



Magnetoresistive Sensor ICs Nanopower Series



Datasheet

Magnetoresistive Sensor ICs

Honeywell's Nanopower Series Magnetoresistive (MR) Sensor ICs are ultra-sensitive devices designed to accommodate a wide range of applications with large air gaps, small magnetic fields and low power requirements.

The sensor ICs respond to either a North or South pole applied in a direction parallel to the sensor. They do not require the magnet polarity to be identified, simplifying installation and potentially reducing system cost.

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).

These Magnetoresistive Sensor ICs, Nanopower Series, are supplied in the subminiature SOT-23 surface mount package on tape and reel (3000 units per reel), for use in automated pick-and-place component installation.

Key Features

- **High sensitivity:** 7 Gauss typ., 11 Gauss max. (SM351LT); 14 G typ., 20 Gauss max. (SM353LT)
- **Nanopower:** Average current of 360 nA typ. (SM351LT) and 310 nA typ. (SM353LT)
- **Supply voltage range:** 1.65 Vdc to 5.5 Vdc; simplifies design-in
- **Omnipolar sensing:** Activates with either pole from a magnet
- **Temperature range:** -40 °C to 85 °C [-40 °F to 185 °F]
- **Push-pull output:** Does not require external pull-up resistor
- **Non-chopper stabilized design**
- **RoHS-compliant materials:** Meets Directive 2002/95/EC
- **Package:** SOT-23

Potential Applications

INDUSTRIAL

- Mobile equipment (i.e., handheld computing equipment, scanners)
- Water, electric and gas utility meters
- Building access control; reed switch replacement for battery-operated security systems
- Industrial smoke detectors

MEDICAL

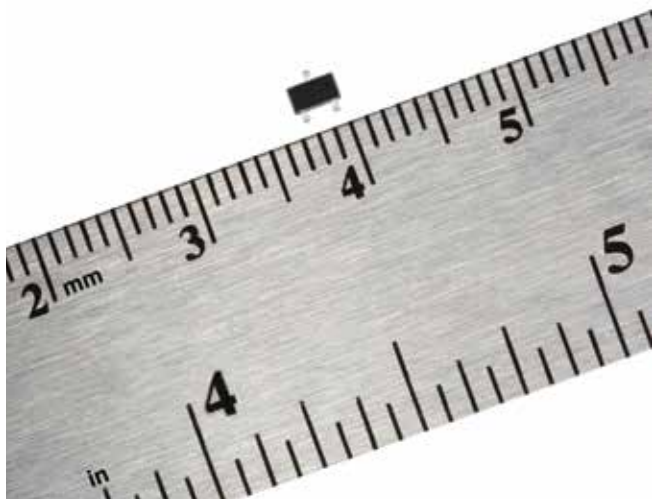
- Exercise equipment
- Infusion pumps
- Drawer position sensing (e.g., medical cabinets)
- Hospital beds

WHITE GOODS

- Lid, door and drawer position detection
- Fluid flow

MEDIUM-SIZED CONSUMER ELECTRONICS

- Battery-optimization position sensor



Magnetoresistive Sensor ICs, Nanopower Series

Table 1A. Electrical Specifications ($V_s = 1.65\text{ V to }5.5\text{ V}$, $T_a = -40\text{ }^\circ\text{C to }85\text{ }^\circ\text{C}$ [-40 °F to 185 °F], Typ. at 1.8 V, 25 °C [77 °F] unless otherwise specified.)

| Characteristic | Condition | Min. | Typ. | Max. | Unit |
|--|----------------------------------|-------------------|----------------------|---------------|---------------|
| Supply voltage (V_s) | V_s reference to ground | 1.65 | 1.8 | 5.5 | V |
| Awake current: SM351LT SM353LT | — | — 0.3 | 1 0.8 | 5 5 | mA |
| Awake time | — | — | 15 | — | μs |
| Sleep current | — | — | 0.2 | 8 | μA |
| | $V_s = 1.65\text{ V}$ | — | 0.16 | 0.8 | |
| | $V_s = 1.8\text{ V}$ | — | 0.2 | 1 | |
| | $V_s = 5.5\text{ Vdc}$ | — | 2.6 | 8 | |
| Sleep time | — | 30 | 100 | 180 | ms |
| Average current: SM351LT SM353LT | 0.015% duty cycle, typ. | — — | 360 310 | 6640 6350 | nA |
| Output voltage: low (V_{OL}) high (V_{OH}) | load current = 100 μA | 0 $V_s - 0.15$ | 0.03 $V_s - 0.03$ | 0.15 V_s | V |

