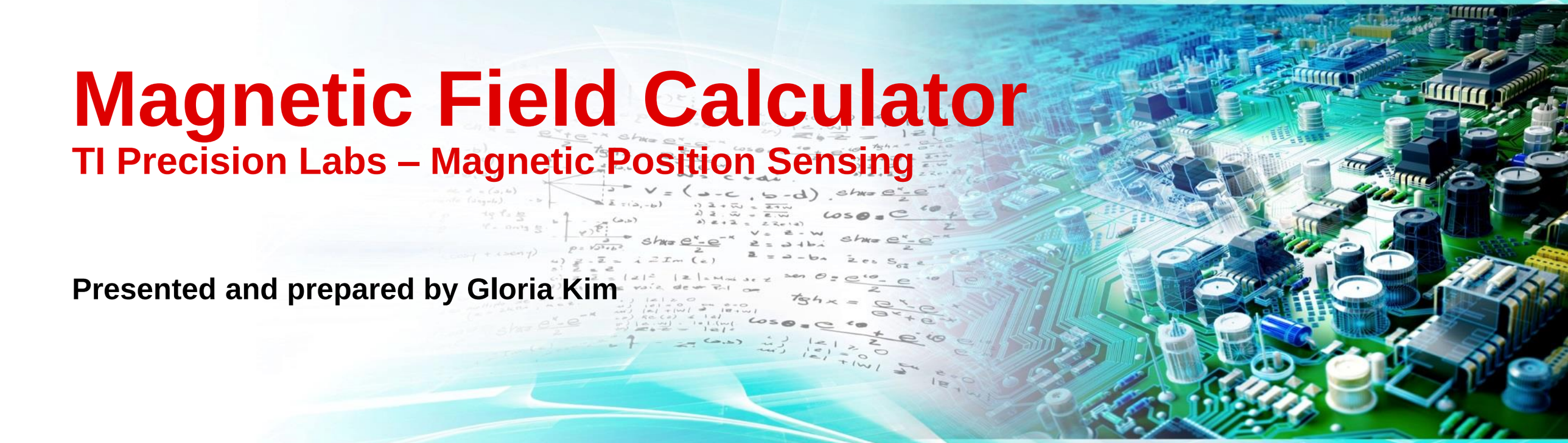
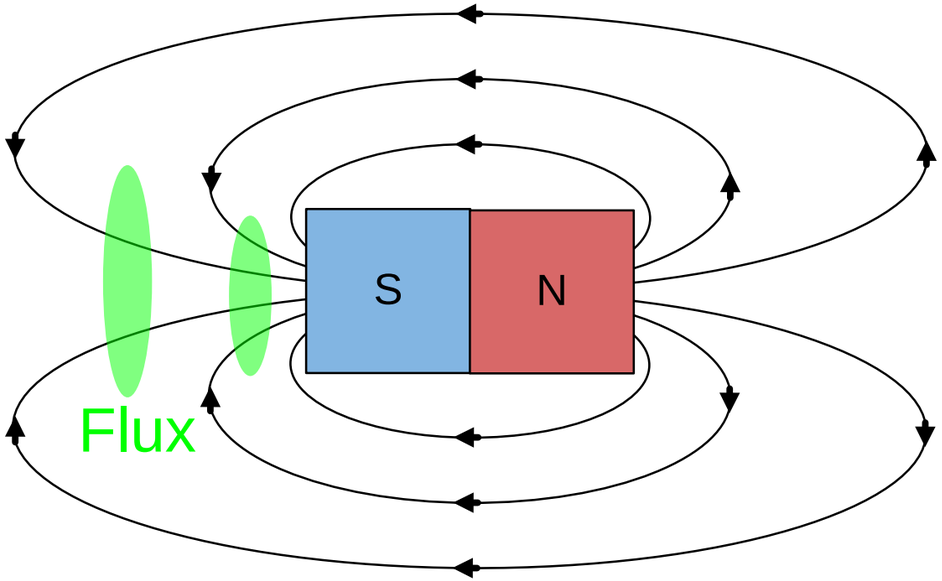
Magnetic Field Calculator

