SNK10486 High Speed High Accuracy Programmable Linear Hall Sensor IC

1. Features and Benefits

- Single supply voltage 3.3V or 5V
- End-of-line programmable sensor
- User-selectable internal or external reference voltage
- User-selectable ratiometry of QVO
- Sensitivity is independent from V_{DD}
- Measurement range from ±0.9 to ±25mV/G
- Wideband sensing: DC to 170KHz
- Very short response time (<3μs)
- RoHS compliant
- TO92-S(4-pin) package
- MSL-1

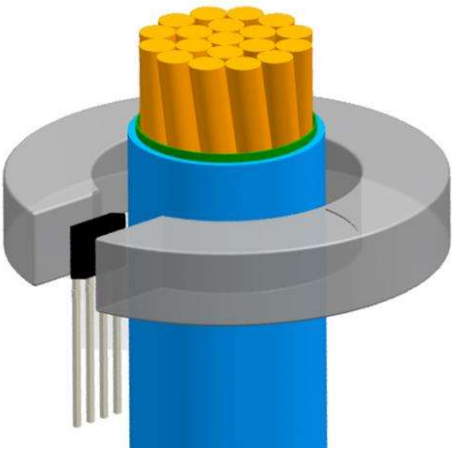


Figure 1. Typical Current Sensing Application

2. Application Examples

- High Voltage Traction Motor Inverter
- 48V Boost Recuperation Inverter
- DC/DC Converter
- BLDC motor current monitoring
- Smart Fuse Overcurrent Detection

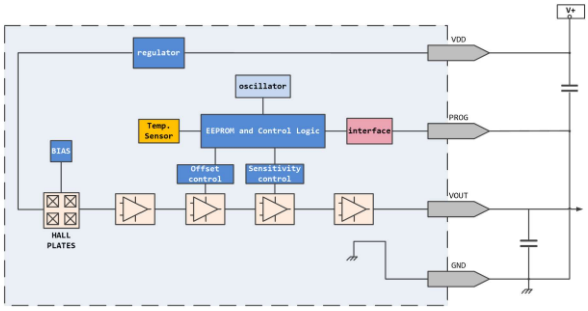


Figure 2. General Block Diagram

3. Description

The SNK10486 is a monolithic programmable Hall sensor IC featuring the planar Hall technology, which is sensitive to the flux density applied orthogonally to the IC surface. The sensor provides an output signal proportional to the applied magnetic flux density and is preferably suited for current measurement.

The transfer characteristic of the SNK10486 is factory trimmed over temperature, and is programmable (offset, gain) during end-of-line customer calibration. The linear analog output is designed for applications where a very fast response is required, such as inverter applications.

In a typical application, the sensor is used in combination with a soft ferromagnetic core. This core is recommended to be laminated for high bandwidth applications. The Hall IC is placed in a small air gap and the current conductor is passed through the inner part of the ferromagnetic core.

The core concentrates and amplifies the magnetic flux on the Hall sensor IC, which generates an output voltage proportional to the current flowing in the conductor.

Contents

4. Ordering Information

Product	Temperature	Package	Option Code	Packing Form
SNK10486KVK	K	VK	1000pcs bulk	BU

Table 1: Available ordering codes.

Temperature Code: *K: from -40°C to 125°C ambient temperature*
Package Code: *"VK" for TO92-S (4-pin) package, refer to Chapter 15 for detailed drawings*
Packing Form: *"BU" for Bulk*
Ordering Example: *SNK10486KVKBU*
SNK10486 Conventional Hall current sensor in TO92-S (4-pin) package,
Temperature range: -40°C to 125°C.
Parts delivered in bulk.

