MH490 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 MH490 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.

Broken ground wire detection, clamps, power-on reset, and under/overvoltage detection provide the required diagnostics for safety-critical automotive applications.

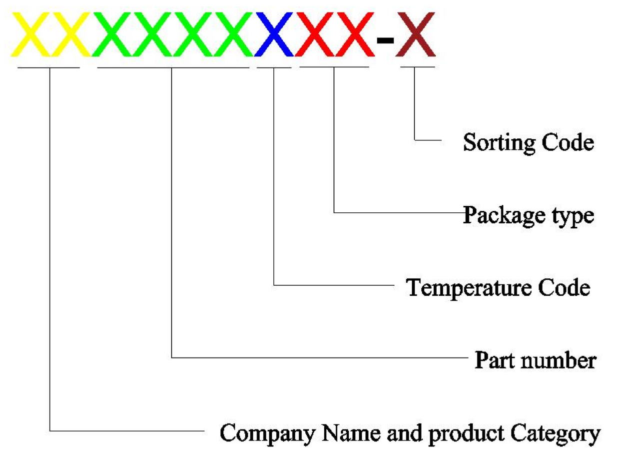
Features and Benefits

- End-of-line programmable sensor
- User-selectable internal or external reference voltage
- User-selectable ratiometry of QVO
- User-selectable ratiometry of Sensitivity
- Measurement range from ±0.9 to ±25mV/G
- Wideband sensing: DC to 240KHz
- Very short response time ~2µs
- RoHS compliant
- TO94(4-pin) package
- MSL-1
- Automotive Grade AECQ100 with diagnostics for safety-critical

Applications

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

Ordering Information



Company Name and Product Category

MH:MST Hall Effect/MP:MST Power IC

Part number

181,182,183,184,185,248,249,276,477,381,381F,381R,382…..

If part # is just 3 digits, the forth digit will be omitted.

