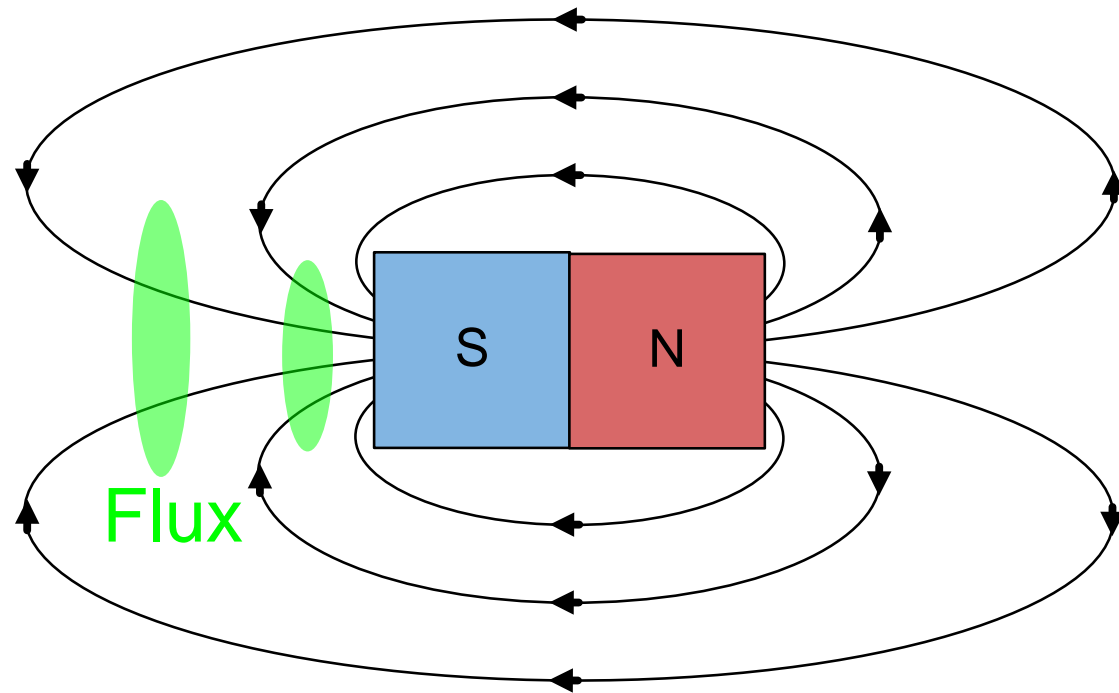


Magnetic Field Calculator

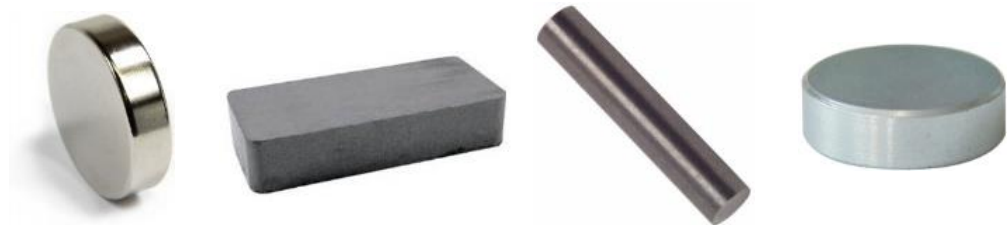
TI Precision Labs – Magnetic Position Sensing

Presented and prepared by Gloria Kim

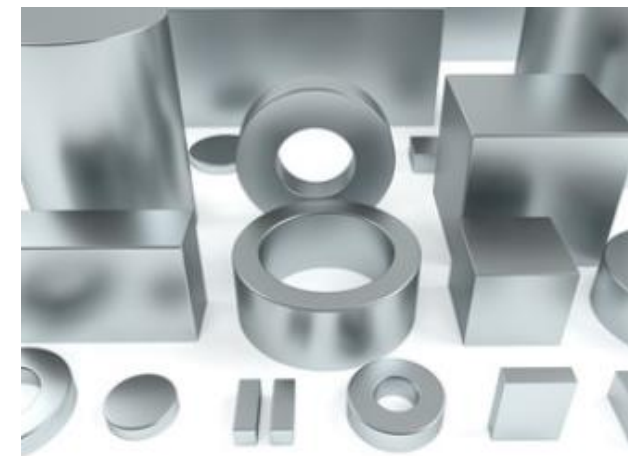
Magnets and flux density overview



- Flux density unit: Gauss (G) or Tesla (T)
 - $10\text{ G} = 1\text{ mT}$
- Common magnet materials: NdFeB, Ferrite, AlNiCo, SmCo