TI Precision Labs – Magnetic Position Sensing

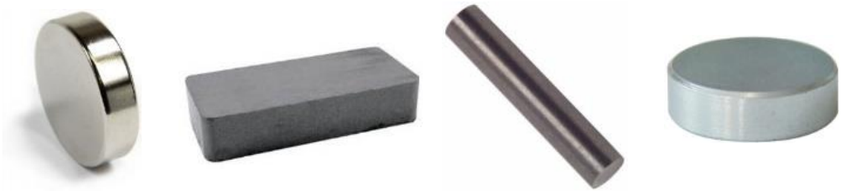


Presented and prepared by Gloria Kim

Magnets and flux density overview



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



- Many possible shapes, sizes, and magnetizations

Equations to determine magnetic flux density

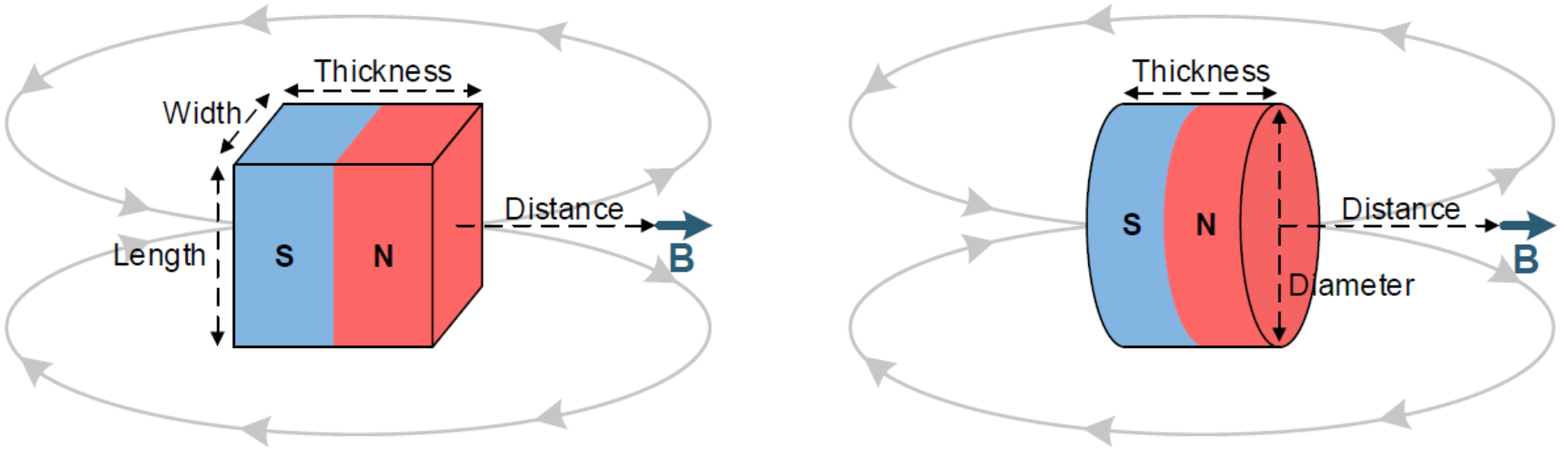


Figure 20. Rectangular Block and Cylinder Magnets

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

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

Use Equation 2 for the cylinder shown in Figure 20:

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

where

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

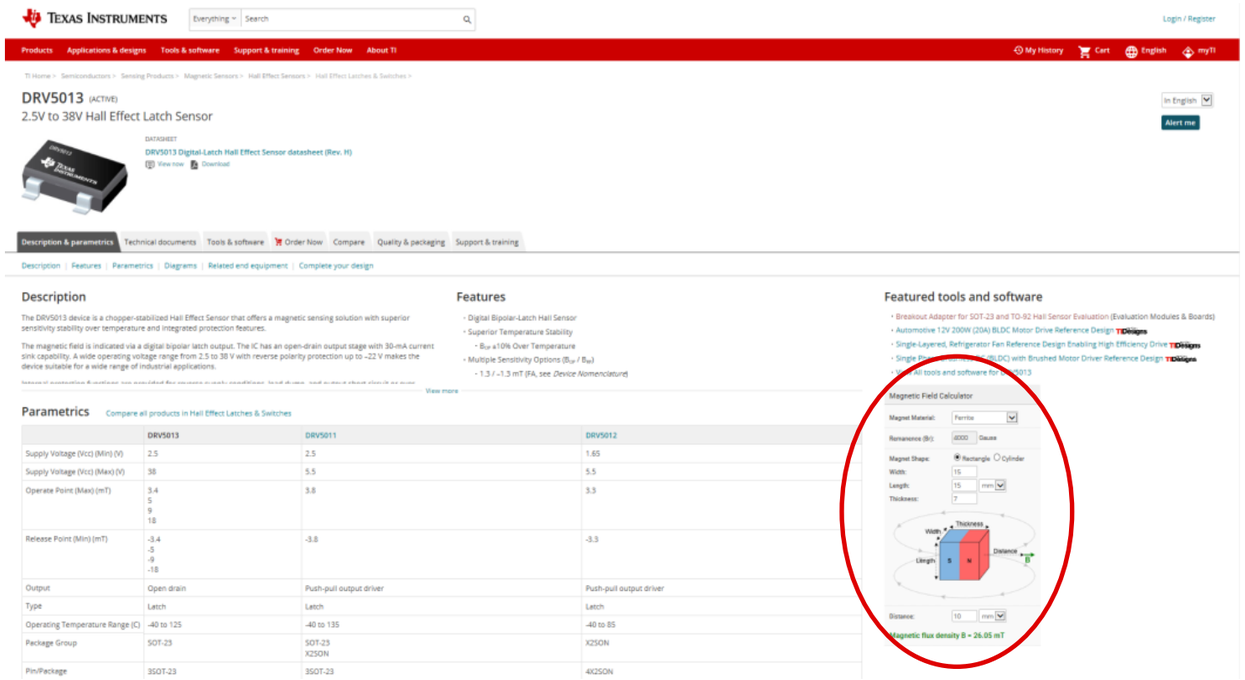
Generic magnetic field calculator on ti.com

