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Texas Instruments New Product Update

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- Phone lines are muted
- Please post questions in the chat or contact your TI sales contact or field applications engineer

Linear 3D Hall-effect Sensors

New Product Update

Kevyn Robins
January 27, 2022

Agenda

- Multi-axis linear and angle position sensor portfolio
- Linear Hall-effect sensor overview
  - Single-axis versus multi-axis sensors
- TI’s new linear 3D Hall-effect sensor: TMAG5273
  - Dedicated interrupt pin
  - Programmable thresholds and tamper detection
  - Configurability
- Example applications
- Tools and resources

Please message Mekre Mesganaw, Applications Engineer, if you have any questions throughout this presentation.

Linear Hall-effect sensor portfolio

Legend:

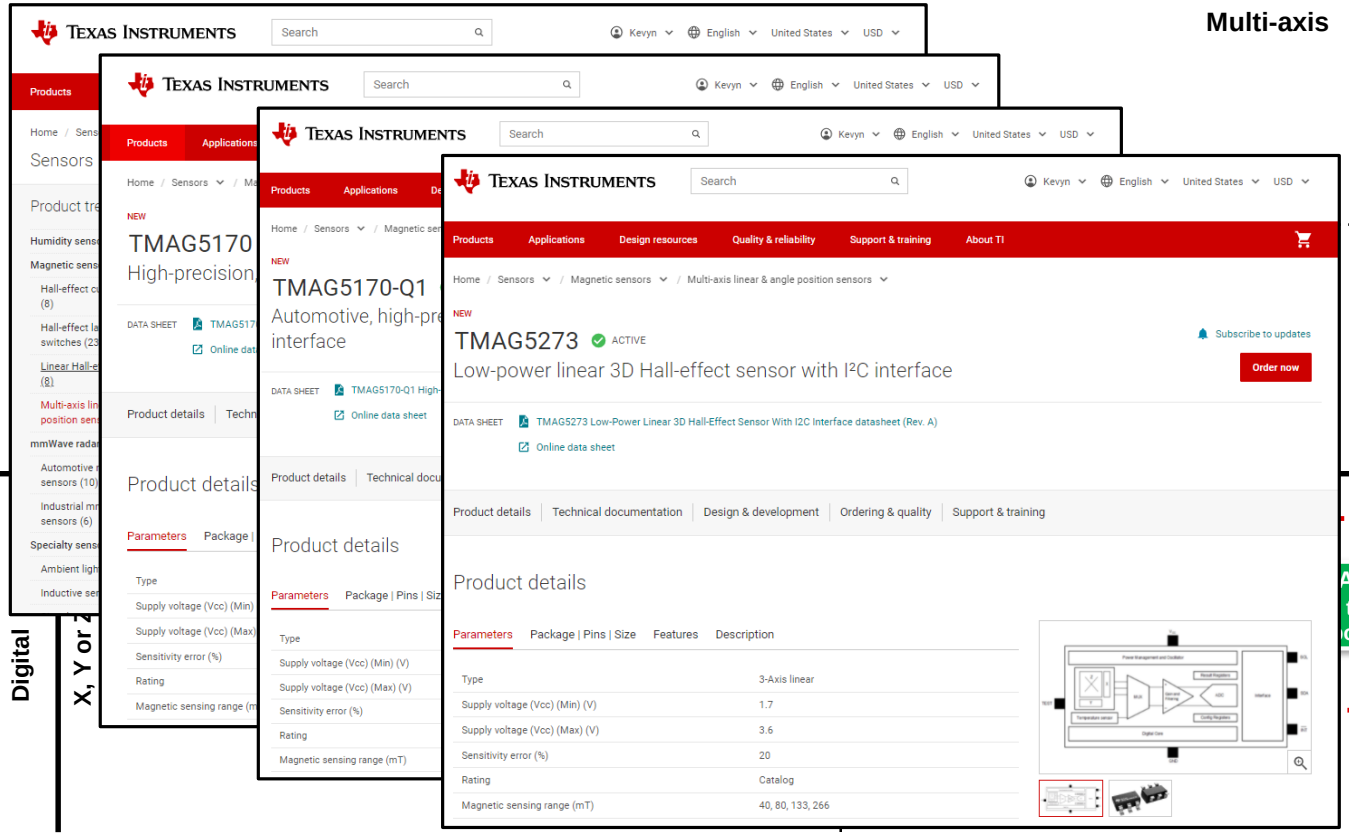
Automotive option available

TO-92 option available

Multi-axis

Digital

X, Y or Z

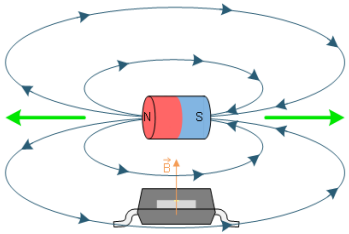


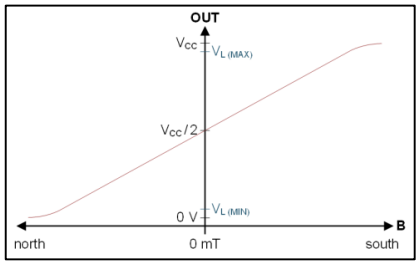
To learn more about the TMAG5170, watch the previously recorded “Hall Sensors” webinar at www.ti.com/npu

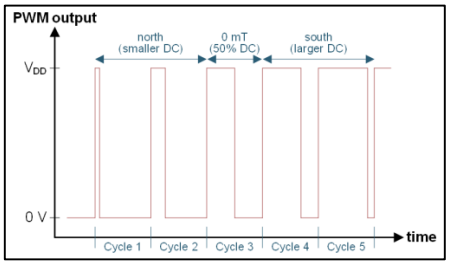
Single-axis linear Hall-effect sensors

- Single-axis (1D) sensors output a signal that's proportional to magnetic flux density to measure precise movement
- Typically, only sensitive to magnetic fields that are perpendicular to the surface of the package

