

## Isolated Current Sensor with Common Mode Field Rejection

### Description

The SENKO SC820 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer.

The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. A precise, proportional voltage is provided by the low-offset, chopper-stabilized Linear Hall IC, which is programmed for accuracy after packaging.

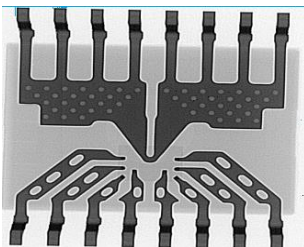
The terminals of the conductive path (from pin1 through 4 to pin 5 through 8) are electrically isolated from the signal leads (pins 9 through 16). This allows the SC820 to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques.

### Package: 16-Lead SOP-SC

Top View:



Current Path:



### Features

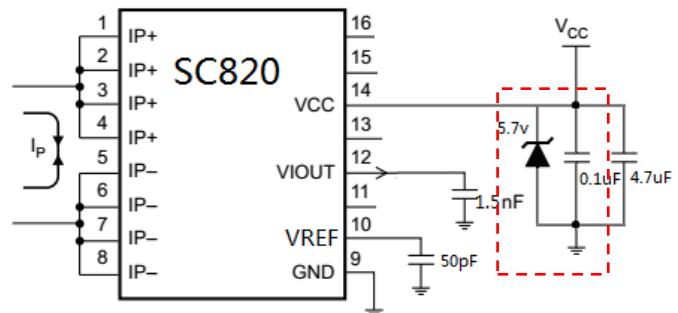
- Differential hall sensing rejects common mode fields
- Output voltage proportional to AC or DC currents
- Selected Reference voltage mode:  $V_{CC}/2$ ,  $0.1 V_{CC}$
- Total output error 0.5% @ $T_A = 25^\circ\text{C}$ , 3% for full temperature range.
- 4 $\mu\text{s}$  output rise time in response to step input current
- 0.8 m $\Omega$  internal conductor resistance
- > 4 kV RMS minimum isolation voltage from pins 1-8 to pins 9-16
- Nearly zero magnetic hysteresis
- Small footprint, low-profile SOP16-SC package

### Application Field

- Smart power meter
- Brushless DC motor commutation
- Load detection and management
- Switch mode power supplies

### Typical Application

- Support 0 ~  $\pm 65\text{A}$  AC or DC



Note:

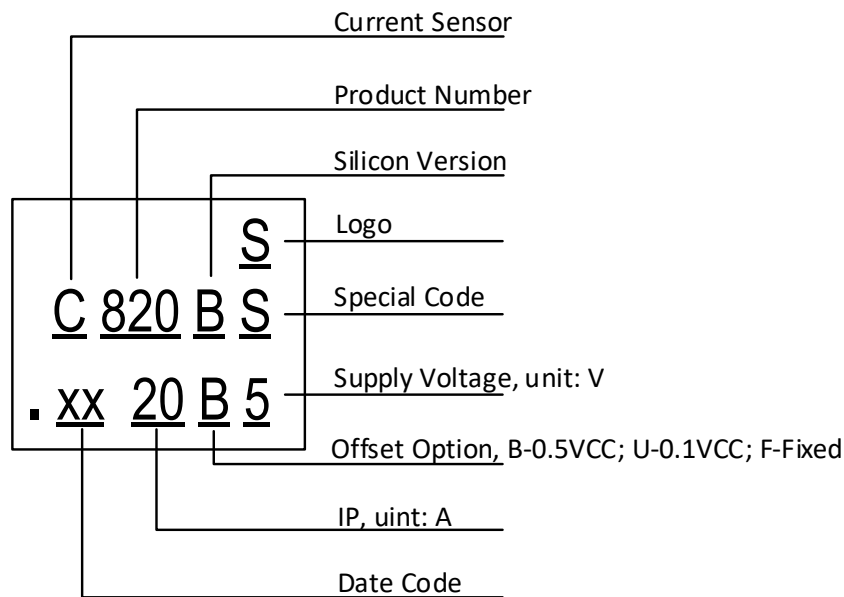
1. 4.7 $\mu\text{F}$  bypass is **MUST** have to guarantee performance;
2. 0.1 $\mu\text{F}$  bypass capacitor is optional for VCC;
3. The Zener or TVS diode is optional for protection purpose.

