Up to 100A, High-precision current sensor chip that With stands surge currents up to 20KA

Description

SC840 is a new member of Senko Micro fully integrated current sensor product line, The industry's first fully integrated current detection chip that can pass 20kA/8us lightning surge test. This product with the world's first packaging technology, in 10mm*11mm*2.3mm wide-body SOP16 encapsulation on realized as low as 0.2 m Ω current lead impedance,this enables it to be applied to power systems requiring continuous operation at measurements up to 100A.

Senko Micro's SC840 series is an isolated current detection chip that uses the principle of open-loop Hall sensor detection. By introducing the current wire on the high-voltage side into the package, based on the magnetic effect of the current, the amount of iso-magnetic field generated around the wire under test is induced by the magnetic sensor of the built-in chip and converted to a treatable ethonal-voltage signal, which is amplified by the built-in high-precision ADC reading, with digital calibration technology, to remove environmental variables such as temperature, noise, hysteresis, nonlinearity, and finally the voltage value of the current under test is nearly ideal.

SC840 adopts automatic production and processing,can bring customers incomparable consistency, high quality and high reliability of module technology.Standard package design is very suitable for customers to carry out batch automatic patch production, which is the best solution for photovoltaic inverter, household appliances, charging pile.

Senko Micro is committed to the research of core chip technology, with the aim of bringing customers the best current detection solution.

Features

- 4.8 kV RMS minimum isolation voltage
- Output voltage proportional to AC or DC currents
- Lowest Current conductor impedance :0.2mΩ
- 20kA 8/20uS surge current bearing capacity
- Support Vout - Vref differential output mode
- Fixed reference reference is built in and is not affected by fluctuations in the supply voltage
- 2µs output rise time in response to step input current
- Wide operation temp. range :-40℃~125℃
- Wide range of measured current:20A~150A
- Total output error <1% @TA =25°C, <3% for full temperature range.
- Strong driving ability,support the output port to connect to the load as low as 2k
- Extremely simple peripheral circuit
- Built-in AC zero-crossing detection function
- 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 Senko Micro.
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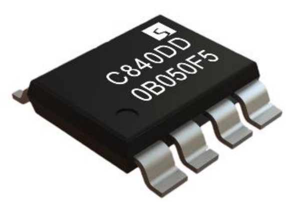
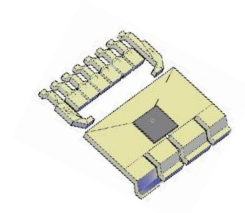
c US
Certificate Number:
E514605-A6002-UL

Package

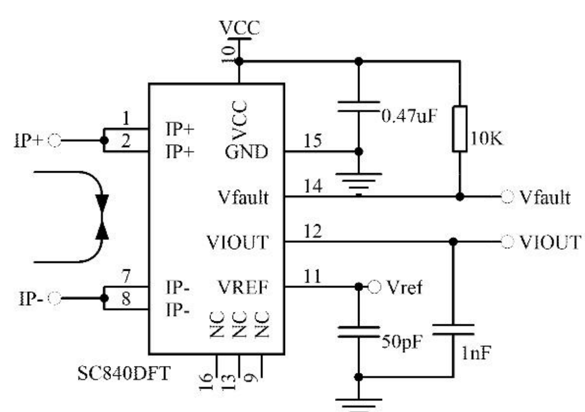
Top View:



Current Path view:



Typical Application



Order information

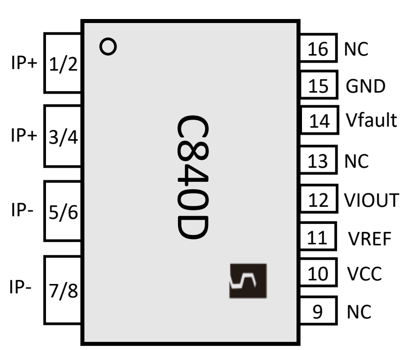
Part Number	Special Code	Temp.Range	Packing	IP(A) *3	Vout@IP=0A[1]	Sens@VCC=5V(mv/A)
SC840DFT-20F5	D	F(-40~125°C)	T (Reel, 1000 pieces/reel)	± 20	F(2.5）	100
SC840DFT-25F5				± 25		80
SC840DFT-50F5				± 50		40
SC840DFT-75F5				± 75		26.67
SC840DET-100F5		E(-40~85°C)		± 100		20
SC840DET-150F5				± 150		13.333
SC840DFT-20B5		F(-40~125°C)		± 20	B(0.5Vcc)	100
SC840DFT-25B5				± 25		80
SC840DFT-50B5				± 50		40
SC840DFT-75B5				± 75		26.67
SC840DET-100B5		E(-40~85°C)		± 100		20
SC840DFT-20I5		F(-40~125°C)		± 20	I*3 (External VREF）	100
SC840DFT-25I5				± 25		80
SC840DFT-30I5				±30		66
SC840DFT-50I5-050				± 50	I=0.5V	40
SC840DFT-50I5-075				± 50	I=0.75V	40
SC840DFT-75I5-075				± 75	I=0.75V	26.67
SC840DET-100I5		E(-40~85°C)		± 100	I*3	20
SC840DFT-50U5		F(-40~125°C)		+50	U(0.1Vcc)	80
SC840DFT-75U5				+75		53.33
SC840DET-100U5		E(-40~85°C)		+100		40

Note 1: F , B , I ,U are different in the reference output when IP=0A,F is recommended by default.

F	When IP=0A,VIOUT@0A=VREF=2.5V,Zero current voltage and sensitivity is fixed
B	When IP=0A,VIOUT@0A=0.5*VCC,suitable for bidirectional current detection,Zero Current Output and sensitivity vary with VCC ratio.
I*3	When IP=0A,VIOUT@0A=VREF=External input voltage (0.5~2.6V input range). Zero Current Output and sensitivity vary with VCC ratio.
U*2,3	When IP=0A,VIOUT@0A=0.1*VCC,suitable for unidirectional current detection,Zero Current Output and sensitivity vary with VCC ratio.

Note 2: Model U, dynamic range x2 sensitivity x2; if there is any other sensitivity requirement,can connect our FAE or agent.
Note 3: Model I , must contact FAE to confirm, with the model to inform the input voltage value, to obtain the best precision parameters. E.g.SC840DFT-20I5. I =0.5 V.

