High sensitivity， Isolated Current Sensor with Common Mode Field Rejection

General Description

SC8102 is a member of SENK SEMI. integrated Hall current sensor product line. Its high sensitivity current detection is convenient for later application. Its ultra-wide dynamic detection capability supports customers to detect the measured current range as low as 1A and as high as 30A. It can meet the needs of users to detect the load current under the condition of insulation and isolation, and is suitable for replacing other passive or discrete sensor detection schemes such as power resistors, linear optocouplers and transformers.

SC8102 series of SENK SEMI. is an isolated current detection chip which works on the detection principle of open-loop Hall sensor. By introducing the current wire on the high voltage side into the package, magnetic effect based on current, After the equal specific magnetic field generated around the measured wire is induced by the magnetic sensor with built-in chip, converted into a processable equal ratio voltage signal. This voltage signal is read and amplified by the built-in high-precision ADC, combined with digital calibration technology, environmental variables such as temperature, noise, hysteresis and nonlinearity are removed, and finally the voltage value which is nearly ideal ratio with the measured current value is output, thus realizing isolated current measurement.

SC8102 adopts automatic production and processing, can bring customers incomparable consistency, high quality and high reliability of module technology. The standard package design is ideal for customers for batch auto-patch production. It is the best solution for home appliances, motor controls, power supplies and other applications.

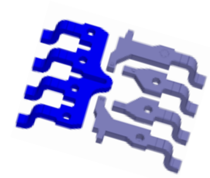
Features

- 3 kV RMS minimum isolation voltage
- Output voltage proportional to AC or DC currents
- Lowest current conductor impedance： 0.8mΩ
- Ultra-wide current detection range, Suitable for detecting 1A level current
- Selected Reference voltage mode: fixed 2.5V, 0.5*V_{CC}, 0.1*V_{CC}
- Nearly zero magnetic hysteresis
- 2µs output rise time in response to step input current
- Wide operation temp. range： -40°C~85℃
- Total output error <1% @T_A =25°C, <6% for full temperature range.
- High driving capacity: suit for >2KΩ resistor load.
- Extremely simple peripheral circuit
- Fully integrated current solution with minimum board area
- Lowest calorific value, suitable for heat treatment in small space and high power
- There is no need to debug the system according to the detected current, and different types can be solved
- The chip is programmed and calibrated before leaving the factory to ensure high consistency
- Support wave soldering full-automatic patch and tape packaging
- It is not interfered by wire magnetic field, external magnetic field and geomagnetic field
- High PSRR
- Independent copyright of SENK SEMI.
- Pb

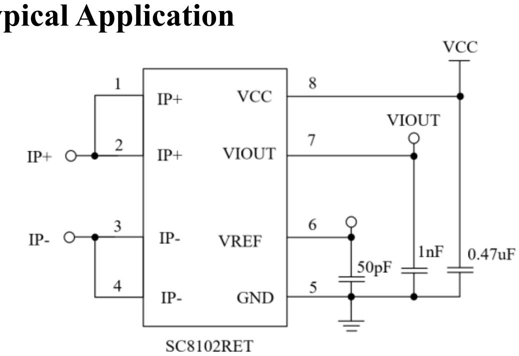
Package: 8-Lead SOP-SC

Top View:

Current Path view:



Typical Application



Order information

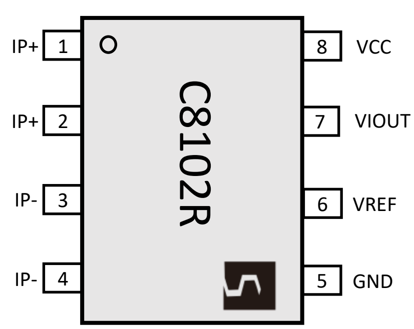
Part Number[1]	Special Code	Temp Range	Packaging	IP(A)	Vout @IP=0A	Sens @ VCC=5V (mV/A)
SC8102RET-02B5	R	E(-40~85℃)	T (3000pcs/reel)	±2	0.5VCC	1000
SC8102RET-03B5				±3		660
SC8102RET-05B5				±5		400
SC8102RET-06B5				±6		330
SC8102RET-20B5				±20		100
SC8102RET-30B5				±30		66
SC8102RET-04U5				4	0.1VCC	1000
SC8102RET-30U5				30		132
SC8102RET-10F5				±10	F(2.5)	200
SC8102RET-20F5				±20		100
SC8102RET-30F5				±30		66
SC8102RET-50F5				±50		40

Note1:B and U types are different in the reference output when IP=0A, and B is recommended by default.

B	When IP=0A,VIOUT@0A=0.5*VCC, suitable for bidirectional current detection,Zero Current Output and sensitivity vary with VCC ratio.
U*2	When IP=0A,VIOUT@0A=0.1*VCC, suitable for unidirectional current detection,Zero Current Output and sensitivity vary with VCC ratio.
F	When IP=0A,VIOUT@0A=2.5V,suitable for bidirectional current detection,Zero Current Output and sensitivity do not change with VCC ratio.

Note2 Model U, Dynamic range x2, sensitivity x2; If there are any different sensitivity requirements, you can contact our FAE or Agent.

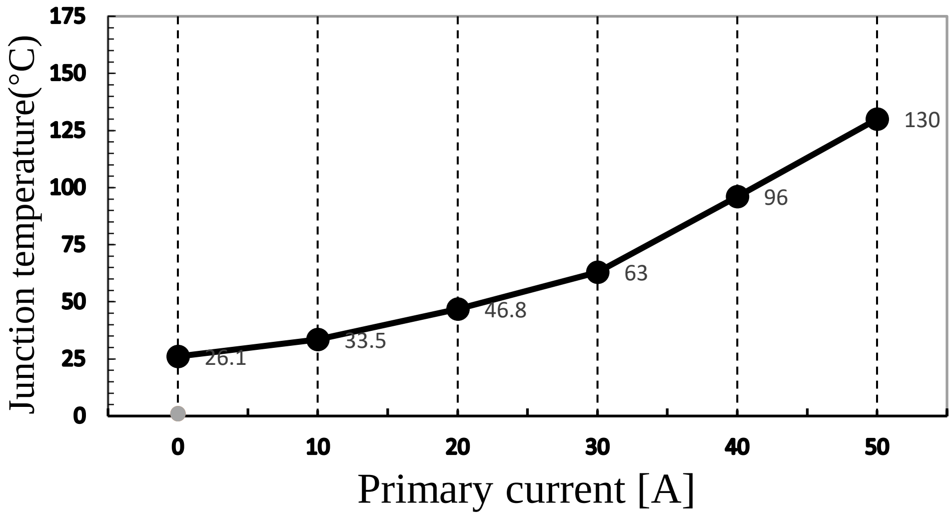
Pin Configuration



Number	Name	Description
1 and 2	IP+	Primary current input positive terminal; fused internally
3 and 4	IP-	Primary current input negative terminal; fused internally
5	GND	Signal Ground terminal
6	VREF	Reference， support input and output(support NC)
7	VIOUT	Analog output signal
8	VCC	Device power supply terminal

