

Ratiometric Linear Hall-Effect IC, Analog Output

1 Product Description

The MT911x 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 $\frac{1}{2}$ of VCC. The output changes linearly with the applied magnetic flux density, and four sensitivity options enable maximal output voltage swing based on the required sensing range. North and south magnetic poles produce unique voltages.

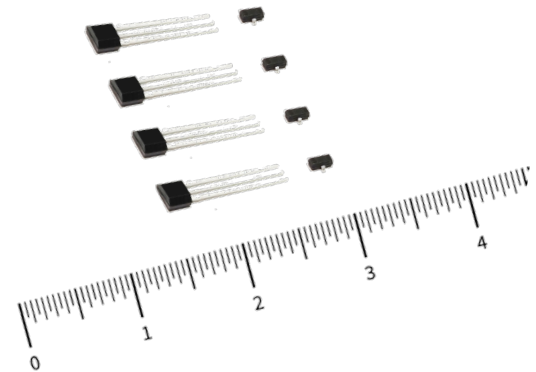
The MT911x family provides a variety of packages to customers. DFN1616 & SOT-23 (Thin Outline) for surface mount and flat TO-92 for through-hole mount. All packages are RoHS compliant.

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 (Thin Outline)/DFN1616
- Magnetic Sensitivity Option for MT911x:
1.00mV/Gs MT9111 Series @Vcc = 3.3V
1.60mV/Gs MT9112 Series @Vcc = 3.3V
2.15mV/Gs MT9113 Series @Vcc = 3.3V
3.15mV/Gs MT9115 Series @Vcc = 3.3V
- RoHS Compliant: (EU)2015/863
- Moisture Sensitivity Level:
MSL 3 (MT911xDT&MT911xET)

3 Product Overview of MT911x

Part No.	Description
MT911xA	Flat TO-92, bulk packaging (500pcs/bag)
MT911xET	SOT-23 (Thin Outline), tape & reel (3000pcs/bag)
MT911xDT-1616	DFN1616, tape & reel (3000pcs/bag)



4 Applications

- Home Appliances
- Industrial
- Speed Detection
- Position Detection
- Magnetic Encoder
- Ferrous Metal Sensing
- Vibration Sensing
- Weight Sensing

5. Pin Configuration and Functions

	Vcc	Out	GND
SOT-23 (Thin Outline)	1	2	3
Flat TO-92	1	3	2
DFN1616	4	2	5
Description	Power	Output	Ground

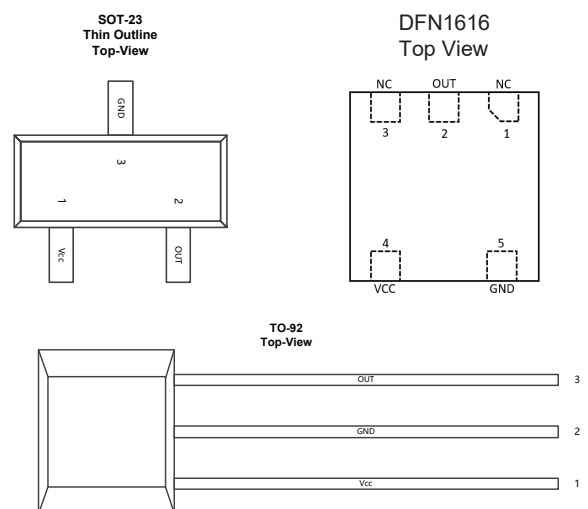


Figure.1 Pin Configuration & Functions

Table of Contents

1	Product Description.....	1
2	Features.....	1
3	Product Overview of MT911x	1
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.....	7
12	Package Material Information.....	8
	12.1 SOT-23 (Thin Outline) Package Information.....	8
	12.2 Flat TO-92 Package Information.....	9
	12.3 DFN1616 Package Information.....	10
13	Copy Rights and Disclaimer.....	11