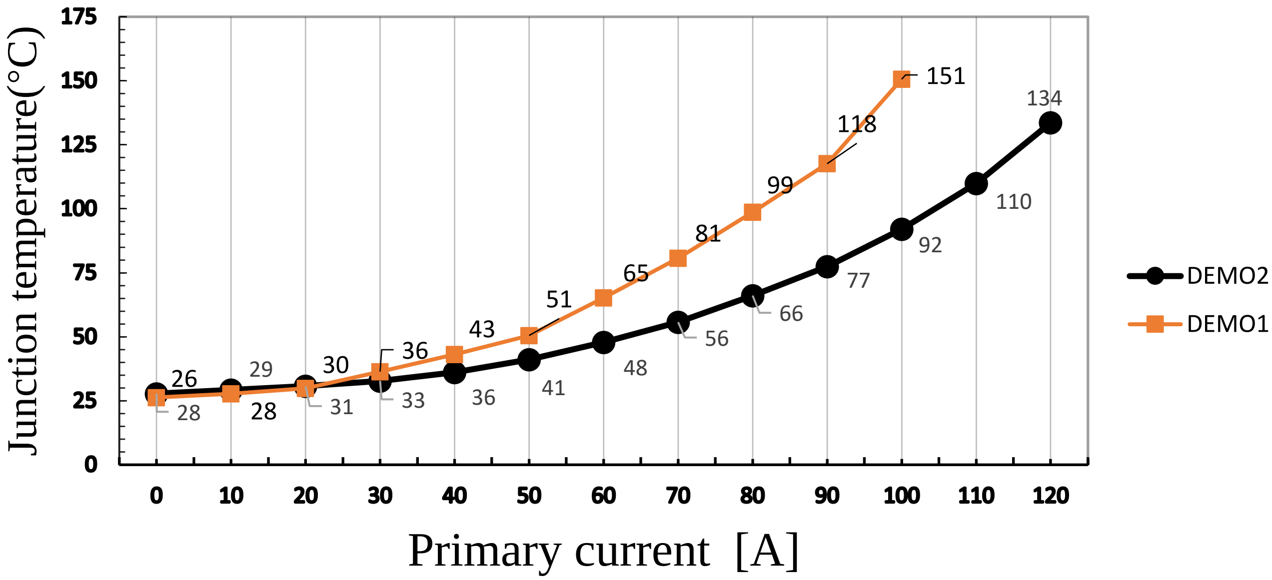
Pin Configuration



Pin Name	Pin Name	Description
1/2/3/4	IP+	The primary current is input to the positive terminal, and only 1/2 or 3/4 connection is supported
5/6/7/8	IP-	The primary current is output to the negative terminal and only 5/6 or 7/8 connection is supported
9/13/16	NC	No Connected
10	VCC	Device power supply
11	Vref	Reference terminal, support input and output.Equal to Vout@IP=0A(IP=0A)
12	VIOUT	Analog output signal. VIOUT=IP*Sens+Vref
14	Vfault	Built-in 1.3 times IP overcurrent protection output and open drain output
15	GND	Signal Ground terminal

Thermal Rise vs.Primary Current

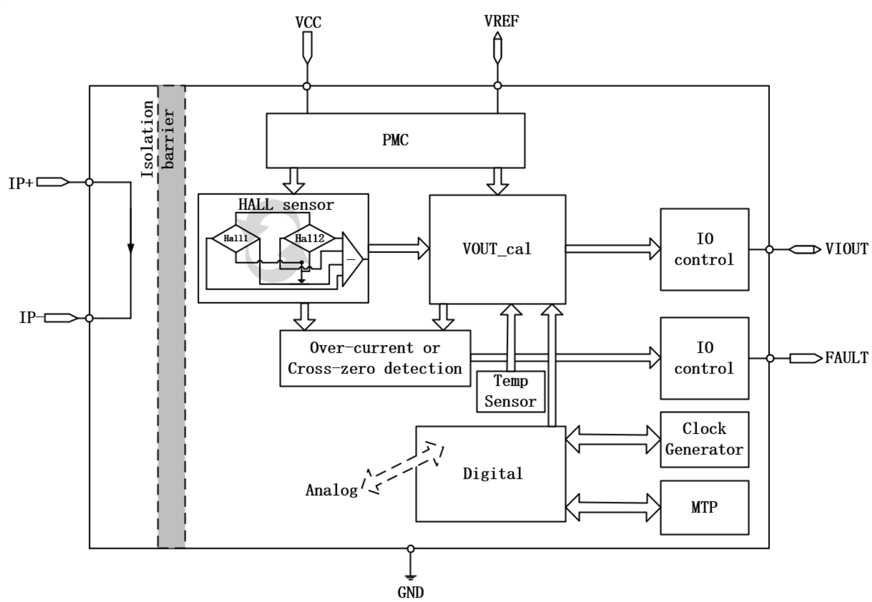
Typical Plastic package temperature[°C] of SC840 vs Primary current [A] based on Demo Board



Demo Board information

Parameter	DEMO1	DEMO2	Units
Layer Number	2	2	
Copper layer thickness	2	2	Oz
Total Copper size connected to Primary pins(including all layers)	1520	4581	mm^2
Board Thickness	1.6	1.6	mm

Fuctional Block Diagram



Absolute Maximum Ratings

Absolute maximum rating is the operating limit of a device, exceeding which may cause device damage. Frequent operation outside this value range 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 F	-40~125	℃
		Range E	-40~85	
Maximum Junction Temperature	$T_{J\ (max)}$		165	℃
Storage Temperature	T_{stg}		–65~170	℃
Output Current Source	$I_{OUT(Source)}$	Shorted Output-to-Ground Current	3.43	mA
Output Current Sink	$I_{OUT(Sink)}$	Shorted Output-to-VCC Current	40	mA
Vref Current Source	$I_{REF(Source)}$	Shorted Vref-to-Ground Current	3.47	mA
Vref Current Sink	$I_{REF(Sink)}$	Shorted Vref-to-VCC Current	40	mA
Overcurrent Fault Output Pin Resistance	Rvfault	Must not be lower than this value @ pull-up power supply =5V	1	kΩ
The Pull-up Voltage of Vfault	VCC_{fault}	Open-drain output, supporting independent VCC connection, but not higher than this requirement	8	V
Maximum Continuing IP Current	IP_{max}	Based on Senko's Demo Test Board	150	A
Transient Over Current at Ambient Temperature	IPover	Based on Senko's Demo Test Board , 1pulse , 100ms , 1% Duty Cycle	400	A
HBM mode	ESD		4	kV

Isolation Characteristics

Parameter	Symbol	Value	Unit	Comment
RMS voltage for AC insulation test,50Hz,1min	V_{ISO}	4800	Vrms	Agency type-tested for 60 seconds per UL60950-1
Working Voltage for Basic Isolation	V_{WVBI}	1600	V_{Peak}	Maximum working voltage according to UL60950-1
Clearance	Dcl	8	mm	Minimum distance through air from IP leads to signal leads
Creepage distance	Dcr	8	mm	Minimum distance along package body from IP leads to signal leads
Comparative trackong index	CTI	600	V	the electrical breakdown (tracking) properties of an insulating material
Maximum surge isolation voltage	V_{IOSM}	10	kV	VTEST=1.3 x VIOTM=13000VPK,1.2/50us waveform
Maximum Transient impulse current	I_{IOSM}	20	kA	ITEST=IIOTM,t=8/20us(qualification);

Reference application Specification

Symbol	Description	Min	Typ	Max	Unit
C_{VCC}	The filter capacitor of power supply is connected between VCC and GDN	0.1	0.47	----	uF
C_{VIOUT}	The filter capacitor of Output is connected between Vout and GND	NC	1	1.5	nF
C_{VREF}	The filter capacitor of Output is connected between Vref and GND	NC	50	100	pF
R_{Vfault}	The pull-up resistence is connected between Vfault and VCC	2	10	100	kΩ

Common Electrical Characteristics

Note: Over full range of T_A=25°C, C_{Bypass}=0.47uF,C_{Load}=1.0nF,V_{CC}=5V,sensitivity=40mv/A

Characteristic	Symbol	Test Comditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	Operating	4.5	5	5.5	V
Supply Current	I_{CC}	VCC = 4.5~5.5V, output open		20		mA
Output Capacitance Load	C_L	VIOUT to GND		1	1.5	nF
Output Resistive Load	R_L	VIOUT to GND	2.2			kΩ
VREF Capacitance Load	C_{LREF}	VREF to GND		50	100	pF
VREF Resistive Load	R_{LREF}	VREF to GND	2.2			kΩ
Hall coupling factor	CF	TA = 25°C		0.84		G/A
Anti-external magnetic interference suppression ratio	CMFR	The external interference magnetic field perpendicular to the chip surface		-38		dB
Primary Conductor Resistance	$R_{PRIMARY}$	TA = 25°C		0.21		mΩ
Temperature Coefficient of Primary Conductor Resistance	TC_R	TA=-40~125°C		8800		ppm/°C
Hysteresis Voltage	V_{hys}	Viout(IP to +40A then return to 0A)-Viout(IP to -40A,then return to0A)		1		mV
Rise time	t_r	IP=50A		2		uS
Propagation Delay	t_{pd}	IP=50A		1.2		uS
Response Time	$t_{response}$	IP=50A		1.5		µS
Bandwidth	f	Small-Signal–3 dB,		180		kHz
Noise Density	I_{ND}	TA = 25°C ,CL=1nF		1545		µA(rms)/√Hz
Noise	I_N	NC		0.46		mA(rms)
	I_N	RC filter BW=10KHz		0.12		mA(rms)
	I_N	RC filter BW=1KHz		0.05		mA(rms)
Nonlinearity	E_{LIN}	-50A<IP<50A			1	%
Bidirectional Quiescent Output(suitable for product with suffix B5)	S_{coef}	VCC=4.5~5.5V, Scoef=Sens(VCC)/Sens(5V)		VCC/5		
Sensitivity under fixed zero voltage(suitable for product with suffix F5)		VCC=5V, Type selection is xxF5		2000/I_{PR}		mv/A
Vout@0A under fixed zero voltage(suitable for product with suffix F5)		VCC=5V, Type selection is xxF5		2.5		V
External Vref Voltage Range		VCC=5.0V, Type selection is xxI5	0.5		2.6	V
VIOUT LinearRail 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		100	200	µS
PSRR of VOUT@0A(suitable for product with suffix F5)	$PSRR_Q$			38		dB
PSRR of Sensitivity(suitable for product with suffix F5)	$PSRR_S$			31		dB