Thermal Rise vs. Primary Current

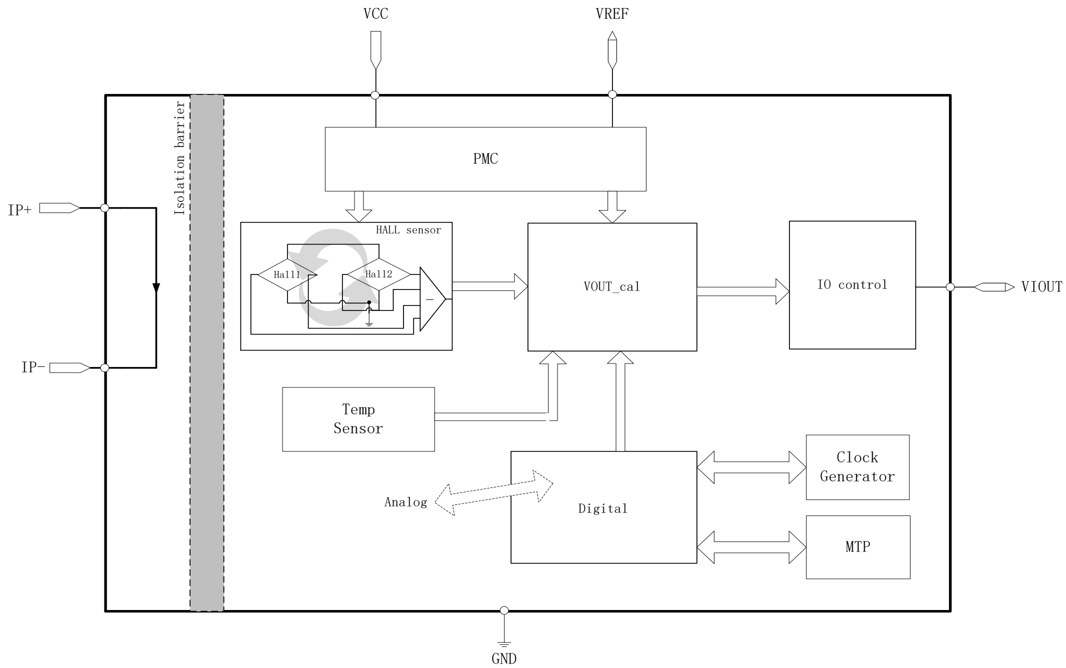
Typical junction temperature [°C] of SC8102 vs Primary current [A] based on Demo Board



Demo Board information

PCB Name	A10-V2
Layer Number	2
Total Copper size connected to Primary pins (Including all layers)	1224 mm^2
Copper layer thickness	2oz / 70um
Board Thickness	1mm

Functional Block Diagram



Absolute Maximum Ratings

Absolute maximum ratings are limiting values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability.

Characteristic	Symbol	Notes	Rating	Unit
Supply voltage	V_{CC}		6.0	V
Reverse Supply Voltage	V_{RCC}		-0.1	V
Output voltage	V_{IOUT}		6.0	V
Reverse Output Voltage	V_{RIOUT}		-0.1	V
Nominal Operating Ambient Temperature	T_A	Range E	-40~85	˚C
Maximum Junction Temperature	$T_{J\ (max)}$		165	˚C
Storage Temperature	T_{stg}		–65~170	˚C
Output Current Source	$I_{IOUT(Source)}$	Shorted Output-to-Ground Current	3.43	mA
Output Current Sink	$I_{IOUT(Sink)}$	Shorted Output-to-VCC Current	40	mA
Reference pin drawing current	$I_{REF(Source)}$	Shorted Vref-to-Ground Current	3.43	mA
Reference foot irrigation current	$I_{REF(Sink)}$	Shorted Vref-to-VCC Current	40	mA
Maximum IP value of sustainable loading at ambient temperature	IP_{max}	It is directly related to the heat dissipation capacity of PCB, and this data depends on the demo test board of SENK	50	A
Transient overload IP value of sustainable loading at ambient temperature	IPover	It is directly related to the heat dissipation capacity of PCB, and this data depends on the demo test board of SENK. 1pulse,100ms,1% duty cycle	100	A
HBM mode	ESD		4	kV

Isolation Characteristics

Parameter	Symbol	Value	Unit	Comment
RMS voltage for AC insulation test, 50Hz,1min	V_{ISO}	3000	V_{RMS}	Agency type-tested for 60 seconds per UL60950-1
Working Voltage for Basic Isolation	V_{WVBI}	420	V_{Peak}	Maximum working voltage according to UL60950-1
Clearance	D_{cl}	3.8-4	mm	Minimum distance through air from IP leads to signal leads
Creepage distance	D_{cr}	3.8-4	mm	Minimum distance along package body from IP leads to signal leads
Leakage mark index	CT1	600	V	The electrical breakdown (tracking) properties of an insulating material

Reference application Specification

Symbol	Description	Min	Typ	Max	Unit
C_{VCC}	The filter capacitor of power supply is connected between VCC and GND	0.1	0.47		uF
C_{VIOUT}	The filter capacitor of Output is connected between Vout and GND		1	1.5	nF
C_{VREF}	Refer to the Vref filter capacitor ; connected between Vref/GND	-	50	100	pF

Common Electrical Characteristics

Note: Over full range of T_A=25°C, C_{Bypass}=0.47uF, C_{Load}=1.0nF, V_{CC}=5V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	Operating	4.5	5	5.5	V
Supply Current	I_{CC}	V_{CC} = 4.5~5.5 V, output open		20		mA
Output Capacitance Load	C_L	V_{IOUT} to GND		1	1.5	nF
Output Resistive Load	R_L	V_{IOUT} to GND	2.2			kΩ
VREF Capacitance Load	C_{LREF}	Between VREF and GND		50	100	pF
VREF Resistive Load	R_{LREF}	Between VREF and GND	2.2			kΩ
Hall coupling factor	CF	T_A = 25°C		2.5		G/A
Anti-external magnetic interference suppression ratio	CMFR	External interference magnetic field perpendicular to the chip surface		-38		dB
Primary Conductor Resistance	$R_{PRIMARY}$	T_A = 25°C		0.8		mΩ
Temperature Coefficient of Primary Conductor Resistance	TC_R	T_A = -40~85°C				ppm/℃
Hysteresis	V_{hys}	Viout(load +20A and return to 0A)-Viout(load -20A and return to 0A)		1		mV
Rise time	t_r	IP=20A(50A/us)		2		uS
Propagation Delay	t_{pd}	IP=20A(50A/us)		1.2		uS
Response Time	$t_{response}$	IP=20A(50A/us)		1.5		uS
Bandwidth	f	–3 dB		150		kHz
Noise Density	I_{ND}	T_A = 25°C ,C_L=1nF		1545		μA(rms) / √Hz
Noise	I_N			0.46		mA(rms)
	I_N	BW=10KHz		0.12		mA(rms)
	I_N	BW=1KHz		0.05		mA(rms)
Nonlinearity	E_{LIN}	-20A<IP<20A			1	%
Proportional coefficient of follow-up sensitivity	S_{coef}	VCC=4.5~5.5V, S_{coef}=Sens(VCC)/Sens(5V)		VCC/5		
Linear rail-to-rail output range	Vrail-rail	R_L=4.7kΩ	10		90	%VCC
Power-On Time	t_{PO}	Output reaches steady state level, T_J = 25°C		84	120	μS
Sensitivity under fixed Zero Current Output (applicable to F5 suffix production Product)		VCC=4.5~5.5V, Type selection is xxF5		2000/I_{PR}		mV/A
Zero Current Output under fixed Zero Current Output (applicable to F5 suffix production Product)		VCC=4.5~5.5V, Type selection is xxF5		2.5		V
Zero Current Output of Power supply rejection ratio (applicable to F5 suffix production Product)	$PSRR_Q$			38		dB

Sensitivity of Power supply rejection ratio (applicable to F5 suffix production Product)	$PSRR_S$			31		dB

SC8102RET-02B5 Individual Performance Characteristics

Note: Over full range of T_A=-40°C~85°C, C_{Bypass}=0.47uF, C_{Load}=1nF, VCC=5V, unless otherwise specified.