## Order information

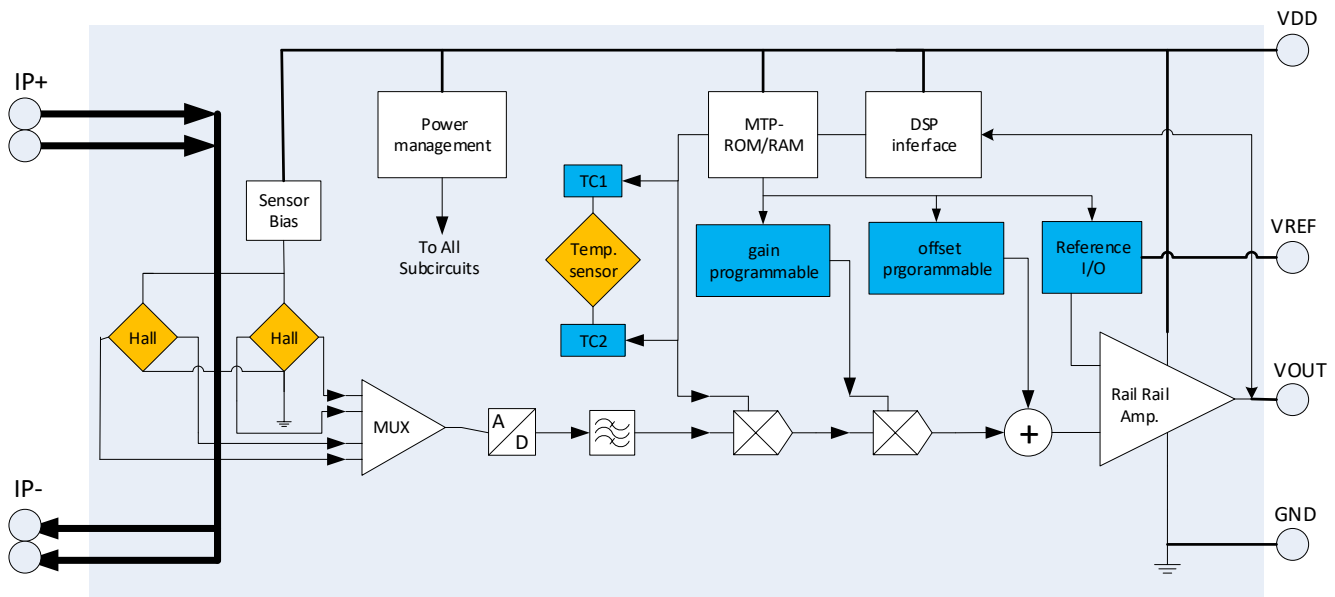
Part Number	Pin Define	Temp. Range	Packaging	IP (A)	Sens @ VCC=5V (mv/A)
SC820RFT-10B5	820	F (-40~125°C)	T (Reel, 1500 pieces/reel)	±10	85
SC820RFT-12B5				±12.5	56
SC820RFT-25B5				±25	28
SC820RFT-30B5				±30	66
SC820RFT-65B5				±65	30.75
SC820NFT-65U5				65	61.5
SC820NFT-30B5	820N			±30	66
SC820NFT-65B5				±65	30.75

\*Any custom requirement, email to [fae@senkomicro.com](mailto:fae@senkomicro.com)

