

Ratiometric Linear Hall-Effect IC, Analog Output

1 Product Description

The MT912x device is a linear Hall effect IC that responds proportionally to magnetic flux density. The device can be used for accurate position sensing in a wide range of applications.

The device operates from 3.0V to 3.6V power supplies. When no magnetic field is present, the analog output drives 85%VCC. The output changes linearly with the applied South magnetic flux density, and four sensitivity options enable maximal output voltage swing based on the required sensing range.

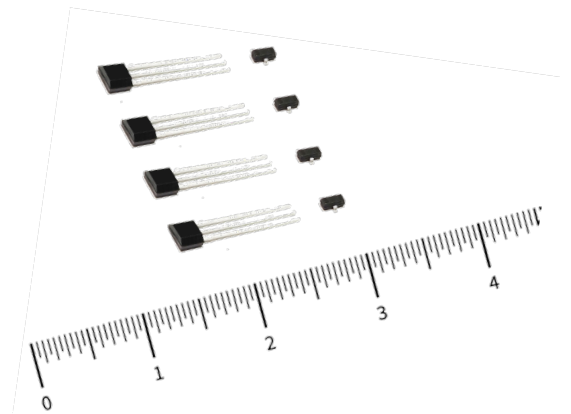
The MT912x family provides a variety of packages to customers. SOT-23-3L for surface mount and flat TO-92 for through-hole mount. All packages are RoHS compliant.

2 Features

- BCD Technology
- Factory-programmed
- Ratiometric Rail to Rail Analog Output
- Low-Noise Output
- 3.0~3.6V Operating Vcc Range
- -40°C~125°C Operating Temperature
- Package Option:
Flat TO-92/SOT-23-3L
- Magnetic Sensitivity Option:
2.0mV/Gs MT9121 Series @Vcc = 3.3V
3.2mV/Gs MT9122 Series @Vcc = 3.3V
4.3mV/Gs MT9123 Series @Vcc = 3.3V
6.3mV/Gs MT9125 Series @Vcc = 3.3V
- RoHS Compliant: (EU)2015/863
- Moisture Sensitivity Level: MSL 3 (MT912xAT)

3 Product Overview of MT912x

Part No.	Description
MT912xA	Flat TO-92, bulk packaging (500pcs/bag)
MT912xAT	SOT-23-3L, tape & reel (3000pcs/bag)



4 Applications

- Position Detection
- Home Appliances
- Industrial
- Keyboard

5 Pin Configuration and Functions

	Vcc	Out	GND
SOT-23-3L	1	2	3
Flat TO-92	1	3	2
Description	Power	Output	Ground

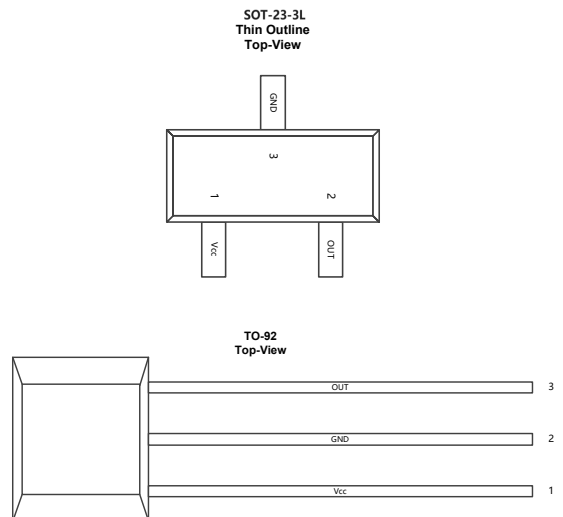


Figure.1 Pin Configuration & Functions

Table of Contents

1 Product Description.....1

2 Features.....1

3 Product Overview of MT912x1

4 Applications.....1

5 Pin Configuration and Functions.....1

6 Transfer Characteristics.....3

7 Function Description.....3

8 Feature Description.....3

9 Functional Block Diagram.....4

10 Electrical and Magnetic Characteristics.....4

 10.1 Absolute Maximum Ratings.....4

 10.2 ESD Ratings.....4

 10.3 Electrical Specifications.....5

 10.4 Magnetic Characteristics.....6

11 Typical Application Circuit.....6

12 Package Material Information.....7

 12.1 SOT-23-3LPackage Information.....7

 12.2 Flat TO-92 Package Information.....8

13 Copy Rights and Disclaimer.....9

Reversion History

1 Version 1.0 Initial Version

6 Transfer Characteristics

Figure.2 show four sensitivity options enable maximal output voltage swing based on the required sensing range