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

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



Magnetic Field Calculator

Magnet Material: Ferrite

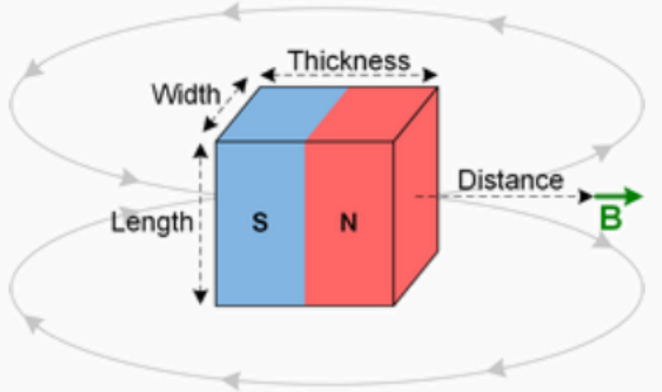
Remanence (Br): 4000 Gauss

Magnet Shape: Rectangle Cylinder

Width: 15

Length: 15 mm

Thickness: 7



Distance: 10 mm

Magnetic flux density B = 26.05 mT

Example using magnetic field calculator

Magnetic Field Calculator

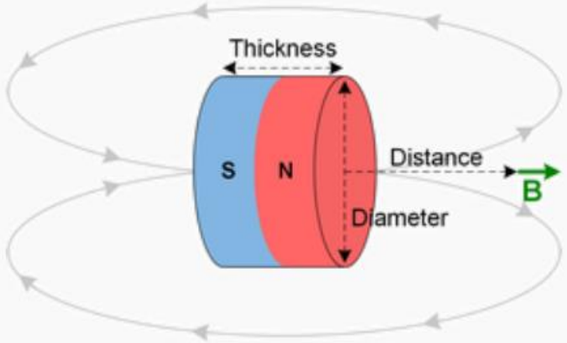
Magnet Material: Other