NOTICE

These magnetoresistive sensor ICs may have an initial output in either the ON or OFF state if powered up with an applied magnetic field in the differential zone (applied magnetic field $>B_{rp}$ and $<B_{op}$). Honeywell recommends allowing 10 μs for output voltage to stabilize after supply voltage has reached its final rated value.

Table 1B. Electrical Specifications ($V_s = 1.8\text{ V}$, $T_a = 25\text{ }^\circ\text{C}$ [77 °F].)

| Characteristic | Condition | Min. | Typ. | Max. | Unit |
|--|-------------------------|--------|------------|--------------|---------------|
| Awake current: SM351LT SM353LT | — | — — | 1 0.8 | 1.12 0.87 | mA |
| Awake time | — | — | 15 | — | μs |
| Sleep current | — | — | 0.2 | 0.59 | μA |
| Sleep time | — | 90 | 100 | 120 | ms |
| Average current: SM351LT SM353LT | 0.015% duty cycle, typ. | — — | 350 350 | 620 600 | nA |

NOTICE

The sensor will turn LOW when the magnetic field is present and switch to HIGH when the field is removed. The sensor will latch and hold the state during the sleep "mode".

Magnetostrictive Sensor ICs, Nanopower Series

Table 2. Magnetic Specifications (Vs = 1.65 V to 5.5 V, Ta = -40 °C to 85 °C [-40 °F to 185 °F].)

| Characteristic | Min. | Typ. | Max. | Unit |
|--------------------|------|------|------|-------|
| SM351LT: | | | | |
| operate (positive) | 3 | 7 | 11 | Gauss |
| release (positive) | 2 | 5 | — | |
| hysteresis | * | 2 | — | |
| SM353LT: | | | | |
| operate (positive) | 6 | 14 | 20 | Gauss |
| release (positive) | 3 | 10 | — | |
| hysteresis | * | 4 | — | |

*At 1.65 V and -40 °C, the hysteresis can reach 0.1 Gauss.

NOTICE

The magnetic field strength (Gauss) required to cause the switch to change state (operate and release) will be as specified in the magnetic characteristics. To test the switch against the specified magnetic characteristics, the switch must be placed in a uniform magnetic field.

Table 3. Absolute Maximum Ratings

| Characteristic | Condition | Min. | Typ. | Max. | Unit |
|-----------------------|---------------------------|-----------|------|-----------|---------|
| Operating temperature | ambient | -40 [-40] | — | 85 [185] | °C [°F] |
| Soldering temperature | ambient applied for <10 s | — | — | 265 [509] | °C [°F] |
| Supply voltage (Vs) | — | -0.5 | — | 6 | V |
| Output (load) current | — | — | — | 5 | mA |

NOTICE

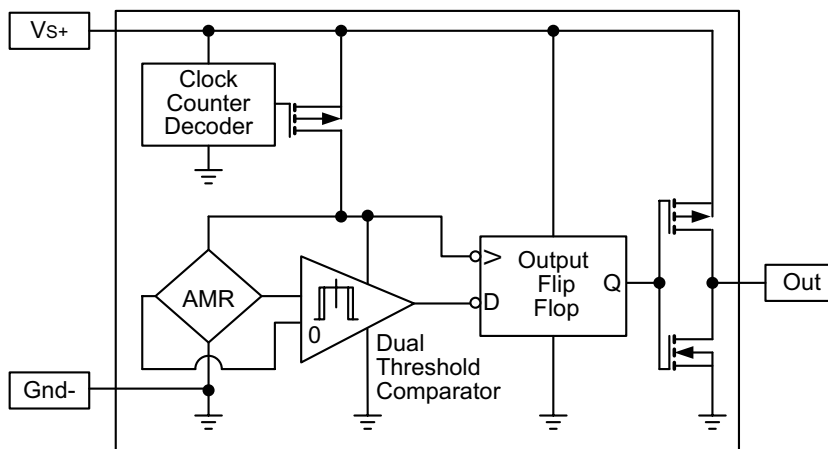
Absolute maximum ratings are the extreme limits that the device will withstand without damage to the device. However, the electrical and mechanical characteristics are not guaranteed as the maximum limits (above recommended operating conditions) are approached, nor will the device necessarily operate at absolute maximum ratings.