5. Functional Diagram

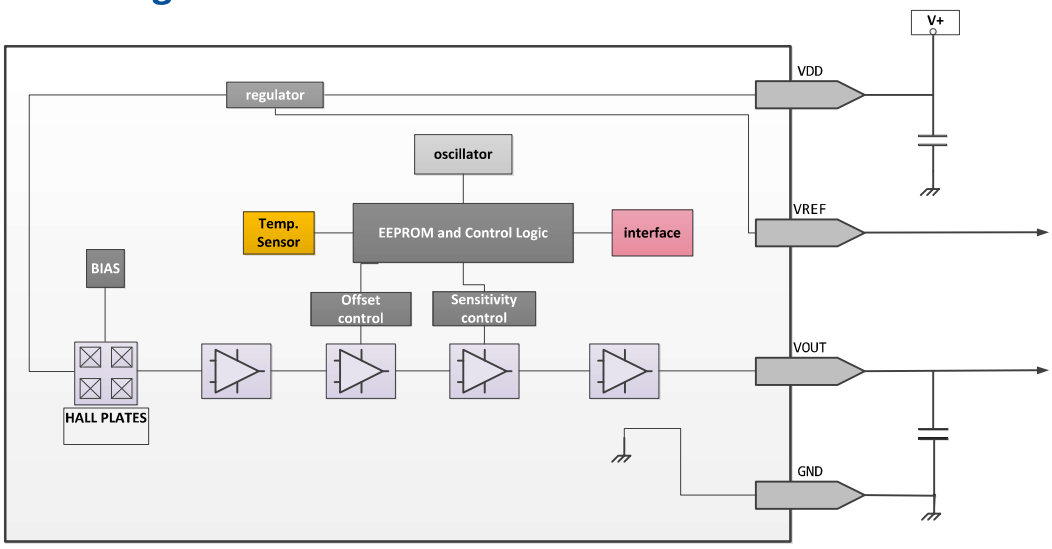


Figure 3: Block Diagram of the SNK10486

6. Glossary of Terms

Terms	Definition
TC	Temperature Coefficient
FS	Full Scale, output referred. Corresponds to 2V excursion around 2.5V V_{OQ} point
T, mT	Tesla, milliTesla = units for the magnetic flux density
G	Gauss = unit for the magnetic flux density [1mT = 10G]

Table 2: Glossary of Terms

7. Pin Definitions and Descriptions

Pin #	Name	Type	Description
1	V_{REF}	Analogue	Reference/standby
2	V_{OUT}	Analogue	Sensor Output
3	GND	Ground	Ground
4	V_{DD}	Supply	Supply Voltage

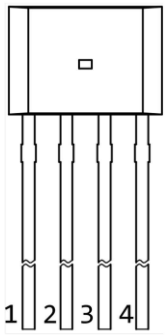


Table 3: Pin definitions and descriptions

8. Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Positive Supply Voltage (overvoltage)	V_{DD}	6.5	V
Reverse Voltage	VS_{REV}	-0.3	V
Positive Output Voltage	V_{OUT}	5.5	V
Output Sink Current	I_{sink}	-40	mA
Output Source Current	I_{source}	60	mA
Reverse Output Voltage	VO_{REV}	-0.3	V
Reverse Output Current	IO_{REV}	-50	mA
Operating Ambient Temperature Range	T_A	-40 to +125	°C
Storage Temperature Range	T_S	-55 to +165	°C
ESD – Human Body Model	ESD_{HBM}	4	KV
Maximum Number of EEPROM Write Cycles	EEPROMW(max)	1000	cycle

Table 4: Absolute maximum ratings

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute maximum - rated conditions for extended periods of time may affect device reliability.

9. General Electrical Specifications

Operating Parameters T_A = -40 to 125°C, V_{DD} = 5V±10%, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Nominal Supply Voltage	V_{DD}		4.5	5	5.5	V
Supply Current	I_{DD}	No OUT load		13	18	mA
Output Impedance	R_{OUT}	Normal Operation		8		Ω
Output Capacitive Load	C_L		1		100	nF
Output Resistive Load	R_L		4.7			KΩ
Linear Output Range	VO_{LIN}	pull-down ≥ 10 kΩ	10		90	$\%V_{DD}$

Table 5: General electrical parameters

10. Magnetic specification

Operating Parameters T_A = -40 to 125°C, V_{DD} = 5V±10%, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Operational Magnetic Field Range	B_{OP}		±100	±1000	±2300	G
Programmable Sensitivity	S		0.9		25	mV/G
Linearity Error (Magnetic)	NL	V_{OUT} in [10%V_{DD}, 90%V_{DD}], T_A = 25°C, RL ≥ 10 kΩ			±0.25	%FS

