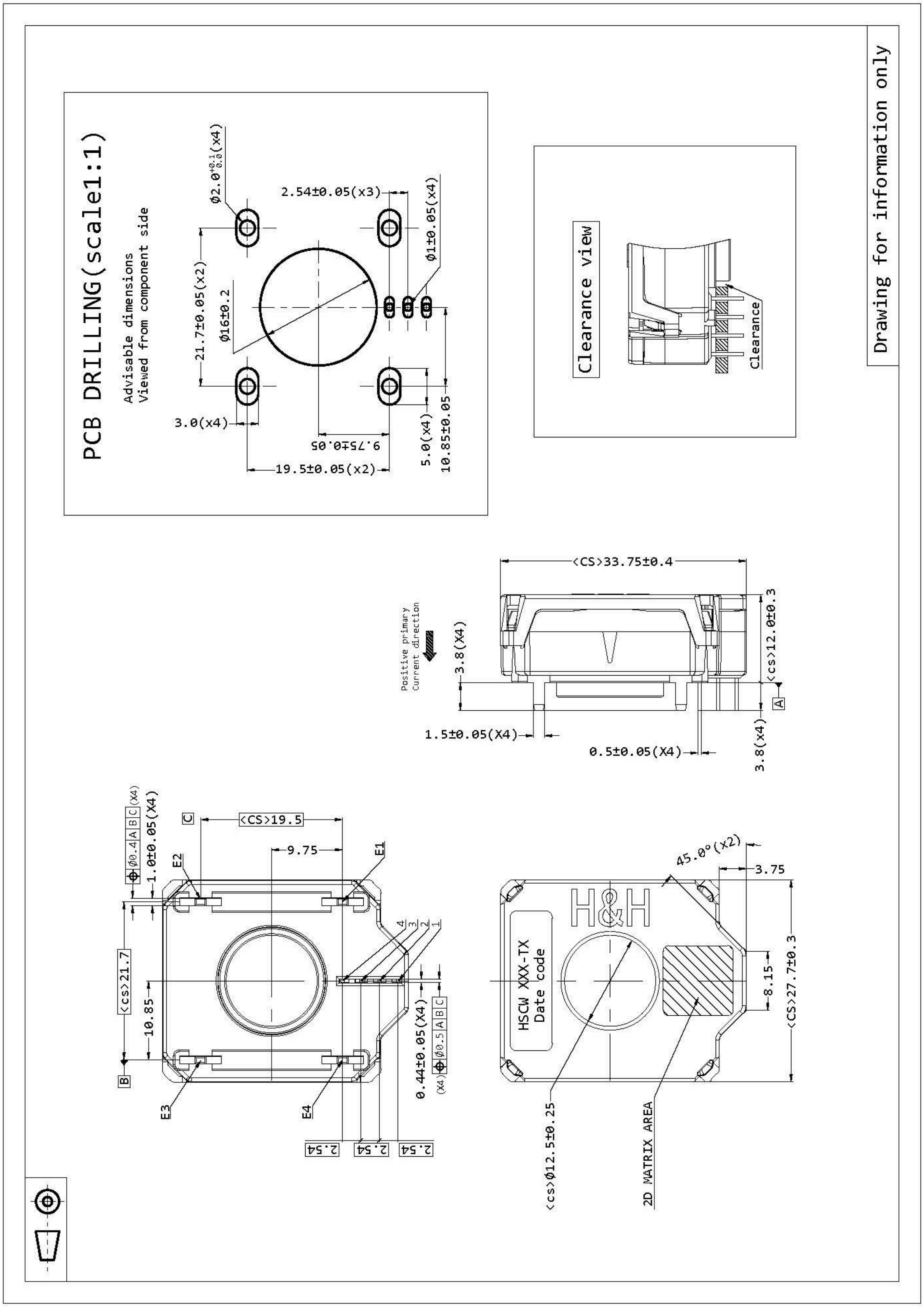
Performance characteristics in nominal range (I_{PN})

