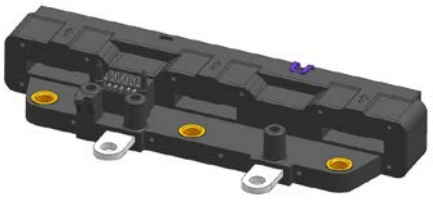
QFTBR20HCA00TVPS3S07-BR Current Sensor Module

QFTBR20HCA00TVPS3S07-BR is 3-in-1 current sensor module designed for low voltage and high current applications in the automotive industry. It provides a faster and more cost-effective solution for AC, DC, or pulse current detection, and provides effective isolation for the primary and secondary sides. The same housing can provide different current measurement with a maximum of ± 1200A.

Features:



- Adapted to Infineon HP DRIVE
- Customized two or three phases current detection
- Open Loop current sensor with Hall effect technology
- Pressfit technology simplifies the installation process
- Built in nuts simplifies the installation of busbar
- Unipolar +5V DC Power supply
- Primary current measuring range up to ±1000 A
- Operating temperature range: −40 °C < T < +125 °C
- Output voltage: full ratio-metric (in sensitivity and offset)
- Excellent accuracy
- Very good linearity
- Low thermal offset drift
- Low thermal sensitivity drift
- High frequency bandwidth
- No insertion losses

Applications:

- Starter Generators
- Inverters
- HEV applications
- EV applications
- DC / DC converter.

Ordering:

Part Number	Primary current measuring range I_P (A)	Sensitivity Sens (Typ.) (mV/A)	Channel	MPQ (PCS)	MOQ (PCS)
QFTBR20HCA00TVPS3S07-BR	±1000	2.0	3	80	80
QFDBR20HCA00TVPS3S07-BR	±1000	2.0	2	80	80

Working Principle:

The open-loop current sensor utilizes Ampere's law (the magnetic field generated around a straight wire is proportional to the current in the wire) and the characteristics of Hall devices to detect the magnitude of the magnetic field intensity B generated by the primary current, thereby detecting the current in the wire. The proportional relationship between B and I within the linear range of hysteresis is:

$B(I_P)= K * I_P$ （K constant）

The Hall voltage is thus expressed by:

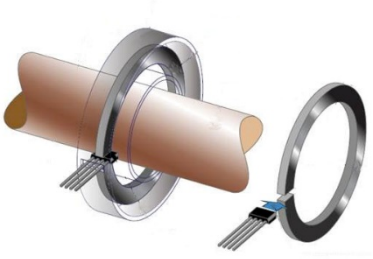
$V_H=(R_H/d) * I * K * I_P$

Except for I_P, all terms of this equation are constant.

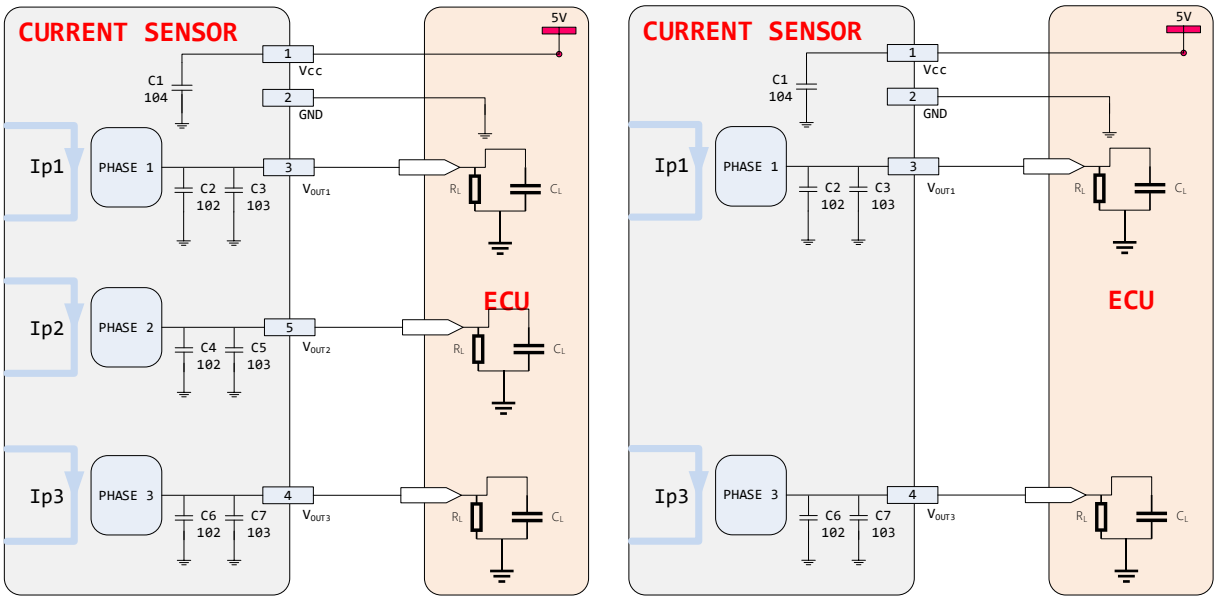
Therefore:

$V_H=K_1 * I_P$（K_1 constant）

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



Recommended Application Diagram:

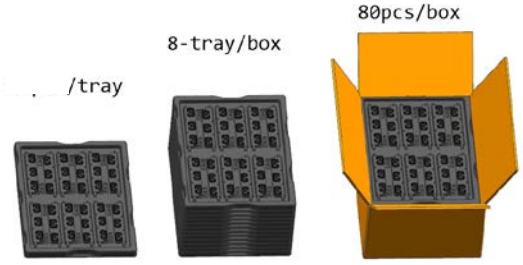


Naming:

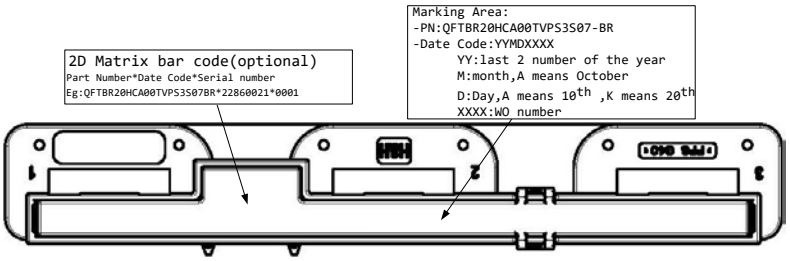
QF	TB	R	20	HC	A00	TVP	S3	S07-	BR
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

① H&H
② Tri-phase Type B
③ Fit for rectangle busbar
④ Maximum width of the busbar is 20mm
⑤ High current series
⑥ I_{PN}=±1000A
⑦ 5-pressfit output pins
⑧ IC version
⑨ Module version
⑩ Bipolar fully ratiometry

Packing information:



Marking information:



Mechanical characteristics

- Housing Materials PPS-GF40
- Magnetic core FeSi wound core
- Pressfit Pins CuSn6/Sn finishing
- Weight 126 g ± 2 %

Mounting recommendation:

- PCBA insertion:
  - Max. insertion force for 5 press fit pins = 500 N
  - Min. retention force after mounting = 125 N
  - Max. insertion force for plastic bosses = 1500 N
- Recommended 3 fasteners for plastic:
  - DELTA PT ® Ø 3 wn5451, torque = 0.8 N·m ±5 %
- Recommended M5 screws:
  - L=10mm, torque: 3.6 N·m ±5 %
- Recommended M4 screws:
  - L=14mm, torque: 2 N·m ±5 %
- Use both lockwashers and flatwashers when mounting three M5 screws and two screws.

Absolute ratings (not operating)

Characteristic	Symbol	Rating	Unit	Condition
Maximun supply voltage	V_{CC}	-0.3 to 10	V	
Ambient working temperature	T_A	-40 to 125	℃	
Ambient storage temperature	T_J	-40 to 125	℃	
Electrostatic discharge voltage	V_{ESD}	Air:±8 (IV) Contact:±6(IV)	KV	ISO 10605/JESD22-114B 150pF,2KΩ;Unpowered
RMS voltage for AC insulation test	V_{ISO}	2.5	KV	50Hz, 1 min, IEC 60664 part1
Isolation resistance	R_{INS}	>500	Mohm	500 V DC, ISO 16750
Creepage distance	d_{CP}	5.5	mm	
Clearance	d_{Cl}	4.1	mm	
Comparative traking index	CTI	PLC3	-	

Operating characteristics

All characteristics noted under conditions −1000 A ≤ I_P ≤ 1000 A, 4.75 V ≤ V_{CC} ≤ 5.25 V, −40 °C ≤ T_A ≤ 125 °C, unless other- wise noted.