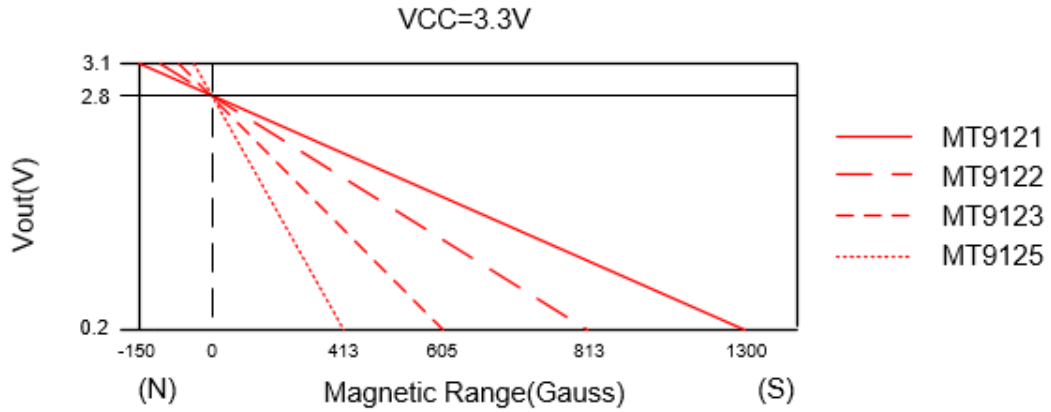


Figure.2 Transfer Characteristics (Vcc=3.3V)

7 Function Description

The device produces a linear response when the output voltage is within the specified voltage range. Outside this range, sensitivity is reduced and nonlinear

8 Feature Description

The MT912x is sensitive to the magnetic field that is perpendicular to the top of the chip package.

When the south pole magnetic field continuously close to the IC from the top, which showed in the left of the Figure.3, the VOUT changing from 2.8 to 0.2V linearity. (VCC=3.3V)

When the south pole magnetic field $\geq +413\text{Gs}$ (MT9125) or $\geq +605\text{Gs}$ (MT9123) or $\geq +813\text{Gs}$ (MT9122) or $\geq +1300\text{Gs}$ (MT9121), which showed in the right of the Figure.3, the VOUT changing from 0.2 to 0V nonlinearity. (VCC=3.3V)