SC840DFT-20B5 Individual Performance Characteristics

Note: Over full range of T_A=-40~125°C, C_{Bypass}=0.47uF,C_{Load}=1.0nF, V_{CC}=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		0.5Vcc		V
VREF Output Voltage	Vref	Independent of the IP input current		0.5Vcc		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-15	0	15	mV
Sensitivity	Sens	-20A<IP<20A		100* S_{coef}		mV/A
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE}$ /(Sens × I_P)						
Sensitivity Error	E_{SENS}	I_P = ±20 A, T_A = 25°C		± 1		%
		I_P = ±20 A, T_A = 25~125°C		± 2		%
		I_P = ±20 A, T_A = - 40~25°C		± 3		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 35		mV
		I_P=0A, T_A = - 40~25°C		± 30		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 25		mV
		I_P=0A, T_A = - 40~25°C		± 20		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P			1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±20 A, T_A=25°C		± 1.0		%
		I_P = ±20 A, T_A=25°C~125°C		± 3		%
		I_P = ±20 A, T_A= - 40°C ~ 25°C		± 3.5		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this range

SC840DFT-20F5 Individual Performance Characteristics

Note: Over full range of TA=-40~125°C, C_{Bypass}=0.47uF, C_{Load}=1nF, V_{CC}=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		2.5		V
VREF Output Voltage	Vref	Independent of the IP input current		2.5		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-15	0	15	mV
Sensitivity	Sens	-20A<IP<20A		100		mV/A
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE}$ /(Sens × I_P)						
Sensitivity Error	E_{SENS}	I_P = ±20 A, T_A = 25°C		± 1		%
		I_P = ±20 A, T_A = 25~125°C		± 2		%
		I_P = ±20 A, T_A = - 40~25°C		± 3		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 35		mV
		I_P=0A, T_A = - 40~25°C		± 30		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 25		mV
		I_P=0A, T_A = - 40~25°C		± 20		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P			1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±20 A, T_A=25°C		± 1.0		%
		I_P = ±20 A, T_A=25°C~125°C		± 3		%
		I_P = ±20 A, T_A= - 40°C ~ 25°C		± 3.5		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this range

SC840DFT-25B5 Individual Performance Characteristics

Note: Over full range of TA=-40~125°C, C_{Bypass}=0.47uF, C_{Load}=1nF, V_{CC}=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-25		25	A
Zero-Current Output Voltage	Voq	IP=0A		0.5Vcc		V
VREF Output Voltage	Vref	Independent of the IP input current		0.5Vcc		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-15	0	15	mV
Sensitivity	Sens	-25A<IP<25A		80* S_{coef}		mV/A
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE} /(Sens \times I_P)$						
Sensitivity Error	E_{SENS}	I_P = ±25 A, T_A = 25°C		± 1		%
		I_P = ±25 A, T_A = 25~125°C		± 2		%
		I_P = ±25 A, T_A = - 40~25°C		± 3		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 35		mV
		I_P=0A, T_A = - 40~25°C		± 30		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 25		mV
		I_P=0A, T_A = - 40~25°C		± 20		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P		± 0.5	1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±25 A, T_A=25°C		± 1.0		%
		I_P = ±25 A, T_A=25°C~125°C		± 3		%
		I_P = ±25 A, T_A= - 40°C ~ 25°C		± 3.5		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this range

SC840DFT-25F5 Individual Performance Characteristics

Note: Over full range of TA=-40~125°C, C_{Bypass}=0.47uF, C_{Load}=1nF, V_{CC}=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-25		25	A
Zero-Current Output Voltage	Voq	IP=0A		2.5		V
VREF Output Voltage	Vref	Independent of the IP input current		2.5		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-15	0	15	mV
Sensitivity	Sens	-25A<IP<25A		80		mV/A
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE} /(Sens \times I_P)$						
Sensitivity Error	E_{SENS}	I_P = ±25 A, T_A = 25°C		± 1		%
		I_P = ±25 A, T_A = 25~125°C		± 2		%
		I_P = ±25 A, T_A = - 40~25°C		± 3		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 35		mV
		I_P=0A, T_A = - 40~25°C		± 30		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 25		mV
		I_P=0A, T_A = - 40~25°C		± 20		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P		± 0.5	1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±25 A, T_A=25°C		± 1.0		%
		I_P = ±25 A, T_A=25°C~125°C		± 3		%
		I_P = ±25 A, T_A= - 40°C ~ 25°C		± 3.5		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this range

SC840DFT-50B5 Individual Performance Characteristics

Note: Over full range of TA=-40~125°C, C_{Bypass}=0.47uF, C_{Load}=1nF, V_{CC}=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		0.5Vcc		V
VREF Output Voltage	Vref	Independent of the IP input current		0.5Vcc		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-15	0	15	mV
Sensitivity	Sens	-50A<IP<50A		40* S_{coef}		mV/A
TOTAL OUTPUT ERROR COMPONENTS: E_{TOT} = E_{SENS} + V_{OE} /(Sens × I_P)						
Sensitivity Error	E_{SENS}	I_P = ±50 A, T_A = 25°C		± 1		%
		I_P = ±50 A, T_A = 25~125°C		± 2		%
		I_P = ±50 A, T_A = - 40~25°C		± 3		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 38		mV
		I_P=0A, T_A = - 40~25°C		± 35		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 25		mV
		I_P=0A, T_A = - 40~25°C		± 20		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P		± 0.5	1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±50 A, T_A=25°C		± 1		%
		I_P = ±50 A, T_A=25°C~125°C		± 3		%
		I_P = ±50 A, T_A= - 40°C ~ 25°C		± 3.5		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this range

SC840DFT-50F5 Individual Performance Characteristics

Note: Over full range of TA=-40~125°C, C_{Bypass}=0.47uF, C_{Load}=1nF, V_{CC}=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	2.495	2.5	2.505	V
VREF Output Voltage	Vref	Independent of the IP input current	2.495	2.5	2.505	V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-5	0	5	mV
Sensitivity	Sens	-50A<IP<50A	39.8	40	40.2	mV/A
TOTAL OUTPUT ERROR COMPONENTS: E_{TOT} = E_{SENS} + V_{OE} /(Sens × I_P)						
Sensitivity Error	E_{SENS}	I_P = ±50 A, T_A = 25°C		± 1		%
		I_P = ±50A, T_A = 25~125°C		± 2		%
		I_P = ±50 A, T_A = - 40~25°C		± 2		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 5		mV
		I_P=0A, T_A = 25~125°C		± 38		mV
		I_P=0A, T_A = - 40~25°C		± 25		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 5		mV
		I_P=0A, T_A = 25~125°C		± 30		mV
		I_P=0A, T_A = - 40~25°C		± 20		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P		± 0.5	1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±50 A, T_A=25°C		± 1		%
		I_P = ±50 A, T_A=25°C~125°C		± 3		%
		I_P = ±50 A, T_A= - 40°C ~ 25°C		± 2.8		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this range