Remanence (Br): 5000 Gauss

Magnet Shape: Rectangle Cylinder

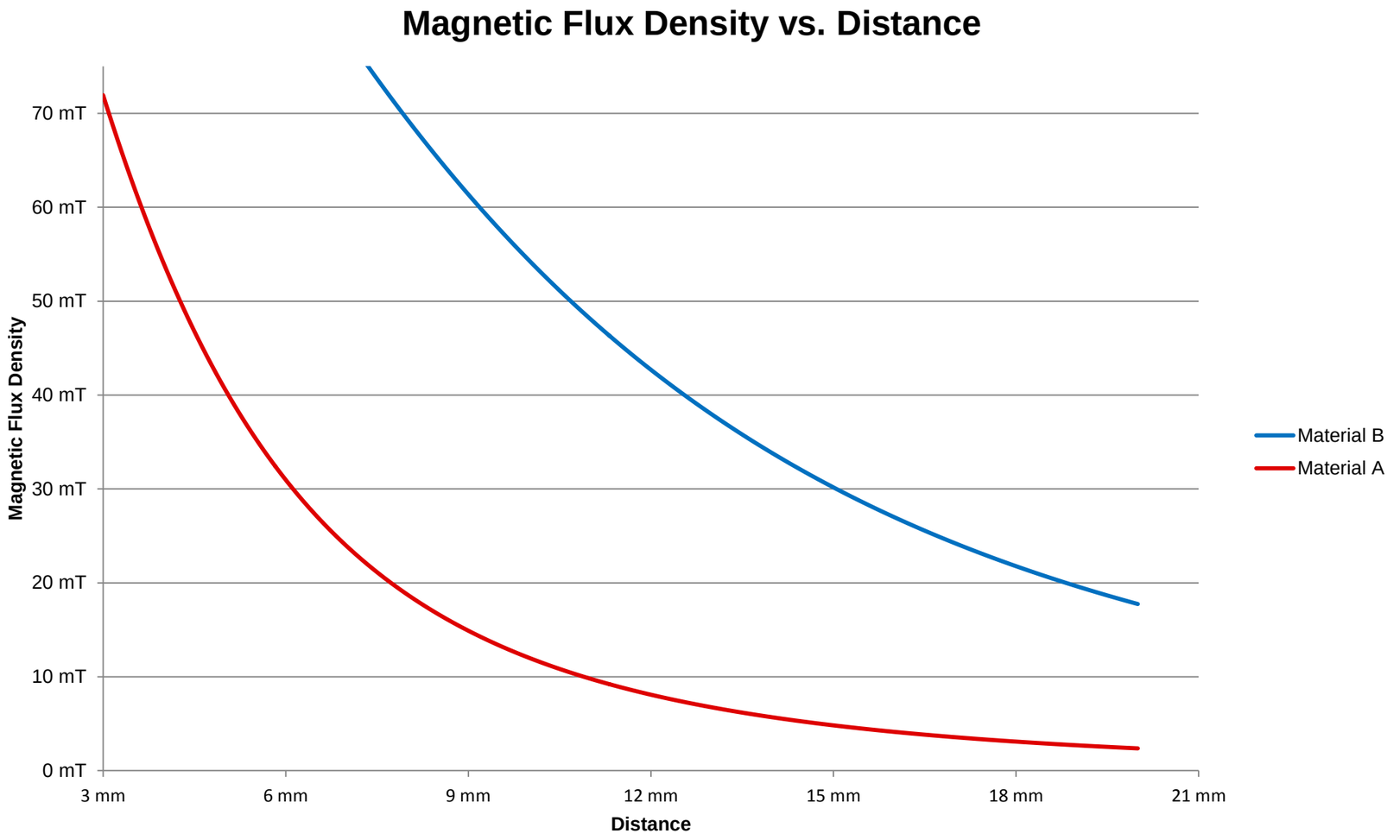
Diameter: 24 mm

Thickness: 10

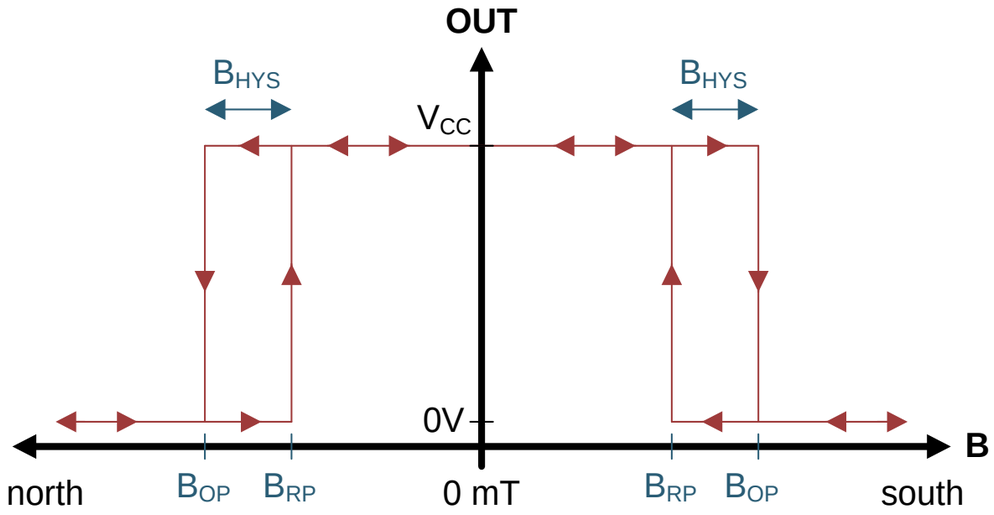


Distance: 9 mm

Magnetic flux density B = 61.37 mT



Switch magnetic field calculator on ti.com



Magnetic Field Calculator

Magnet Material: Ferrite

Remanence (Br): 4000 Gauss

Magnet Shape: Rectangle Cylinder

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Length: 15 mm