CAUTION
ELECTROSTATIC
SENSITIVE
DEVICES

DO NOT OPEN OR HANDLE
EXCEPT AT A
STATIC FREE WORKSTATION

**ESD SENSITIVITY:
CLASS 2**

Figure 1. Block/Electrical Diagram

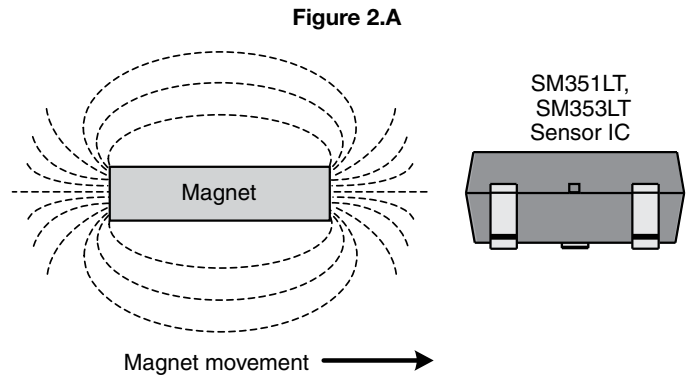


Magnetostrictive Sensor ICs, Nanopower Series

Figure 2. Alignment of the Magnet to the Omnipolar Magnetostrictive Sensor IC

Ideal alignment: The magnet is aligned in the same plane as the sensor IC.

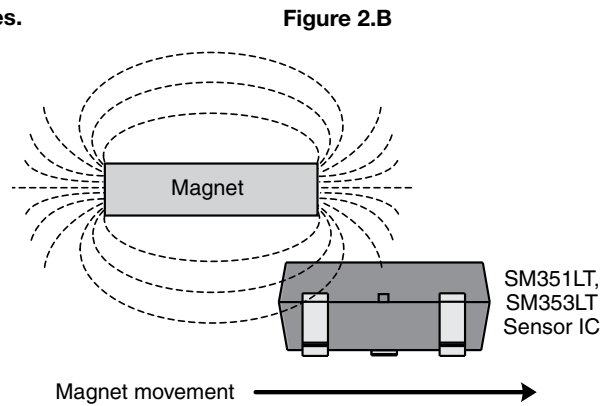
The magnetic flux lines stay horizontal as the magnet approaches the sensor IC (see Figure 2.A).



Offset alignment: The magnet is not aligned in the same plane as the sensor IC.

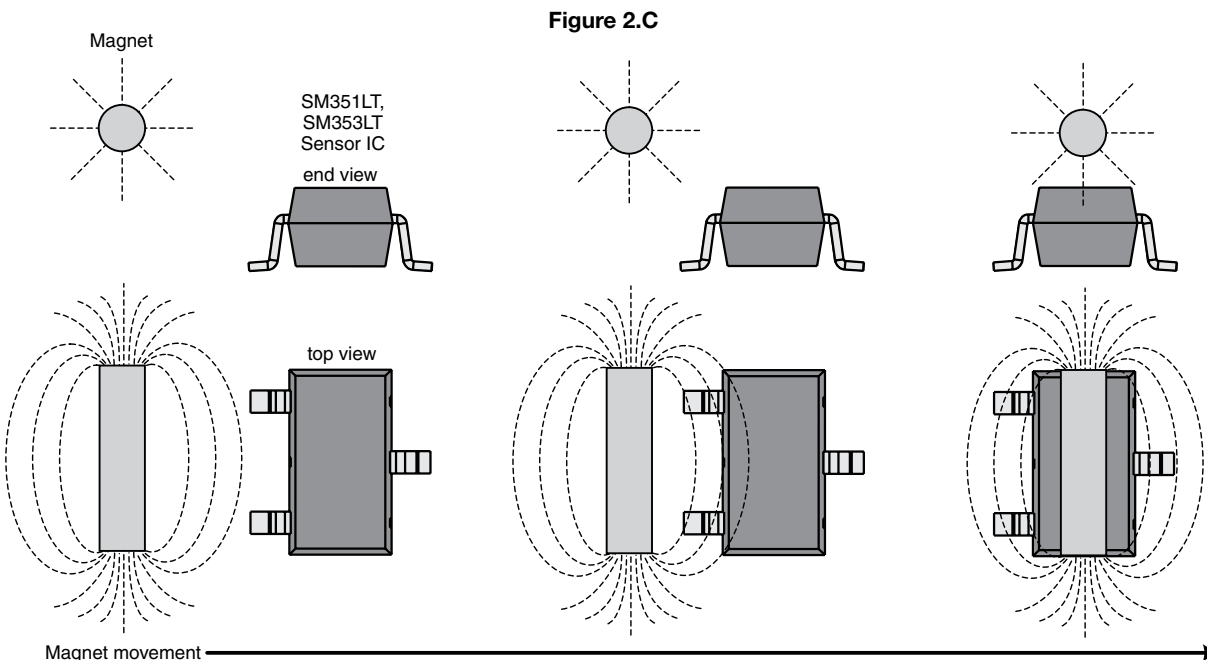
Parallel magnet approach to the sensor IC may cause dead zones.