Characteristic	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-2		2	A
Zero-Current Output Voltage	Voq	IP=0A, T_A=25°C	0.496Vcc	0.5Vcc	0.504Vcc	V
Sensitivity	Sens	-2A<IP<2A	990*S_{coef}	1000*S_{coef}	1010*S_{coef}	mV/A
ACCURACY PERFORMANCE						
Sensitivity Error	E_{SENS}	I_P = ±2 A, T_A = 25°C	-1		1	%
Sensitivity Error	E_{SENS}	I_P = ±2 A, TA = 25~85°C	-2		2	%
Sensitivity Error	E_{SENS}	I_P = ±2 A, TA = -40~25°C	-3		3	%
Offset Voltage	V_{OE}	I_P=0A, TA = 25°C	-20		20	mV
Offset Voltage	V_{OE}	I_P=0A, TA = 25~85°C	-40		40	mV
Offset Voltage	V_{OE}	I_P=0A, TA = -40~25°C	-50		50	mV
Nonlinearity	E_{LIN}	Measured using full-scale and half-scale IP	-1.5		1.5	%
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE} /(Sens \times I_P)$						
Total Output Error[2]	E_{TOT}	I_P = ±2 A, T_A= 25°C	-1.5		1.5	%
Total Output Error[2]	E_{TOT}	I_P = ±2 A, T_A= 25~85°C	-5		5	%
Total Output Error[2]	E_{TOT}	I_P = ±2 A, T_A= -40~25°C	-6		6	%

[1] Typical values with +/- are 3 sigma values
[2] Percentage of IP , with IP = $I_{PR(max)}$.

SC8102RET-06B5 Individual Performance Characteristics

Note: Over full range of T_A=-40°C~85°C , C_{Bypass}=0.47uf, C_{Load}=1nF, VCC=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-6		6	A
Zero-Current Output Voltage	Voq	IP=0A, T_A=25°C	0.498Vcc	0.5Vcc	0.502Vcc	V
Sensitivity	Sens	-6A<IP<6A	297*S_{coef}	330*S_{coef}	333*S_{coef}	mV/A
ACCURACY PERFORMANCE						
Sensitivity Error	E_{SENS}	I_P = ±6 A, T_A = 25°C	-1		1	%
Sensitivity Error	E_{SENS}	I_P = ±6 A, T_A = 25~85°C	-2		2	%
Sensitivity Error	E_{SENS}	I_P = ±6 A, T_A = -40~25°C	-3		3	%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C	-10		10	mV
Offset Voltage	V_{OE}	I_P=0A, T_A = 25~85°C	-30		30	mV
Offset Voltage	V_{OE}	I_P=0A, T_A = -40~25°C	-40		40	mV
Nonlinearity	E_{LIN}	Measured using full-scale and half-scale I_P	-1		1	%
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE} /(Sens \times I_P)$						
Total Output Error[2]	E_{TOT}	I_P = ±6 A, T_A=25°C	-1.5		1.5	%
Total Output Error[2]	E_{TOT}	I_P = ±6 A, T_A=25~85°C	-4		4	%
Total Output Error[2]	E_{TOT}	I_P = ±6 A, T_A= -40~25°C	-5		5	%

[1] Typical values with +/- are 3 sigma values
[2] Percentage of IP , with IP = $I_{PR(max)}$.

SC8102RET-20B5 Individual Performance Characteristics

Note: Over full range of T_A=-40°C~85°C , C_{Bypass}=0.47uf, C_{Load}=1nF, VCC=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-20		20	A
Zero-Current Output Voltage	Voq	IP=0A, T_A=25°C	0.498Vcc	0.5Vcc	0.502Vcc	V
Sensitivity	Sens	-20A<IP<20A	99*S_{coef}	100*S_{coef}	101*S_{coef}	mV/A
ACCURACY PERFORMANCE						
Sensitivity Error	E_{SENS}	I_P = ±20 A, T_A = 25°C	-1		1	%
		I_P = ±20 A, T_A = 25~85°C	-2		2	%
		I_P = ±20 A, T_A = -40~25°C	-3		3	%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C	-10		10	mV
		I_P=0A, T_A = 25~85°C	-30		30	mV
		I_P=0A, T_A = -40~25°C	-40		40	mV
Nonlinearity	E_{LIN}	Measured using full-scale and half-scale I_P	-1		1	%
TOTAL OUTPUT ERROR COMPONENTS: E_{TOT} = E_{SENS} + V_{OE} /(Sens × I_P)						
Total Output Error[2]	E_{TOT}	I_P = ±20 A, T_A=25°C	-1.5		1.5	%
		I_P = ±20 A, T_A=25~85°C	-4		4	%
		I_P = ±20 A, T_A= -40~25°C	-5		5	%

[1] Typical values with +/- are 3 sigma values
[2] Percentage of IP , with IP = $I_{PR(max)}$.

SC8102RET-30B5 Individual Performance Characteristics

Note: Over full range of T_A=-40°C~85°C , C_{Bypass}=0.47uf, C_{Load}=1nF, VCC=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-30		30	A
Zero-Current Output Voltage	Voq	IP=0A, T_A=25°C	0.498Vcc	0.5Vcc	0.502Vcc	V
Sensitivity	Sens	-30A<IP<30A	65.34*S_{coef}	66*S_{coef}	66.66*S_{coef}	mV/A
ACCURACY PERFORMANCE						
Sensitivity Error	E_{SENS}	I_P = ±30 A, T_A = 25°C	-1		1	%
		I_P = ±30 A, T_A = 25~85°C	-2		2	%
		I_P = ±30 A, T_A = -40~25°C	-3		3	%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C	-10		10	mV
		I_P=0A, T_A = 25~85°C	-30		30	mV
		I_P=0A, T_A = -40~25°C	-40		40	mV
Nonlinearity	E_{LIN}	Measured using full-scale and half-scale I_P	-1		1	%
TOTAL OUTPUT ERROR COMPONENTS: E_{TOT} = E_{SENS} + V_{OE} /(Sens × I_P)						
Total Output Error[2]	E_{TOT}	I_P = ±30 A, T_A=25°C	-1.5		1.5	%
		I_P = ±30 A, T_A=25~85°C	-4		4	%
		I_P = ±30 A, T_A= -40~25°C	-5		5	%

[1] Typical values with +/- are 3 sigma values
[2] Percentage of IP , with IP = $I_{PR(max)}$.