Temperature range

E: 85 ℃, I: 105 ℃, K: 125 ℃, L: 150 ℃

Package type

UA:TO-92S, VK:TO-94(4pin), VF:TO-92S(5pin),

SO:SOT-23,SQ:QFN-3,ST:TSOT-23,SN:SOT-553,

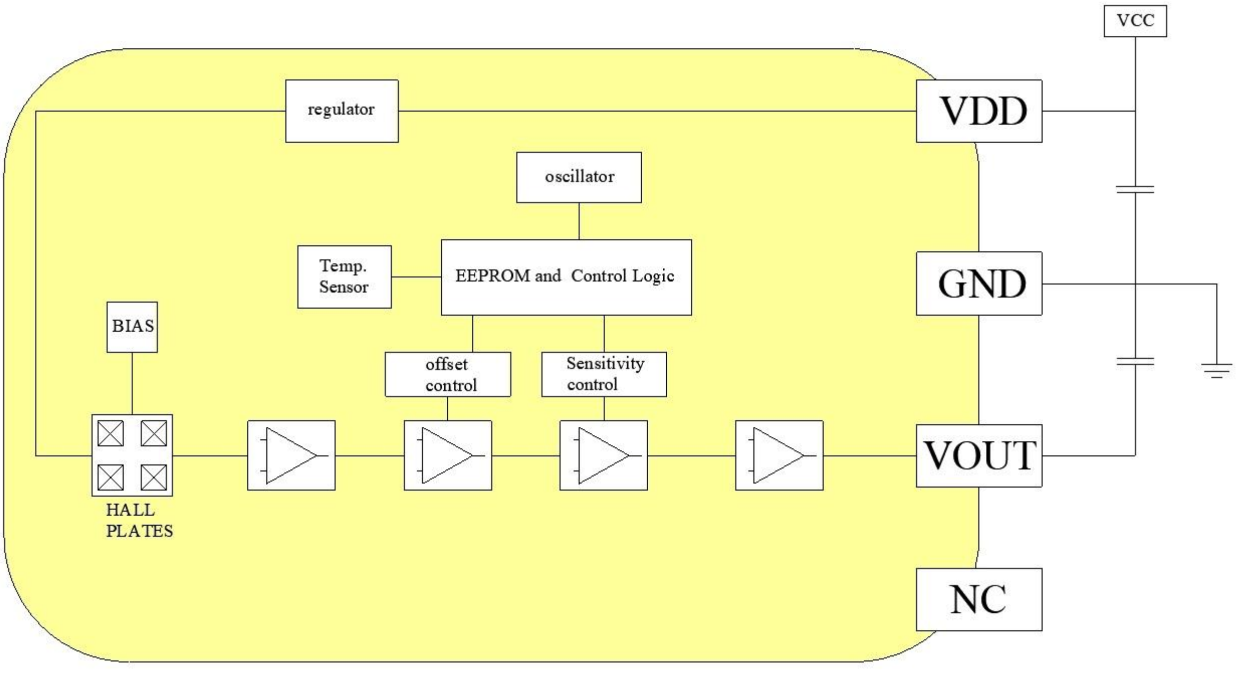
SF:SOT-89(5pin),SS:TSOT-26,SD:DFN-6

Sorting

α , β ,Blank…..

Part No.	Temperature Suffix	Package Type
MH490KVK	K (-40°C to + 125°C)	VK (To-94-4pin)
MH490MKVK	K (-40°C to + 125°C)	VK (To-94-4pin)

Functional Diagram



Absolute Maximum Ratings *At (Ta=25°C)*

Parameter	Symbol	Value	Unit
Positive Supply Voltage (overvoltage)	VDD	10.5	V
Reverse Voltage	VSREV	-0.3	V
Positive Output Voltage	VOUT	5.5	V
Output Sink Current	ISink	-40	mA
Output Source Current	ISource	60	mA
Reverse Output Voltage	VOREV	-0.3	V
Reverse Output Current	IOREV	-50	mA
Operating Ambient Temperature Range	TA	-40 to +125	°C
Storage Temperature Range	TS	-40 to +150	°C
ESD – Human Body Model	ESDHBM	8	KV
Maximum Number of EEPROM Write Cycles	EEPROMW(max)	1000	cycle

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

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
Power-On Reset Voltage	$V_{POR(H)}$	T_A = 25°C, V_{DD} rising	2.82	3.0	3.25	V
	$V_{POR(L)}$	T_A = 25°C, V_{DD} falling	2.58	2.8	3.06	V
Power-On Reset Hysteresis	$V_{POR(HYS)}$	T_A = 25°C	158	200	190	mV
Power-On Delay Time	t_{PO}	T_A = 25°C, C_{BYPASS} = 104, CL = 1 nF			1	ms
Overvoltage Detection	$V_{OVD(EN)}$	T_A = 25°C	6.35	6.50	6.70	V
	$V_{OVD(DIS)}$	T_A = 25°C	5.85	6.00	6.20	V
OVD Hysteresis	$V_{OVD(HYS)}$	T_A= 25°C		0.50		mV
Undervoltage Detection	$V_{UVD(H)}$	T_A = 25°C	4.10	4.20	4.35	V
	$V_{UVD(L)}$	T_A = 25°C	3.70	3.80	3.95	V
UVD Hysteresis	$V_{UVD(HYS)}$	T_A = 25°C		400		mV
OVD and UVD Enable/Disable Delay Time	$t_{VD(EN)}$	T_A = 25°C	7	14	21	us
	$t_{VD(DIS)}$	T_A = 25°C	7	14	21	us
Linear Output Range	VO_{LIN}	pull-down ≥ 10 kΩ	10		90	%Vdd