- Many possible shapes, sizes, and magnetizations



Equations to determine magnetic flux density

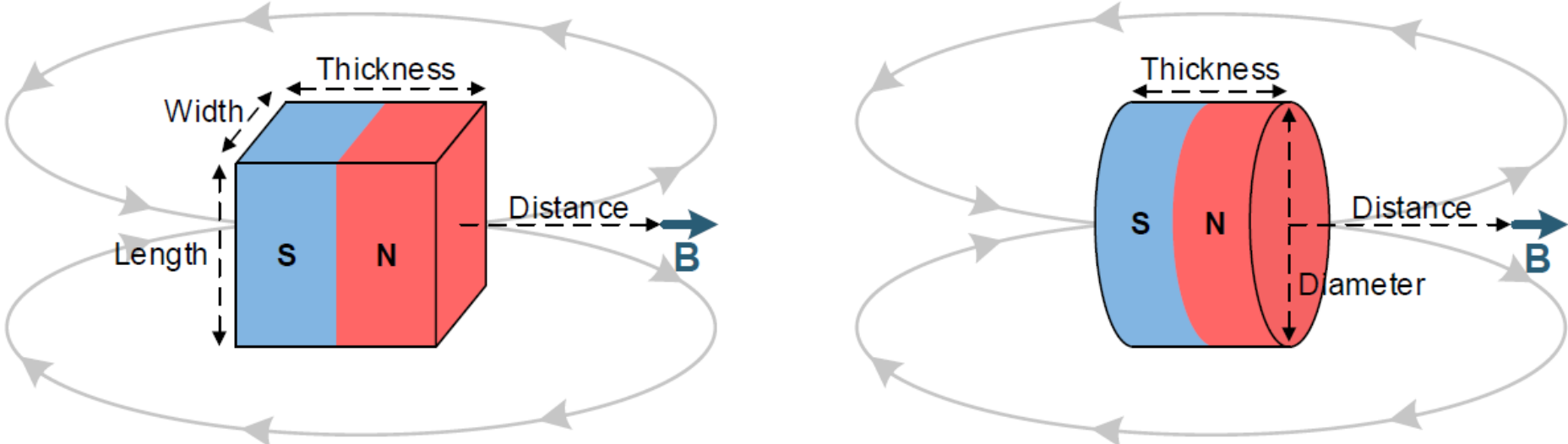


Figure 20. Rectangular Block and Cylinder Magnets

Use Equation 1 for the rectangular block shown in Figure 20:

$$\vec{B} = \frac{B_r}{\pi} \left(\arctan\left(\frac{WL}{2D\sqrt{4D^2 + W^2 + L^2}}\right) - \arctan\left(\frac{WL}{2(D + T)\sqrt{4(D + T)^2 + W^2 + L^2}}\right) \right) \tag{1}$$

Use Equation 2 for the cylinder shown in Figure 20:

$$\vec{B} = \frac{B_r}{2} \left(\frac{D + T}{\sqrt{(0.5C)^2 + (D + T)^2}} - \frac{D}{\sqrt{(0.5C)^2 + D^2}} \right)$$

where

- W is width.
- L is length.
- T is thickness (the direction of magnetization).
- D is distance.
- C is diameter.