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

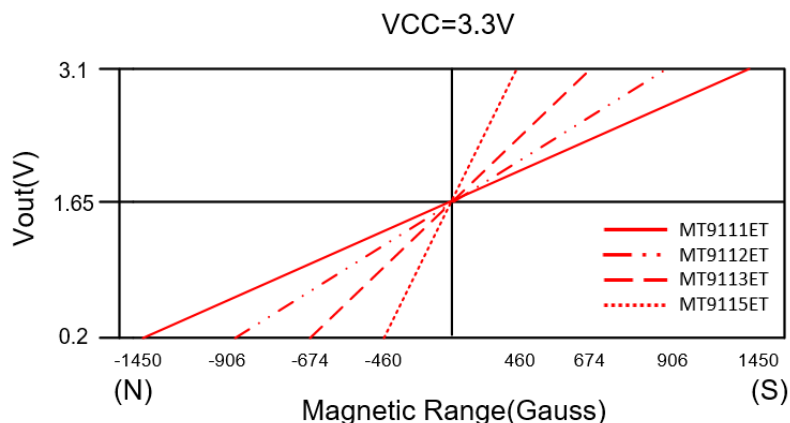


Figure.2 Transfer Characteristics (Vcc=3.3V)

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 MT911x device is sensitive to the magnetic field component that is perpendicular to the top of the package

When the magnetic field moving from the left side of the IC to the middle which showed in the left of the Figure.3, the VOUT changing from 0.2 to 1.65V linearity when VCC=3.3V

When the magnetic field located at the middle of the IC which showed in the middle of the Figure.3, the VOUT is 1.65V (1/2 of the VCC=3.3V)

When the magnetic field moving from the middle side of the IC to the right which showed in the right of the Figure.3, the VOUT changing from 1.65 to 3.1V linearity when VCC=3.3V

