



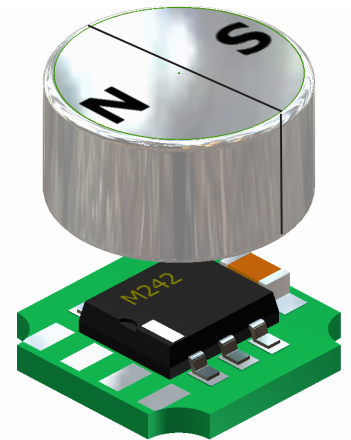
# AKM EM-3242 360 Deg Angle Position Ref Design without “In Range” Detection RD101-EM3242

The RD101-EM3242 is a reference design for the AKM EM-3242 Non-Contact Angle Position Sensing IC. The EM-3242 senses the angle of magnetic field component in the top plane of the device package. The EM-3242 provides an analog output voltage of 10% to 90% of the supply voltage for a mechanical angle range of 360 degrees of rotation. The EM-3242 has two operating modes. One with the “In Range” detector enabled and one with the “In Range” detector disabled. The “In Range” detector includes internal circuitry which causes the output voltage to drop to 0V whenever the magnetic field level at the EM-3242 is greater than 60mT or less than 10mT.

This reference design illustrates the operating mode which has the “In-Range” detector disabled. Please note that the PDN (Power Down) function is also disabled in this mode.

GMW offers a development kit that can be used to demonstrate this reference design. The kit P/N is AN\_134KIT

RD102-EM3242 details the design for a angle sensor that has the “In Range” detector enabled and the PDN (Power Down) enabled. The engineering development kit for RD102-EM3242 is AN\_133KIT.



EM-3242 on PCB with 0.250” dia.. X 0.150 thick SmCo24 magnet (55B0082).

## FEATURES

- 360 Degree Non-Contact Magnetic Angle Position Sensing
- Analog Output 10% to 90% of VDD
- Nonlinearity less than 3.5 deg at 3V
- Magnetic to EM-3242 separation of 0.120” to 0.190” (55B0082 magnet)
- Tolerant of mechanical misalignment
- Expanded Magnet to IC separation with increased non-linearity

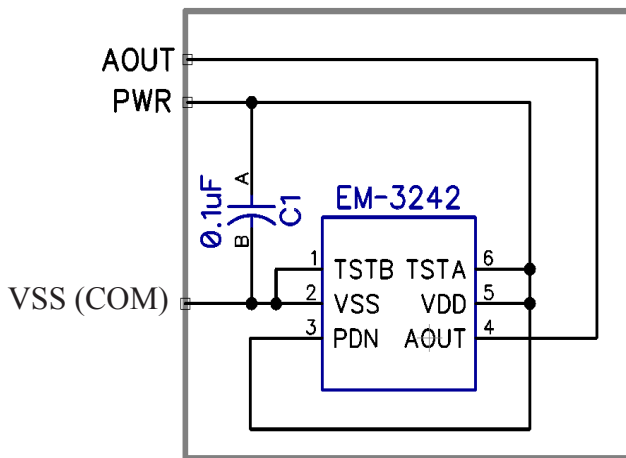
- Only 1 external component required ( 0.1uF)
- Less than 10mA operating current
- Ratio-metric output
- Very small 6 pin IC package (3.6mm x 4.2mm).
- Circuitry fits on a 0.25” x 0.25” PCB.
- 10 Bit Resolution (0.36 deg)

## Reference Documents

- EM-3242 Specification Sheet - July, 2008
- 55B0082 Spec Sheet (0.25”dia. x 0.15”T SmCo24 Magnet)
- 55B0081 Spec Sheet (0.15”dia. x 0.15”T SmCo24 Magnet)
- 55C0126 Spec Sheet (0.25”Sq. x 0.10”T SmCo24 Magnet)
- AN\_133KIT- Eng Development Kit
- RD102-EM3242 Ref Design for Angle sensing with “In Range” Detector