SC840DFT-75B5 Individual Performance Characteristics

Note: Over full range of TA=-40~125°C, C_{Bypass}=0.47uF, C_{Load}=1nF, V_{CC}=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-75		75	A
Zero-Current Output Voltage	Voq	IP=0A		0.5Vcc		V
VREF Output Voltage	Vref	Independent of the IP input current		0.5Vcc		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-5	0	5	mV
Sensitivity	Sens	-75A<IP<75A		26.67* S_{coef}		mV/A
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE}/(Sens \times I_P)$						
Sensitivity Error	E_{SENS}	I_P = ±75 A, T_A = 25°C		± 1		%
		I_P = ±75 A, T_A = 25~125°C		± 2		%
		I_P = ±75 A, T_A = - 40~25°C		± 3		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 35		mV
		I_P=0A, T_A = - 40~25°C		± 30		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 25		mV
		I_P=0A, T_A = - 40~25°C		± 20		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P		± 0.5	1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±75 A, T_A=25°C		± 1		%
		I_P = ±75 A, T_A=25°C~125°C		± 3		%
		I_P = ±75A, T_A= - 40°C ~ 25°C		± 2.8		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this range

SC840DFT-75F5 Individual Performance Characteristics

Note: Over full range of TA=-40~125°C, C_{Bypass}=0.47uF, C_{Load}=1nF, V_{CC}=5V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-75		75	A
Zero-Current Output Voltage	Voq	IP=0A		2.5		V
VREF Output Voltage	Vref	Independent of the IP input current		2.5		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-5	0	5	mV
Sensitivity	Sens	-75A<IP<75A		26.67		mV/A
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE}/(Sens \times I_P)$						
Sensitivity Error	E_{SENS}	I_P = ±75 A, T_A = 25°C		± 1		%
		I_P = ±75 A, T_A = 25~125°C		± 2		%
		I_P = ±75 A, T_A = - 40~25°C		± 3		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 35		mV
		I_P=0A, T_A = - 40~25°C		± 30		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 10		mV
		I_P=0A, T_A = 25~125°C		± 25		mV
		I_P=0A, T_A = - 40~25°C		± 20		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P		± 0.5	1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±75A, T_A=25°C		± 1		%
		I_P = ±75 A, T_A=25°C~125°C		± 3		%
		I_P = ±75A, T_A= - 40°C ~ 25°C		± 2.8		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this range

SC840DET-100B5 Individual Performance Characteristics

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

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-100		100	A
Zero-Current Output Voltage	Voq	IP=0A		0.5Vcc		V
VREF Output Voltage	Vref	Independent of the IP input current		0.5Vcc		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-5	0	5	mV
Sensitivity	Sens	-100A<IP<100A		20* S_{coef}		mV/A
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE}$ /(Sens × I_P)						
Sensitivity Error	E_{SENS}	I_P = ±100 A, T_A = 25°C		± 1		%
		I_P = ±100 A, T_A = 25~85°C		± 2.5		%
		I_P = ±100 A, T_A = -40~25°C		± 3.0		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 15		mV
		I_P=0A, T_A = 25~85°C		± 30		mV
		I_P=0A, T_A = - 40~25°C		± 25		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 20		mV
		I_P=0A, T_A = 25~85°C		± 40		mV
		I_P=0A, T_A = -40~25°C		± 30		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P			2	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±100A, T_A=25°C		± 1		%
		I_P = ±100 A, T_A=25°C~85°C		± 3		%
		I_P = ±100 A, T_A= -40°C~25°C		± 3.2		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this range

SC840DET-100F5 Individual Performance Characteristics

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

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-100		100	A
Zero-Current Output Voltage	Voq	IP=0A		2.5		V
VREF Output Voltage	Vref	Independent of the IP input current		2.5		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-5	0	5	mV
Sensitivity	Sens	-100A<IP<100A		20		mV/A
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE}$ /(Sens × I_P)						
Sensitivity Error	E_{SENS}	I_P = ±100 A, T_A = 25°C		± 1		%
		I_P = ±100 A, T_A = 25~85°C		± 2.5		%
		I_P = ±100 A, T_A = - 40~25°C		± 3.0		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 15		mV
		I_P=0A, T_A = 25~85°C		± 30		mV
		I_P=0A, T_A = - 40~25°C		± 25		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 15		mV
		I_P=0A, T_A = 25~85°C		± 25		mV
		I_P=0A, T_A = - 40~25°C		± 30		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P			1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±100A, T_A=25°C		± 1		%
		I_P = ±100 A, T_A=25°C~85°C		± 3		%
		I_P = ±100 A, T_A= - 40°C ~ 25°C		± 3.2		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this rang

SC840DET-150F5 Individual Performance Characteristics

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

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Unit
NOMINAL PERFORMANCE						
Current-Sensing Range	I_{PR}		-150		150	A
Zero-Current Output Voltage	Voq	IP=0A		2.5		V
VREF Output Voltage	Vref	Independent of the IP input current		2.5		V
Differential Output Offset Voltage	Voq-VREF	IP=0A	-5	0	5	mV
Sensitivity	Sens	-150A<IP<150A		13.333		mV/A
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + V_{OE} /(Sens \times I_P)$						
Sensitivity Error	E_{SENS}	I_P = ±150 A, T_A = 25°C		± 1		%
		I_P = ±150 A, T_A = 25~85°C		± 2.5		%
		I_P = ±150 A, T_A = -40~25°C		± 3.0		%
Offset Voltage	V_{OE}	I_P=0A, T_A = 25°C		± 15		mV
		I_P=0A, T_A = 25~85°C		± 30		mV
		I_P=0A, T_A = -40~25°C		± 25		mV
Differential Output Error	$E_{(Voq-VREF)}$	I_P=0A, T_A = 25°C		± 15		mV
		I_P=0A, T_A = 25~85°C		± 25		mV
		I_P=0A, T_A = -40~25°C		± 30		mV
Nonlinerity	E_{LIN}	Measured using full-scale and half-scale I_P			1	%
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	I_P = ±150A, T_A=25°C		± 1		%
		I_P = ±150 A, T_A=25°C~85°C		± 3		%
		I_P = ±150 A, T_A= -40°C~25°C		± 3.2		%
Over Life Time drift Error	E_{olt}			±1		%

[1] The typical value is +/-1 sigma, and 68.27% of products fall within this range; The maximum/minimum value is +/-3 sigma value, and 99.73% of products fall within this rang

Accuracy Characteristic Curve (SC840DFT-50F5 V1)

Fig1:Vref output Error vs. Temp.

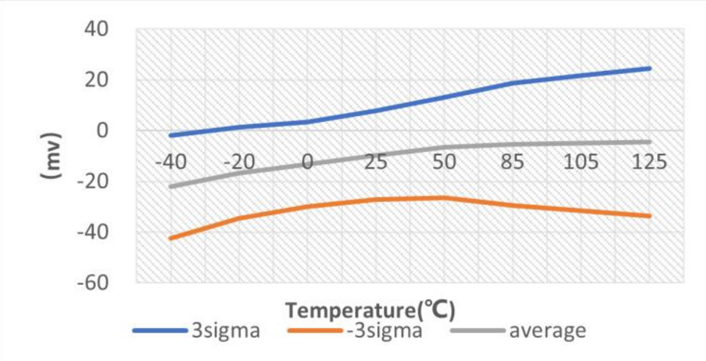


Fig2; Offset Voltage vs. Temp.

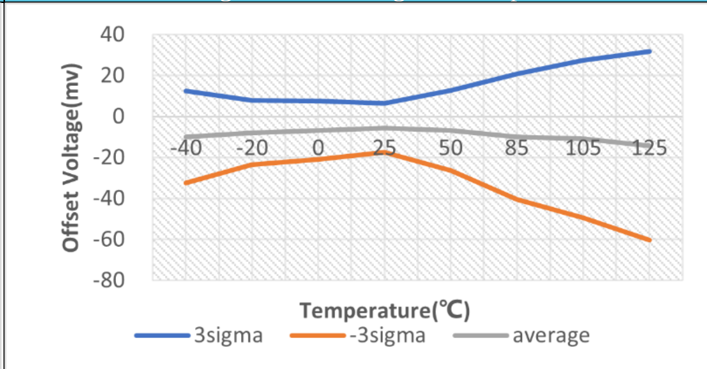


Fig3:Voq vs. Temp.