Parameter	Symbol	Condition		Min	Typ.	Max	Unit
Primary current, measuring range	I_{PM}			-1000		1000	A
Supply voltage	V_{CC}			4.75	5.00	5.25	V
Sensitivity	$Sens_{TA}$	@V_{CC}=5.0V			2.0		mV/A
Output voltage (Analog)	V_{OUT}	@V_{CC}			$V_{OUT} = V_{CC}/5 \times (2.5 + 2 \times I_P/I_{P\_MAX})$		V
Offset voltage	V_{QVO}				V_{CC}/2±0.01		V
Output voltage range	V_{OUT}-V_{QVO}			0.5		4.5	V
Current consumption	I_{CC}	no load on V_{OUT}	3-phase		39	55	mA
			2-phase		26	42	
Load resistance	R_L	V_{OUT} to V_{CC} or GND		10			KΩ
Load Capacitance	C_L	V_{OUT} TO GND				68	nF

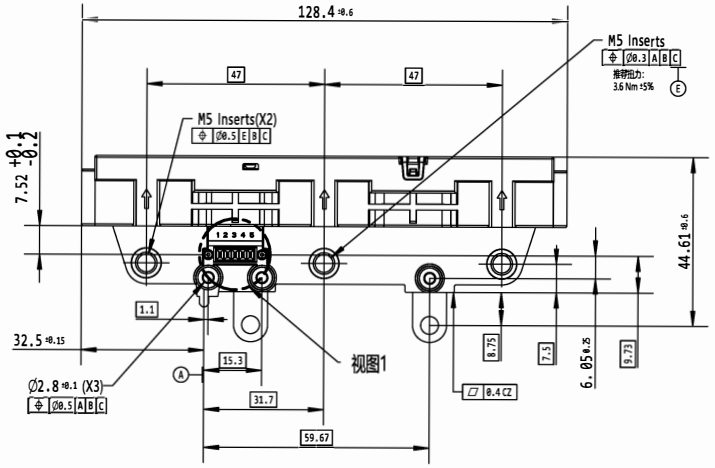
Performance Data

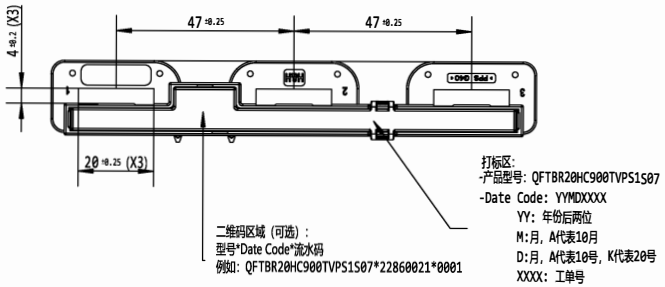
All characteristics noted under conditions −1000 A ≤ IP ≤1000 A, 4.75 V ≤ VCC ≤ 5.25 V, −40 °C ≤ TA ≤ 125 °C, unless other- wise noted.

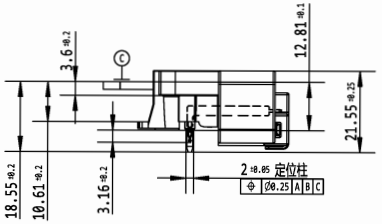
Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Sensitivity error	ε_{Sens}	@T_A=25°C;V_{CC}=5.0V	-1	±0.5	1	%
Ratiometricity error	ε_r		-0.5		0.5	%
Electrical offset voltage	V_{OE}	I_P=0A， T_A=25°C	-3	±2	3	mV
Magnetic offset voltage	V_{OM}	I_P=0A, T_A=25°C, after excursion of 1000A		±1		mV
Offset voltage	V_{OFFSET}	T_A=25°C		±10		mV
Offset voltage over temperature	V_{OETC}	@-40<T_A<125℃	-15		15	mV
Sensitivity error over temperature	$Sens_{ETC}$	@-40<T_A<125℃			2	%
Linearity Error	Lin_{ERR}	Of full rang	-1		1	%
Response Time	t_r			4	6	μs
Bandwidth	BW	@-3dB	40			KHz