## Magnetic flux density (Magnetic Field) units of Gauss and Tesla

- 1G=100uT or 0.1mT
- 10G =1mT
- 100G =10mT



Schematic Diagram

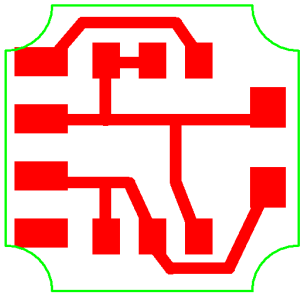
## Bill of Material

- IC-1 EM-3242 IC
- C1- 0.1uF Ceramic cap-0603 SMD +/-10%
- PCB FR-4, 0.8mm thick, 0.5 oz copper
- 55B0082 Cylindrical Magnet or
- 55B0081 Cylindrical Magnet or
- 55C0126 Square Magnet

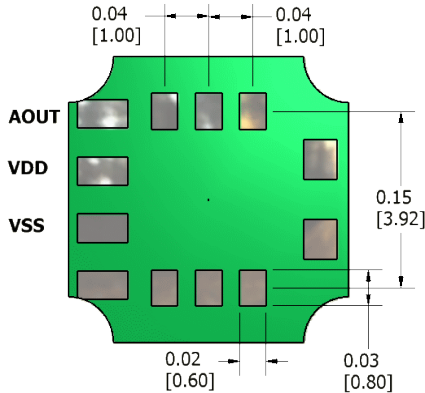
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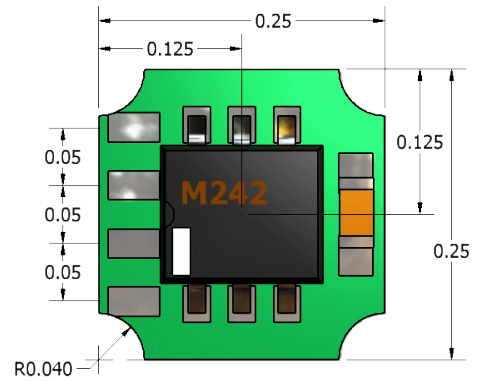
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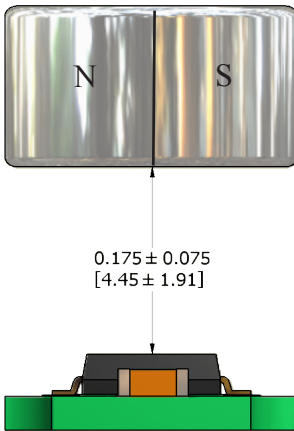
PCB Artwork



EM-3242 Solder PAD Recommendation



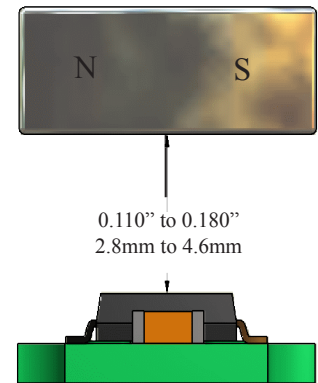
PCB Outline Diagram



Air Gap Operating Range for the 55B0082 Cylindrical Magnet



Air Gap Operating Range for the 55B0081 Cylindrical Magnet



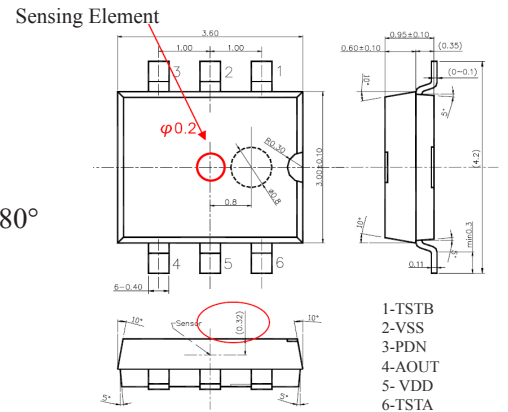
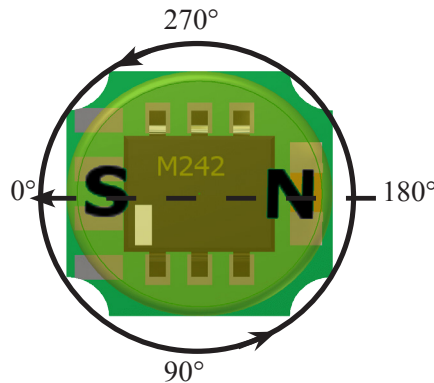
Air Gap Operating Range for the 55C0126 Square Magnet