Table 6: Magnetic specification

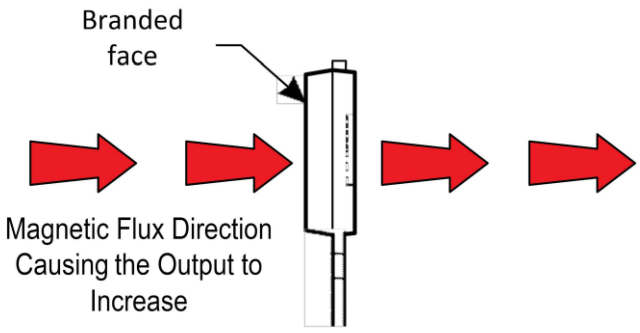


Figure 4: Magnetic Flux Direction

11. Analogue output specification

11.1 Accuracy specifications

Operating Parameters T_A = -40 to 125°C, V_{DD} = 5V±10%, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
RMS Output Noise(high-gain)	N_{RMS-HG}	Values for S=12.5mV/G, 1KHz-100KHz		7		mV_{RMS}
V_{OQ} Ratiometry	$\Delta^R V$	V_{DD} = 5V±5%, V_{OQ} = 50%V_{DD}		±0.24	±0.4	$\%V_{OQ}$
Temperature coefficient variation of Sensitivity	δTC_{VO}	Over full range of B_M and T_A, calibrated IC, without TC_{OF}	-200		200	ppm/°C
Reference Voltage(output)	V_{REF}	Ta = 25°C, after trimming	0.496	0.50	0.504	V
			2.496	2.50	2.504	V
			VCC/2 -4m	VCC/2	VCC/2 +4m	V
				VCC/10		
Reference Voltage(input)	V_{REF}		0.5		VCC/2	V
Offset Temperature characteristic	TC_{VOF}	B_M = 0 µT, S=12.5mV/G, V_{OUT} – V_{DD}/2	-0.120		0.120	mV/°C
Average Fine Sensitivity Programming Step Size	$Step_{SENS}$	S=12.5mV/G, T_A = 25°C		1.5		µV/G

Table 6: Accuracy specifications – analogue parameters

The accuracy specifications are defined for the factory calibrated sensitivity. The achievable accuracy is dependent on the user's end-of-line calibration.

11.2 Timing specifications

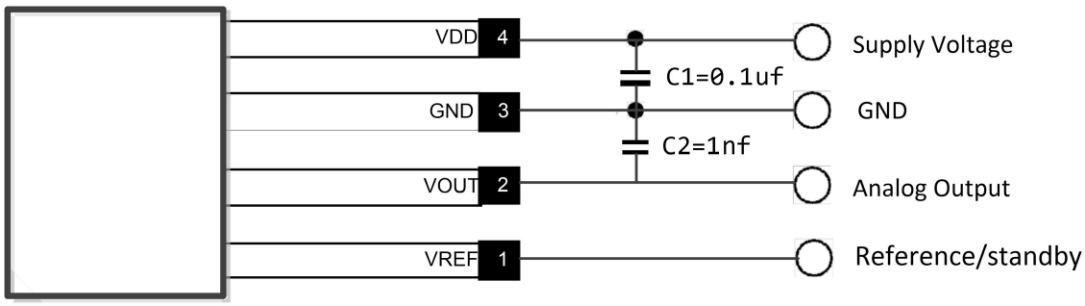
Operating Parameters T_A = -40 to 125°C, V_{DD} = 5V±10%, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Response Time	t_{RISE}	T_A = 25 °C, C_L=1nf, Magnetic field step of 400G, Sens=2mV/G, Measured 90% input to 90% output.		3		µs
Frequency bandwidth	BW	-3 dB, T_A = 25 °C	170			KHz