SC8102RET-10F5 Individual Performance Characteristics

Note: Over full range of T_A=-40°C~85°C , C_{Bypass}=0.47uF, C_{Load}=1nF, VCC=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Zero-Current Output Voltage	I_{PR}		-10		10	A
Sensitivity	Voq	IP=0A T_A=25°C		2.5		V
Zero-Current Output Voltage	Sens	-10A<IP<10A		200		mV/A
ACCURACY PERFORMANCE						
Sensitivity Error	E_{SENS}	I_P = ±10 A, T_A = 25°C	-1		1	%
		I_P = ±10 A, T_A = 25~85°C	-2		2	%
		I_P = ±10 A, T_A = -40~25°C	-3		3	%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C	-10		10	mV
		I_P=0A, T_A = 25~85°C	-30		30	mV
		I_P=0A, T_A = -40~25°C	-40		40	mV
Nonlinearity	E_{LIN}	Measured using full-scale and half-scale I_P	-1		1	%
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE} /(Sens \times I_P)$						
Total Output Error[2]	E_{TOT}	I_P = ±10 A, T_A=25°C	-1.5		1.5	%
		I_P = ±10 A, T_A=25~85°C	-4		4	%
		I_P = ±10 A, T_A= -40~25°C	-5		5	%

[1] Typical values with +/- are 3 sigma values
[2] Percentage of IP , with IP = $I_{PR(max)}$.

SC8102RET-20F5 Individual Performance Characteristics

Note: Over full range of T_A=-40°C~85°C , C_{Bypass}=0.47uF, C_{Load}=1nF, VCC=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-20		20	A
Zero-Current Output Voltage	Voq	IP=0A, T_A=25°C	2.490	2.5	2.510	V
Sensitivity	Sens	-20A<IP<20A		100		mV/A
ACCURACY PERFORMANCE						
Sensitivity Error	E_{SENS}	I_P = ±20 A, T_A = 25°C	-1		1	%
		I_P = ±20 A, T_A = 25~85°C	-2		2	%
		I_P = ±20 A, T_A = -40~25°C	-3		3	%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C	-10		10	mV
		I_P=0A, T_A = 25~85°C	-30		30	mV
		I_P=0A, T_A = -40~25°C	-40		40	mV
Nonlinearity	E_{LIN}	Measured using full-scale and half-scale I_P	-1		1	%
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE} /(Sens \times I_P)$						
Total Output Error[2]	E_{TOT}	I_P = ±20 A, T_A=25°C	-1.5		1.5	%
		I_P = ±20 A, T_A=25~85°C	-4		4	%
		I_P = ±20 A, T_A= -40~25°C	-5		5	%

[1] Typical values with +/- are 3 sigma values
[2] Percentage of IP , with IP = $I_{PR(max)}$.

SC8102RET-30F5 Individual Performance Characteristics

Note: Over full range of T_A=-40°C~85°C , C_{Bypass}=0.47uF, C_{Load}=1nF, VCC=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-30		30	A
Zero-Current Output Voltage	Voq	IP=0A, T_A=25°C	2.490	2.5	2.510	V
Sensitivity	Sens	-30A<IP<30A		66		mV/A
ACCURACY PERFORMANCE						
Sensitivity Error	E_{SENS}	I_P = ±30 A, T_A = 25°C	-1		1	%
		I_P = ±30 A, T_A = 25~85°C	-2		2	%
		I_P = ±30 A, T_A = -40~25°C	-3		3	%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C	-10		10	mV
		I_P=0A, T_A = 25~85°C	-30		30	mV
		I_P=0A, T_A = -40~25°C	-40		40	mV
Nonlinearity	E_{LIN}	Measured using full-scale and half-scale I_P	-1		1	%
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE}/(Sens \times I_P)$						
Total Output Error[2]	E_{TOT}	I_P = ±30 A, T_A=25°C	-1.5		1.5	%
		I_P = ±30 A, T_A=25~85°C	-4		4	%
		I_P = ±30 A, T_A= -40~25°C	-5		5	%

[1] Typical values with +/- are 3 sigma values
[2] Percentage of IP , with IP = $I_{PR(max)}$

SC8102RET-50F5 Individual Performance Characteristics

Note: Over full range of T_A=-40°C~85°C , C_{Bypass}=0.47uF, C_{Load}=1nF, VCC=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-50		50	A
Zero-Current Output Voltage	Voq	IP=0A T_A=25°C	2.490	2.5	2.510	V
Sensitivity	Sens	-50A<IP<50A		40		mV/A
ACCURACY PERFORMANCE						
灵敏度误差	E_{SENS}	I_P = ±50 A, T_A = 25°C	-1		1	%
		I_P = ±50 A, T_A = 25~85°C	-2		2	%
		I_P = ±50 A, T_A = -40~25°C	-3		3	%
单端输出零点误差	V_{OE}	I_P=0A, T_A = 25°C	-10		10	mV
		I_P=0A, T_A = 25~85°C	-30		30	mV
		I_P=0A, T_A = -40~25°C	-40		40	mV
非线性度	E_{LIN}	Measured using full-scale and half-scale I_P	-1		1	%
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE}/(Sens \times I_P)$						
Total Output Error[2]	E_{TOT}	I_P = ±50 A, T_A=25°C	-1.5		1.5	%
		I_P = ±50 A, T_A=25~85°C	-4		4	%
		I_P = ±50 A, T_A= -40~25°C	-5		5	%

[1] Typical values with +/- are 3 sigma values
[2] Percentage of IP , with IP = $I_{PR(max)}$

Accuracy characteristic curve (SC8102RET-20B5)

Fig1: Voq vs. Temp.

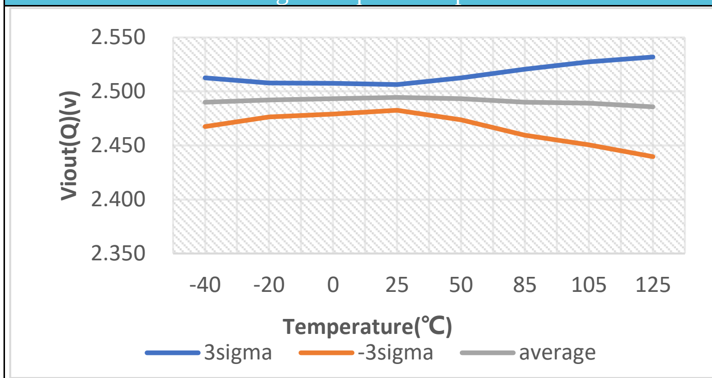


Fig2: Sensitivity Error vs.Temp.

