High Precision, Programmable Linear Hall Effect Sensor with up to +/-15V Supply and +/-12V Output Swing

Description

The SENKO® SL920 programmable linear Hall effect sensor has been designed to provide a fully integrated Hall current sensor IC for use in current sensing applications running off of a dual supply voltage. The high voltage design allows up to a +/-18V bipolar supply and has a nominal output swing of +/-12V.The SL920 employs a segmented, linearly interpolated temperature compensation technology, providing greater accuracy in sensitivity and offset voltage trimming and hence virtually zero temperature drift. This improvement does not degrade the high analog signal bandwidth of the device but greatly reduces total error over the operating temperature range.

The sensor incorporates a highly sensitive Hall element with a BiCMOS interface integrated circuit, a small-signal high-gain amplifier, a clamped low-impedance output stage, and a proprietary, high bandwidth dynamic offset cancellation technique. The SL920 Hall effect sensor is extremely fast and temperature stable providing an open loop Hall effect solution that can compete with more expensive closed loop devices.

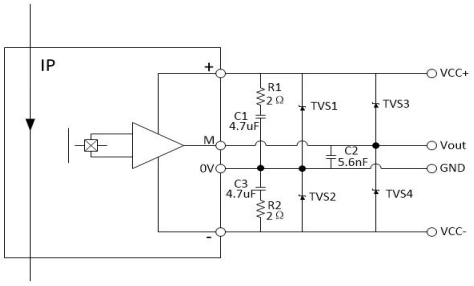
The sensor is available in an ultra-thin (1.6 mm thick), through-hole single in-line package (TO94)

Features and Benefits

- Proprietary segmented, linearly interpolated temperature compensation (TC) technology provides a typical accuracy error of 1.5% over the full operating temperature range
- High sensitivity Hall element for maximum accuracy
- Extremely low noise and high resolution achieved via proprietary Hall element and low noise amplifier circuits
- Less than 5µS fast response time achieved via advanced packaging and chopper stabilization techniques
- Customer programmable, high resolution offset and sensitivity trim
- Factory programmed sensitivity and quiescent output voltage TC with extremely stable temperature performance
- Up to +/-18V supply voltage range and +/-12V output voltage swing with nominal zero field quiescent voltage level at 0V
- Customer programmable sensitivity range between 1.4 and 20 mV/G
- Precise recoverability after temperature cycling
- Wide ambient temperature range: –40°C to 105°C
  Extremely thin package: 1.6mm case thickness provides magnetic circuit flexibility in current sensing applications

Typical Application

- Support 0 ~ ±1000A Dynamic range



Note:

1. R1/C1 R2/C3 is **necessary** to reduce hot swap damage;
2. TVS is designed for limiting inrush current /voltage surging

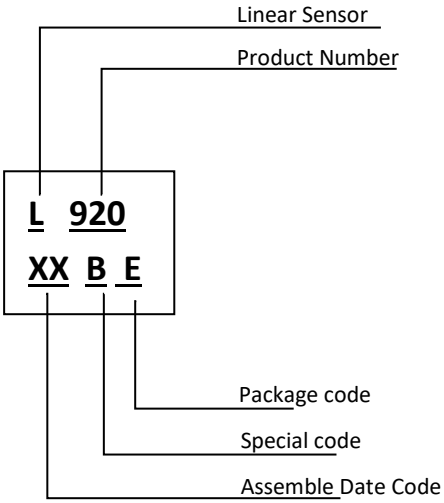
Package: TO94

Top View:

- **Order information**

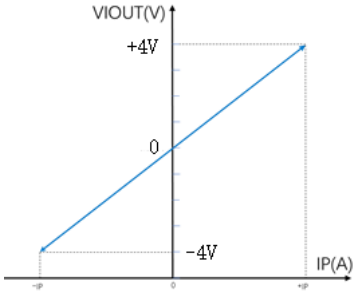
Part Number	Special Code	Packaging	Temp Range	Packing	Selection guide
SL920-BEE	B	TO94 (E)	E (-40~105℃)	1k/Bag	typical
SL920-BHE	B	TO94 (H)			Lowest lifetime drift

