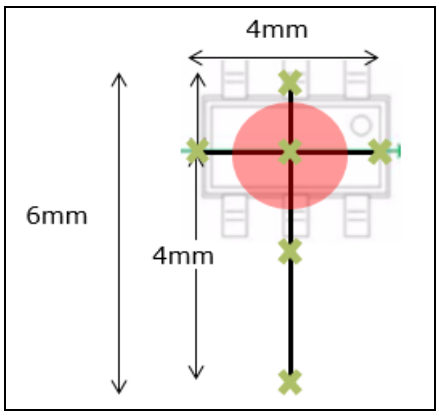
Linear multi-point position detection

with a magnetic 3D sensor



About this document

Scope and purpose

After reading this application note you know how to make a magnetic design for multi-position detection. You can use it for dedicated points along a line or for up to 6 points along a “T” shaped human machine interface.

Directly, a magnet and design parameters are proposed to come quickly to the first running solution. Go directly to **Chapter 3** to check out the magnetic design proposal.

Note: *The following information is given as a hint for the implementation of our devices only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the device.*

Intended audience

This document is intended for designers to use a 3D Magnetic Sensor for linear multi-point position detection.

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1 Introduction

This application note describes a possible realization of a position detection application. With the product family of the 3D Magnetic Sensor, Infineon offers an innovative solution for three-dimensional magnetic position sensing. By allowing a measurement of all three components of a magnetic field at the same time, it enables a multitude of applications with different ranges. Furthermore the integrated temperature sensor enables the application to compensate possible temperature-dependent magnetic field changes. The family supports automotive and industrial.

2 How to realize a magnetic design for multi-point detection

Possible applications to address are:

- General purpose man-machine interface
- Mirror control
- Contactless sliding switch

2.1 Application description

Target is to create a contactless system in order to detect 6 dedicated points or the linear movement along two crossing lines.

