



MAGNETIC SENSORS FOR BATTERY- POWERED APPLICATIONS

Application Note

Considerations and recommended products for battery-powered applications.

BACKGROUND

With Honeywell nanopower AMR (SM351LT/353LT) and micropower (SL353LT/SL353HT) omnipolar Hall-effect sensor ICs, the life of battery-powered devices can be lengthened as our sensor ICs offer low power consumption and high sensitivity. They are a key component when designed into on/off, position, and tamper detection applications.

SENSING BACKGROUND

Omnipolar magnetic sensor ICs operate with either a strong positive or negative magnetic field. This means, in applications, the operating magnet can be mounted with either of the magnet's poles toward the omnipolar sensor. The magnetic flux will activate the sensor to switch its state. The sensor IC will remain in this state until the magnetic flux is removed. They do not require the magnet polarity to be identified, simplifying installation and potentially reducing system cost.

SM (Nanopower) overview

Honeywell Nanopower Series sensor ICs are ultra-sensitive AMR devices designed to accommodate a wide range of applications with large air gaps, small magnetic fields, and low power requirements. These sensor ICs use a very low average current consumption and a push-pull output which does not require a pull-up resistor. The sensor ICs can operate from a supply voltage as low as 1.65 V, promoting energy efficiency.

The Nanopower Series is available in two magnetic sensitivities to accommodate a variety of application needs:

- **SM351LT:** For applications requiring ultra-high magnetic sensitivity (7 G typical operate, 11 G maximum operate) and a very low current draw (360 nA typical)
- **SM353LT:** For applications requiring very high magnetic sensitivity (14 G typical operate, 20 G maximum operate) and a very low current draw (310 nA typical)

SL (Micropower) overview

The SL353 Series consists of small, versatile, digital Hall-effect devices designed to meet a wide range of applications with low power requirements, including battery-operated equipment. These low-power sensing devices use BiCMOS (Bipolar Complementary Metal Oxide Semiconductor) technology and a timing circuit that turns the power on for only a short time – significantly reducing the average current consumption.

Micropower omnipolar digital Hall-effect sensor ICs can operate from a supply voltage as low as 2.2 V, promoting energy efficiency. The push-pull output does not require a pull-up resistor and can operate with very low current levels, potentially helping to reduce cost and minimizing the total current consumption.



The SL353 Series is available in two duty cycle configurations to accommodate a variety of application needs:

- **SL353HT:** High duty cycle (13 % typ.) for applications requiring high switching speed and a lower current (0.33 mA typ.) than standard Hall-effect sensor ICs
- **SL353LT:** Very low duty cycle (0.013 % typ.) resulting in extended battery life in applications requiring extremely low current drain (1.8 μ A typ.) and not requiring a high switching speed



	Nanopower Series (SM351LT/SM353HT)	Micropower Series (SL353LT/SL353HT)
Description	omnipolar AMR sensor IC	omnipolar Hall-effect digital sensor IC
Magnetic actuation type	omnipolar	omnipolar
Package style and packaging	SOT-23, pocket tape and reel	SOT-23, pocket tape and reel
Supply current	SM351LT: 360 nA typ. SM353LT: 310 nA typ.	@28 Vdc SL353LT: 1.8 mA typ. SL353HT: 0.33 mA typ.
Output type	low: 0.03 V typ high: Vs -0.03 V typ.	–
Operating temp. range	-40°C to 85°C [-40°F to 185°F]	-40°C to 85°C [-40°F to 185°F]
Features	high sensitivity: SM351LT: 7 G typ., 11 G max. SM353LT: 14 G typ., 20 G max. Designed to accommodate apps with large air gaps, small magnetic fields, and low power requirements	low supply voltage combined with very low average current reduces power consumption



APPLICATIONS

Gas Metering

Gas metering applications often rely on batteries to supply energy – oftentimes for up to ten years. Ultra-low power consumption is a key design element in these smart metering applications. Along with extended battery life, gas meters also require design flexibility, durability, accuracy, and a small package size.

Within this application, the flowmeter provides high reliability and accuracy through the contactless sensing principle of the magnetic sensors. Hall-effect sensor ICs to sense the magnetic flux from the magnets mounted on the edges of the rotating paddle within the meter.

In addition to this use, Honeywell sensor ICs can also be used as a counting mechanism where one magnetic sensor counts the pulse. They can also perform as an external field anti-tamper switch. The sensor ICs sense the presence/absence of an external magnetic field with a second sensor located 180° from the first – they indicate an external field is present if both sensors are activated.

When used to detect the removal of the meter's radio module, the sensor IC is permanently installed to sense a magnet and will send an alarm when the module is removed – the removal of the magnetic field causes the sensor IC to change state.

In addition, they can be incorporated to provide fluid flow sensing and display wake-up.



Home Security for Windows & Doors

Honeywell nanopower and micropower sensor ICs may be designed into home security applications, particularly on doors and windows. The digital sensor detects the presence or absence of the magnet to indicate whether the door or window is open or closed (depending on the setting). To excel in this application, the sensors must be compact in order to take up as small of space as possible – the sensor ICs should be nearly invisible when mounted in the window/door frames. They also must feature high sensitivity to have large tolerances, thereby reducing the size and cost of the magnet required for activation. And finally, low power draw is a must to increase the battery's lifetime.

Consumer White Good – Refrigeration

Appliances like refrigerators and freezers can consume significant amounts of energy; often, not being environmentally friendly. Manufacturers may consider replacing mechanical switches in white goods applications with solid state sensors for longer life. These sensors can be used for door open/close, fill level detection, and presence detection of a pitcher or other features.



White Good – Blender/Coffee Machine

When blending a smoothie, it's vital to have the blender lid locked and in place prior to engaging the motor. Omnipolar magnetic sensors can be used to indicate whether the pourable blender cup is in place. The sensor is designed into the base of the smoothie blender, whereas the magnet is incorporated into the blender cup. The user has confidence that the cup is seated before the motor is engaged.

The same concept can be also applied to single-serve coffee makers. Omnipolar magnetic sensors may be used to ensure the lid for the coffee pod is in engaged and in the right place. The sensor is installed in the base, and the magnet is designed into the moving part (usually the lid). When they come together and align, the sensor turns on and gives a signal to the controller that the pod is in place and brewing can occur.

White Good – Electric Toothbrush

Within electric toothbrushes – or even electric shavers – omnipolar magnetic sensors are used to detect the position of the toothbrush in the charging station. The magnetic is designed into the charging base; whereas, the sensor is in the toothbrush. Once the sensor indicates the device is off, and in the correct position within the charger, the base will begin charging the device. Within this applications, omnipolar magnetic sensors may also be used for on/off control, as well as within the instrument itself as part of the PC board.



⚠️ WARNING IMPROPER INSTALLATION

- Consult with local safety agencies and their requirements when designing a machine control link, interface and all control elements that affect safety.
- Strictly adhere to all installation instructions.

Failure to comply with these instructions could result in death or serious injury.

For more information

Honeywell Sensing & Safety Technologies services its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing, or the nearest Authorized Distributor, visit sps.honeywell.com/ast or call:

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