Analog output specification

Accuracy specifications

Operating Parameters TA = -40 to 125°C, VDD = 5V±10%, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Output Impedance	R_{OUT}	Normal Operation		8		Ω
Output Capacitive Load	C_L			10	68	nF
Output Resistive Load	R_L		4.7	10		KΩ
VOUT pin sink/source current		V_{OUT} shorted to V_{DD}			-20	mA
		V_{OUT} shorted to G_{ND}	28			mA
Output Voltage Clamp	$V_{CLP(HIGH)}$	T_A = 25°C, R_L = 10 KΩ to GND, Bias = 400 G		V_{DD}-(V_{DD}*0.06)	V_{DD}-0.25	V
	$V_{CLP(LOW)}$	T_A = 25°C, R_L = 10 KΩ to V_{DD}, Bias = 400 G	0.25	V_{DD}*0.06		V
Output Voltage with Broken GND/VDD	V_{BRK_DN}	T_A = 25°C, R_L = 10 KΩ to GND, Pin 3 = NC		100	200	mV
	V_{BRK_UP}	T_A = 25°C, RL = 10 KΩ to V_{DD} (5V), Pin 3 = NC	4.8	4.9	5	V
V_{OQ} Ratiometry	$\Delta^R V$	V_{DD} = 5V±5%, V_{OQ} = 50%V_{DD}		±0.24	±0.4	%V_{OQ}
RMS Output Noise(high-gain)	N_{RMS-HG}	Values for S=12.5mV/G, 1KHz-100KHz		7		mVRMS
Temperature coefficient variation of Sensitivity	δ_{TCVO}	Over full range of BM and T_A, calibrated IC, without TC_{OF}	-200		200	ppm/°C
Offset Temperature characteristic	TC_{VOF}	BM = 0G, 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, TA = 25°C		1.5		µV/G

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

Timing specifications

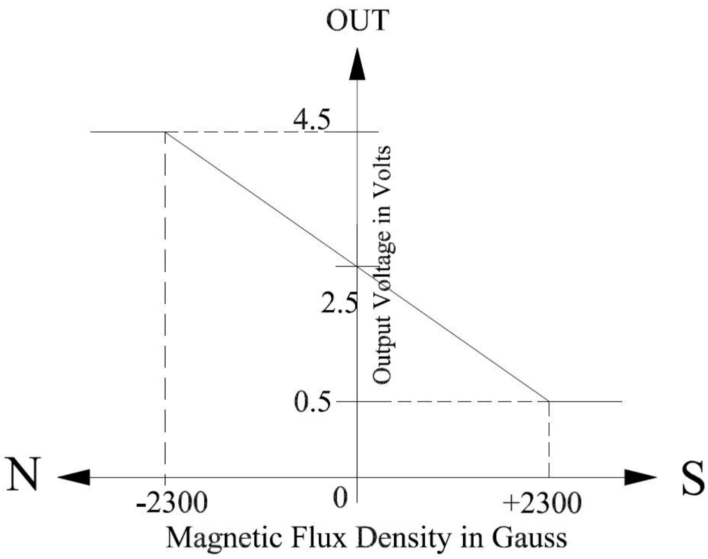
Operating Parameters T_A = -40 to 125°C, V_{DD} = 5V±10%, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Response Time	tRESP	T_A = 25 °C, C_L=1nf, Magnetic field step of 400G, Sens=2mV/G, Measured 90% input to 90% output.		2		µs
Frequency bandwidth	BW	-3 dB, TA = 25 °C		240		kHz

Magnetic specification

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

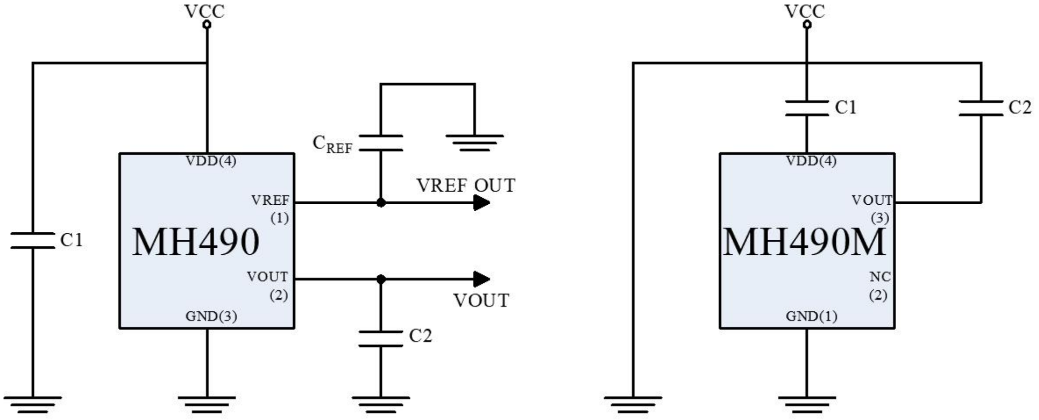
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Operational Magnetic Field Range	BOP		±100	±1000	±2300	G
Programmable Sensitivity	S		0.9	2	25	mV/G
Linearity Error (Magnetic)	NL	V_{OUT} in [10%V_{DD}, 90%V_{DD}], T_A = 25°C, $R_L \geq 10$ kΩ			±0.25	%FS