Table 7: Timing specifications of the high-speed analogue output

Parameter	Bits	Factory Setting	Comment
$V_{QVOOFFTRIM}$[2:0]	3	trimmed	Rough QVO adjustment
V_{QVO}[4:0]	5	trimmed	Fine QVO adjustment
RG[4:0]	5	trimmed	Rough gain adjustment
FG[7:0]	8	trimmed	Fine gain adjustment
POL	1	0	0: default polarity as described in section 10 (figure 4) 1: opposite polarity
ID[15:0]	16		CUSTOMER ID
VDDSEL	1	0	0: 5V 1: 3.3V
VREFSEL[2:0]	3		0: 0.5V 1: V_{DD}/10 2: 1.65V 3&VDDSEL=0: 2.5V 3&VDDSEL=0: V_{DD}/2

12. Recommended Application Diagram



13. ESD Precautions

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

14. Packaging Outline Drawing

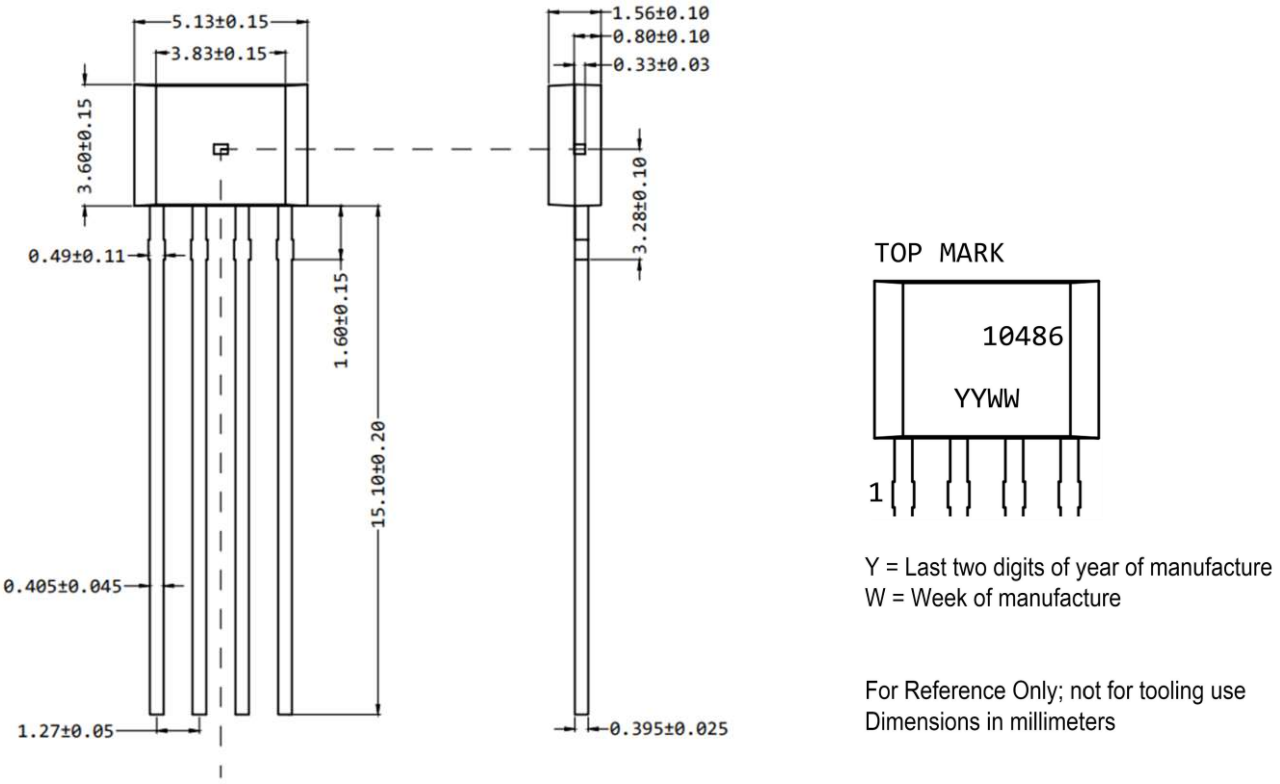


Figure 5. VK/TO94-S (4-pin) / 15mm lead length - Package Information