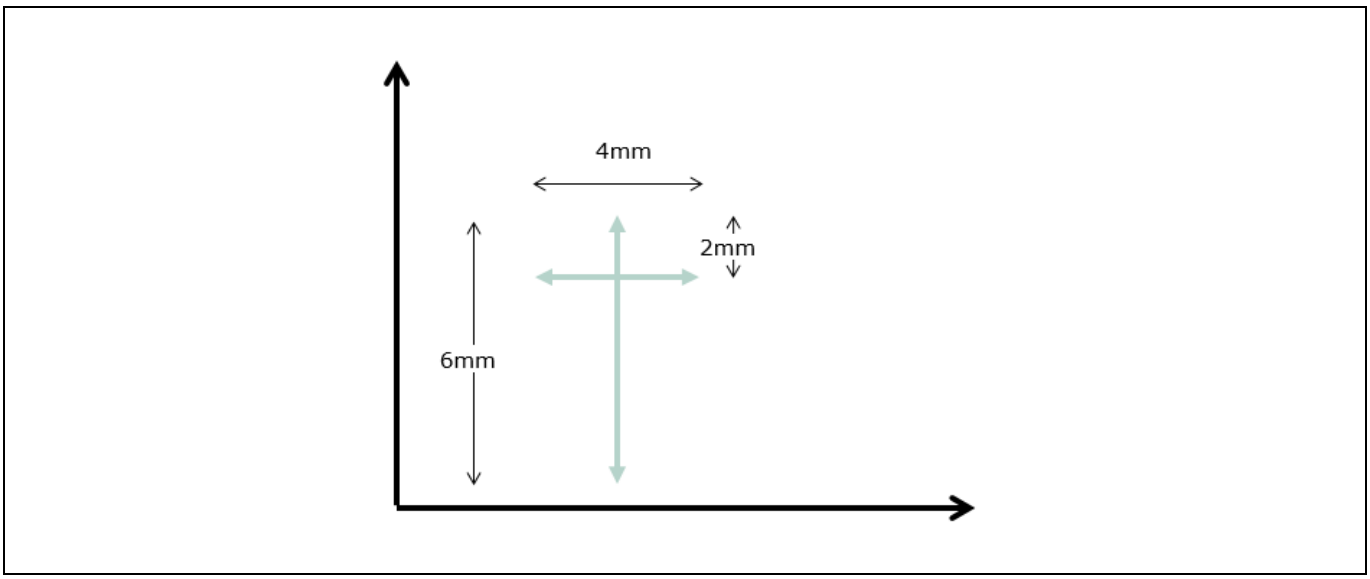

Figure 1 Application view

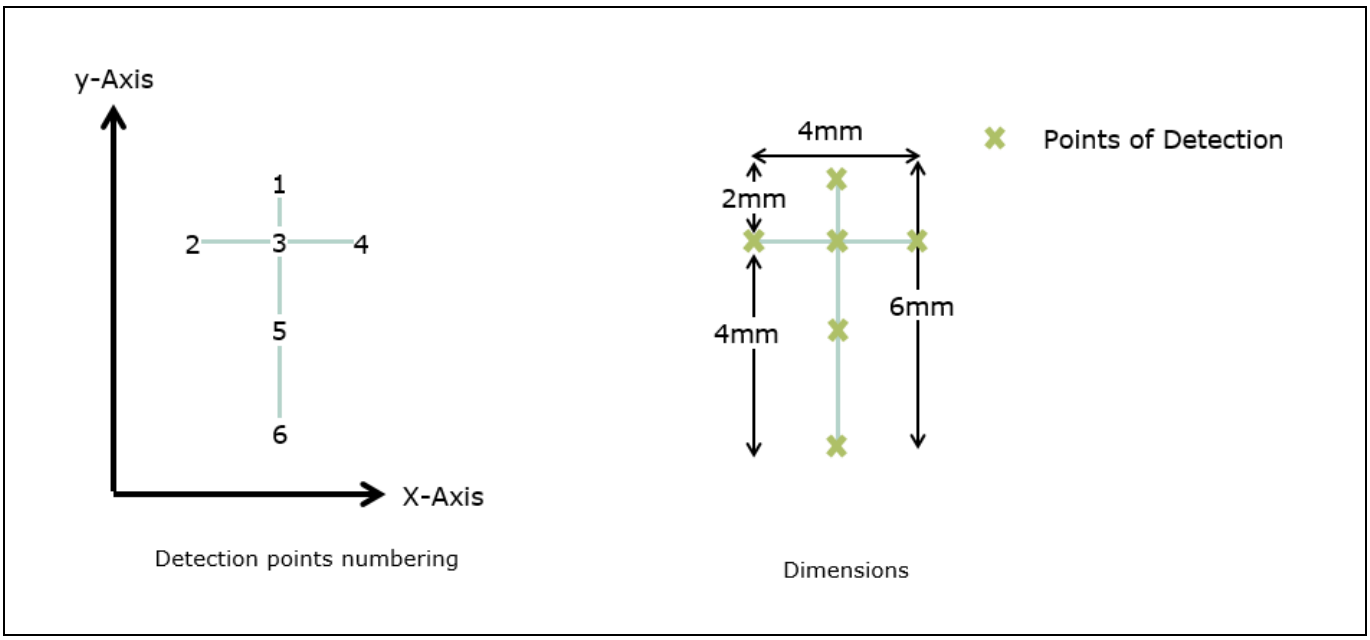

Figure 2 Detection points numbering and dimensions

2.2 Application description and parameters

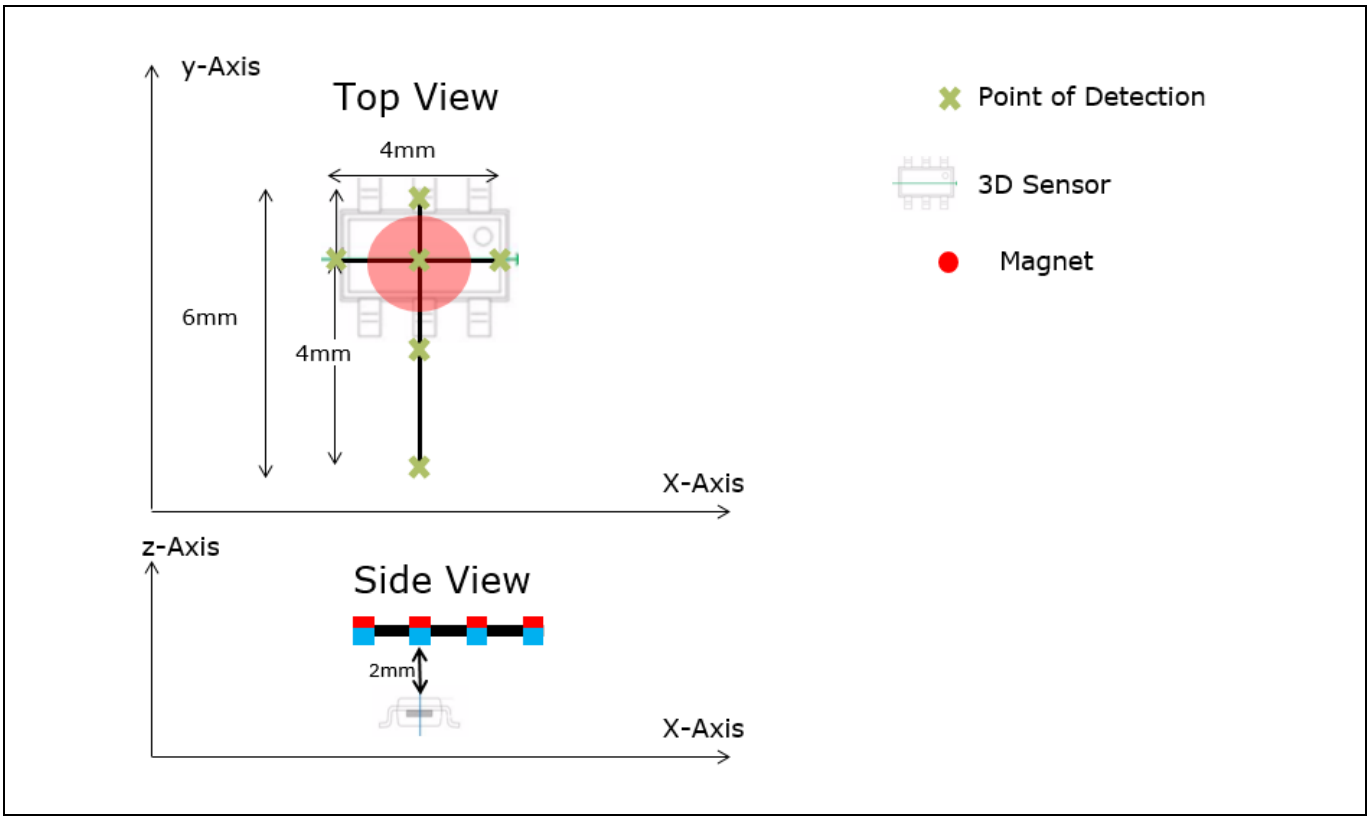

Figure 3 Application description and parameters

3 Solution proposal

Table 1 Solution parameters

Magnet		S-04-04-N
Shape		Pill
Material		NdFeB
Magnetic remanenz	B_R	1350 mT (simulated)
Outer diameter	Ø	4 mm
Height	h	4 mm
Air gap[1]	AG_{mech}	4.6 mm

[1] AG_{Mech} = distance between sensor surface and magnet surface.