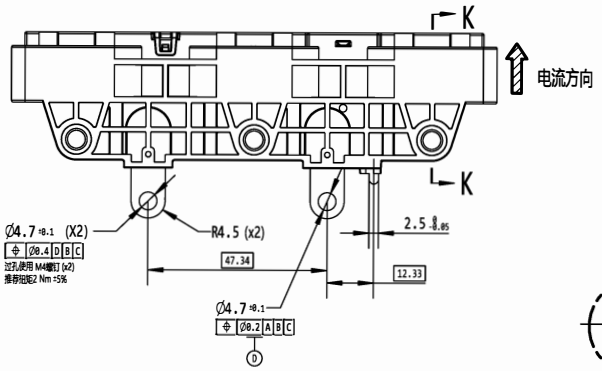
Total Error:

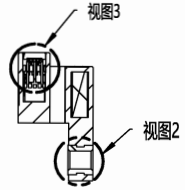
	-1000	-500	0	500	1000
@25℃	20	15	10	15	20
@T℃ Range	50	32.5	15	32.5	50

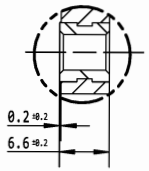






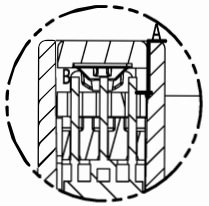




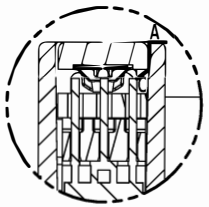


视图2
比例1:1

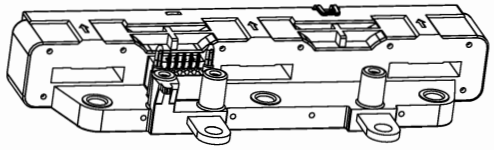
爬电距离 A至B 5.5mm



电气间隙 A至C 4.1mm

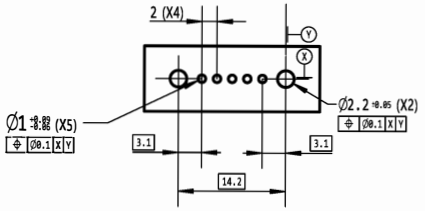


视图3
比例1:1

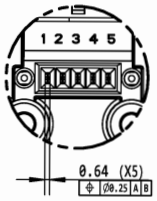


3D视图
比例1:2

PCB钻孔最终尺寸:
1.PCB安装孔的最终直径面:
镀铜厚度25-50μm,
镀锡厚度1-2μm;
2.PCB尺寸参考IEC 60352-5标准。



PIN OUT	
Pin 1	Vcc(+5V)
Pin 2	GND
Pin 3	Output 1
Pin 4	Output 3
Pin 5	Output 2



视图1
比例1:1

技术要求:

1. 产品表面无损伤及明显污痕;
2. 端子Pin脚定义如图所示;
3. PCBA插入：插拔力=500N最大值，安装后保持力=125N;
4. 3个固定孔推荐螺钉DELTA PT30,推荐扭矩为0.4-1.2N.m;
5. 安装时使用锁紧垫圈和平垫圈，M5螺钉3颗，推荐扭力值为4.2N.m±10%;
6. 此处钣金表面处理：电镀锌镍合金10um以上;
   安装时使用锁紧垫圈和平垫圈，M4螺钉2颗，推荐扭力值为2N.m±5%;
7. 产品阻燃性满足UL94 V0。

Performance Parameters Definitions:

- **Offset Voltage @ I_P = 0 A**
  The offset voltage is the output voltage when the primary current is zero. The ideal value of $V_{QVO} = V_{CC}/2$
  So, the difference of $V_{QVO} - V_{CC}/2$ 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.