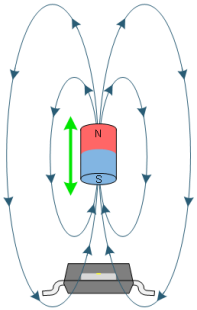
Bipolar

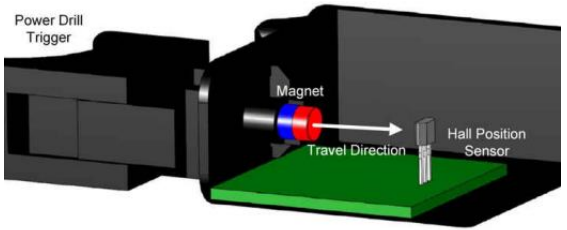


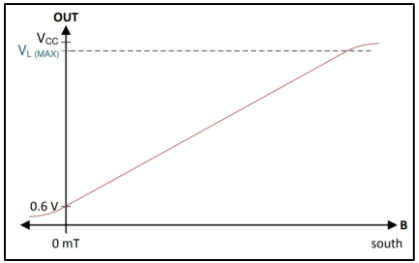




Unipolar

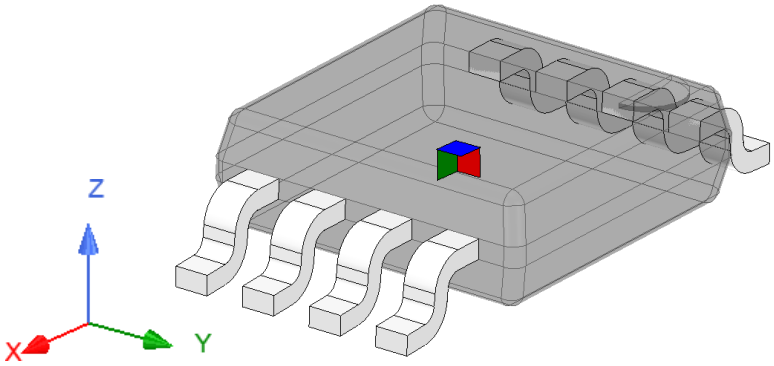


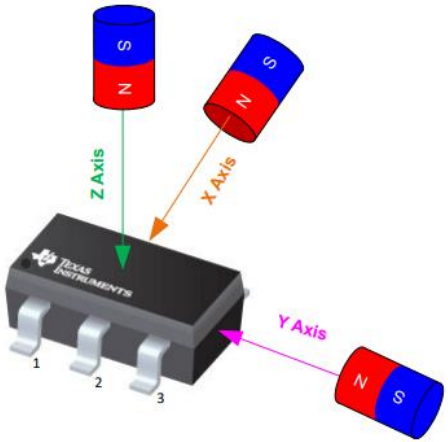




Multi-axis linear Hall-effect sensors

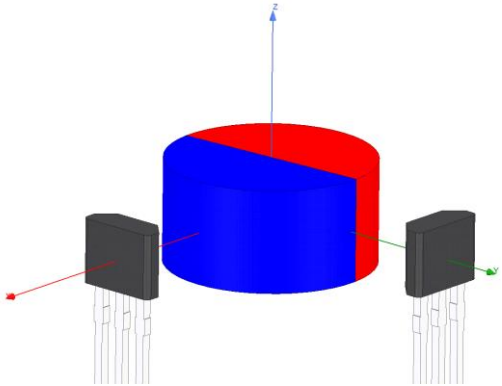
- Three-dimensional (3D) sensors enable optimal absolute position measurements with a high degree of flexibility in function and placement
- Integrates three independent Hall elements in the X, Y and Z axes in a single package



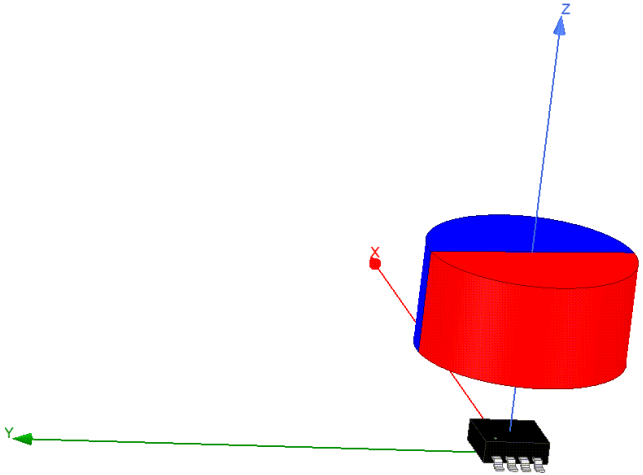