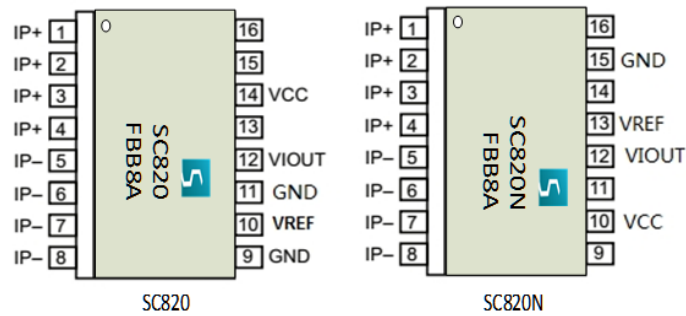
## Mark Description



## Functional Block Diagram



## Pin Configuration



Pin of 820	Pin of 820N	Pin Name	Description
1,2,3,4	1,2,3,4	IP+	Terminals for current being sampled; fused internally
5,6,7,8	5,6,7,8	IP-	Terminals for current being sampled; fused internally
9, 11	15	GND	Signal Ground terminal
10	13	VREF	Reference voltage with zero IP
12	12	VIOUT	Analog output signal
14	10	VCC	Device power supply

## Absolute Maximum Ratings

Absolute maximum ratings are limiting values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability is not necessarily implied. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability.

Symbol	Characteristic	Notes	Rating	Unit
$V_{CC}$	Supply voltage		6.0	V
$V_{RCC}$	Reverse Supply Voltage		-0.1	V
$V_{IOUT}$	Output voltage		6.0	V
$V_{RIOUT}$	Reverse Output Voltage		-0.1	V
$V_{ISO}$	Dielectric strength test voltage	Agency type-tested for 60 seconds per UL60950-1	4800	Vrms
$V_{WVRI}$	Working Voltage for Basic Isolation	Maximum working voltage according to UL60950-1	1550	V <sub>Peak</sub>
$I_P$	Overcurrent Transient Tolerance	1 pulse, 100ms, 1% duty cycle	100	A
$I_{OUT(SOURCE)}$	Output Current Source		20	mA
$I_{OUT(SINK)}$	Output Current Sink		20	mA
$T_A$	Nominal Operating Ambient Temperature	Range F	-40~125	°C
$T_{J(max)}$	Maximum Junction Temperature		165	°C
$T_{stg}$	Storage Temperature		-65~170	°C

## Common operating Characteristics

Note: Over full range of  $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ ,  $C_{bypass} = 4.7\mu\text{f}$ ,  $C_{load} = 1.5\text{nF}$ ,  $V_{CC} = 5\text{V}$ , unless otherwise specified.

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Supply Voltage	$V_{CC}$	Operating	4.5		5.5	V
Supply Current	$I_{CC}$	$V_{CC} = 5.0\text{V}$ , output open		9	12	mA
Output Capacitance Load	$C_{LOAD}$	$V_{IOUT}$ to GND		1.5	3	nF
Output Resistive Load	$R_{LOAD}$	$V_{IOUT}$ to GND	0.17			k $\Omega$
Primary Conductor Resistance	$R_{PRIMARY}$	$T_A = 25^{\circ}\text{C}$		0.8	1.0	m $\Omega$
Rise Time	$t_r$	$I_P = I_P(max)$ , $T_A = 25^{\circ}\text{C}$ , $C_{OUT} = \text{open}$		4.0	5	$\mu\text{s}$
Frequency Bandwidth	f	-3 dB, $T_A = 25^{\circ}\text{C}$ ; $I_P = 10\text{A}$ peak-to-peak		120		kHz
Nonlinearity	$E_{LIN}$	Over full range of $I_P$		0.3	1	%
Symmetry	$E_{SYM}$	Over full range of $I_P$	99	100	101	%
Power-On Time	$t_{PO}$	Output reaches 90% of steady-state level, $T_J = 25^{\circ}\text{C}$ , 20 A present		0.09		mS
Magnetic Coupling		$T_{J(max)}$ is not exceeded		12		G/A
Internal Filter Resistance	$R_{F(INT)}$			1.7		k $\Omega$
Power supply bypass capacitor	$C_{bypass}$	Normal operating	2.2	4.7		$\mu\text{F}$
Vref capacitance load	$C_{ref}$			0	100	pF