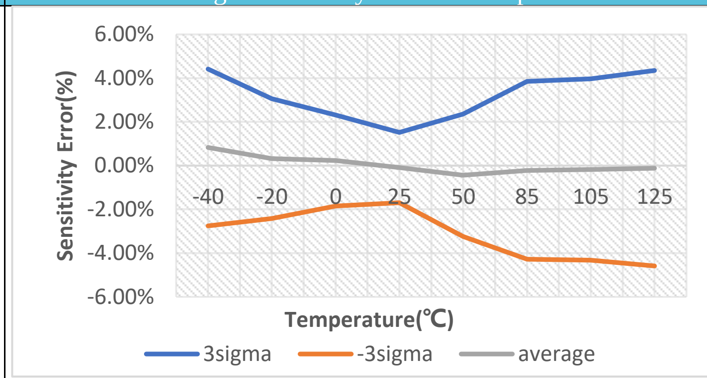


Fig3: Sensitivity Error vs.Temp. @XXX-20B5

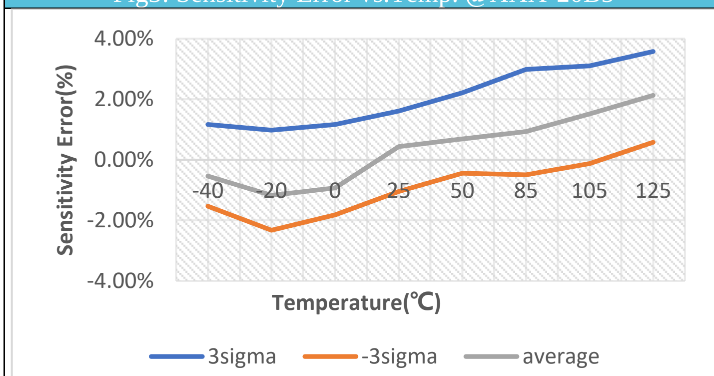


Fig4: Non-linearility vs. Temp.

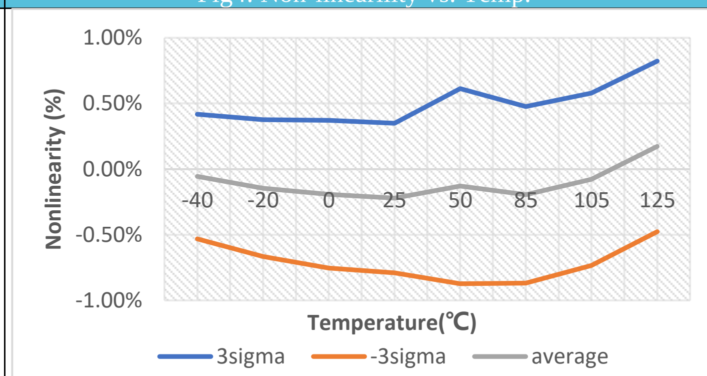


Fig5: Toltal output Error vs. Temp.

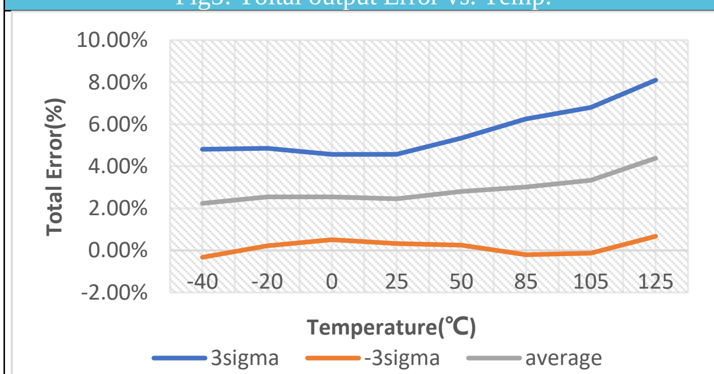
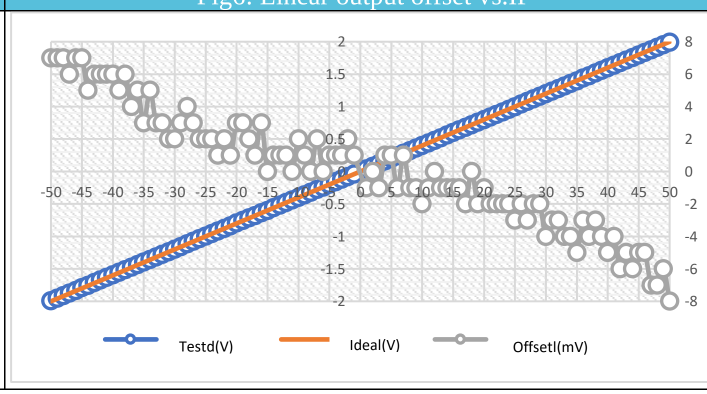