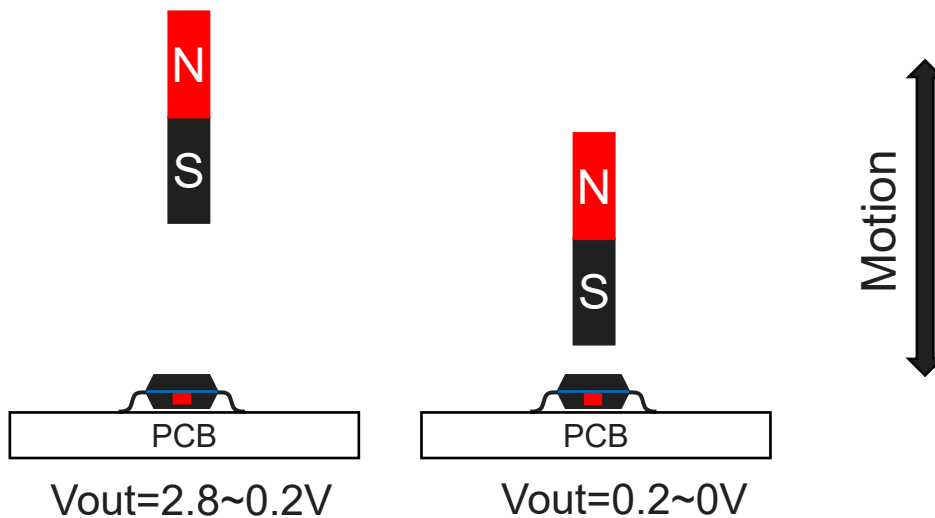


Figure.3 Feature Description

9 Functional Block Diagram

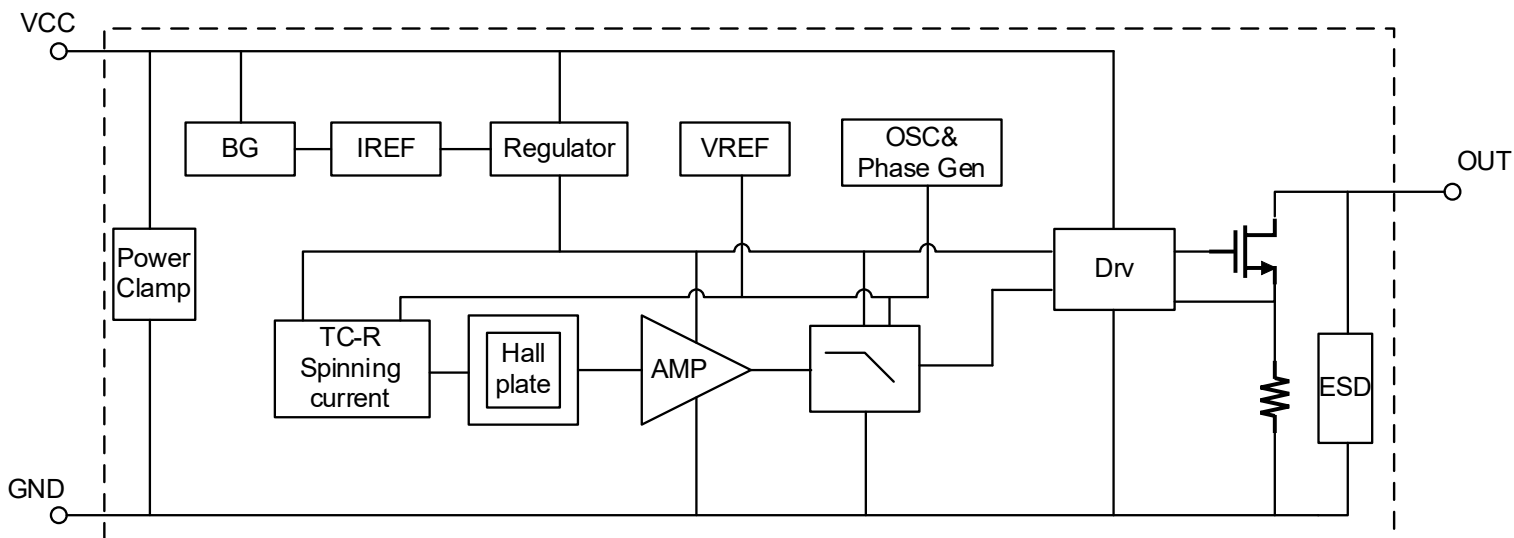


Figure.4 Functional Block Diagram

10 Electrical and Magnetic Characteristics

10.1 Absolute Maximum Ratings

Absolute maximum ratings are limited 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	Parameters	Min	Max	Units
VCC	Supply Voltage	-	5	V
VRCC	Reverse Battery Voltage	-0.2	-	V
VOUT	Output Voltage	-	5	V
IOUT	Continuous Output Current	-5	5	mA
TA	Operating Ambient Temperature	-40	125	°C
TS	Storage Temperature	-40	150	°C
TJ	Junction Temperature	-	165	°C

10.2 ESD Ratings

Symbol	Reference	Values	Unit
VESD	Human-body model (HBM)	±7500	V
	Charged-device model (CDM)	±1000	V