## Common Thermal Characteristics

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Operating Internal Lead Frame Temperature	$T_A$	F range	-40		125	°C
Junction-to-Lead Thermal Resistance	$R_{\theta JL}$				5	°C/W
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$				23	°C/W

### X-10B Individual Performance Characteristics

Note: Over full range of  $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ ,  $C_{\text{Bypass}} = 4.7\mu\text{f}$ ,  $C_{\text{Load}} = 1.5\text{nF}$ ,  $V_{\text{CC}} = 5\text{V}$ , unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	$I_P$		-10		10	A
VIOUT @ 0A	$V_{\text{Oq}}$	$I_P = 0\text{A}$ , $T_A = 25^{\circ}\text{C}$		$0.5V_{\text{CC}}$		V
Sensitivity	Sens	Over full of $T_A = 25^{\circ}\text{C}$		85		mV/A
Zero Current Output Slope	$\Delta I_{\text{OUT(Q)}}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.2$		mV/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		$\pm 0.15$		mV/ $^{\circ}\text{C}$
Sensitivity Slope	$\Delta \text{Sens}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.017$		mV/A/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		-0.02		mV/A/ $^{\circ}\text{C}$
Total Output Error	$E_{\text{TOT}}$	$I_P = \pm 10\text{A}$ , $T_A = 25^{\circ}\text{C}$ , output filtered		$\pm 0.5$		%
		$I_P = \pm 10\text{A}$ , $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ , output filtered	-3		3	%

### X-12B Individual Performance Characteristics

Note: Over full range of  $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ ,  $C_{\text{Bypass}} = 4.7\mu\text{f}$ ,  $C_{\text{Load}} = 1.5\text{nF}$ ,  $V_{\text{CC}} = 5\text{V}$ , unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	$I_P$		-12.5		12.5	A
VIOUT @ 0A	$V_{\text{Oq}}$	$I_P = 0\text{A}$ , $T_A = 25^{\circ}\text{C}$		$0.5V_{\text{CC}}$		V
Sensitivity	Sens	Over full of $T_A = 25^{\circ}\text{C}$		56		mV/A
Zero Current Output Slope	$\Delta I_{\text{OUT(Q)}}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.2$		mV/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		$\pm 0.15$		mV/ $^{\circ}\text{C}$
Sensitivity Slope	$\Delta \text{Sens}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.017$		mV/A/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		-0.018		mV/A/ $^{\circ}\text{C}$
Total Output Error	$E_{\text{TOT}}$	$I_P = \pm 12.5\text{A}$ , $T_A = 25^{\circ}\text{C}$ , output filtered		$\pm 0.5$		%
		$I_P = \pm 12.5\text{A}$ , $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ , output filtered	-3		3	%

### X-25B Individual Performance Characteristics

Note: Over full range of  $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ ,  $C_{\text{Bypass}} = 4.7\mu\text{f}$ ,  $C_{\text{Load}} = 1.5\text{nF}$ ,  $V_{\text{CC}} = 5\text{V}$ , unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	$I_P$		-25		25	A
VIOUT @ 0A	$V_{\text{Oq}}$	$I_P = 0\text{A}$ , $T_A = 25^{\circ}\text{C}$		$0.5V_{\text{CC}}$		V
Sensitivity	Sens	Over full of $T_A = 25^{\circ}\text{C}$		28		mV/A
Zero Current Output Slope	$\Delta I_{\text{OUT(Q)}}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.2$		mV/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		$\pm 0.15$		mV/ $^{\circ}\text{C}$
Sensitivity Slope	$\Delta \text{Sens}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.01$		mV/A/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		-0.007		mV/A/ $^{\circ}\text{C}$
Total Output Error	$E_{\text{TOT}}$	$I_P = \pm 25\text{A}$ , $T_A = 25^{\circ}\text{C}$ , output filtered		$\pm 0.5$		%
		$I_P = \pm 25\text{A}$ , $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ , output filtered	-2.5		2.5	%