(2)

Generic magnetic field calculator on ti.com

Rectangle

$$\vec{B} = \frac{B_r}{\pi} \left(\arctan\left(\frac{WL}{2D\sqrt{4D^2 + W^2 + L^2}}\right) - \arctan\left(\frac{WL}{2(D+T)\sqrt{4(D+T)^2 + W^2 + L^2}}\right) \right)$$

Cylinder

$$\vec{B} = \frac{B_r}{2} \left(\frac{D+T}{\sqrt{(0.5C)^2 + (D+T)^2}} - \frac{D}{\sqrt{(0.5C)^2 + D^2}} \right)$$

The screenshot shows the Texas Instruments website for the DRV5013. A red circle highlights a small 'Magnetic Field Calculator' widget located in the 'Featured tools and software' section of the product page.

The 'Magnetic Field Calculator' interface includes the following inputs and outputs:

- Magnet Material: Ferrite
- Remanence (Br): 4000 Gauss
- Magnet Shape: Rectangle Cylinder
- Width: 15
- Length: 15 mm
- Thickness: 7
- Distance: 10 mm
- Output: Magnetic flux density B = 26.05 mT

A diagram of a rectangular magnet with South (S) and North (N) poles is shown. Dimensions are labeled: Width, Length, Thickness, and Distance. Magnetic field lines are depicted as loops around the magnet.

Example using magnetic field calculator

Magnetic Field Calculator

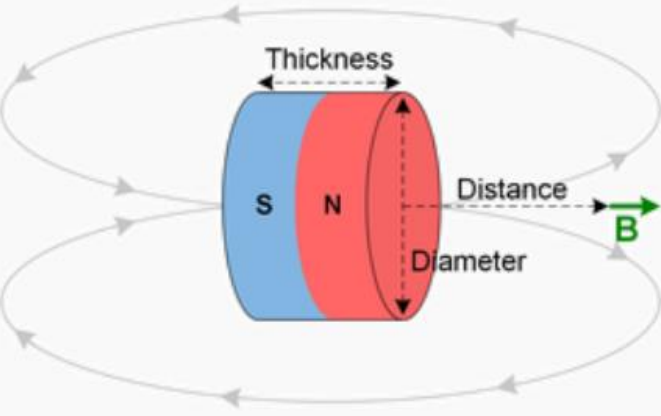
Magnet Material:

Remanence (Br): Gauss

Magnet Shape: Rectangle Cylinder

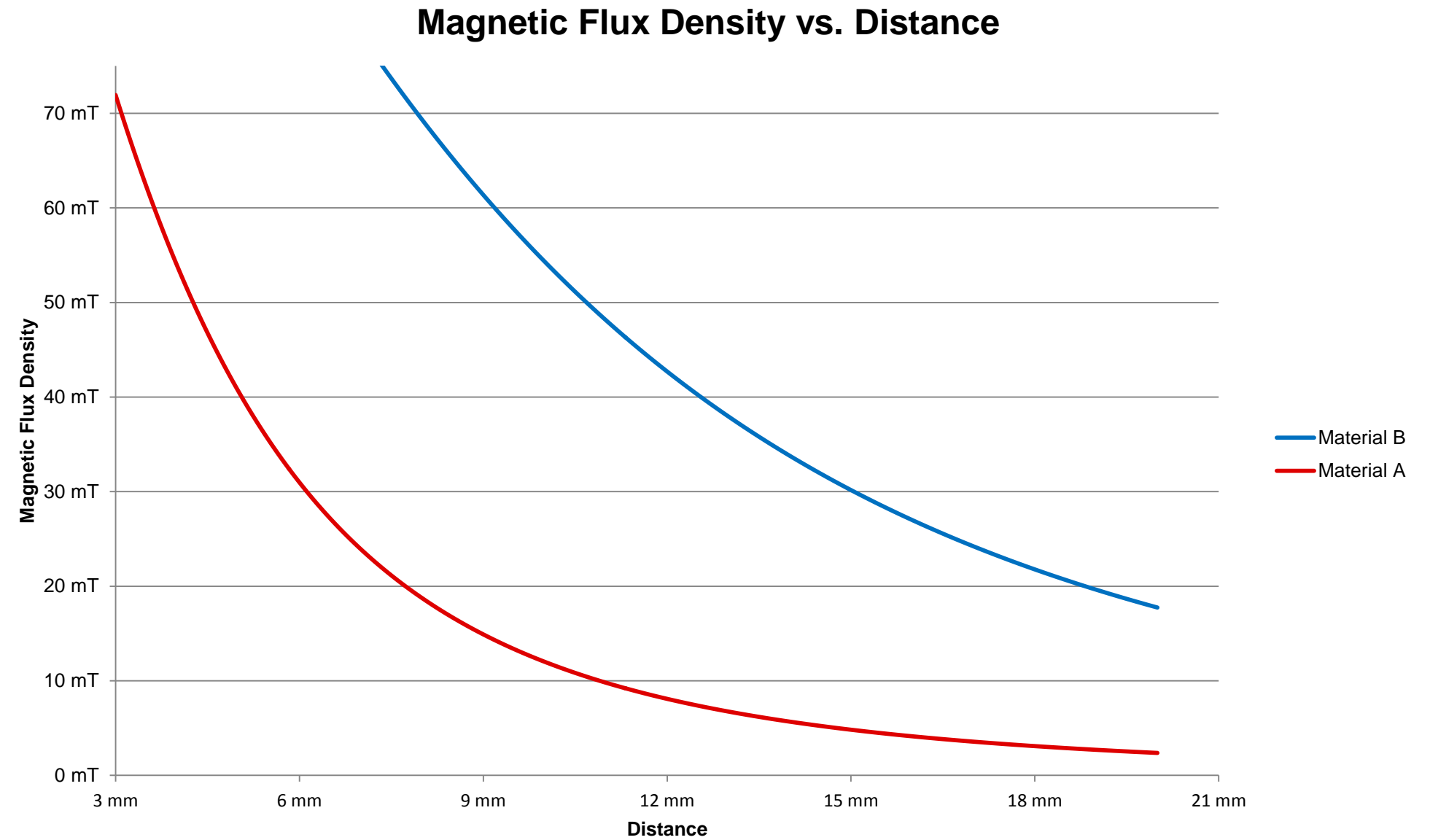
Diameter: mm

Thickness:

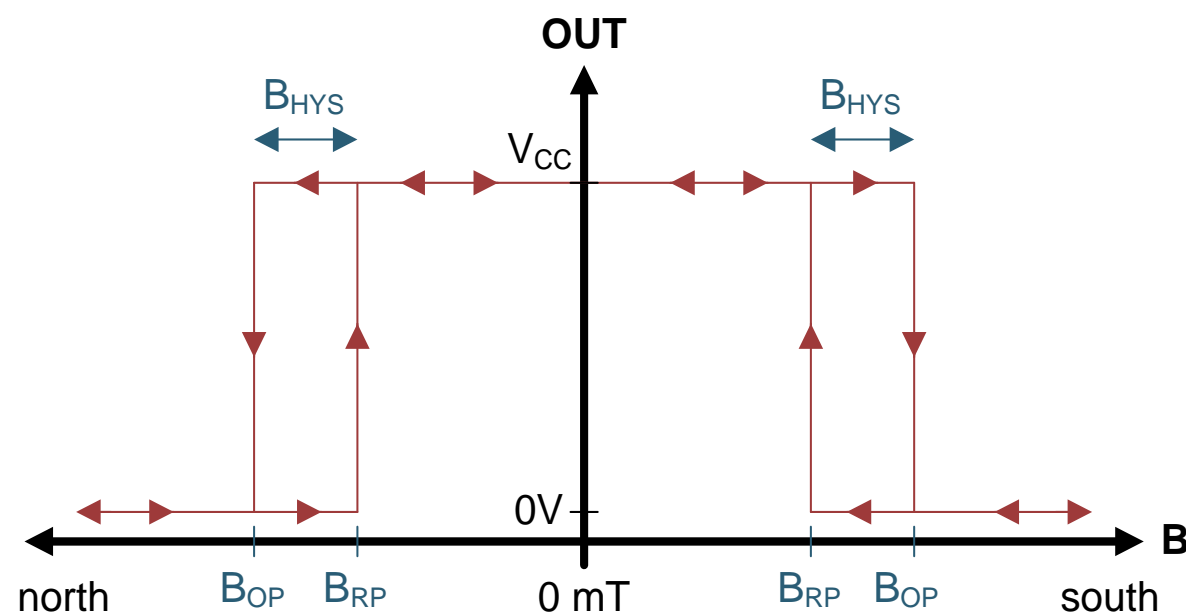


Distance: mm

Magnetic flux density B = 61.37 mT



Switch magnetic field calculator on ti.com



Magnetic Field Calculator

Magnet Material:

Remanence (Br): Gauss

Magnet Shape: Rectangle Cylinder

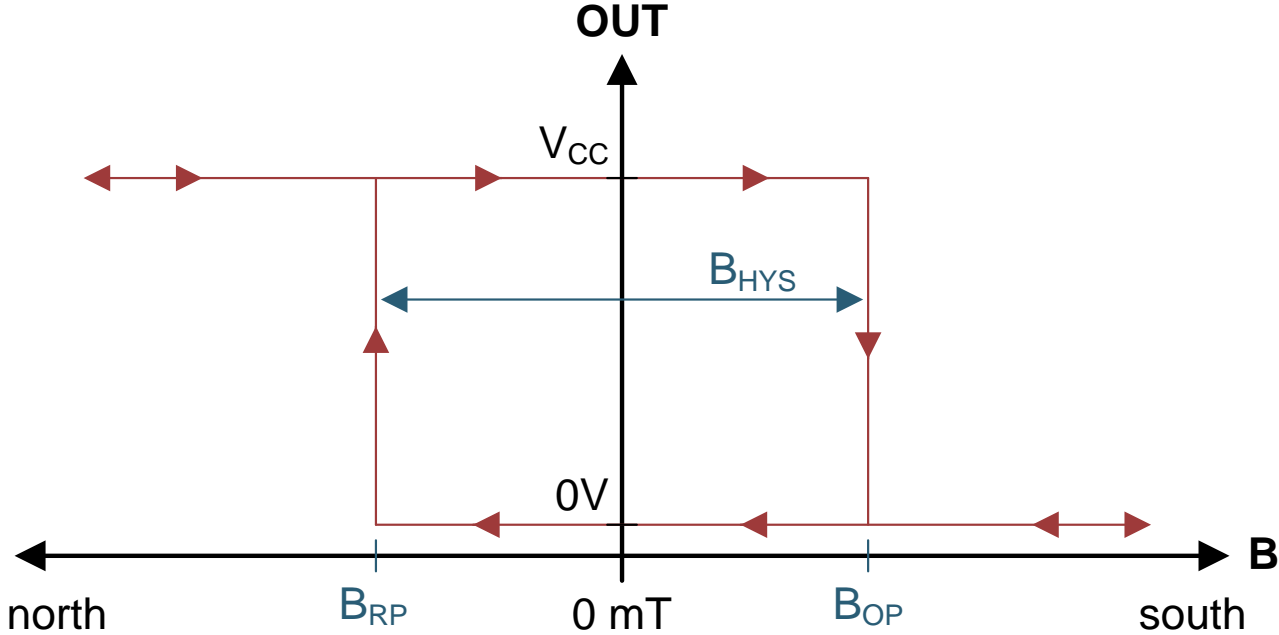
Width:

Length:

Thickness:

DRV5032 Version	Distance of max- B_{OP}	Distance of min- B_{RP}
DRV5032DU	24.99 mm	44.06 mm
DRV5032FA	22.91 mm	54.38 mm
DRV5032FB	22.91 mm	54.38 mm
DRV5032FC	22.91 mm	54.38 mm
DRV5032FD	22.91 mm	54.38 mm
DRV5032AJ	16.99 mm	27.77 mm
DRV5032ZE	4.82 mm	9.14 mm

Latch magnetic field calculator on ti.com



Hall Effect Latch Magnetic Field Calculator

Magnet Material:

Remanence (Br): Gauss

Magnet Shape: Rectangle Cylinder

Width:

Length:

Thickness:

Version	Distance of max- B_{OP} and min- B_{RP}
DRV5015A1	32.58 mm
DRV5015A2	25.49 mm
DRV5015A3	25.49 mm

To find more magnetic position sensing technical resources and search products, visit ti.com/halleffect