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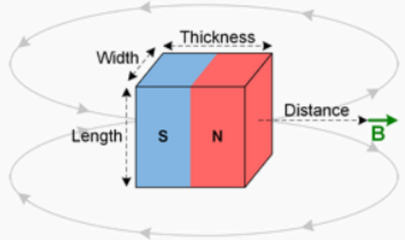
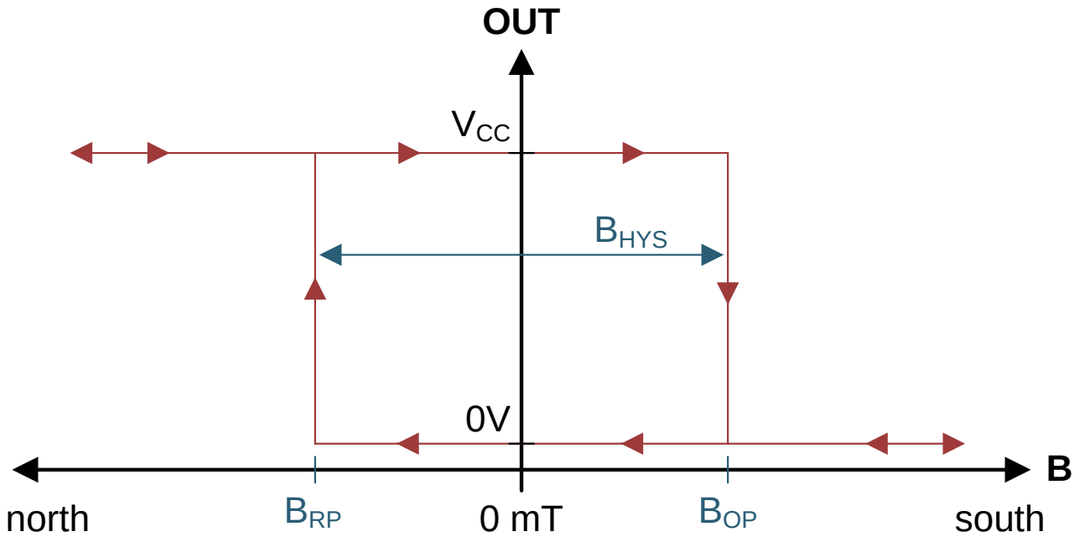
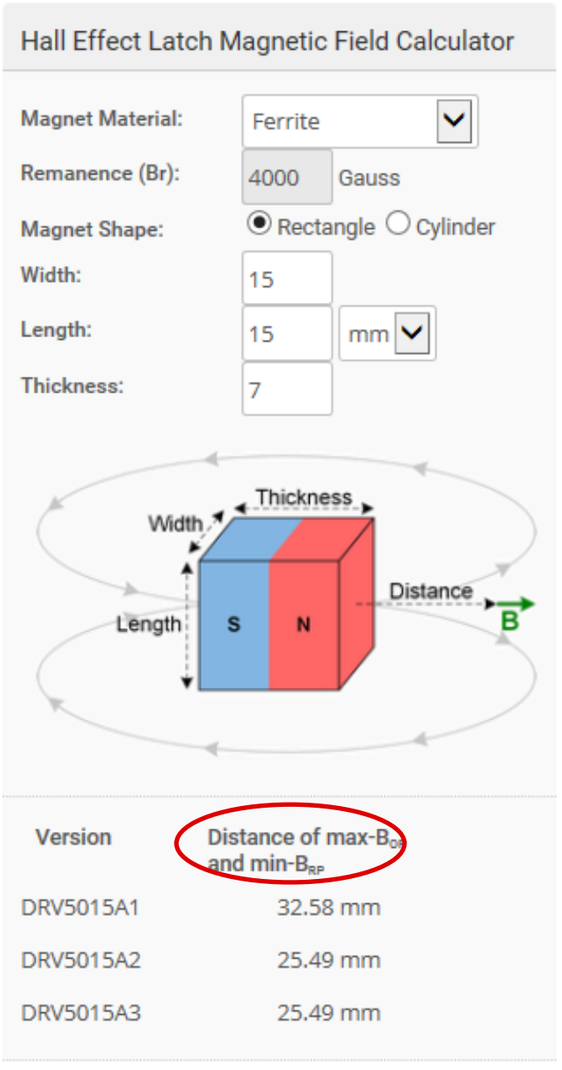


DRV5032 Version	Distance of max-B_{OP}	Distance of min-B_{RP}
DRV5032DU	24.99 mm	44.06 mm
DRV5032FA	22.91 mm	54.38 mm
DRV5032FB	22.91 mm	54.38 mm
DRV5032FC	22.91 mm	54.38 mm
DRV5032FD	22.91 mm	54.38 mm
DRV5032AJ	16.99 mm	27.77 mm
DRV5032ZE	4.82 mm	9.14 mm

Latch magnetic field calculator on ti.com





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