Fig6: Linear output offset vs.IP



AC & Dynamic Characteristic Curve

Fig1: Trans. Rising time

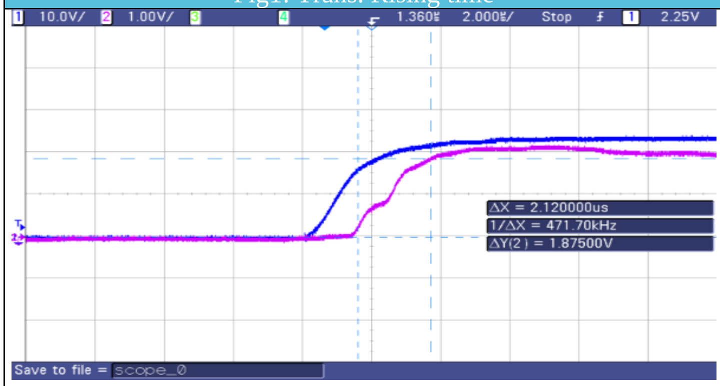


Fig2: Response Time

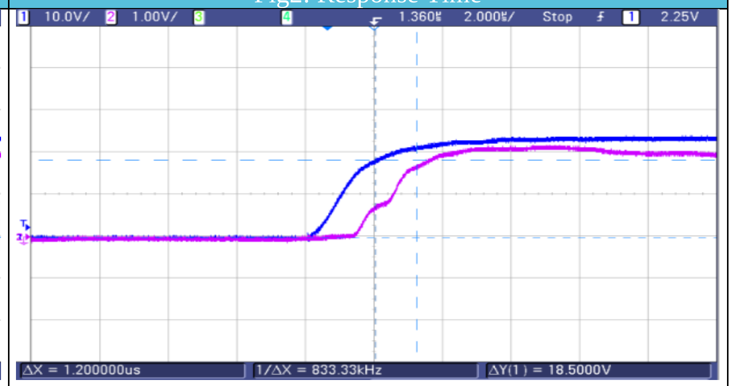


Fig3: Response delay time

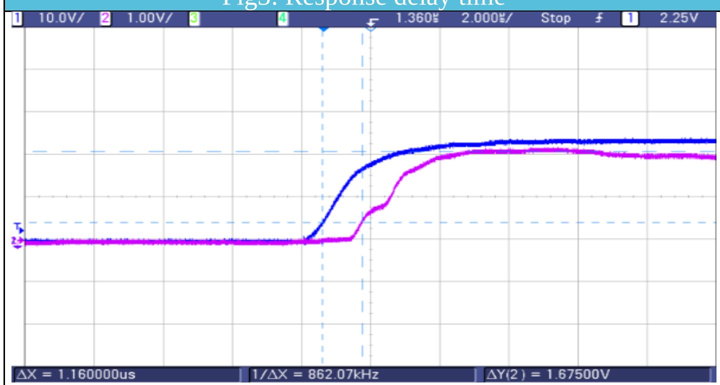


Fig4: Noise FFT

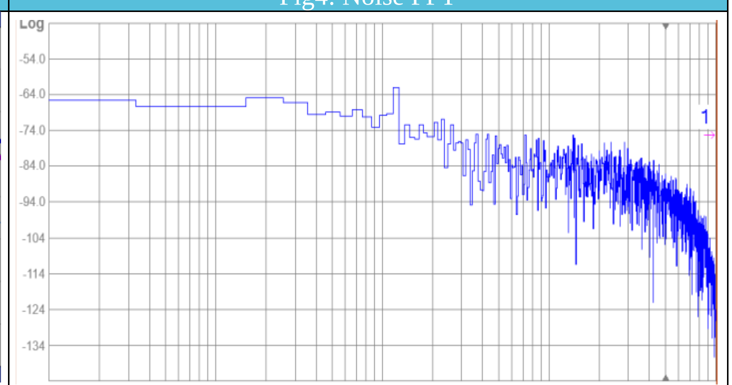


Fig5: Sinwave deltect

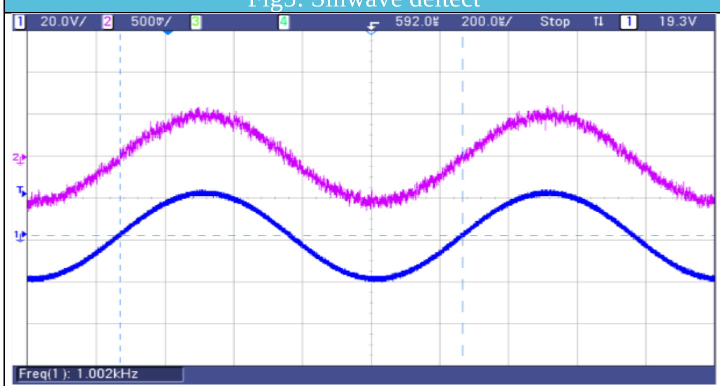


Fig6: Pluse deltect

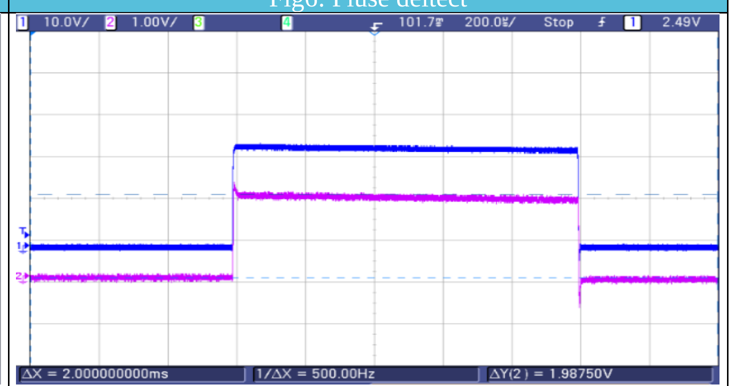


Fig7: Power on time

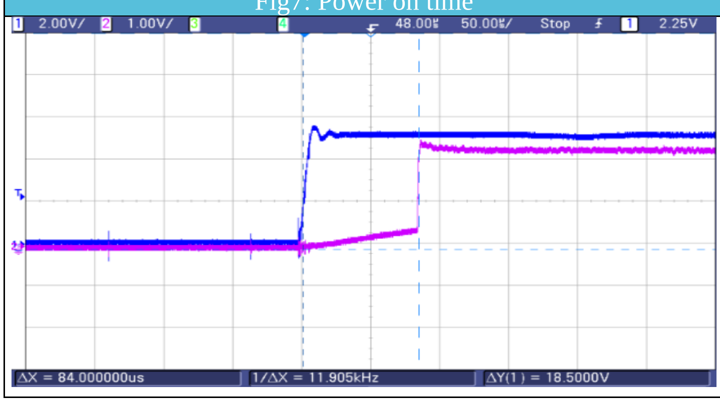
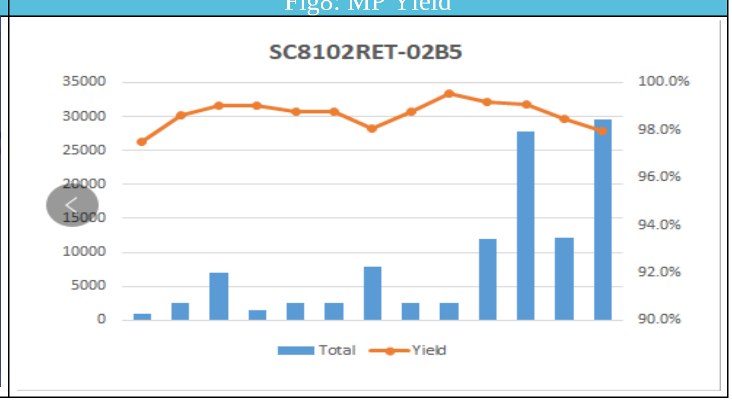


Fig8: MP Yield



Functional Description

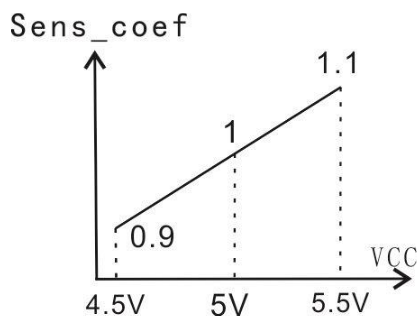
◆ Proportional Coefficient Of Sensitivity

Sensitivity ratio coefficient (sens_coef), which defines the coefficient proportional to the sensitivity and VCC. The ideal coefficient is 1. If the VCC increases by 10%, the sensitivity will increase by 10%. At this time, the coefficient is 1.1, which means that the sensitivity increases by 10% compared with the ideal proportion. The relationship between the scale coefficient is described by the following equation:

S_{coef}=Sens_coef=$SENS_{VCC}/SENS_{VCCN}$

It is the ratio of the sensitivity $SENS_{VCC}$ under the supply voltage Vcc to the sensitivity $SENS_{VCCN}$ under the rated supply voltage VCCN. Through this value, we can get the sensitivity under any supply voltage.