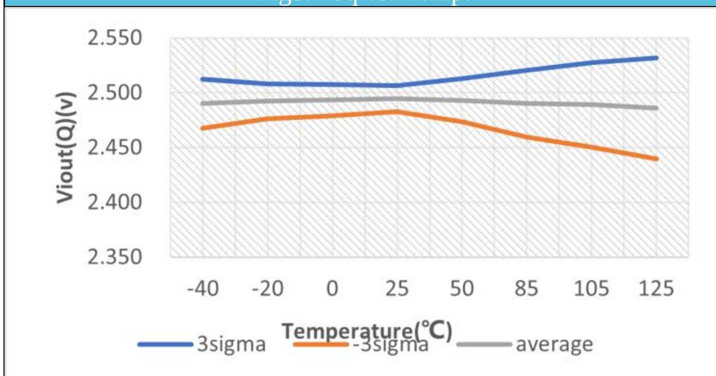


Fig4:Sensitivity Error vs. Temp.

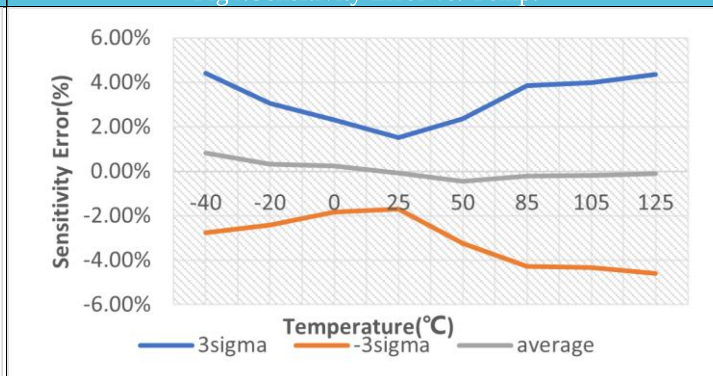


Fig5:Sensitivity vs. Temp.

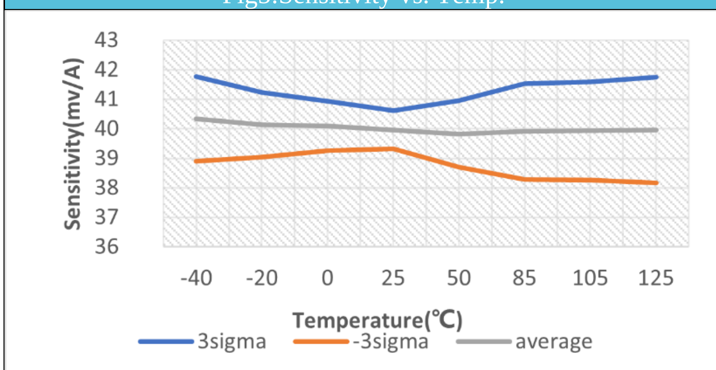


Fig6:Non-linearility vs. Temp.

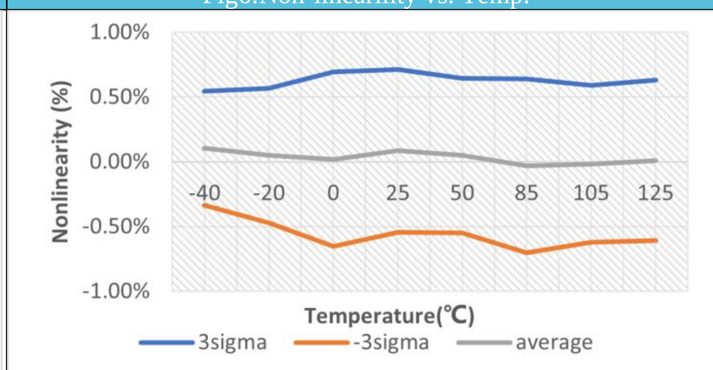


Fig7:Toltal output Error vs. Temp.

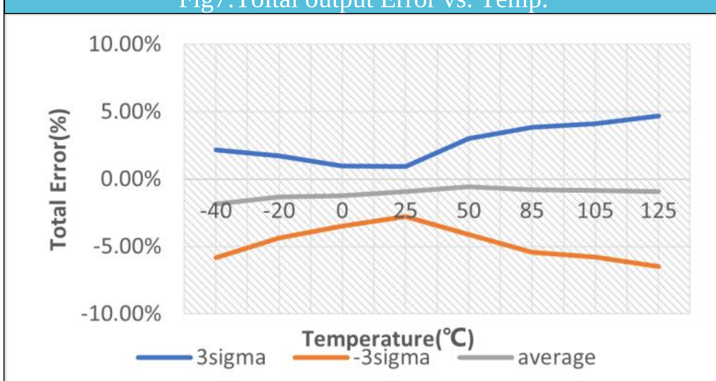
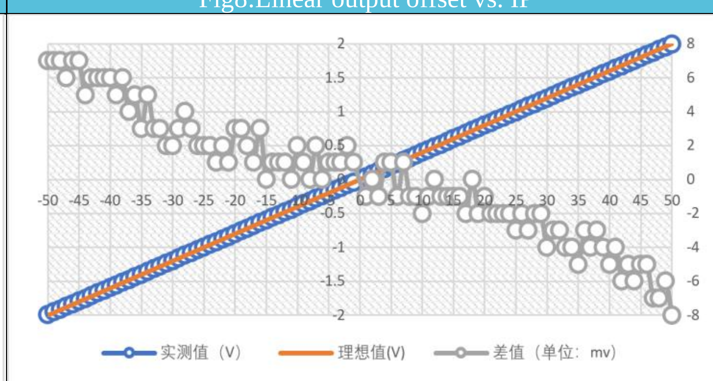