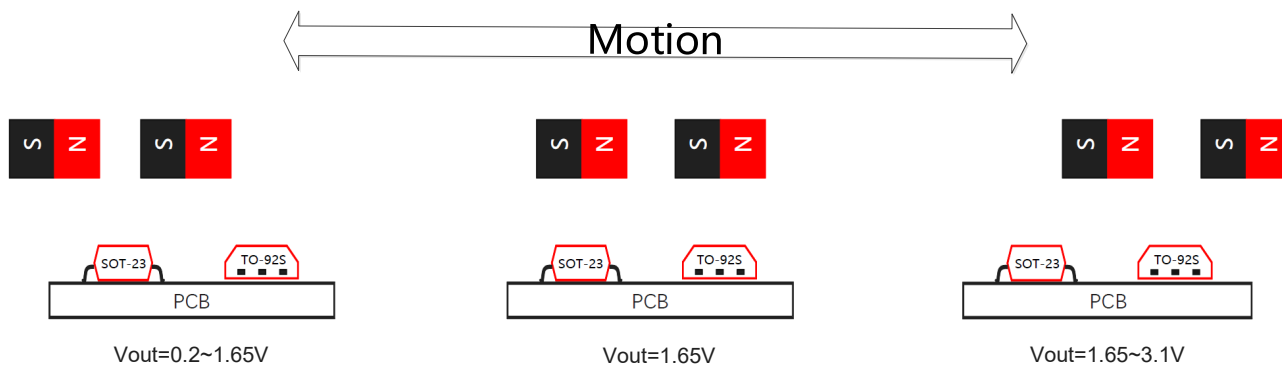


Figure.3 Feature Description

9 Functional Block Diagram

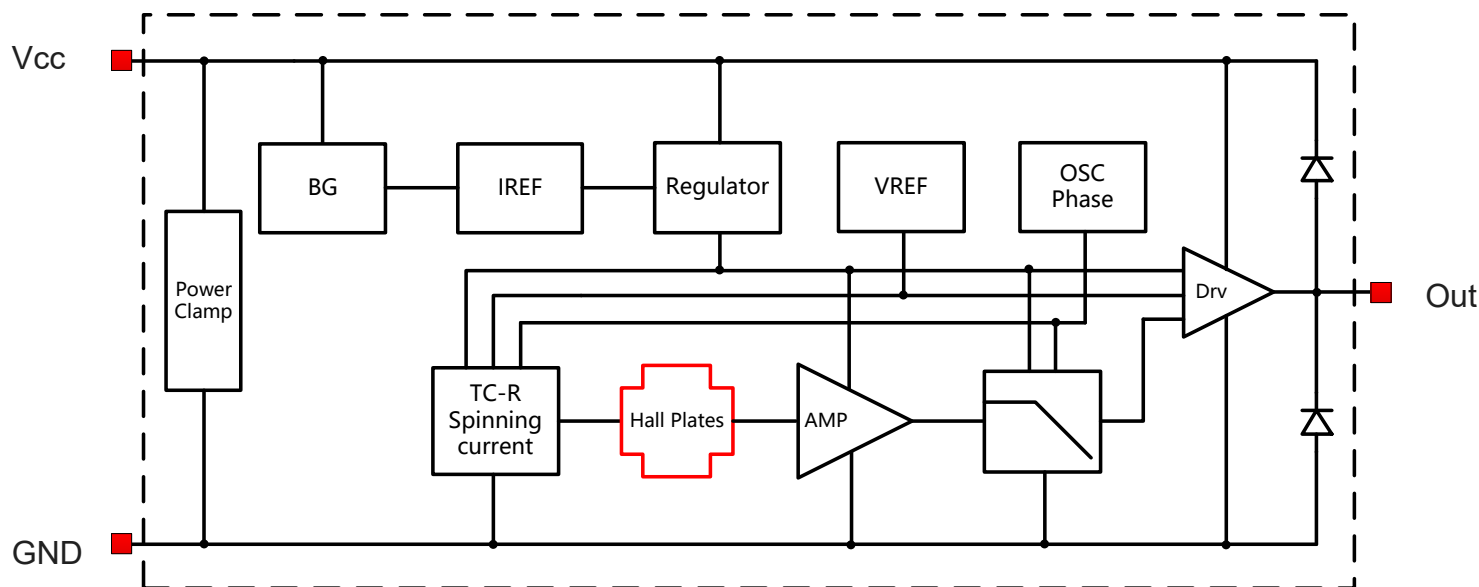


Figure.4 Functional Block Diagram

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)	AEC-Q100-002	±4000	V
	Charged-device model (CDM)	AEC-Q100-011	±1000	V

10.3 Electrical Specifications

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

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
VCC	Supply Voltage		3.0	-	3.6	V
ICC	Supply Current	$T_A = 25^\circ\text{C}$, $V_{CC} = 3.3\text{V}$	-	2	-	mA
TPO	Power on Time	$dV_{CC}/dt \geq 5\text{V}/\mu\text{s}$	-	15	30	μs
ISINK	Sink Current	$B=0$; $V_{OUT}=V_{CC}$	-1	-	-	mA
ISOURCE	Source Current	$B=0$; $V_{OUT}=0$	-	-	1	mA
BW	Bandwidth		20	30	-	kHz
TRESP	Response Time	$T_A = 25^\circ\text{C}$	-	16	-	μs
TR	Rise Time	$T_A = 25^\circ\text{C}$	-	16	-	μs
TPD	Propagation Delay	$T_A = 25^\circ\text{C}$	-	5.5	-	μs
NF	Noise	$B=0$; $T_A = 25^\circ\text{C}$	-	3.2	-	mG/root(Hz)
		MT9111; $T_A = 25^\circ\text{C}$	-	9	-	mVpp
		MT9112; $T_A = 25^\circ\text{C}$	-	13	-	mVpp
		MT9113; $T_A = 25^\circ\text{C}$	-	16	-	mVpp
		MT9115; $T_A = 25^\circ\text{C}$	-	22	-	mVpp
ROUT	Output Resistance	$I_{OUT} \leq \pm 1\text{mA}$	-	2	4	Ohm
RL	Output Loading Resistance	$I_{OUT} \leq 1\text{mA}$ Output to GND or to V_{CC}	4.7	-	-	k Ω
CL	Output Loading Capacitance	$I_{OUT} \leq \pm 1\text{mA}$ Output to GND	-	-	10	nF
RTH	Thermal Resistance	SOT-23 (Thin outline)	-	301	-	$^\circ\text{C}/\text{W}$
		DFN1616	-	301	-	$^\circ\text{C}/\text{W}$
		Flat TO-92	-	230	-	$^\circ\text{C}/\text{W}$