### X-30B Individual Performance Characteristics

Note: Over full range of  $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ ,  $C_{\text{Bypass}} = 4.7\mu\text{f}$ ,  $C_{\text{Load}} = 1.5\text{nF}$ ,  $V_{\text{CC}} = 5\text{V}$ , unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	$I_P$		-30		30	A
VIOUT @ 0A	$V_{oq}$	$I_P = 0\text{A}$ , $T_A = 25^{\circ}\text{C}$		$0.5V_{\text{CC}}$		V
Sensitivity	Sens	Over full of $T_A = 25^{\circ}\text{C}$		66		mV/A
Zero Current Output Slope	$\Delta I_{\text{OUT}(Q)}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.2$		mV/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		$\pm 0.15$		mV/ $^{\circ}\text{C}$
Sensitivity Slope	$\Delta \text{Sens}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.015$		mV/A/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		-0.01		mV/A/ $^{\circ}\text{C}$
Total Output Error	$E_{\text{TOT}}$	$I_P = \pm 30\text{A}$ , $T_A = 25^{\circ}\text{C}$ , output filtered		$\pm 0.5$		%
		$I_P = \pm 30\text{A}$ , $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ , output filtered	-3		3	%

### X-65B Individual Performance Characteristics

Note: Over full range of  $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ ,  $C_{\text{Bypass}} = 4.7\mu\text{f}$ ,  $C_{\text{Load}} = 1.5\text{nF}$ ,  $V_{\text{CC}} = 5\text{V}$ , unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	$I_P$		-65		65	A
VIOUT @ 0A	$V_{oq}$	$I_P = 0\text{A}$ , $T_A = 25^{\circ}\text{C}$		$0.5V_{\text{CC}}$		V
Sensitivity	Sens	Over full of $T_A = 25^{\circ}\text{C}$		30.75		mV/A
Zero Current Output Slope	$\Delta I_{\text{OUT}(Q)}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.2$		mV/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		$\pm 0.15$		mV/ $^{\circ}\text{C}$
Sensitivity Slope	$\Delta \text{Sens}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.01$		mV/A/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		-0.005		mV/A/ $^{\circ}\text{C}$
Total Output Error	$E_{\text{TOT}}$	$I_P = \pm 65\text{A}$ , $T_A = 25^{\circ}\text{C}$ , output filtered		$\pm 0.5$		%
		$I_P = \pm 65\text{A}$ , $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ , output filtered	-2.5		2.5	%

### X-65U Individual Performance Characteristics

Note: Over full range of  $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ ,  $C_{\text{Bypass}} = 4.7\mu\text{f}$ ,  $C_{\text{Load}} = 1.5\text{nF}$ ,  $V_{\text{CC}} = 5\text{V}$ , unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	$I_P$		0		65	A
VIOUT @ 0A	$V_{oq}$	$I_P = 0\text{A}$ , $T_A = 25^{\circ}\text{C}$		$0.1V_{\text{CC}}$		V
Sensitivity	Sens	Over full of $T_A = 25^{\circ}\text{C}$		61.5		mV/A
Zero Current Output Slope	$\Delta I_{\text{OUT}(Q)}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.2$		mV/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		$\pm 0.15$		mV/ $^{\circ}\text{C}$
Sensitivity Slope	$\Delta \text{Sens}$	$T_A = -40 \sim 25^{\circ}\text{C}$		$\pm 0.015$		mV/A/ $^{\circ}\text{C}$
		$T_A = 25 \sim 125^{\circ}\text{C}$		-0.01		mV/A/ $^{\circ}\text{C}$
Total Output Error	$E_{\text{TOT}}$	$I_P = 65\text{A}$ , $T_A = 25^{\circ}\text{C}$ , output filtered		$\pm 0.5$		%
		$I_P = 65\text{A}$ , $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ , output filtered	-3		3	%