Fig8:Linear output offset vs. IP



AC & Dynamic Characteristic Curve

Fig1:Trans. Rising time

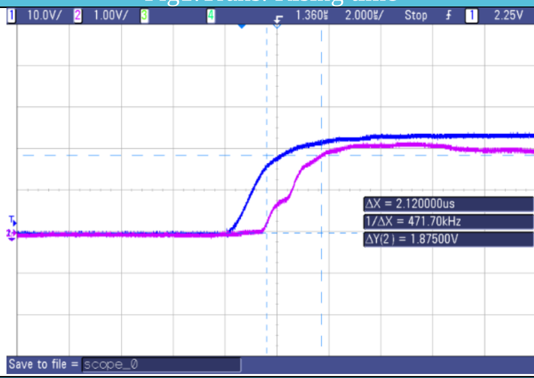


Fig2:Response Time

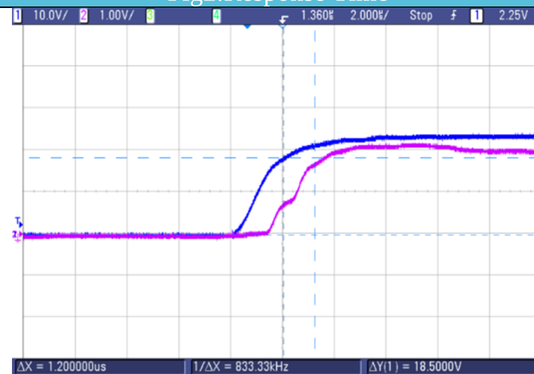


Fig3:Propagation delay time

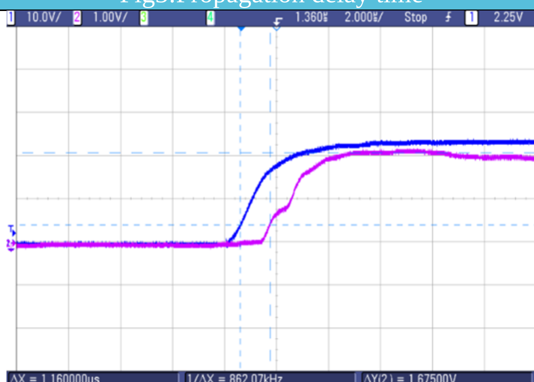


Fig4:Noise spectrum

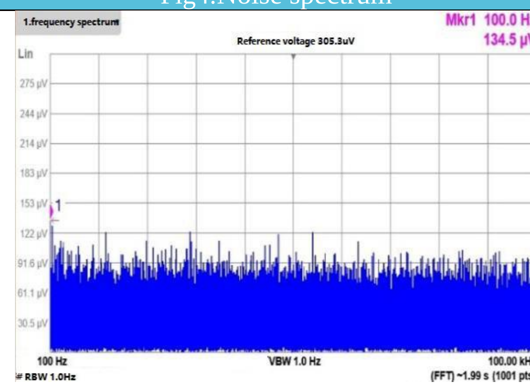


Fig5:Sinwave deltect

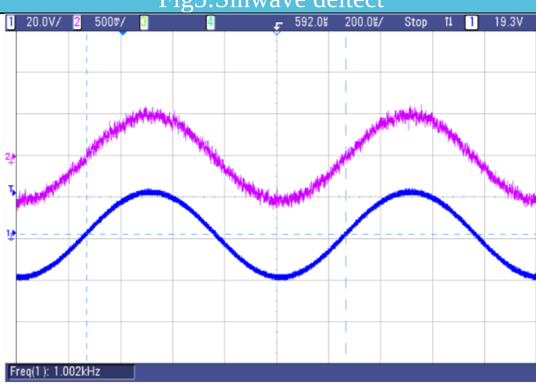


Fig6:Pluse deltect

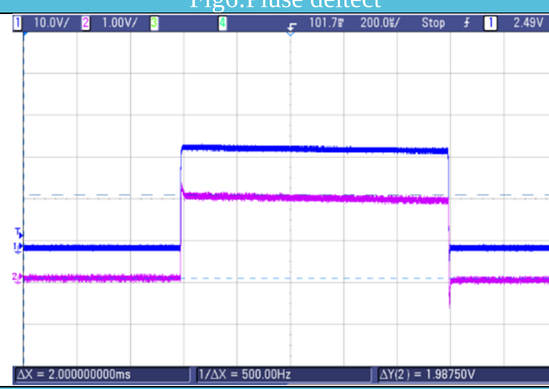


Fig7:Power on time

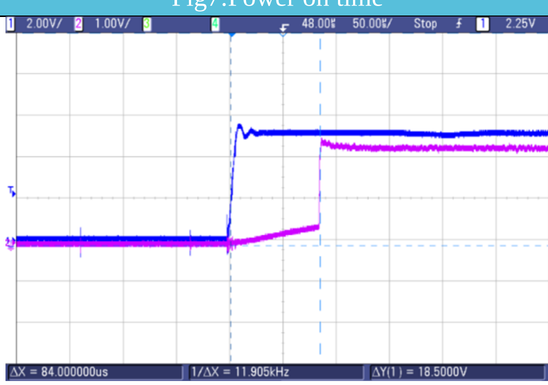
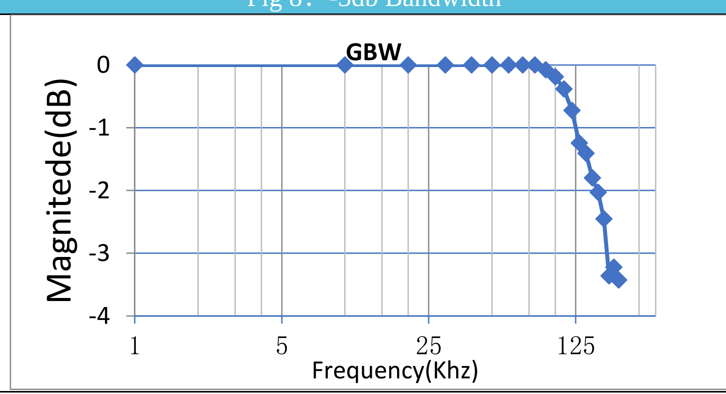


Fig 8: -3db Bandwidth



Functional Description

◆ Internal Reference Voltage

Vref is always equal to the static bias output value of VIOUT, that is, VIOUT value when IP=0A.

The relationship between VIOUT and Vref obey that following formula:

VIOUT=IP*Sens+Vref,

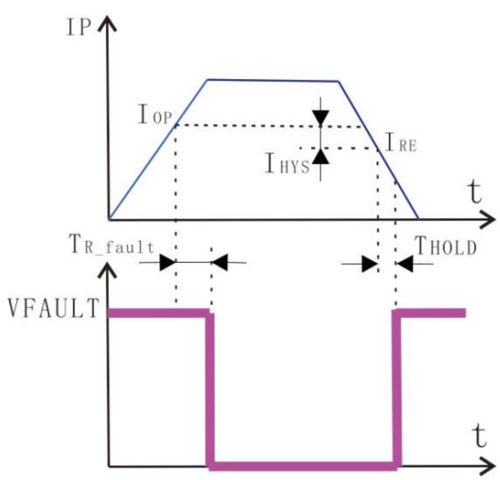
When SC840DFT**F5 is used, VREF constantly outputs 2.5VCC, And has a driving capacity of more than 3mA;

When SC840DFT **B5 is used, VREF constantly outputs 0.5VCC, And has a driving capacity of more than 3mA;

When SC840DFT **U5 is used, VREF constantly outputs 0.1VCC, And has a driving capacity of more than 3mA;

When SC840DFT **I5 is used, VREF is the input mode and can be modified to 0.5V-2.6V using an external input voltage.

◆ Vfault Function



The Vfault pin can be used as an indication of overcurrent detection output after being pulled up.
When primary current exceeds I_{OP} and after T_{R_fault},Vfault pin will be low;
When primary current is below I_{RE} and after T_{HOLD}, Vfault pin will be high;

Parameter definition:

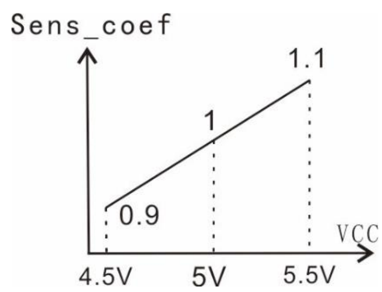
I_{OP}: Action threashold point,for SC840, I_{OP} =IP×1.3
I_{RE}: Recover threashold point
I_{HYS}: Hysteresis, $I_{HYS} = |I_{OP}| - |I_{RE}|$
T_{R_fault}: The response time of Fault .That is, the delay time from the occurrence of overcurrent to the action of Vfault pin.
T_{HOLD}: The hold time of Fault.That is,the delay time from overcurrent recovery to Vfault pin recovery.

◆ Proportional Coefficient Of Sensitivity(suitable for products with suffix B or U)

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:



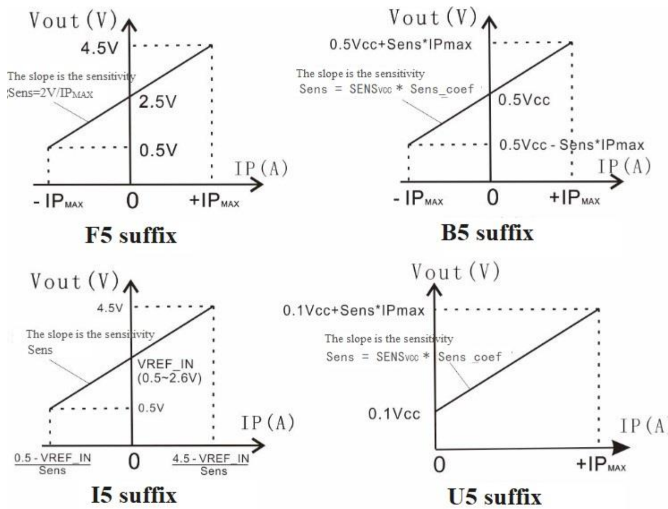
◆ Proportional Relationship

Using SC840DFT * * F5, sensitivity and zero voltage does not change with VCC proportion, including zero constant is 2.5 V. The sensitivity is 2V/IPMAX; IP_{MAX} is the measurement range value of forward current.