- **Mark Description**

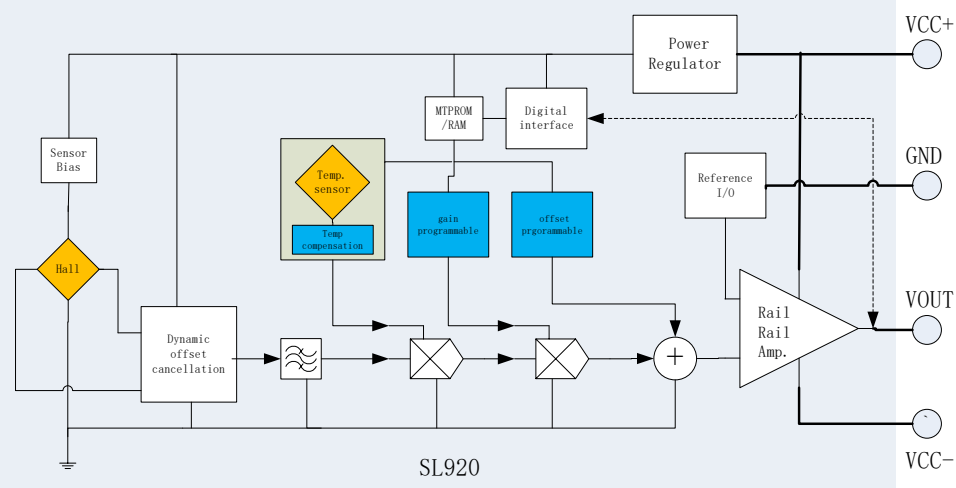


- **Typical I/O Curve**

Input Current vs. output Voltage

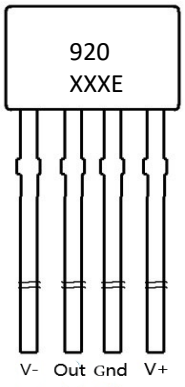


Functional Block Diagram

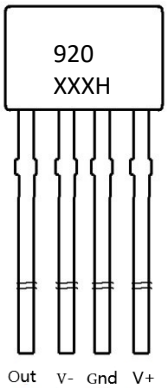


Pin-out Diagrams

Package E



Package H



Package E	Package H	Pin name	Description
1	2	V-	Negative power supply
2	1	VIOUT	Output signal, and digital I/O
3	3	GND[1]	Ground and zero current reference
4	4	V+	Positive power supply
Note1: low impedance design in PCB layout			

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.

Characteristic	Symbol	Notes	Rating	Unit
Positive Supply Voltage	V_+–V_-		36	V
Output Voltage	VOUT		+18 to -18	V
Output Sourcing Current	IOUT(SOURCE)	VOUT to GND, for a maximum of 60 Seconds, minimum Resistive Load of 1Kohms to GND, maximum capacitive load of 1000pF to GND. Vout = +12V	5	mA
Output Sinking Current	IOUT(SINK)	VOUT to GND, for a maximum of 60 Seconds, minimum Resistive Load of 1Kohms to GND, maximum capacitive load of 1000pF to GND. Vout = -12V	-5	mA
Operating Ambient Temperature	TA		-40 to 105	°C
Storage Temperature	Tstg		-65 to 165	°C
Maximum Junction Temperature	T_J(max)		165	°C
ESD		HBM	4	kv

Common operating Characteristics

Note: Over full range of T_A=-40°C ~ 105°C, C_{Bypass}=4.7uf, R_{filter}=2Ω, C_{Load}=3.3nF, V_{CC}=+-15V, unless otherwise specified.

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Supply Voltage	V_+-V_-	Operating	22	30	36	V
Supply Current	I_{CCV+}	output open		10	12	mA
Supply Current	I_{CCV-}	output open		-5	-7	mA
Output Capacitance Load	C_{LOAD}	V_{IOUT} to GND	1.5	3.3	20	nF
Output Resistive Load	R_{LOAD}	V_{IOUT} to GND	4.7			kΩ
Response Time	t_r	I_P = I_P(max), T_A = 25°C, C_{OUT} = open		4.0	5	µS
Frequency Bandwidth	f	–3 dB, T_A=25°C; I_P=50 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		100		%
Power-On Time	T_{po}	Output reaches 90% of steady-state level, T_J = 25°C, 3 A present		100	500	uS
Power supply bypass capacitor	C_{bypass}	Normal operating	4.7	4.7	10	uF

