Product Training Module: Magnetoresistive Sensor ICs Nanopower Series
Summary of Contents

• In this training module, you will learn the following about Honeywell’s Magnetoresistive Sensor ICs, Nanopower Series
  – Overview of new products
  – Key features and benefits to design engineers
  – Competitive overview versus MR sensors, Hall-effect sensors and reed switches
  – Potential applications
  – Where to obtain product information
Introduction

• **Magnetoresistive Sensor ICs, Nanopower Series, consist of:**
  – SM351LT
  – SM353LT

• **Honeywell’s new products offer design engineers:**
  – High magnetic sensitivity
  – Nanopower
  – Design flexibility
  – Savings from the use of low-cost magnets
Features and Benefits

1. Two magnetic sensitivities
2. Nanopower
3. Supply voltage range
   - 1.65 V to 5.5 V
4. Temperature range
   - -40 °C to 85 °C [-40 °F to 185 °F]
5. RoHS-compliant materials
   - Meet Directive 2002/95/EC
6. Subminiature SOT-23
   - Surface mount package on tape and reel
   - 3000 units per reel

7. Omnipolar
   - Responds to either a north or south pole
   - Eliminates the need for the magnet polarity to be identified
   - Simplifies the manufacturing process

8. Push-pull (CMOS) output
   - Eliminates the need for external resistors
   - Helps reduce production costs

9. Non-chopper stabilized design
   - Eliminates electrical noise generated by the sensor
MR senses in the parallel plane and has higher sensitivity than Hall-effect sensing.
SM353LT and SM351LT versus MR

• Lower power versus competitive MR sensors
  – SM353LT: 310 nA
  – SM351LT: 360 nA
  – Competitive low power MR sensor ICs at 3 µA or more use at least 10 times more power

• High sensitivity
  – Equal to or better sensitivity
SM353LT versus Hall-effect

• SM353LT advantages versus Hall-effect
  – Higher sensitivity
    • 14 Gauss at 1.65 V versus high sensitivity Hall at 30 Gauss typical
    • Two times or more sensitive
    • Improves design flexibility
    • Reduces costs by using less magnetic material or a more common magnet
  – Nanopower
    • 310 nA
    • Competitive low power Hall-effect sensor ICs at 3 μA or more use at least 10 times more power

Design flexibility, cost savings and 10 times less power
SM351LT Advantages versus Reed Switches

- **Power**: 360 nA vs. 0 power for reed switches
- **Sensitivity**: Equivalent or more sensitive
  - Gauss versus amp turns (AT) in reed switches
- **Reliability**: Stable over temperature range
- **Solid state technology**: Does not wear out over time
- **Quality**: Plastic molded sensor does not break
- **SOT-23**: Smaller than equivalent reed switches
  - 2.9 mm x 2.8 mm x 1.45 mm

**Smaller, more reliable and durable at the same or better sensitivity and essentially the same cost**
Potential Applications – Metering/Flow Sensing

Application:

- **Counting mechanism**
  - One magnetic sensor to count pulses

- **Anti-tamper switch**
  - Absence/presence of external magnetic field
  - Add a second sensor 180° from first
  - External field present if both are activated

Design Engineers Need:

- **Low power**
  - Battery lasts 7-10 years or more

- **High sensitivity**
  - Large air gap
  - 10 Gauss to 20 Gauss max. allows for design flexibility

- **Temperature range up to 85 °C [185 °F]**

- **Durability**

Water and gas utility meters
Potential Applications – Security Systems

**Application:**

- Door/window closure for alarm
  - Magnetic sensor on window frame
  - Magnet applied to window
  - Sensor detects data and wirelessly sends it to security control when the window/door is opened or closed

**Design Engineers Need:**

- **Low power**
  - Battery operated wireless control

- **High sensitivity**
  - Due to larger air gap needs
  - 10 Gauss to 20 Gauss max. provides design flexibility

- **Small package**

- **Temperature range up to 85 °C [185 °F]**

- **Durability due to open/closure movements**
Potential Applications – Industrial Smoke Detector

Application:
- Alarm test switch
  - Magnetic sensor is built into the industrial smoke detector
  - To test, a magnet is brought to the alarm

Design Engineers Need:
- Low power
  - Battery operated wireless control
- Very high sensitivity
  - Due to very large air gap needs
- Small package
- Temperature range up to 85 °C [185 °F]
Potential Applications – In Cylinder/Piston Detection

Application:

• Piston position detection
  – Sensor detects the piston’s position inside the cylinder
  – Magnet is attached to the piston ring
  – Senses through a 0.25 inch [6.35 mm] thick aluminum wall
  – A low Gauss MR sensor will work where standard Hall-effect sensors would not provide a long enough sensing distance for reliable operation

Design Engineers Need:

✓ High sensitivity
  – Ability to sense through a thick cylinder wall
✓ Reliable magnetics
✓ Temperature range up to 150 °C [302 °F]
  – Depending on application
✓ Durability
Potential Applications – Battery Operated Tools

**Application:**
- **Selector position switch**
  - Sensor is used to detect position of speed/torque selector
- **Battery position**
  - Sensor is used for absence/presence detection of battery in charger

**Design Engineers Need:**
- ✓ **Low power**
  - Battery operated wireless control
- ✓ **Small package**
- ✓ **Temperature range up to 85 °C [185 °F]**
Potential Applications – Lid Detection in White Goods

Application:
- Senses the open/close position of a door or lid in white good applications
- Magnet on door/lid
- Sensor is placed on the base of the product for detection

Design Engineers Need:
- Low power for energy efficiency
- Durability
  - Moving parts should not cause the sensor to break
- Temperature range up to 85 °C [185 °F]
- Cost competitive
Potential Applications – Exercise Equipment

Application:

- **Emergency stop switch**
  - Magnet is pulled if the user has an emergency that requires the need to stop the machine

- **RPMs**
  - Sensor is used to count revolutions to measure speed

- **Incline position switch**
  - Sensor is used to determine incline position

Design Engineers Need:

- **Durability**
  - Breaking parts due to shake and vibration causes the machine to break

- **High sensitivity for emergency stop switch**

- **Temperature range up to 85 °C [185 °F]**
Potential Applications – Infusion Pumps

Application:
- **Cartridge detection switch**
  - Sensor is part of the pump
  - Cartridge has a magnet applied to it
  - Sensor is used to detect when the cartridge is in position

Design Engineers Need:
- ✔ Sensitivity (medium to high)
  - Design flexibility and to reduce the cost of magnets
- ✔ Durability
- ✔ Low power for battery operated pumps
  - Power does not matter for wired pumps
Potential Applications – Hospital Bed Position

Application:
- Bed position sensing
  - Sensor is used to determine bed adjustment end and beginning positions

Design Engineers Need:
- High sensitivity for lower cost magnets
- Small package
- Durability
- Temperature range up to 85 °C [185 °F]
About Honeywell Sensing and Control Products

- For more information about all of Honeywell Sensing and Control sensor and switch solutions, visit http://sensing.honeywell.com