10.4 Magnetic Characteristics

At $T_A = -40 \sim 150\text{ }^{\circ}\text{C}$, $V_{CC} = 3.0\text{V} \sim 3.6\text{V}$ (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
VOL	Linear output low voltage	$V_{CC} = 3.3\text{V}$, $R_L \geq 10\text{k}\Omega$	-	-	0.2	V
VOH	Linear output high voltage	$V_{CC} = 3.3\text{V}$, $R_L \geq 10\text{k}\Omega$	$V_{CC} - 0.2$	-	-	V
ELIN	Nonlinearity error		-1.5	-	1.5	%
VOQ	Quiescent Voltage	$V_{CC} = 3.3\text{V}$; $B = 0$ $T_A = 25^{\circ}\text{C}$	1.625	1.650	1.675	V
ERAT_VOQ	Ratiometry Quiescent Voltage Output Error	$V_{CC} = 3.0 \sim 3.6\text{V}$; $B = 0$ $T_A = 25^{\circ}\text{C}$	-1.5	-	1.5	%
ERAT_SNST	Ratiometry Sensitivity Error	$V_{CC} = 3.0 \sim 3.6\text{V}$; $B = 0$ $T_A = 25^{\circ}\text{C}$	-1.5	-	1.5	%
VOQ_TC	VOQ Variation Over Temperature		-1.5	-	1.5	%
SNST_TC	SNST Variation Over Temperature		-	0	-	ppm/ $^{\circ}\text{C}$
SNST	Sensitivity $T_A = 25^{\circ}\text{C}$; $V_{CC} = 3.3\text{V}$	MT9111	0.950	1.000	1.050	mV/Gs
		MT9112	1.520	1.600	1.680	mV/Gs
		MT9113	2.042	2.150	2.257	mV/Gs
		MT9115	2.992	3.150	3.307	mV/Gs