10.3 Electrical Specifications

At $T_A = -40 \sim 125$ °C, $V_{CC} = 3.0V \sim 3.6V$ (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
VCC	Supply Voltage		3.0	-	3.6	V
ICC	Supply Current	$T_A = 25^\circ\text{C}$, $V_{CC} = 3.3V$	-	2	-	mA
TPO	Power on Time	$dV_{CC}/dt \geq 5V/\mu\text{s}$	-	-	30	μs
BW	Bandwidth		20	30	-	kHz
TRESP	Response Time	$T_A = 25^\circ\text{C}$	-	15	-	μs
TR	Rise Time	$T_A = 25^\circ\text{C}$	-	12	-	μs
TPD	Propagation Delay	$T_A = 25^\circ\text{C}$	-	5.5	-	μs
NF	Noise	$B=0$; $T_A = 25^\circ\text{C}$	-	3.15	-	mG/root(Hz)
		MT9121; $T_A = 25^\circ\text{C}$	-	16	-	mVpp
		MT9122; $T_A = 25^\circ\text{C}$	-	24	-	mVpp
		MT9123; $T_A = 25^\circ\text{C}$	-	31	-	mVpp
		MT9125; $T_A = 25^\circ\text{C}$	-	42	-	mVpp
ROUT	Output Resistance	$I_{OUT} \leq 1\text{mA}$	-	1	12	Ω
RL	Output Loading Resistance	$I_{OUT} \leq 1\text{mA}$ Output to VCC	-	2.7	-	k Ω
CL	Output Loading Capacitance	$I_{OUT} \leq 1\text{mA}$ Output to GND	-	-	4.7	nF
VOL	Linear output low voltage	$V_{CC} = 3.3V$, $R_L = 3k\Omega$	-	-	0.2	V
VOH	Linear output high voltage	$V_{CC} = 3.3V$, $R_L = 3k\Omega$	3.1	-	-	V
RTH	Thermal Resistance	SOT-23-3L	-	301	-	$^\circ\text{C}/\text{W}$
		Flat TO-92	-	230	-	$^\circ\text{C}/\text{W}$

10.4 Magnetic Characteristics

At $T_A = -40 \sim 125$ °C, $V_{CC} = 3.0V \sim 3.6V$ (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
ELIN	Nonlinearity error		-1.5	-	1.5	%
VOQ	Quiescent Voltage	$V_{CC} = 3.3V$; $B = 0$ $T_A = 25^\circ C$	2.75	2.8	2.85	V
ERAT_VOQ	Ratiometry Quiescent Voltage Output Error	$V_{CC} = 3.0 \sim 3.6V$; $B = 0$ $T_A = 25^\circ C$	-1.5	-	1.5	%
ERAT_SNST	Ratiometry Sensitivity Error	$V_{CC} = 3.0 \sim 3.6V$; $B = 0$ $T_A = 25^\circ C$	-1.5	-	1.5	%
SNST_TC	SNST Variation Over Temperature		-	1200	-	ppm/°C
SNST	Sensitivity $T_A = 25^\circ C$; $V_{CC} = 3.3V$	MT9121	1.900	2.000	2.100	mV/Gs
		MT9122	3.040	3.200	3.360	mV/Gs
		MT9123	4.084	4.300	4.514	mV/Gs
		MT9125	5.984	6.300	6.614	mV/Gs
B	Magnetic Field Range $T_A = 25^\circ C$; $V_{CC} = 3.3V$	MT9121	-150		1300	Gs
		MT9122	-94		813	Gs
		MT9123	-70		605	Gs
		MT9125	-48		413	Gs