3.1 Solution: magnetic figures x-movement: x = -2…2 mm

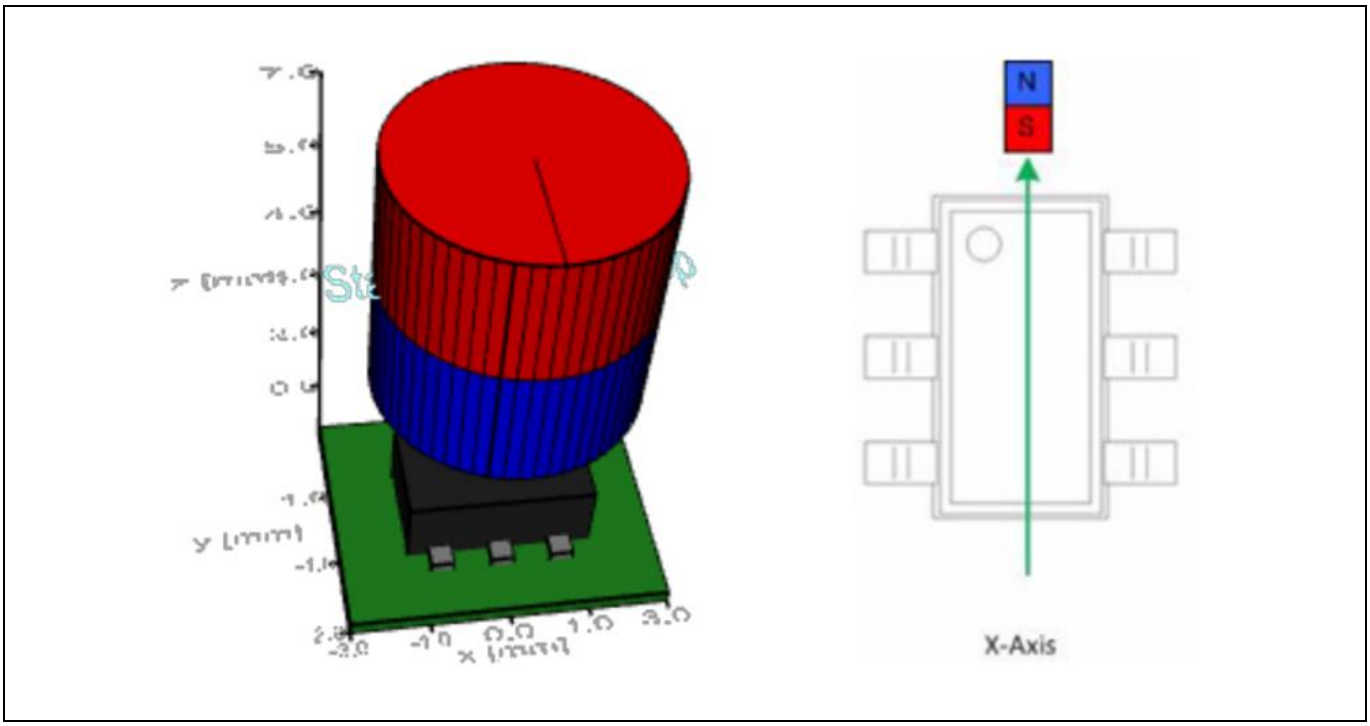

Figure 4 Sensor and magnet; X-axis definition

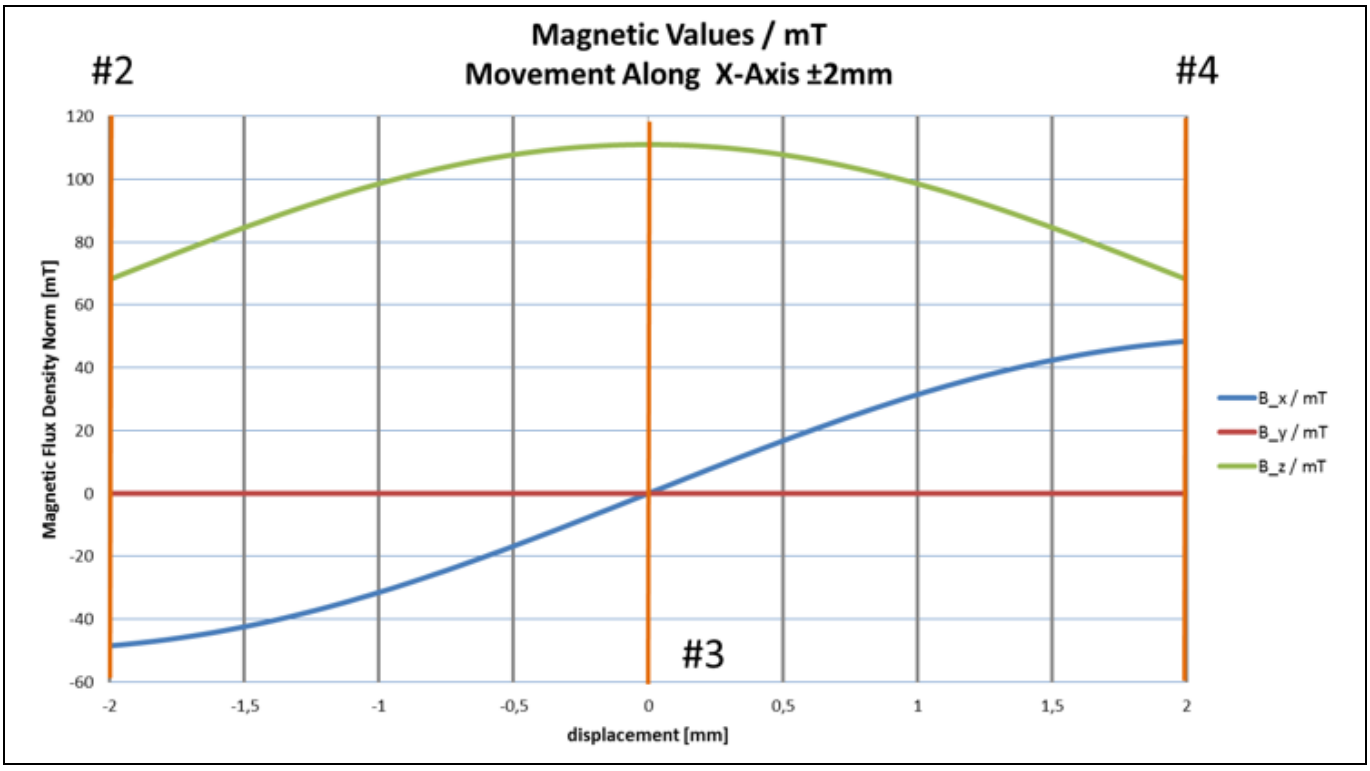

Figure 5 Field components at points of detection #2, #3 and #4

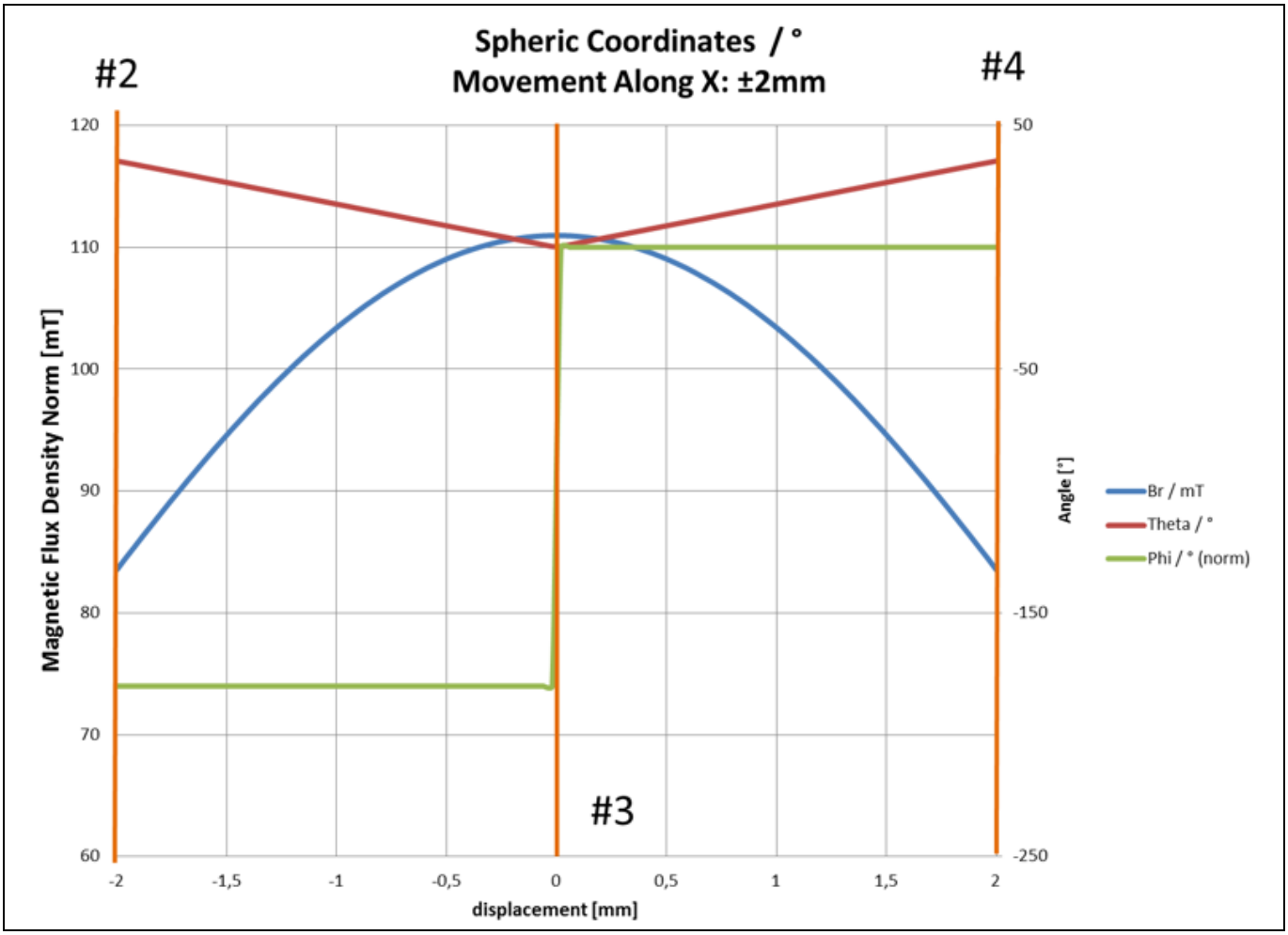

Figure 6 Spheric coordinates at points of detection #2, #3 and #4