11 Typical Application Circuit

MT9111ET as example

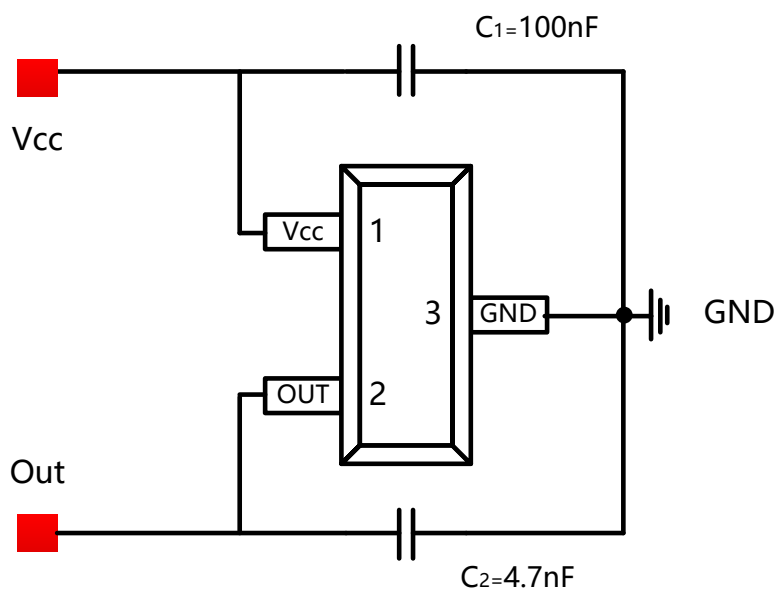


Figure.5 Typical Application Circuit

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

12.1 SOT-23 (Thin Outline) Package Information

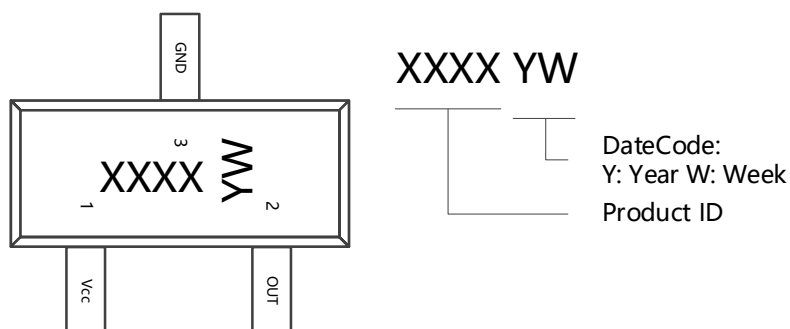


Figure.6 SOT-23 (Thin Outline) Chip Marking Spec

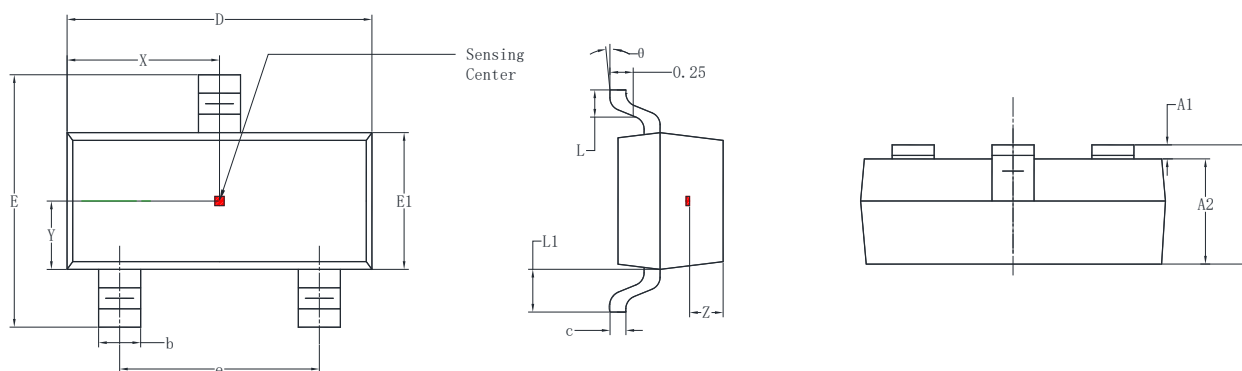


Figure.7 SOT-23 (Thin Outline) Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	2.250	2.550	0.089	0.100
E1	1.200	1.400	0.047	0.055
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0 °	8 °	0 °	8 °
x	1.450 TYP		0.057 TYP	
y	0.650 TYP		0.026 TYP	
z	0.430 TYP		0.017 TYP	

12.2 Flat TO-92 Package Information

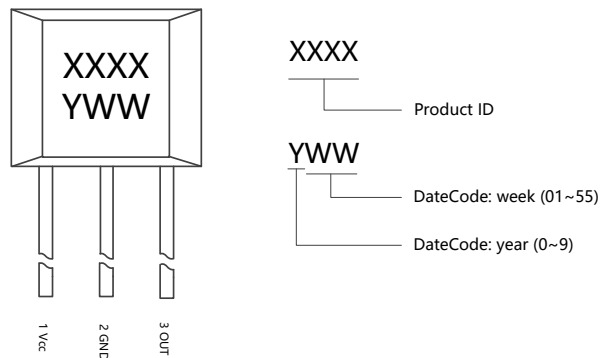


Figure.8 Flat TO-92 Chip Marking Spec

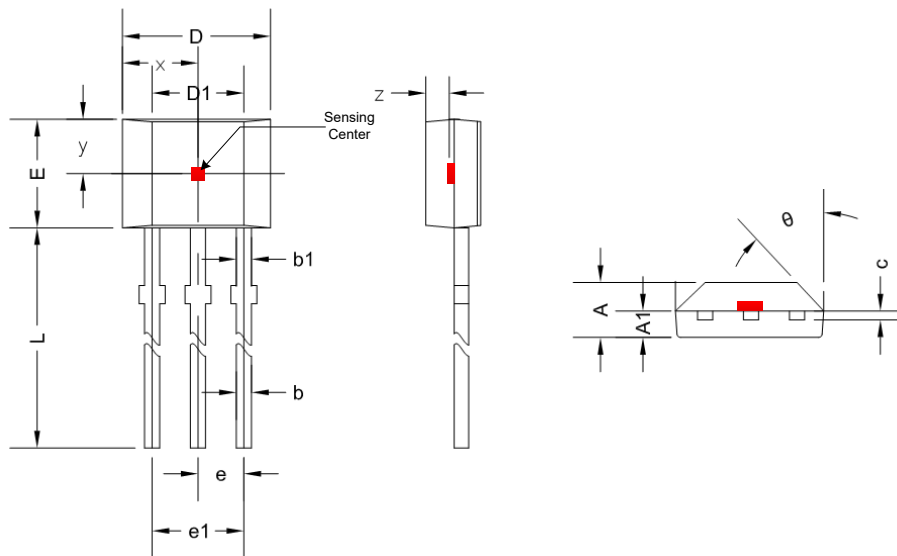


Figure.9 Flat TO-92 Package Drawing

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		0.078 TYP	
y	1.575 TYP		0.062 TYP	
z	0.590 TYP		0.023 TYP	