*Air-Gap ranges to produce specified linear output. See graph on page 4 for expanded ranges*

## Magnet Orientation

Output increases as magnet is rotated CounterClockwise. See output curve, next page

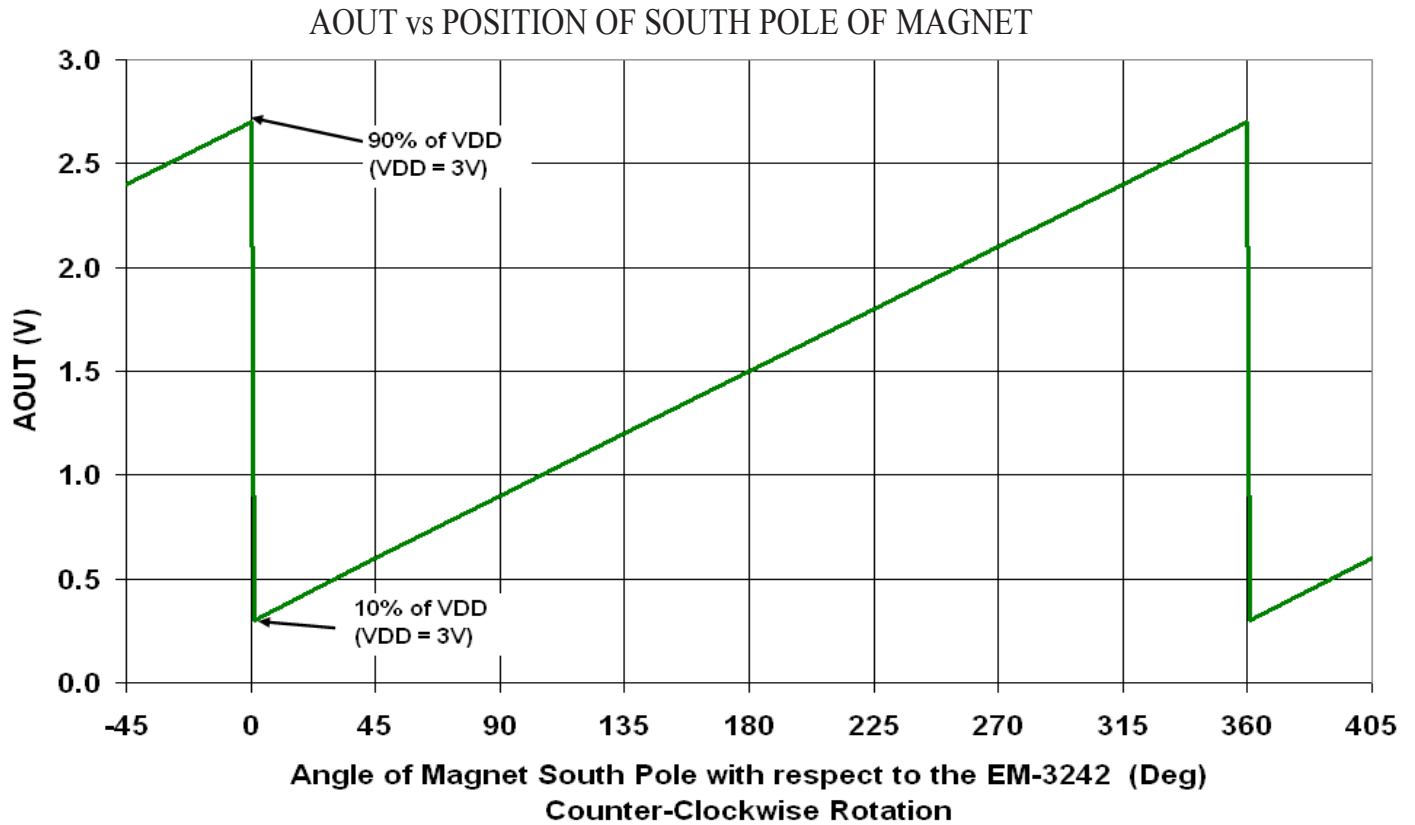
Zero Degrees occurs when the South Pole of the magnet is in line with pin and 6 of the IC.