Common Thermal Characteristics

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Operating Internal Lead Frame Temperature	TA	E range	–40		-105	°C
Junction-to-Lead Thermal Resistance	$R_{\theta JL}$				10	°C/W
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$				30	°C/W

SL920-BEE Individual Performance Characteristics

Note: TJ(max) is not exceeded, TA=-40°C ~ 105°C, C_{Bypass}=4.7uF, C_{Load}=3.3nF, VCC=+-15V, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	Vip		-4		4	V
Linearity range			-12		+12	
VIOUT @ 0mT	V_{OQ}	IP=0mT, T_A=25°C		0		V
Sensitivity range	Sens	Over full of T_A=25°C	1.4		20	mV/mT
Zero Current Output Slope	$\Delta I_{OUT(Q)}$	T_A = -40~25°C		±40		mV
		T_A = 25~105°C		±30		mV
Sensitivity Slope	ΔSens	T_A = -40~25°C		±1.6		%
		T_A = 25~105°C		±1.5		%
Total Output Error	E_{TOT}	T_A=25°C, output filtered		±1		%
		T_A=-40°C ~ 105°C, output filtered	-3		3	%
Thermal stress and life time drift			-1		+1	%

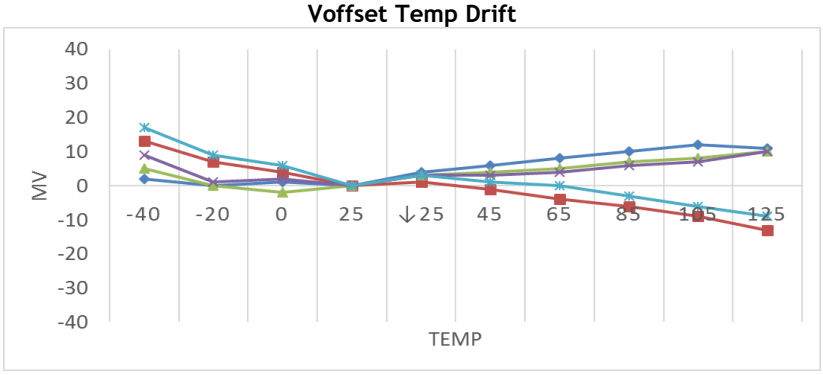
SL920-BHE Individual Performance Characteristics

Note: TJ(max) is not exceeded, TA=-40°C ~ 105°C, C_{Bypass}=4.7uF, C_{Load}=3.3nF, VCC=+-15V, unless otherwise specified

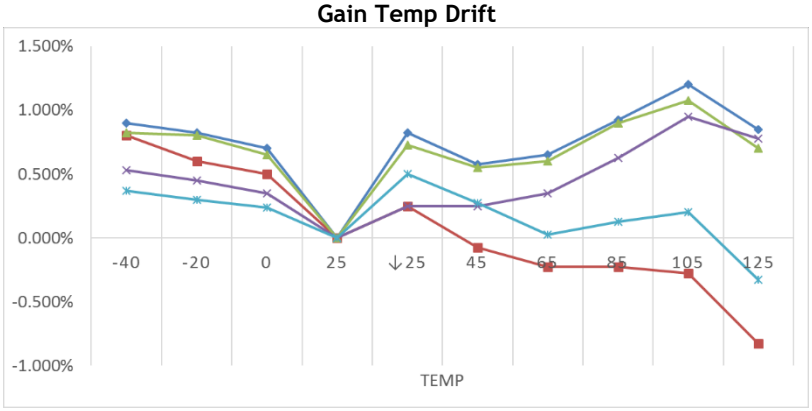
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Optimized Accuracy Range	Vip		-4		4	V
Linearity range			-12		+12	
VIOUT @ 0mT	V_{OQ}	IP=0mT, T_A=25°C		0		V
Sensitivity range	Sens	Over full of T_A=25°C	1.4		20	mV/mT
Zero Current Output Slope	$\Delta I_{OUT(Q)}$	T_A = -40~25°C		±40		mV
		T_A = 25~105°C		±30		mV
Sensitivity Slope	ΔSens	T_A = -40~25°C		±1.6		%
		T_A = 25~105°C		±1.5		%
Total Output Error	E_{TOT}	T_A=25°C, output filtered		±1		%
		T_A=-40°C ~ 105°C, output filtered	-2.5		2.5	%
Thermal stress and life time drift			-0.3		+0.3	%