1D versus 3D sensors: angle measurement

1D linear implementation



3D linear implementation



TMAG5273

Low-power, linear 3D Hall-effect sensor with I^2C output interface

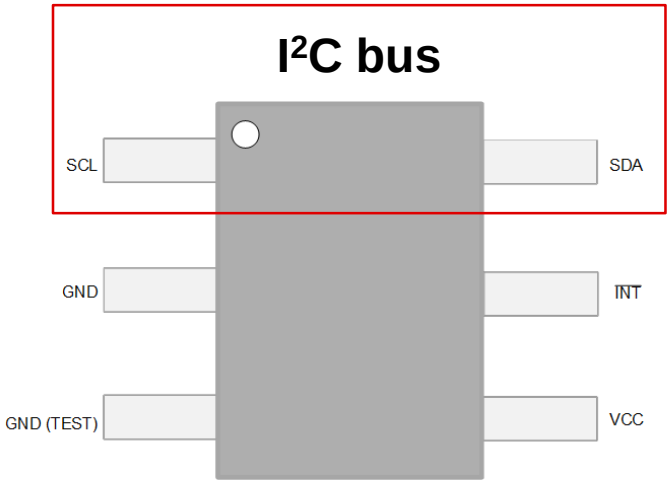
Features

- Dedicated interrupt pin
- Multiple power mode options, including wake-up and sleep mode for low-power operation
- Integrated CORDIC angle calculation
- I^2C output interface with cyclic redundancy check (CRC)
- Selectable X, Y and Z magnetic ranges:
  - A1: ±40mT, ±80mT
  - A2: ±133mT, ±266mT
- V_{CC} from 1.7 V to 3.6 V