11 Typical Application Circuit

MT9121AT as example

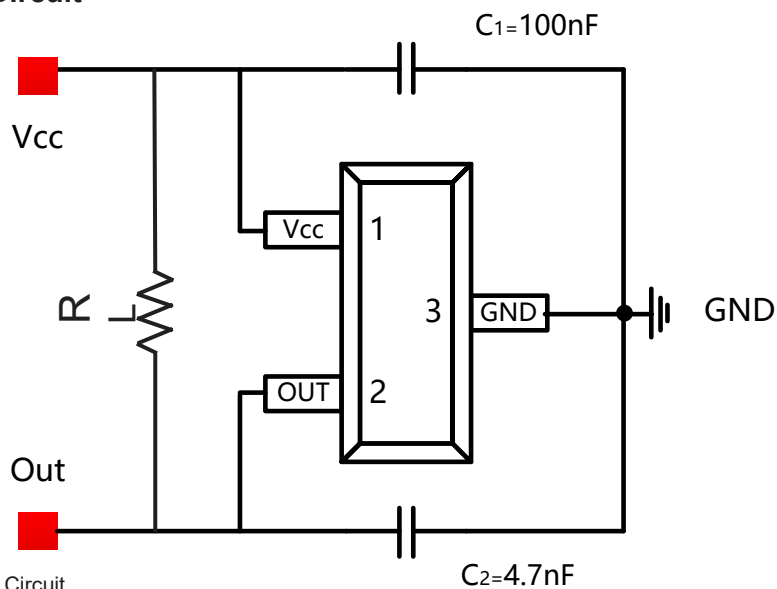


Figure.5 Typical Application Circuit

12 Package Material Information (For Reference Only – Not for Tooling Use)

12.1 SOT-23-3L Package Information

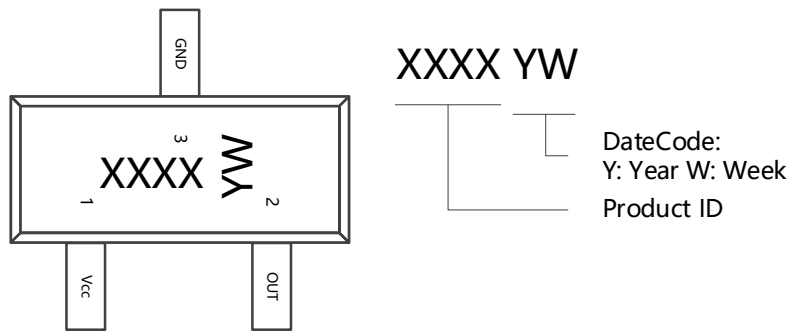


Figure.6 SOT-23-3L Chip Marking Spec

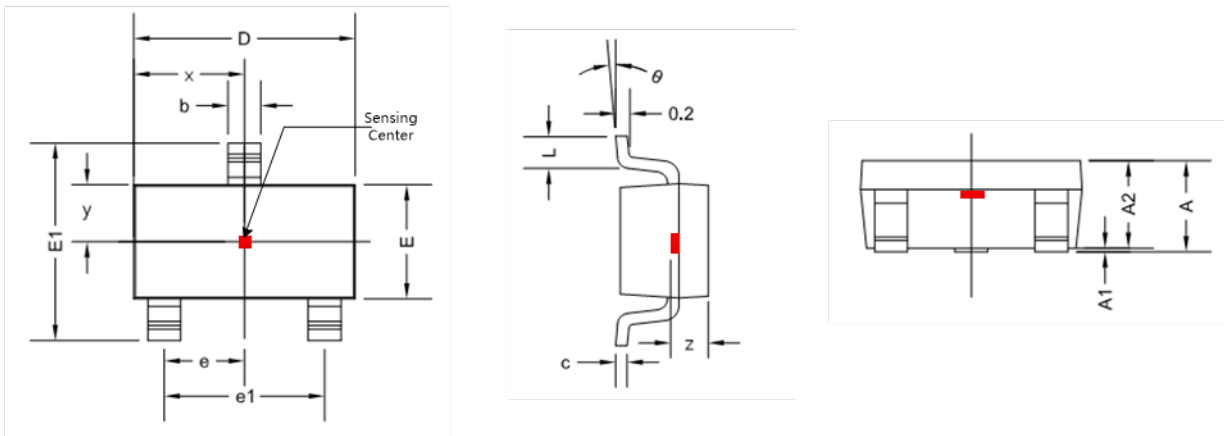


Figure.7 SOT-23-3L Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0 °	8 °	0 °	8 °
x	1.460 TYP		0.057 TYP	
y	0.800 TYP		0.032 TYP	
z	0.700 TYP		0.028 TYP	