Typical Performance Graphs

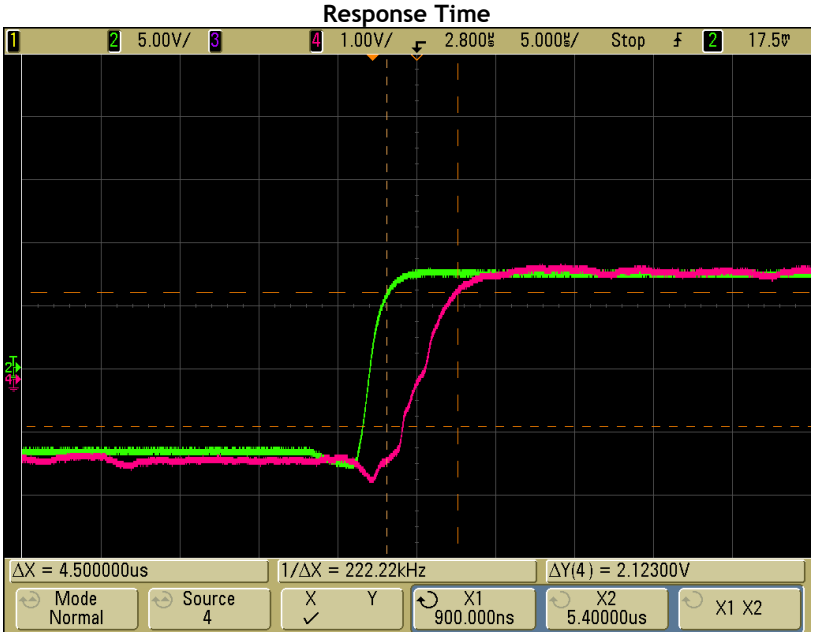
Voffset Temp Drift



Gain Temp Drift



Response Time



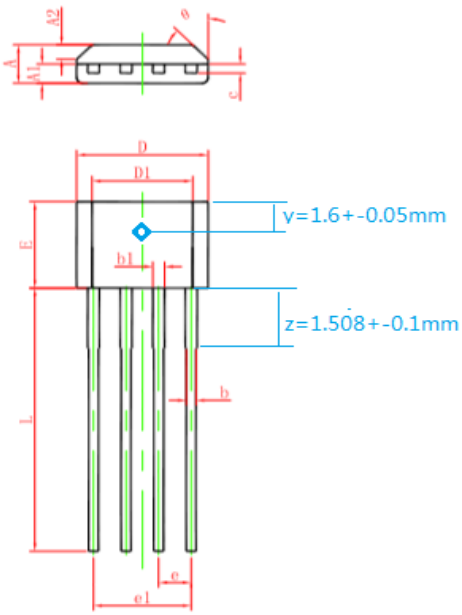
Programming Serial Interface

The SL920 incorporates a serial interface that allows an external controller(SP102) to read and write registers in the ROM and volatile memory. And the auto. calibration software can be downloaded in our website

The temperature coefficient of sensitivity and offset are factory programmed and the following parameters of SL920 are user programmable:

- Sensitivity (mV/G)
- Zero Field Output Voltage
- Output polarity

Package 4-Pin (TO94)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.800	0.055	0.071
A1	0.700	0.900	0.028	0.035
A2	0.500	0.700	0.020	0.028
b	0.360	0.500	0.014	0.020
b1	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.980	5.280	0.196	0.208
D1	3.780	4.080	0.149	0.161
E	3.450	3.750	0.136	0.148
e	1.270 TYP.		0.050 TYP.	
e1	3.710	3.910	0.146	0.154
L	14.900	15.300	0.587	0.602
θ	45° TYP.		45° TYP.	

For Reference Only
Dimensions in millimeters
Exact case and lead configuration at supplier discretion within limits shown

A Active Area Depth, 0.28mm REF

B Reference land pattern layout
All pads a minimum of 0.20mm from all adjacent pads; adjust as necessary to meet application process requirements and PCB layout tolerances

C Branding scale and appearance at supplier discretion

D Hall element, not to scale

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

Revision Table

Revision	Change	Page	Author	Date
1.0	Initial draft		Jon	2017. 01
1.1	Add application note		Jon	2018.06
1.2	Update application circuit.		Tom	2018.11
2.0	Add package type and selection guide		Jon	2019.06