12.3 DFN1616 Package Information

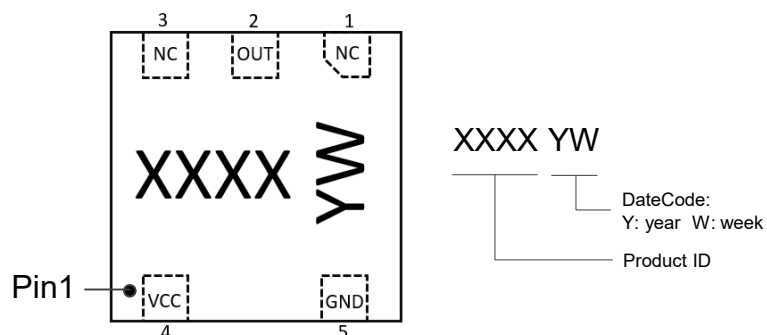


Figure.10 DFN1616 Chip Marking Spec

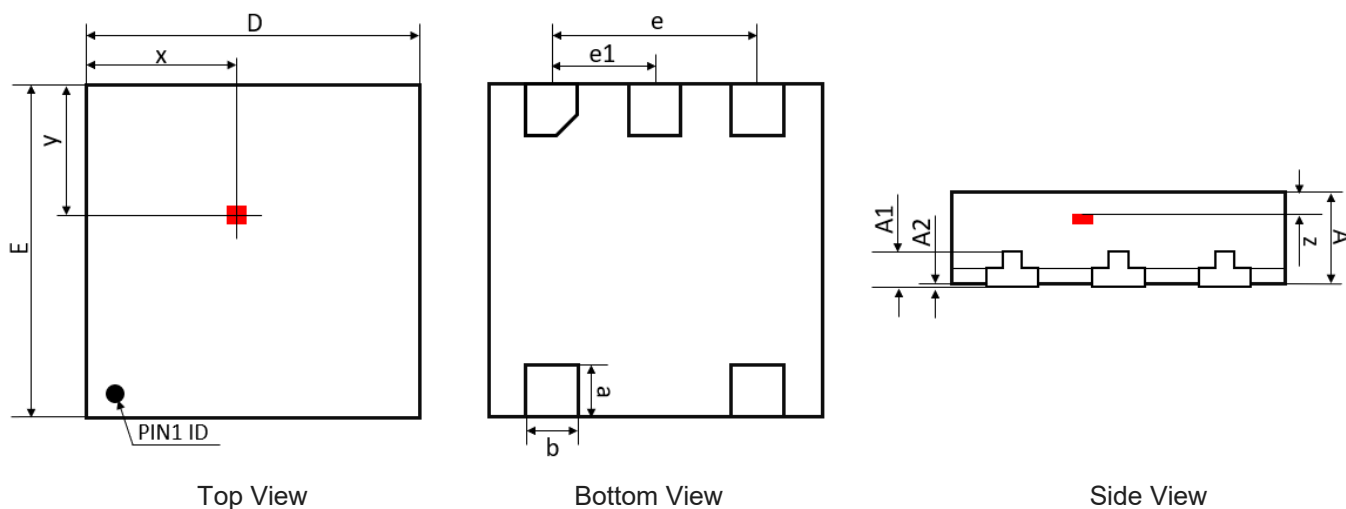


Figure.11 DFN1616 Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.450	0.550	0.018	0.022
A1	0.150 TYP		0.006 TYP	
A2	0.000	0.050	0.000	0.002
D	1.550	1.650	0.061	0.065
E	1.550	1.650	0.061	0.065
a	0.200	0.300	0.008	0.012
b	0.200	0.300	0.008	0.012
e	0.950	1.050	0.037	0.041
e1	0.450	0.550	0.018	0.022
x	0.690		0.027	
y	0.630		0.025	
z	0.180		0.007	

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