Using SC840DFT * * B5, sensitivity and zero voltage are changing with VCC proportion, zero for the VCC / 2, sensitivity to $SENS_{VCC}$* Sens_coef.

Using SC840DFT * * U5, sensitivity and zero voltage are changing with VCC proportion, zero point 0.1 VCC, sensitivity to $SENS_{VCC}$* Sens_coef.

Using SC840DFT * * I5, sensitivity and zero voltage does not change with VCC proportion, zero voltage is equal to VREF input voltage; Sensitivity SENS =2V/IP, IP is the current value in the model. Measurable current range is $[(0.5-VREF\_IN)/Sens,(4.5-VREF\_IN)/Sens]$



◆ 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.

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

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 A_{CM} is 0.04mv/G.

◆ 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-VCC_N)/VCC_N. The absolute value of the ratio is 20 times of the common logarithm, the unit is dB.

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

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

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

◆ 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;

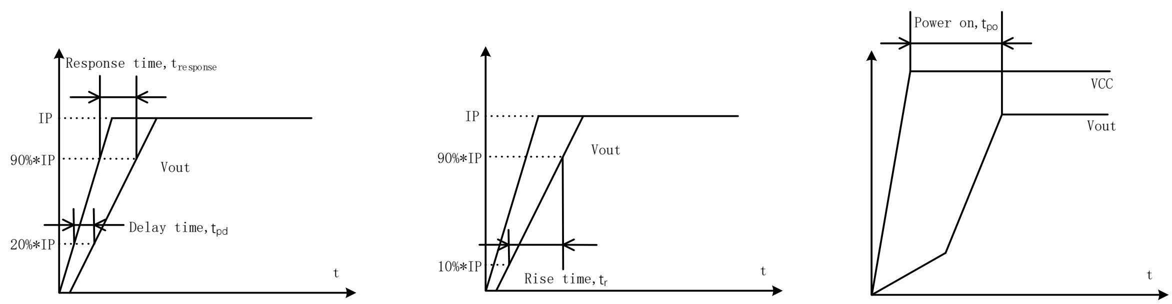
The response time is the time difference when the secondary output reaches 90% of the steady-state output value and the primary output reaches 90% of the steady-state current.

Rise Time t_r

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

Power-On Time t_{po}

Power-On Time is defined as the time it takes for the output voltage to settle within ±10% of its steady-state value under an applied magnetic field,after the power supply has reached its minimum specified operating voltage.



◆ 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.

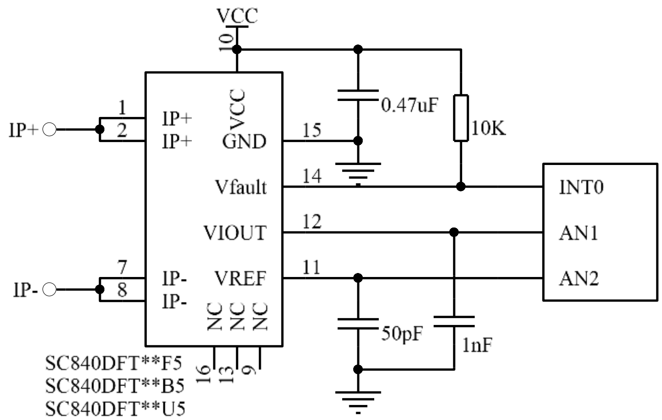
$$T_J = T_A + (R_{\theta JA} * POWER) = T_A + (R_{\theta JA} * IP^2 * R_{PRIMARY});$$

Where T_J is junction temperature and T_A is ambient temperature.

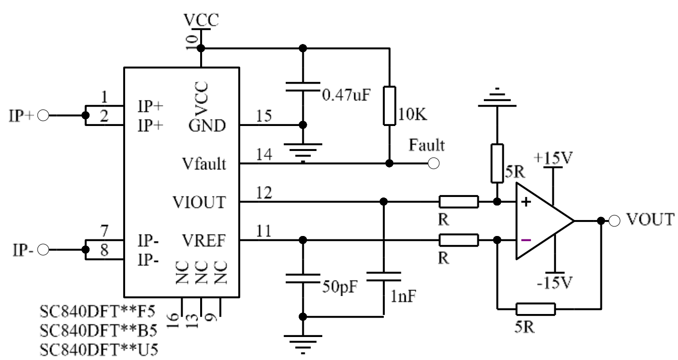
◆ Typical Application

When SC840DFT**F5/B5/U5 is used, VREF is in output mode, which can be connected to other circuits or suspended.

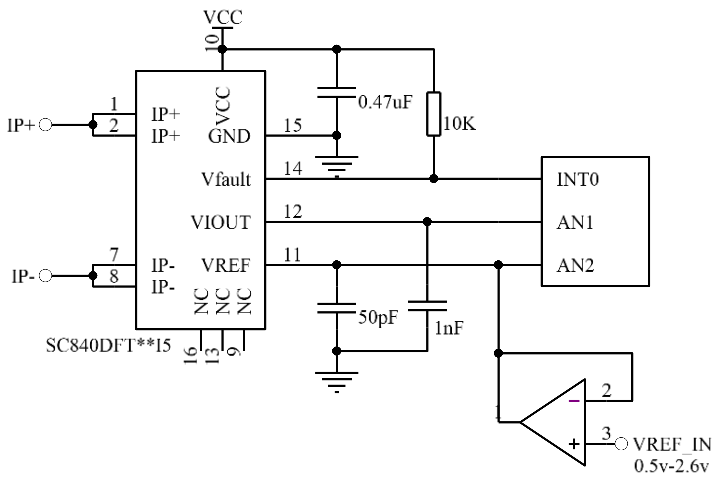
1. Schematic diagram of connection between SC840 and ADC:



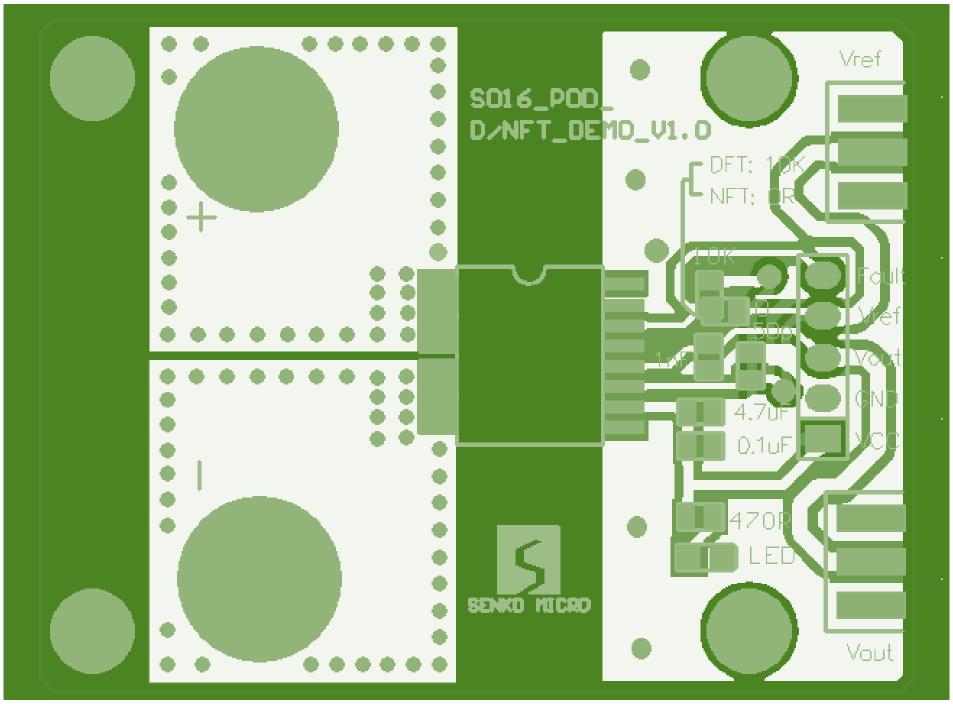
2. Schematic diagram of connection between SC840 and ADC:
   VOUT = IP * Sensitivity * (5R / R)