### X-30BN Individual Performance Characteristics

Note: Over full range of  $T_A = -40^\circ\text{C} \sim 125^\circ\text{C}$ ,  $C_{\text{Bypass}} = 4.7\mu\text{f}$ ,  $C_{\text{Load}} = 1.5\text{nF}$ ,  $V_{\text{CC}} = 5\text{V}$ , unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	$I_P$		-30		30	A
V <sub>IOUT</sub> @ 0A	$V_{oq}$	$I_P = 0\text{A}$ , $T_A = 25^\circ\text{C}$		$0.5V_{\text{CC}}$		V
Sensitivity	Sens	Over full of $T_A = 25^\circ\text{C}$		66		mV/A
Zero Current Output Slope	$\Delta I_{\text{OUT}(Q)}$	$T_A = -40 \sim 25^\circ\text{C}$		$\pm 0.35$		mV/ $^\circ\text{C}$
		$T_A = 25 \sim 125^\circ\text{C}$		$\pm 0.25$		mV/ $^\circ\text{C}$
Sensitivity Slope	$\Delta \text{Sens}$	$T_A = -40 \sim 25^\circ\text{C}$		$\pm 0.017$		mV/A/ $^\circ\text{C}$
		$T_A = 25 \sim 125^\circ\text{C}$		-0.01		mV/A/ $^\circ\text{C}$
Total Output Error	$E_{\text{TOT}}$	$I_P = \pm 30\text{A}$ , $T_A = 25^\circ\text{C}$ , output filtered		$\pm 0.5$		%
		$I_P = \pm 30\text{A}$ , $T_A = -40^\circ\text{C} \sim 125^\circ\text{C}$ , output filtered	-3		3	%

### X-65BN Individual Performance Characteristics

Note: Over full range of  $T_A = -40^\circ\text{C} \sim 125^\circ\text{C}$ ,  $C_{\text{Bypass}} = 4.7\mu\text{f}$ ,  $C_{\text{Load}} = 1.5\text{nF}$ ,  $V_{\text{CC}} = 5\text{V}$ , unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	$I_P$		-65		65	A
V <sub>IOUT</sub> @ 0A	$V_{oq}$	$I_P = 0\text{A}$ , $T_A = 25^\circ\text{C}$		$0.5V_{\text{CC}}$		V
Sensitivity	Sens	Over full of $T_A = 25^\circ\text{C}$		30.75		mV/A
Zero Current Output Slope	$\Delta I_{\text{OUT}(Q)}$	$T_A = -40 \sim 25^\circ\text{C}$		$\pm 0.3$		mV/ $^\circ\text{C}$
		$T_A = 25 \sim 125^\circ\text{C}$		$\pm 0.2$		mV/ $^\circ\text{C}$
Sensitivity Slope	$\Delta \text{Sens}$	$T_A = -40 \sim 25^\circ\text{C}$		$\pm 0.01$		mV/A/ $^\circ\text{C}$
		$T_A = 25 \sim 125^\circ\text{C}$		-0.005		mV/A/ $^\circ\text{C}$
Total Output Error	$E_{\text{TOT}}$	$I_P = \pm 65\text{A}$ , $T_A = 25^\circ\text{C}$ , output filtered		$\pm 0.5$		%
		$I_P = \pm 65\text{A}$ , $T_A = -40^\circ\text{C} \sim 125^\circ\text{C}$ , output filtered	-3		3	%

## Typical Performance Graphs

Note: Over full range of  $T_A = -40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ ,  $C_{\text{Bypass}} = 4.7\mu\text{f}$ ,  $C_{\text{Load}} = 1.5\text{nF}$ ,  $V_{\text{CC}} = 5\text{V}$ ,  $I_P = 20\text{A}$ , unless otherwise specified.