Operating Characteristics, V_{CC} = 5V, T_A = -40°C to 125°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Primary nominal DC or rms current	I_{PN}		-900		900	A
Sensitivity	$Sens_{TA}$		2.22 1)		10.00 1)	mV/A
Sensitivity Error	E_{Sens}	@T_A=25°C;V_{CC}=5V	-1		1	%
Electrical offset voltage	V_{OE}	I_P=0A, T_A=25°C	-5	±4	5	mV
Magnetic offset voltage	V_{OM}	I_P=0A, T_A=25°C, after excursion of 900A		3	5	mV
Global accuracy @ 0 A	V_{OFFSET}	T_A=25°C	±10			mV
Linearity error	Lin_{ERR}	Of full rang	-1	0.5	1	%
Average TC of V_{OE}	TCV_{OEAV}	@-40~125℃	-0.2		0.2	mv/℃
Average TC of sensitivity	TCV_{SENAV}	@-40~125℃	-0.03		0.03	%/℃

1).Sensitivity of 200A~900A please see ordering information

2D Drawing (in mm)



Mechanical characteristic

- Plastic case PA 66 GF 25
- Magnetic core FeSi alloy
- Electrical terminal coating Tin plated

Performances Parameters Definitions

- **Quiescent Voltage Output (QVO)**: the module output voltage in the quiescent state (no significant magnetic field: B = 0 G) output ($V_{OUT(Q)}$) has a constant ratio to the supply voltage (V_{CC}) throughout the entire operating ranges of V_{CC} and ambient temperature (T_A) .
  -TR: V_{QVO} has a constant ratio to the supply voltage (V_{CC}) throughout the entire operating ranges of V_{CC} and ambient temperature (T_A), $V_{QVO}=V_{CC}/2$
  -TF: V_{QVO} does not proportional to the supply voltage (V_{CC}) throughout the entire operating ranges of V_{CC} and ambient temperature (T_A), for 5V products，V_{QVO}=2.5V

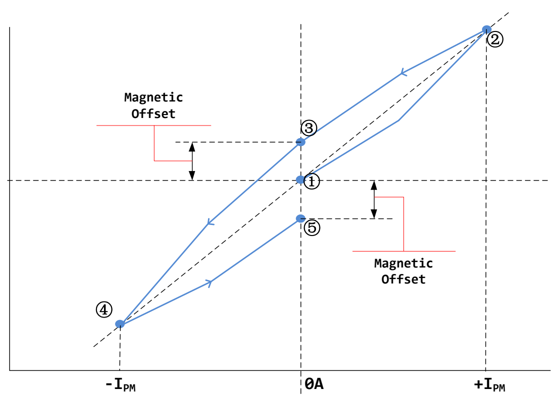
- **Sensitivity(Sen):** The sensor's sensitivity is the slope of the straight line
  -TR: $V_{OUT} = V_{CC}/2 + 2 \times I_P/I_{P\_MAX}$
  -TF: $V_{OUT} = 2.5 + 2 \times I_P/I_{P\_MAX}$
  $\mathrm{Sens} = 2/I_{P\_MAX}$

- **Offset with Temperature:** The error of the offset in the operating temperature is the variation of the offset in the temperature considered with the initial offset at 25 °C.

- **Sensitivity with temperature:** The error of the sensitivity in the operating temperature is the relative variation of sensitivity with the temperature considered with the initial offset at 25 °C.

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

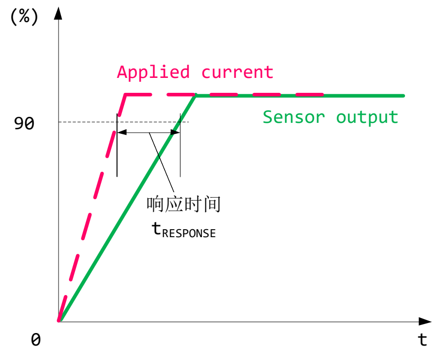
- **Magnetic Offset:** The magnetic offset is the consequence of an any current on the primary side. It's defined after a stated excursion of primary current.