In ideal situation:



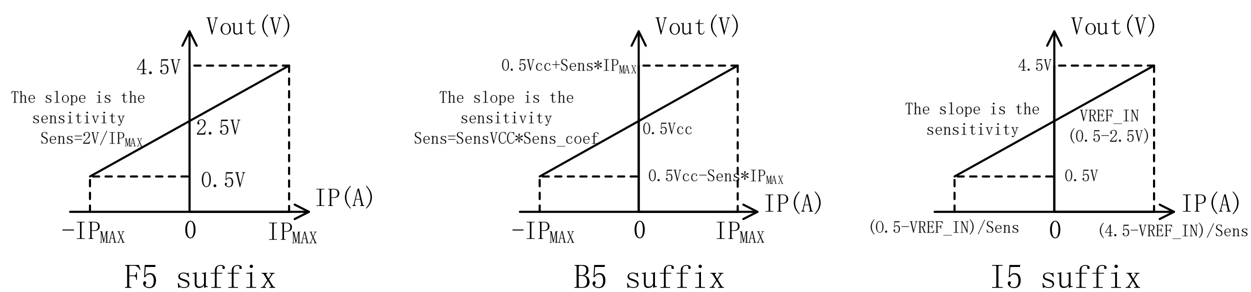
◆ Proportional Relationship

With SC8102**B5,Zero output voltage and sensitivity vary with VCC ratio. The Vout@0A is VCC/2.Sensitivity is $SENS_{VCC}$ * Sens_coef.

With SC8102**U5,Zero output voltage and sensitivity vary with VCC ratio. The Vout@0A is VCC/10.Sensitivity is $SENS_{VCC}$ * Sens_coef.

Zero-current voltage is fixed at 2.5V and sensitivity is fixed at 2V/IPMAX when VCC change if using SC8102**F5.

IPMAX is the Maximum current.



◆ Impact of External Magnetic Fields

CMFR is used to express the ability of sensor resisting impact of external magnetic fields. The larger the absolute value of CMFR, the stronger the ability to resist external magnetic interference is. CMFR is defined as The absolute value of the ratio of the voltage change A_{CM} (mv/G) caused by external magnetic interference to the sensor itself is 20 times of the common logarithm, and the unit is decibel (dB).

$$CMFR = 20\lg\left|\frac{A_{CM}}{Sens/CF}\right|$$

CF is the coupling factor in G/A, multiplying by the sensitivity of the part(Sens)gives the error in mV.

For example: CMFR= -40dB, Sens = 40mv/A, CF = 10G/A, then ACM is 0.04mv/G. That is, the output changes by 40uv for every 1Guass increase of external magnetic field.

◆ Power Supply Rejection Ratio(suitable for products with suffix F)

Sensitivity power supply rejection ratio($PSRR_S$) It refers to the sensitivity change rate ($SENS_{VCC}$-$SENS_{VCCN}$)/$SENS_{VCCN}$ caused by the power supply change rate(VCC-VCCN)/VCCN. The absolute value of the ratio is 20 times of the common logarithm, the unit is dB.

$$\mathrm{PSRR_S} = 20\lg\left|\frac{(\mathrm{VCC}-\mathrm{VCC_N})/\mathrm{VCC_N}}{(\mathrm{SENS_{VCC}}-\mathrm{SENS_{VCCN}})/\mathrm{SENS_{VCCN}}}\right|$$

Zero current power supply rejection ratio($PSRR_Q$) It refers to the zero point change VOE - VOEN caused by the change of voltage VCC - VCCN. The absolute value of the ratio is 20 times of the common logarithm, the unit is dB.

$$\mathrm{PSRR_Q} = 20\lg\left|\frac{\mathrm{VCC}-\mathrm{VCC_N}}{\mathrm{VOE}-\mathrm{VOE_N}}\right|$$

◆ Delay time t_{pd} and Response time $t_{response}$

Both delay time and response time are used to characterize the time difference between primary side and secondary side;

The delay time is the time difference when the secondary output reaches 20% of the steady-state output value and the primary output reaches 20% of the steady-state current;

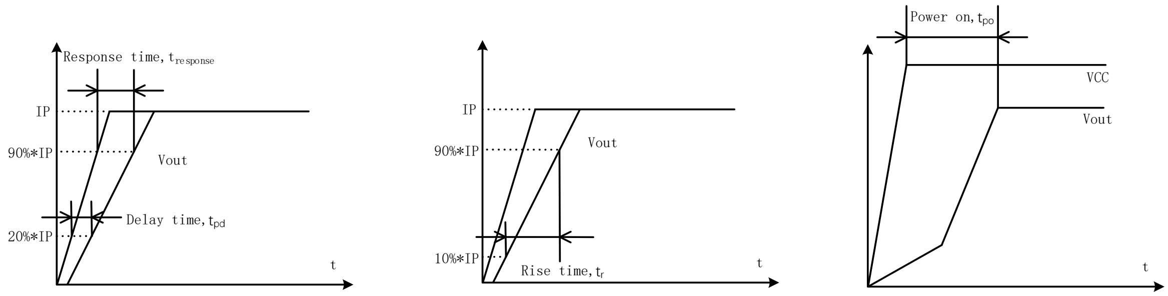
The response time is the time difference when the secondary output reaches 90% of the steady-state output value and the primary output reaches 90% of the steady-state current.

Rise Time tr

Rise time is used to characterize the time difference of the secondary side itself, that is, the time difference between when the secondary side output reaches 90% of the steady-state output value and when it reaches 10% of the steady-state output value.

Power-On Time t_{po}

The power-on time is used to characterize the time difference between the secondary side and the power supply VCC, that is, the time difference between the secondary side output reaching the steady-state output value and the VCC reaching the steady-state output value.



◆ Thermal resistance $R_{\theta JA}$

Based on a demo board, the thermal resistance is calculated by measuring the chip top temperature and power value. According to the thermal resistance, the junction temperature can be calculated as a reference. The actual surface temperature measurement value is shown in the relationship between the package temperature and the measured current.

$$T_J = T_A + \left(R_{\theta JA} * POWER\right) = T_A + (R_{\theta JA} * IP^2 * R_{PRIMARY});$$

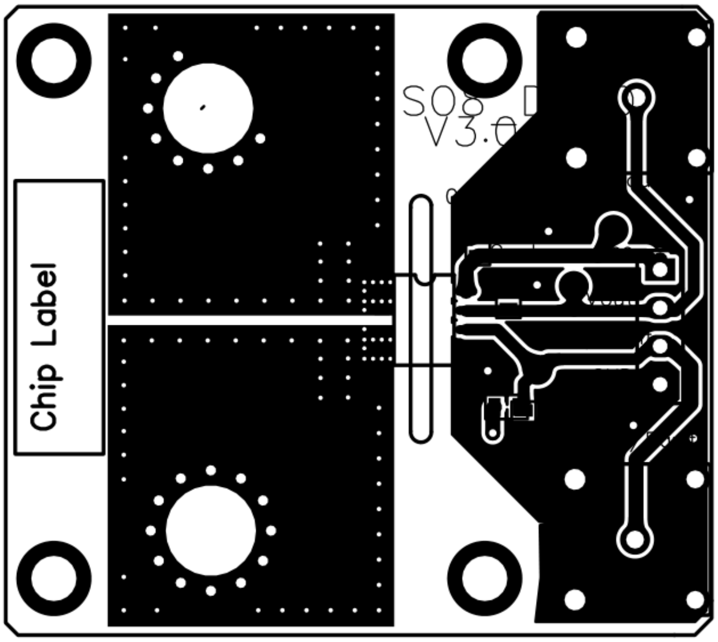
Where TJ is junction temperature and TA is ambient temperature.