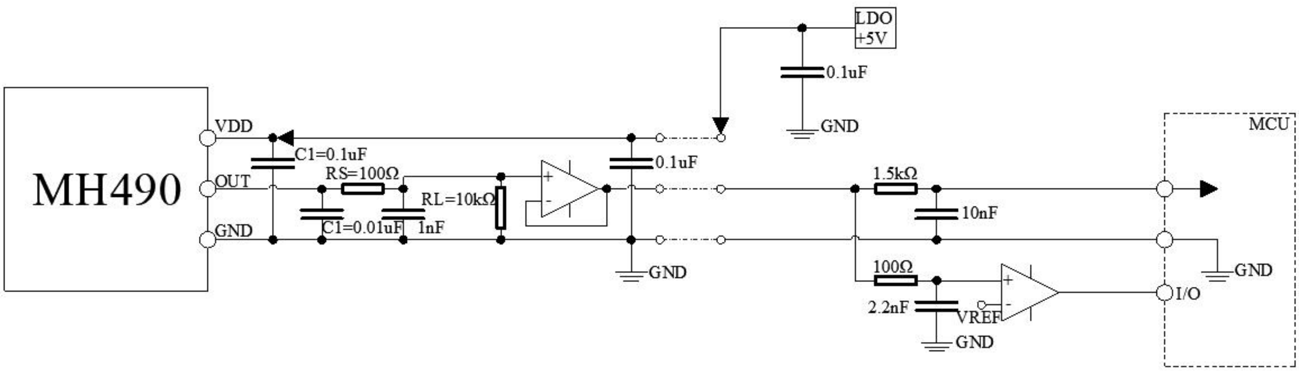
Programmable Items

Parameter	Bits	Factory Setting	Comment
QVO[4:0]	5	trimmed	Quiescent output level (0 Gauss) 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 11 (figure 4)
			1: opposite polarity
ID[19:0]	20		CUSTOMER ID

Recommended Application Diagram



Application Circuit for Harsh and Noisy Environment



For proper operation a 100nF or bigger bypass capacitor C1 should be placed as close as possible to the VDD and GND pins, and a bypass capacitor C2 of 1nF to 10nF can be placed on the output of MH490.

ESD Precautions

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

Under- and overvoltage detection (UVD, OVD)

Under- and overvoltage detection is implemented to prevent the device from operating outside the required supply voltage range. A fault condition is detected if the supply voltage is below or above the limits. The undervoltage detection is kept in reset (undervoltage detected) during the start-up of the device and is released by the digital as soon as the digital finished the EEPROM reading. The overvoltage detection can be enabled/disabled by the EEPROM.

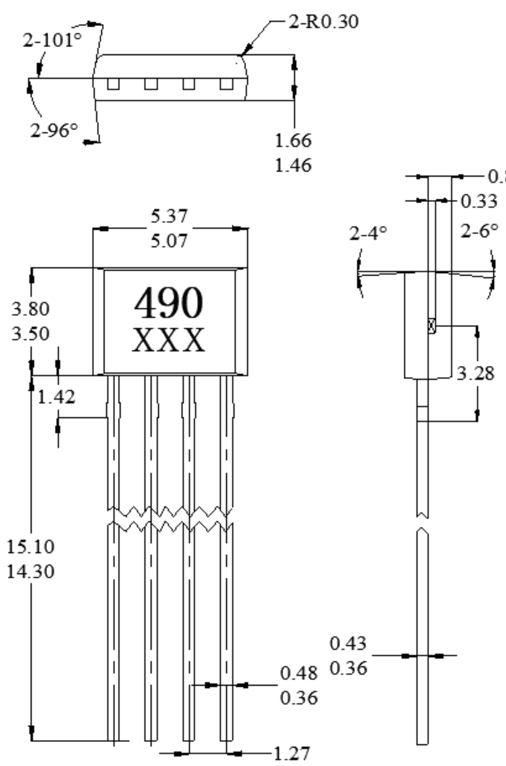
The outputs of the UVD and OVD are used to force the VREF and VOUT to predefined states incase of a detected fault.