Benefits

- High level of configurability to:
  - Optimize speed and power consumption
  - Set programmable thresholds for the X, Y and Z axes and temperature sensor
  - Implement offset and gain correction
- Integrated CORDIC angle calculation eliminates need for post-processing in host microcontroller
- Offers flexibility in device functionality and sensor placement

Dedicated interrupt pin

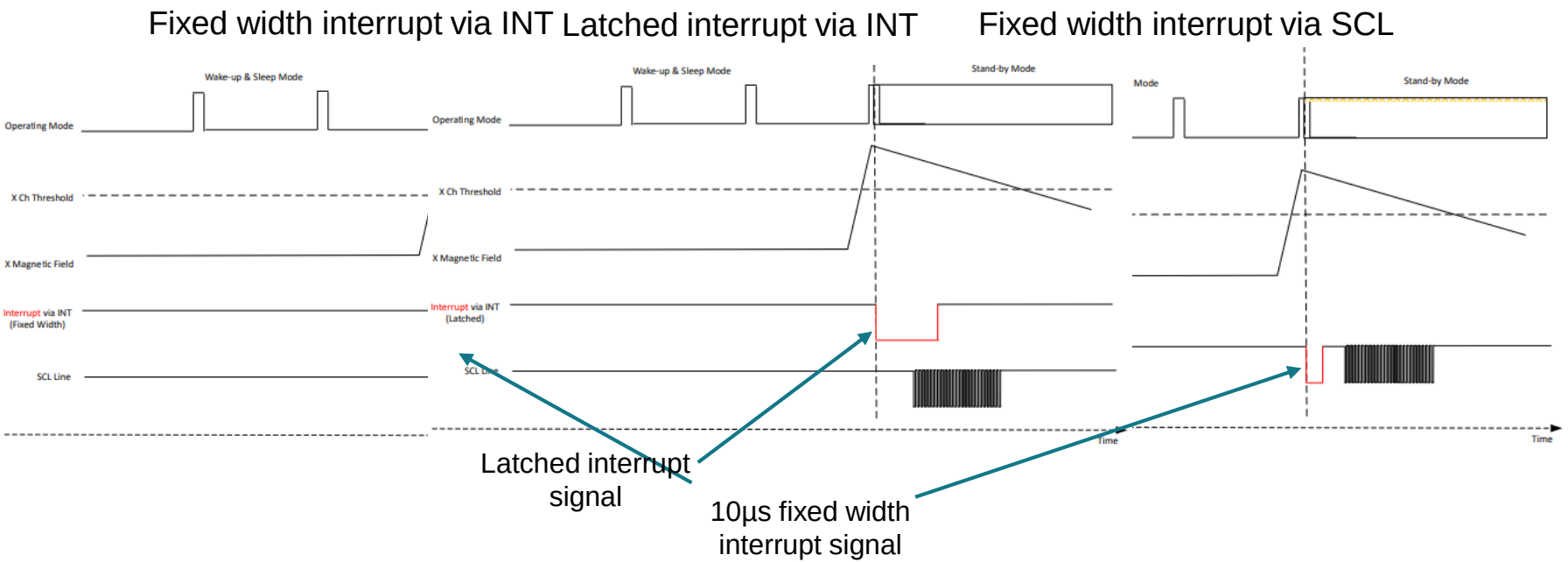


DBV (6-SOT23) package
(2.9mm × 2.8mm)

Interrupt pin functionality:

- Can be used to implement **low power system operation**. The device wakes up periodically to measure the sensor parameters and only wakes up the MCU through the INT\ pin if a predefined threshold is crossed.
- The MCU can **trigger** a new conversion through the INT\ pin