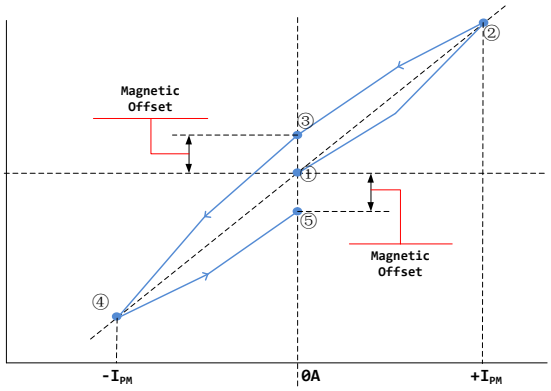
- **Sens(Sensitivity)**: The current sensor's sensitivity Sens is the slope of the straight line $V_{OUT} = V_{CC}/5 \times (2.5 + 2 \times I_P/I_{P\_MAX})$

- **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. The offset voltage variation V_{OETC} is a maximum variation the offset voltage in the temperature range: $V_{OETC} = V_{OETC}$ max − V_{OETC} min

- **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.

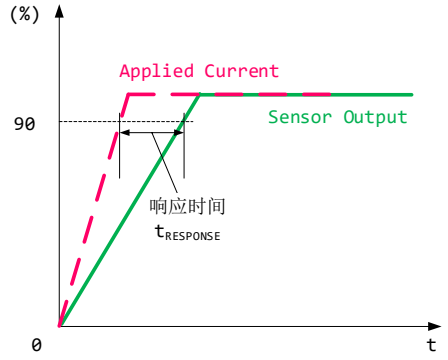
- **Electrical Offset Voltage**: The error caused by the noise of the amplification factor of the HALL component and the internal operational amplifier itself is called the electrical offset voltage

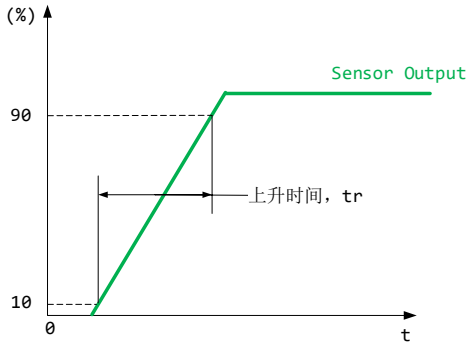
- **Magnetic Offset**: The magnetic offset is the consequence of an any current on the primary side. It's defined after a stated excursion of primary current.



- **Response Time**: The time interval between a) when the applied current reaches 90% of its final value, and b) when the sensor reaches 90% of its output corresponding to the applied current

- **Rise time**: The time interval between a) when the sensor reaches 10% of its final value, and b) when it reaches 90% of its final value





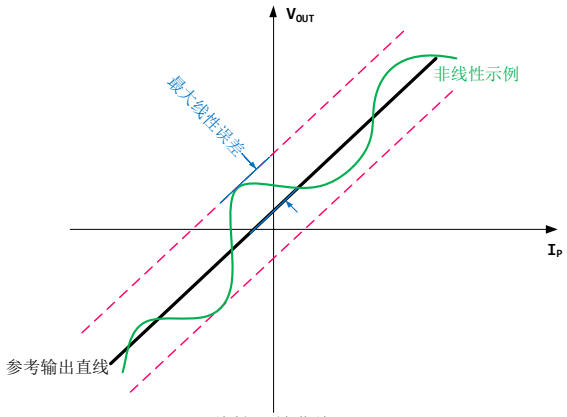
- **QVO Ratiometricity error**: When the supply voltage V_{CC} changes from 5V to 4.75<VCC1<5.25V, the deviation between the QVO output of the sensor and the theoretical value. The formula is defined as follows:

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

- **Linearity Error**: Non linearity is an indicator that measures the linearity of a sensor IC within the full current measurement range, the end base line is used as the reference working line:

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

$\mathrm{Lin_{ERR}}$ – End base linearity error of sensors
ΔLMAX – The absolute value of the arithmetic mean of the output signal values measured multiple times in the forward and reverse strokes at the same calibration point, compared to the maximum difference between the corresponding point on the reference line



线性误差曲线

Notes:

1. Incorrect connection may damage the sensor. After connecting the sensor to a 5V power supply, the measured current passes through the direction of the sensor arrow, and the corresponding voltage value can be measured at the output.
2. Full ratiometry: When the supply voltage increases or decreases by a certain percentage, V_{QVO}, Sens are also increased or decreased by the same percentage. V_{OUT} follows: $\boldsymbol{V_{OUT} = V_{CC}/5 \times (2.5 + 2 \times I_P/I_{P_{MAX}})}$
3. Storage conditions: Storage temperature ≤ 30 ℃, storage humidity 30-60%