Condition	Description	VREF output	VOUT output
UVD	During device startup and UVD detected	Forced to GND	Floating (Hi-Z)
OVD	OVD detected (only when EN_OVD = 1)	VREF	Floating (Hi-Z)

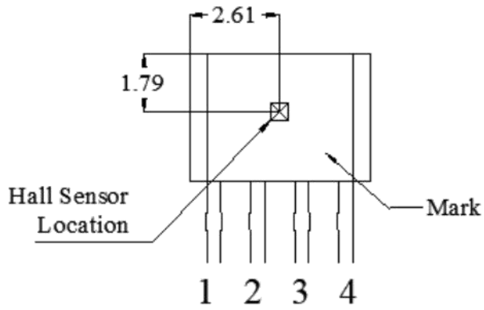
The VREF output is forced to GND during startup of the device and at an undervoltage condition. The VREF output stays in normal operation at an overvoltage condition.
The V_{OUT} output is forced to Hi-Z mode in both the UVD and OVD condition. These fault conditions can be detected by a connected controller in case a pull-up or pull-down resistor at V_{OUT} is used (V_{OUT} = V_{CC} or V_{OUT} = GND).

MH490 Sensor Location, package dimension and marking

VK Package (To-94-4pin)



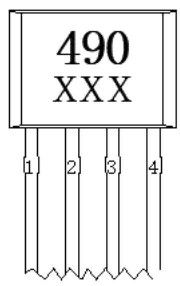
Hall Chip location



NOTES:
1.Controlling dimension: mm
2.Leads must be free of flash
and plating voids
3.Do not bend leads within 1 mm
of lead to package interface.
4.PINOUT:

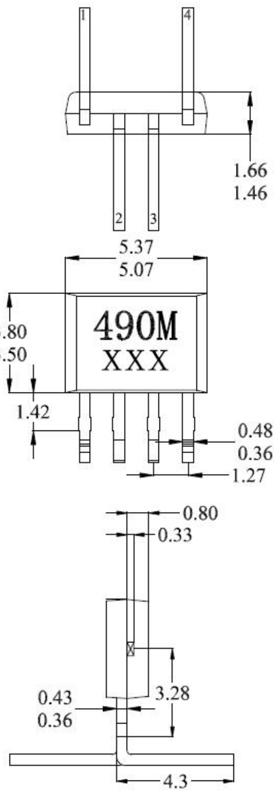
Pin 1	VREF
Pin 2	VOUT
Pin 3	GND
Pin 4	VCC

Output Pin Assignment



MH490M Sensor Location, package dimension and marking

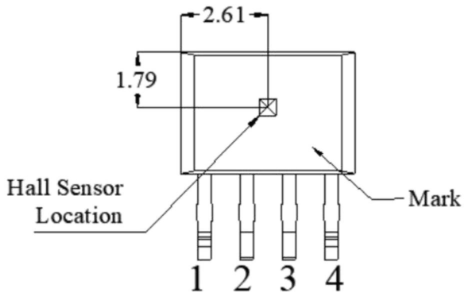
VK Package (To-94-4pin)



NOTES:

1. Controlling dimension: mm
2. Leads must be free of flash and plating voids
3. Do not bend leads within 1 mm of lead to package interface.
4. PINOUT:
   - Pin 1 GND
   - Pin 2 GND
   - Pin 3 VOUT
   - Pin 4 VDD

Hall Chip location



Output Pin Assignment