12.2 Flat TO-92 Package Information

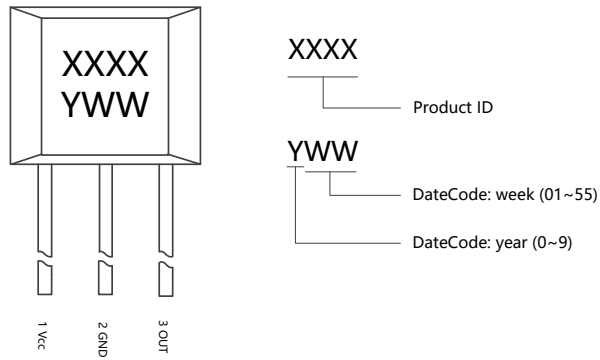


Figure.8 Flat TO-92 Chip Marking Spec

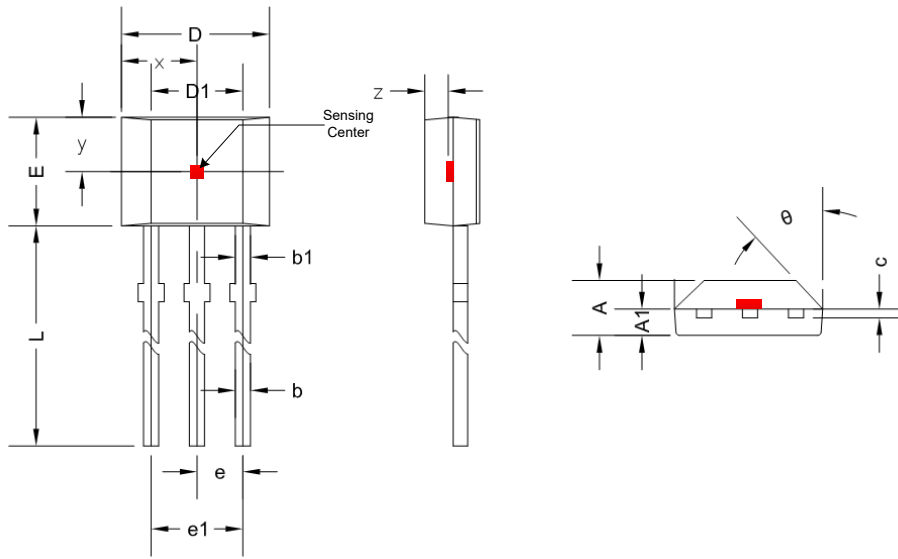


Figure.9 Flat TO-92 Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.420	1.620	0.056	0.064
A1	0.660	0.860	0.026	0.034
b	0.330	0.430	0.013	0.017
b1	0.330	0.430	0.013	0.017
c	0.330	0.510	0.013	0.020
D	3.900	4.100	0.154	0.161
D1	2.280	2.680	0.090	0.106
E	3.050	3.250	0.120	0.128
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	14.350	14.750	0.564	0.580
θ	45 ° TYP		45 ° TYP	
x	2.000 TYP		0.079 TYP	
y	1.575 TYP		0.062 TYP	
z	0.590 TYP		0.023 TYP	

13 Copy Rights and Disclaimer

1. This document may not be reproduced or duplicated, in any form, in whole or in part without prior written consent of MagnTek . Copyrights © 2019, MagnTek Incorporated.
2. MagnTek reserves the right to make changes to the information published in this document at anytime without notice.
3. MagnTek's products are limited for use in normal commercial applications. MagnTek's products are not to be used in any device or system, including but not limited to medical life support equipment and system.

For the latest version of this document, please visit our website: www.magntek.com.cn