Configurable interrupt functions: $\overline{INT}$ or SCL pin



Programmable thresholds and tamper detection

- Programmable magnetic field thresholds to initiate an interrupt
  - Independent X, Y and Z axis and temperature channel thresholds
    - Thresholds can be monitored simultaneously for all channels
  - Any channels not used for measurement can act as an additional input source to initiate an interrupt and force the MCU to protect the system to:
    - Detect magnetic tampering
    - Reject inputs when stray fields are present

TMAG5273 configurability

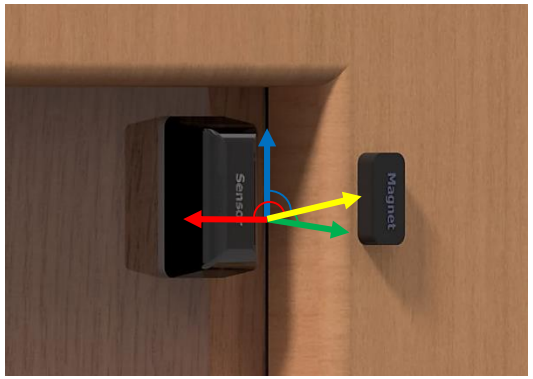
- **Selectable linear magnetic ranges:**
  - A1: ±40mT, ±80mT or A2: ±133mT, ±266mT
- **Supported conversion rates:**
  - 20, 13.3, 8, 4.4, 2.4, & 1.2 kSPS single axis conversion rate
- **Integrated temperature compensation for multiple magnet types:**
  - 0.0 $\frac{\%}{°C}$, +0.12 $\frac{\%}{°C}$ (neodymium magnets), +0.2 $\frac{\%}{°C}$ (ceramic magnets)
- **Supported wake-up and sleep mode intervals:**
  - 1, 5, 10, 15, 20, 30, 50, 100, 500, 1000, 2000, 5000, and 20000-ms
- **Configurable averaging up to 32x for noise reduction**

Wake-up duty cycle	Sleep interval	Temp and 3-ch operation $I_{average}$ @ 3.3 V	Temp and 1-ch operation $I_{average}$ @ 3.3 V
1,000 Hz	1 ms	240.17 µA	160.90 µA
100 Hz	10 ms	28.19 µA	18.64 µA
20 Hz	50 ms	6.58 µA	4.64 µA
1 Hz	1,000 ms	1.37 µA	1.28 µA

Example applications

Electricity meters

Door and window sensors



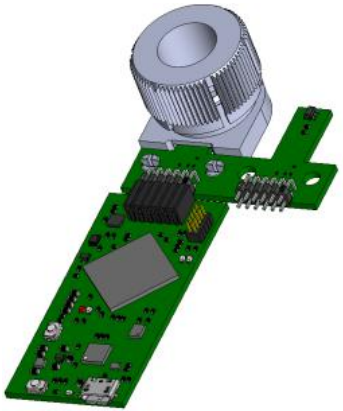
Electronic smart locks

HMI knobs

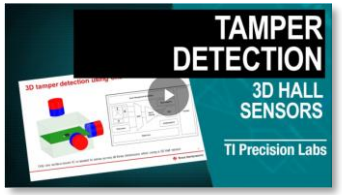
Joysticks

Tools and resources

- Visit the TMAG5273 product folder
- Start evaluating with the TMAG5273EVM
  - Includes a 3D printed rotate and push module
  - Compatible with our additional 3D print attachment design files (slide-by, joystick, head-on linear and orbital attachments)
  - Watch our EVM getting started video
- Magnetic sensors TI Precision Labs video series
  - Tamper detection TI Precision Labs video
- Limit detection for tamper detection application brief
- Reed switch replacement with Hall-effect sensors application note
- Magnetic sensing proximity tool




Application Brief
Limit Detection for Tamper and End-of-Travel Detection Using Hall-Effect Sensors
Texas Instruments



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