3.2 Solution: magnetic figures y-movement: y = -2…4 mm

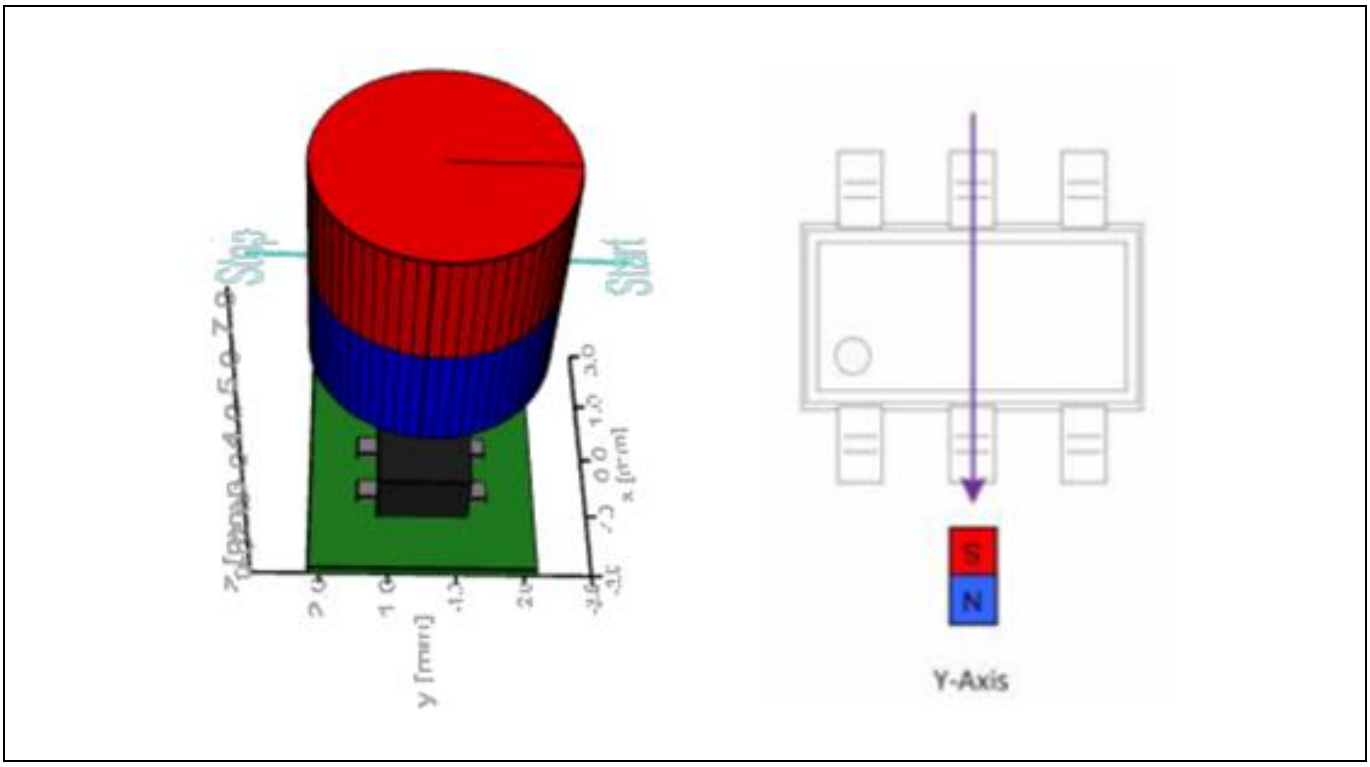

Figure 7 Sensor and magnet; Y-axis definition

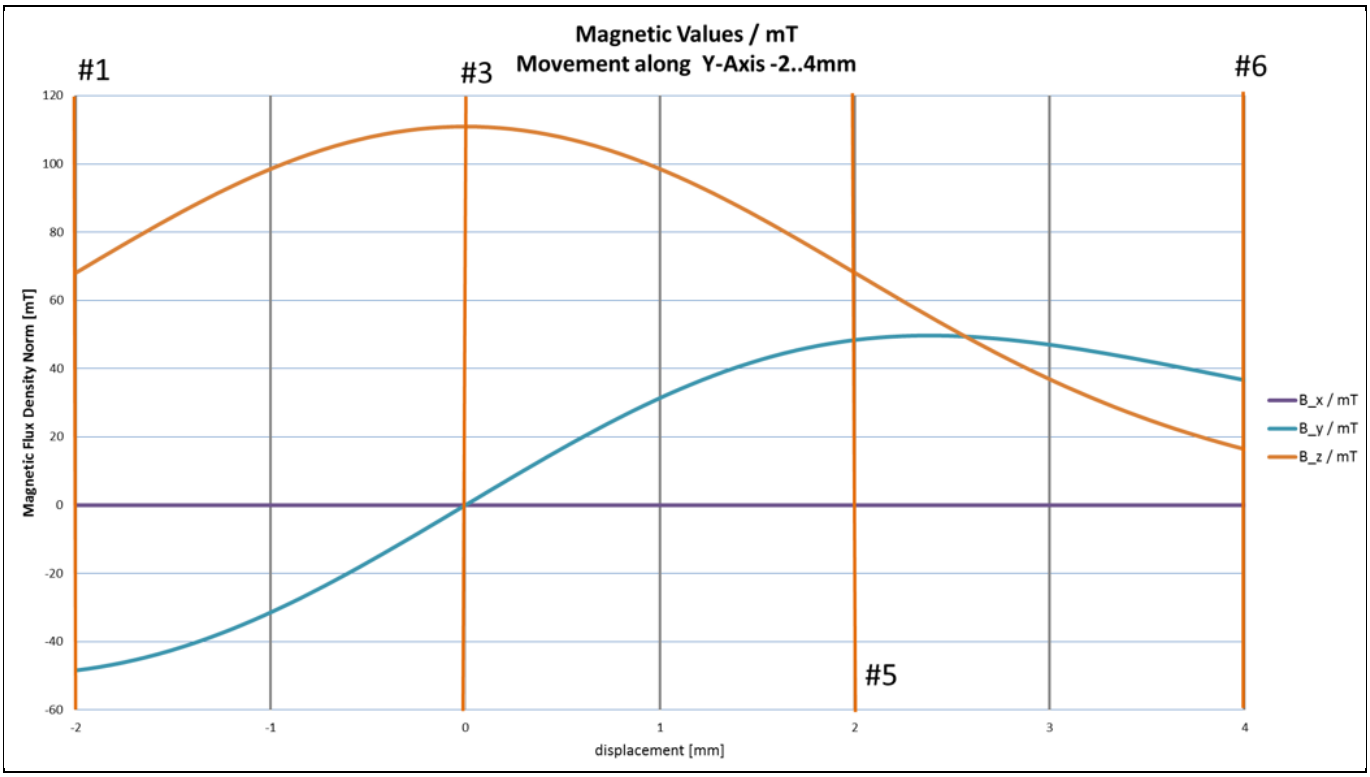

Figure 8 Field components at points of detection #1, #3, #5 and #6

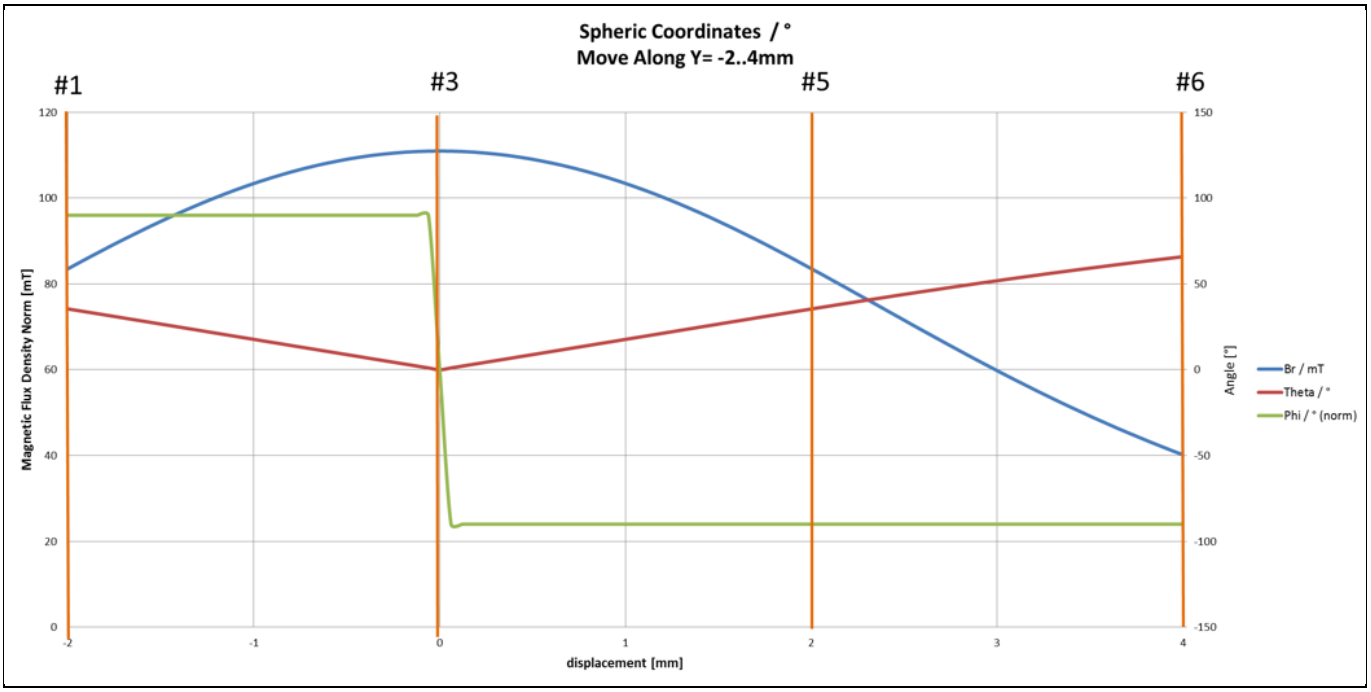

Figure 9 Spheric coordinates at points of detection #1, #3, #5 and #6

3.3 Magnetic values

The following table indicates the magnetic values at room temperature on idle conditions. Magnet and sensor variations are not considered!

Note: *It is strongly recommended to work with spherical coordinates or at least with ratios of the values. Magnetic values only are temperature dependent.*

Table 2 Magnetic values at room temperature on idle conditions

Point	x [mT]	y [mT]	z [mT]	Phi [°]	Theta [°]	Br [mT]
#1	0	-48	68	90	35	84
#2	-48	0	68	-180	35	84
#3	0	0	111	-	0	111
#4	48	0	68	0	35	84
#5	0	48	68	-90	35	65
#6	0	37	16	-90	66	40

Revision history

Document version	Date of release	Description of changes
1.0	2018-09-17	• editorial changes • graphics updated • removed “Chapter 3.1 Solution: magnetic figures y-movement”
0.1	2018-09-13	• Initial creation

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Edition 2018-09-17

Published by

Infineon Technologies AG

81726 Munich, Germany

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Document reference

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