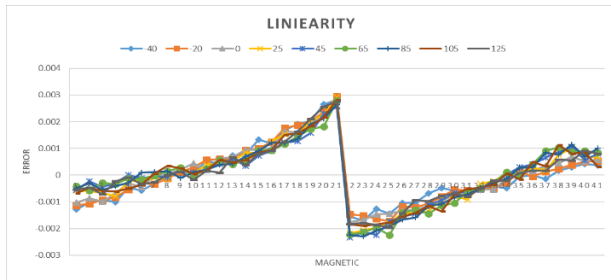


Figure 1. Linearity versus Ambient Temperature

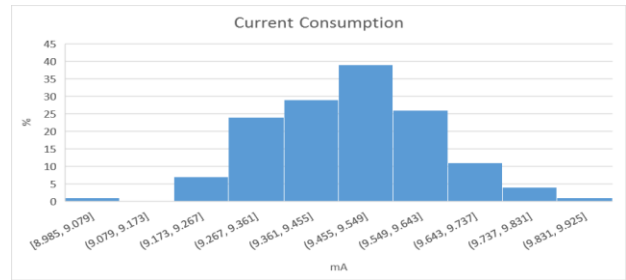


Figure 2. Current Consumption

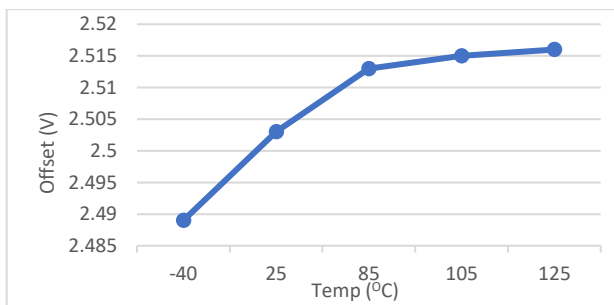


Figure 3. Zero Current Output versus Ambient Temperature

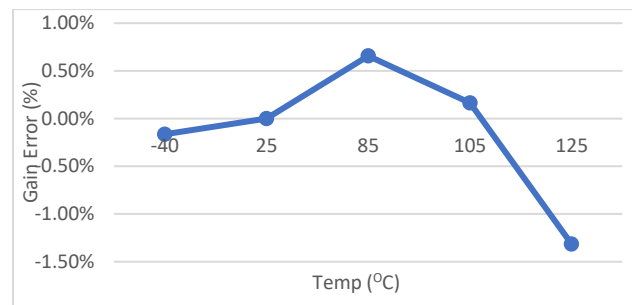


Figure 4. Sensitivity Error versus Ambient Temperature

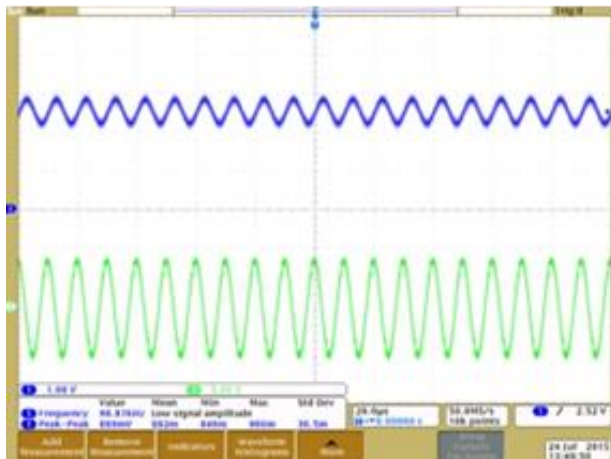


Figure 5. 100k 25A IP Frequency response

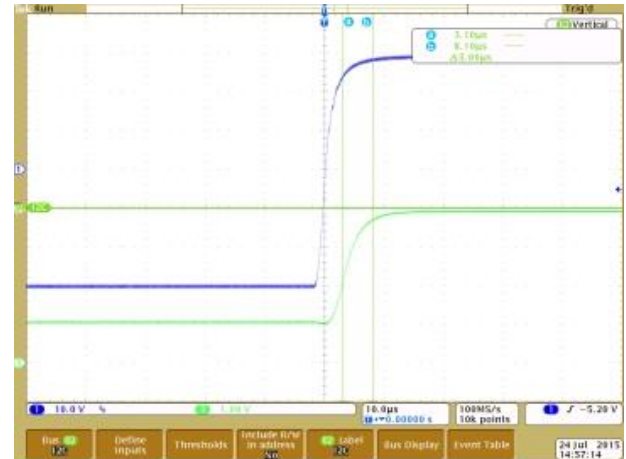
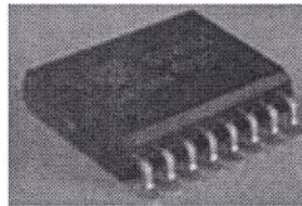
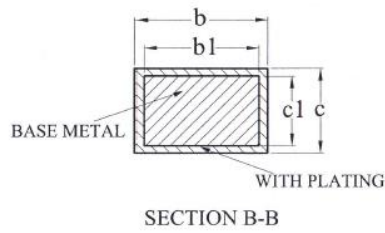
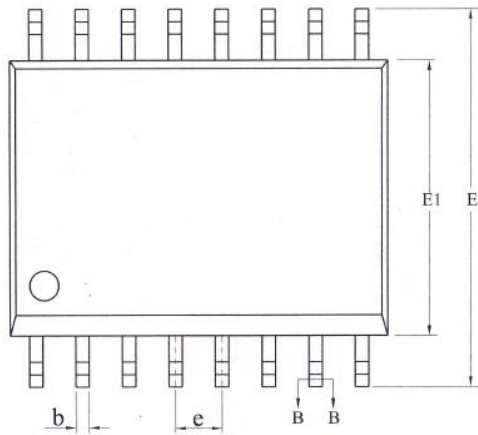
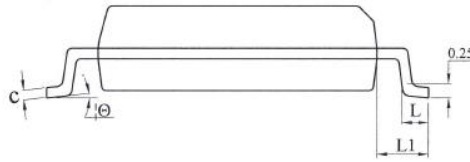
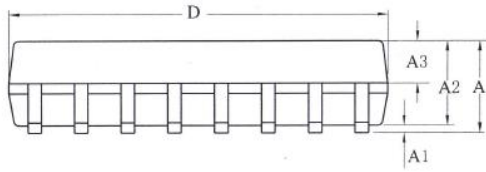


Figure 6. <5us Response time



## Package information

Note: Package is SOP16-SC, all dimensions are in millimeters.



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	2.65
A1	0.10	—	0.30
A2	2.25	2.30	2.35
A3	0.97	1.02	1.07
b	0.35	—	0.44
b1	0.34	0.37	0.39
c	0.25	—	0.31
c1	0.24	0.25	0.26
D	10.10	10.30	10.50
E	10.26	10.41	10.60
E1	7.30	7.50	7.70
e	1.27BSC		
L	0.55	—	0.85
L1	1.40BSC		
θ	0	—	8°

## Important Notice

SENKO micro-electronics co., Ltd. reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the performance, reliability, or manufacturability of its products. Before placing an order, the user is cautioned to verify that the information being relied upon is current.

SENKO micro's products are not to be used in life support devices or systems, if a failure of an SENKO product can reasonably be expected to cause the failure of that life support device or system, or to affect the safety or effectiveness of that device or system.

The information included herein is believed to be accurate and reliable. However, SENKO micro-electronics co., Ltd. assumes no responsibility for its use; nor for any infringement of patents or other rights of third parties which may result from its use.

For the latest version of this document, visit our website: [www.senkomicro.com](http://www.senkomicro.com)

## Revision Table

Revision	Change	Page	Author	Date
1.0	Initial draft		Jon	2014.03
1.1	Add unipolar IP detect mode		Jon	2016.07
1.2	Add Common mode field rejection		Jon	2017.04
1.3	Add figure, modify sensitivity		Hao	2017.12
1.4	Add SC820N		Hao	2018.01
1.5	Change Format		Hao	2018.03
1.6	Change Part Number in Order Information	2	Hao	2018.03
1.7	Modify Max Current Tolerance	3	Hao	2018.03
1.8	Remove Noise Spec, Charts		Hao	2018.04
1.9	Change Part Number	1	Hao	2018.06

单击下面可查看定价，库存，交付和生命周期等信息

[>>Senko Micro\(兴工微\)](#)