◆ Refer to application information

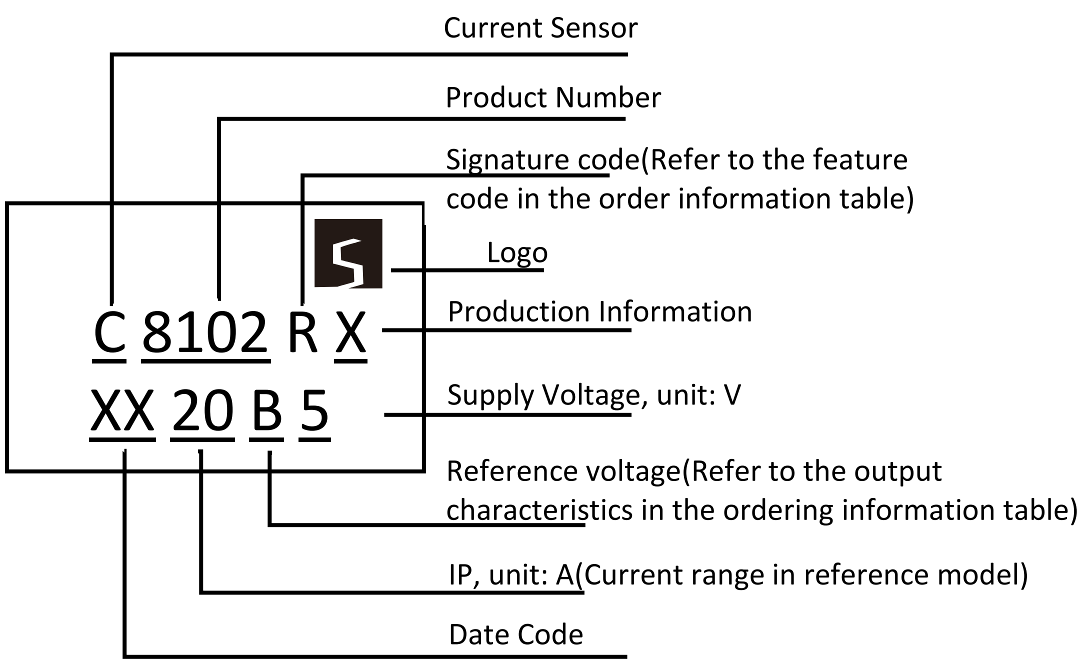
Selection of SC8102RET-xxB5/xxU5/xxF5 suffix

B	Output varies with VCC ratio, which basically has no ability to suppress high frequency noise of power supply. It is applicable to the system where the power supply voltage fluctuates greatly, and the subsequent MCU or DSP processing adopts 0.5VCC as the reference conversion and sensitivity as the VCC ratio calculation. And the VCC fluctuation error is offset by synchronous calculation.
U	Same as B mode, but suitable for unidirectional current detection.
F	Output is not affected by power supply voltage, and has high power supply suppression ability, low output noise and strong anti-interference ability. Especially in the case of high noise of system power supply, to ensure excellent output characteristics. However, it is required that the post-processing is not based on VCC, or when VCC fluctuates very little, so as to obtain high suppression ratio capability.

Demo Board Layout



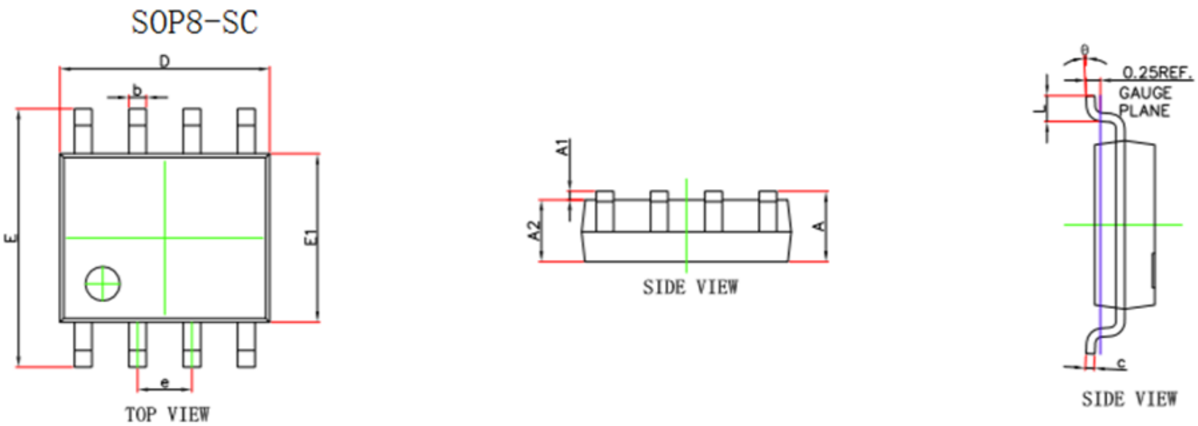
Mark Description



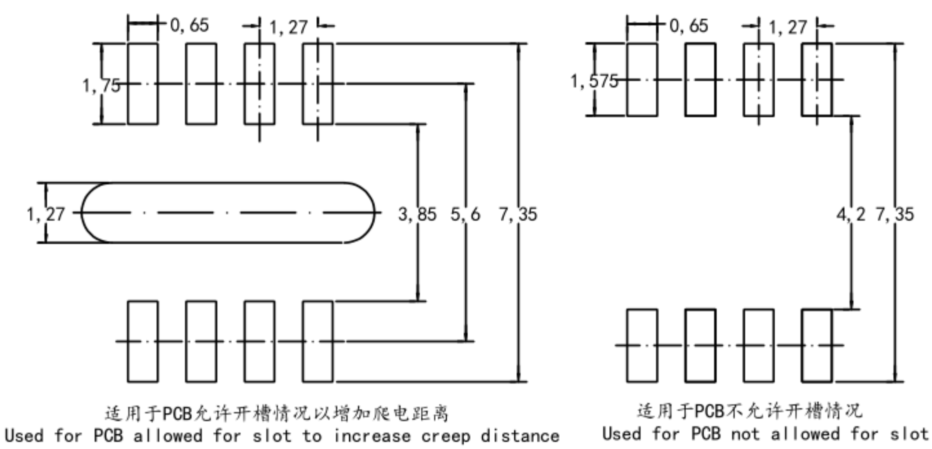
Note: X is non fixed character, defined by SENK SEMI. naming rules

Package Information

Note: Package is SOP8-SC, all dimensions are in millimeters.



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
D	4.700	5.100	0.185	0.201
E1	3.800	4.000	0.150	0.157
E	5.800	6.200	0.228	0.244
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



PCB Layout Reference View

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Revision Table

Revision	Change	Page	Author	Date
1.0	Initial draft for basic version		Jerry	2018.01
2.0	Update to 601 version; Delete FFT ; Check and review EC TABLE; Update non-mass supply models; Delete VREF and modify bandwidth parameters; Add UL and environmental protection logo; Modify Functional Block Diagram; New models 20F5 and 30F5; Modify part of the data and description;		Emma	2021.03
3.0	Add models 10F5，50F5， SC8102RET-05B5; Change the definition of PIN6 from NC to VREF;		ZJF	2022.05