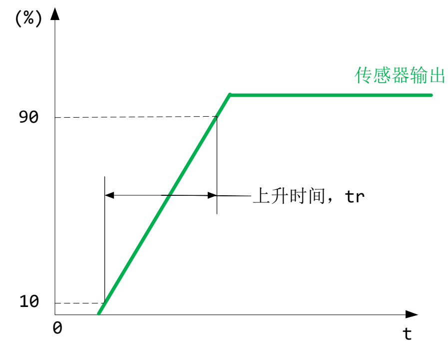


- **Offset voltage:** The offset voltage is the output voltage when the primary current is zero. The ideal value of V_{OUT} is $V_{CC}/2$. So, the difference of $V_{OUT} - V_{CC}/2$ is called the total offset voltage error. This offset error can be attributed to the electrical offset (due to the resolution of the ASIC quiescent voltage trimming), the magnetic offset, the thermal drift and the thermal hysteresis.

- **Response Time:** The response time of the sensor refers to the time interval between when the applied current(red line) reaches 90% of its final value, and when the sensor output(green line) reaches 90% of its output corresponding to the applied current.

- **Rise time(tr):** The rise time of the sensor refers to the time interval between the 10% of sensor output and the 90% of the sensor output.

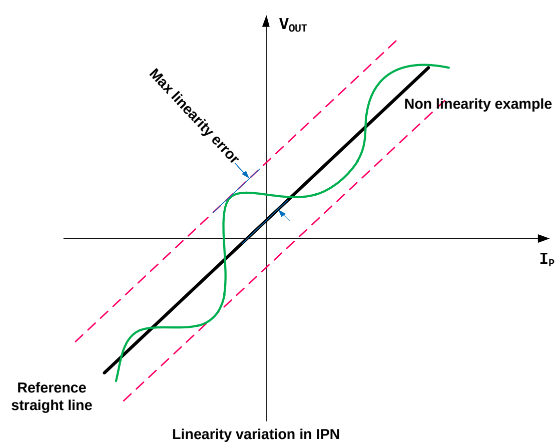




- **QVO Ratiometricity error:** the Quiescent Voltage Output ($V_{OUT(Q)}$) is proportional to the Supply Voltage (V_{CC}). When the supply voltage increases or decreases by a certain percentage, $V_{OUT(Q)}$ also increases or decreases by the same percentage. Error is the difference between the measured change in the supply voltage relative to 5 V, and the measured change in each characteristic. The ratiometric error in Quiescent Voltage Output, E_r(%), for a given supply voltage (VCC) is defined as:

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

- **Linearity:** The maximum positive or negative discrepancy with a reference straight line $V_{OUT} = f(I_P)$.
  -TR: $V_{OUT} = V_{CC}/2 + 2 \times I_P/I_{P\_MAX}$
  -TF: $V_{OUT} = 2.5 + 2 \times I_P/I_{P\_MAX})$



Notes：

1. Incorrect wiring may cause damage to the sensor. After the sensor is connected to the 5V power supply, the measured current passes along the direction of the sensor arrow, and the corresponding voltage value can be measured at the output terminal.
   –TR: V_{QVO}=V_{CC}/2，Gain=2V，V_{OUT} line is defined as：$V_{OUT} = V_{CC}/2 + 2 \times I_P/I_{P\_MAX}$; V_{OUT} changes when the V_{CC} changed.
   e.g.：V_{CC} changed between 4.75V~5.25V；Corresponding V_{QVO} range is 2.375V~2.625V; $V_{OUT(IPMAX)}$ range is 4.375V~4.625V

   -TF: V_{QVO}=2.5V，Gain=2V，V_{OUT} line is defined as：$V_{OUT} = 2.5 + 2 \times I_P/I_{P\_MAX}$；The supply voltage changes within a certain range will not cause a change in V_{OUT}.
   e.g.：V_{CC} changed between 4.75V~5.25V；Corresponding V_{QVO}=2.5V; $V_{OUT(IPMAX)}$=4.5V