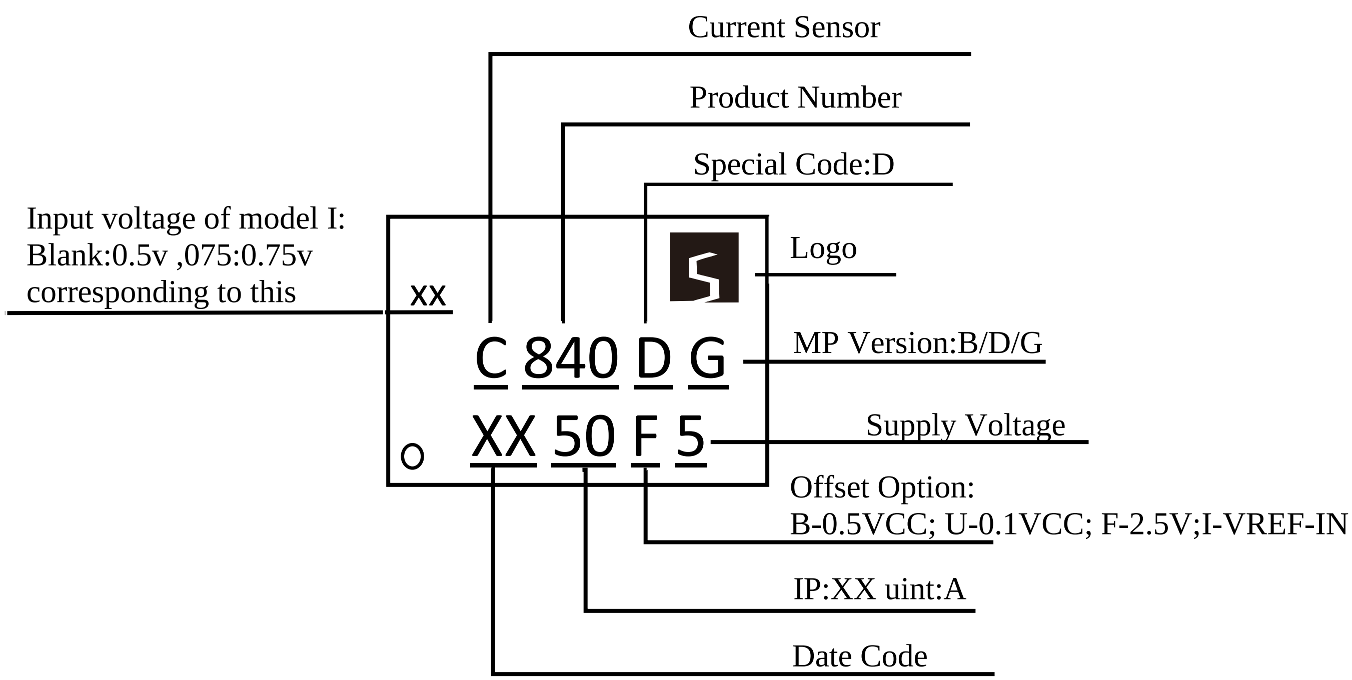
3. When SC840DFT**I5 is used, VREF is the input mode, and the external input voltage can be used to 0.5V-2.6V. At this time, the static output voltage of VOUT (i.e. under zero current input) is also modified to the same voltage as VREF.



SC840 Evaluation Board Layout

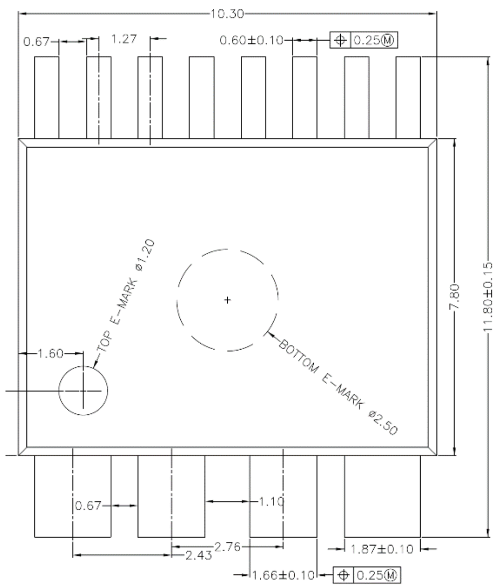


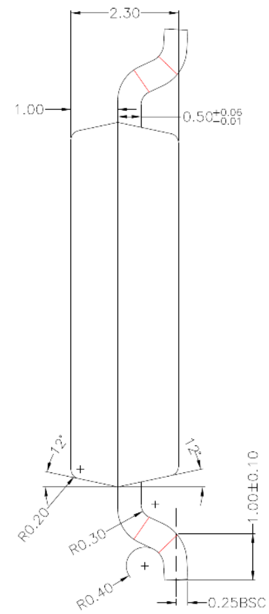
Mark Description

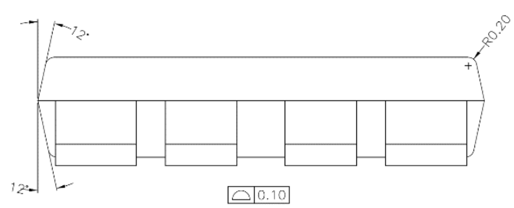


Package Information

Note: Package is SOP-16SW, all dimensions are in millimeters.

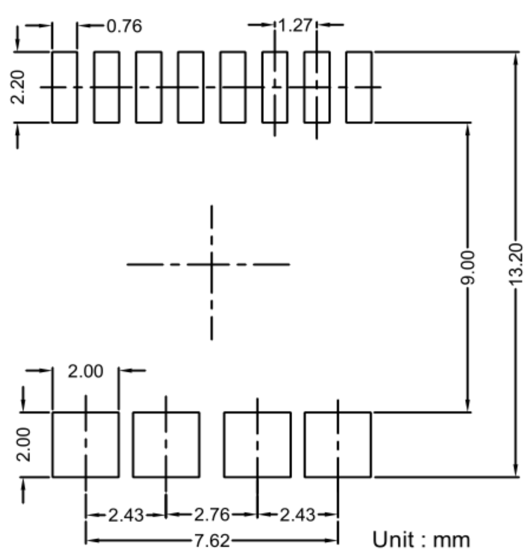






NOTES:

1.GENERAL TOLERANCE: LINEAR ±0.05,
ANGULAR ±1°, RADIUS ±0.05.
2.PKG SURFACE Ra=0.60~1.0um EXCEPT SLEEK AREAS.
3.EJECTION & INDEX PIN MARK DEPTH 0.20±0.10.
4.GENERAL CORNER RADIUS R0.20.
5.MAX RESIN GATE PROTRUSION 0.25MAX.
6.ALL DIMENSIONS IN MILLIMETERS.



PCB Layout Reference View

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Revision History

Revision	Change	Page	Author	Date
1.0	Initial draft		Jon	2019.09
1.1	Released to AE/TE/PE/FAE review		Jon	2019.12
1.2	Double check for all review		All	2020.01
1.3	Release to customer for sample		Jon	2020.02
1.4	Add order info. In page2		Jon	2020.02
1.5	Modify the application circuit diagram and noise spectrum diagram		Tom	2020.2
1.6	Update the mark information of page17 from 050 to 50/x-g.		Jon	2020.03
1.7	Correct the batch accuracy data to TBD		Jon	2020.03
1.8	Fixed model code on page2		Jon	2020.07
1.9	Modify the tape to 1000pcs		Mei	2020.10
2.0	Add 30I5 model and modify the new block diagram		Mei	2021.1
2.1	Replace Exterior View		HY	2021.3
2.2	Add SC840DET-150F5		Emma	2021.03
2.3	Update typical parameters		Mei	2021.03
2.4	Update typical parameters		Mei	2021.03
2.5	Add UL,supplement the I description of VREF input mode	1,2,18	Jon	2021.04

单击下面可查看定价，库存，交付和生命周期等信息

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