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### 360 to 0 Degree Transition

When the Angle of rotation approaches the 360 degree position, the output will approach 90% of the supply voltage and then abruptly change to 10% of VDD and then start increasing again as the angle increases. This transition can be as wide as 0.5deg. If the position of the magnet is held steady at a point within the 0.5 deg. range, there is a possibility that the output will randomly switch between the 90% level and the 10% level. Both levels represent the same angle of 0 deg. If the output is filtered with a low pass filter, the average voltage output could be approximately 50% of VDD, thus creating an error in the reading. This can be avoided by not using a low pass filter. If a uP is used to sample the output, it can simply register a 10%VDD reading and a 90%VDD reading as the same angle (zero degrees).

### Non-Linearity Specifications.

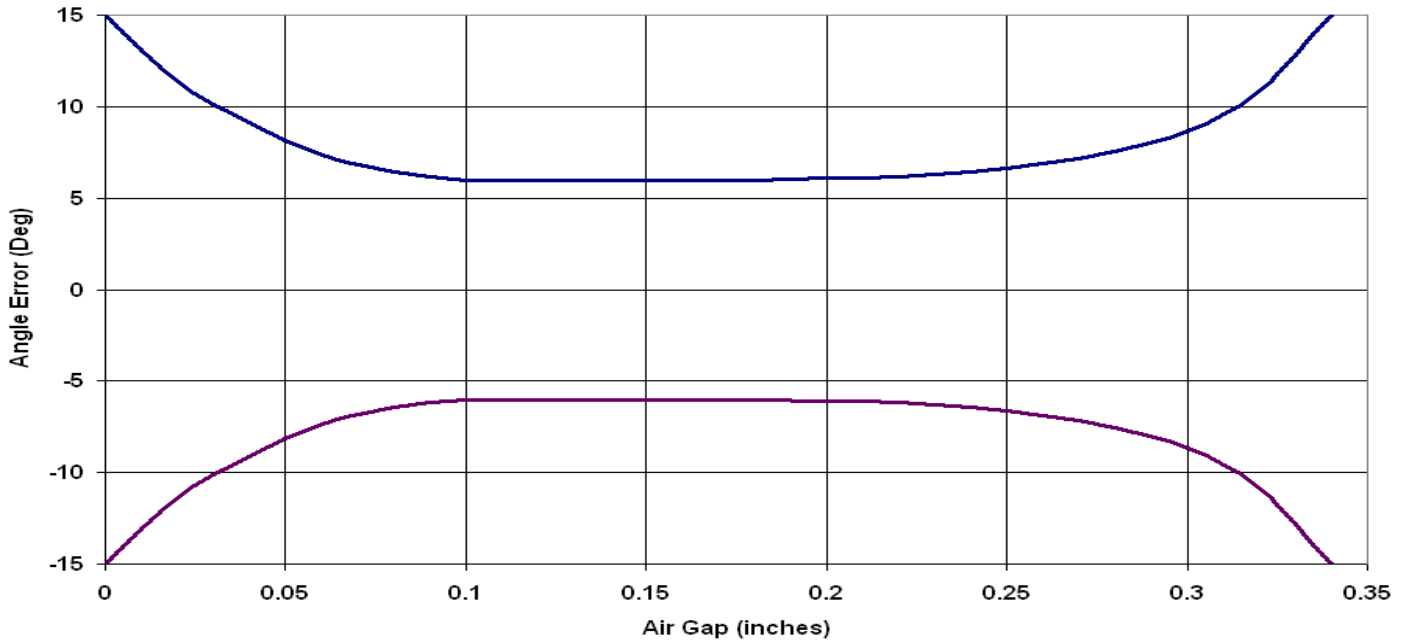
The EM-3242 is specified to operate within +/-6 degrees of non-linearity when the supply is 3V over the magnetic field range of 20mT to 40mT. With the "In Range" detector disabled, as in this case, the sensor will continue to function normally over a wider range, but with an increased angle error. The following graphs show the relationship between the non-linearity range and the air gap between the magnet and sensor for the 55B0082 magnet.

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Expanded Range Operating Mode  
Angle Error vs Air Gap for the 55B0082 Magnet  
VDD = 3.0V



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