Dead zones may occur when the majority of the magnet's magnetic flux lines become vertical as it approaches the sensor IC, turning the sensor IC to ON, then OFF, then ON (see Figure 2.B).



Perpendicular magnet approach to the sensor IC eliminates possible dead zones.

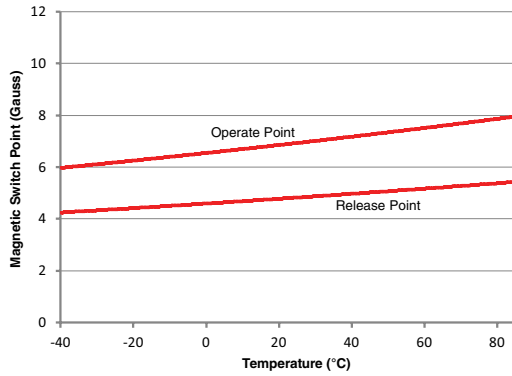
The sensor IC detects the approaching magnet's horizontal magnetic flux lines, turning the sensor IC to ON. The sensor IC stays ON as the magnet continues to approach. When the magnet is located directly over the sensor IC, all magnetic flux lines are now horizontal (see Figure 2.C). (Note: This alignment decreases the magnetic flux strength at the sensor IC.)



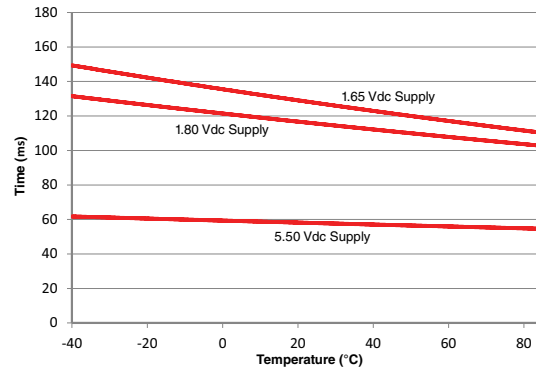
Magneto-resistive Sensor ICs, Nanopower Series

Figure 3. SM351LT Typical Performance Characteristics

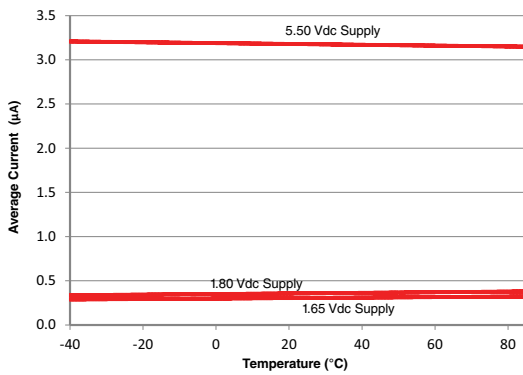
Magnetic Performance vs Temperature ($V_s = 1.8\text{ V}$)



Period vs Temperature



Average Current vs Temperature



Active Mode Time vs Temperature

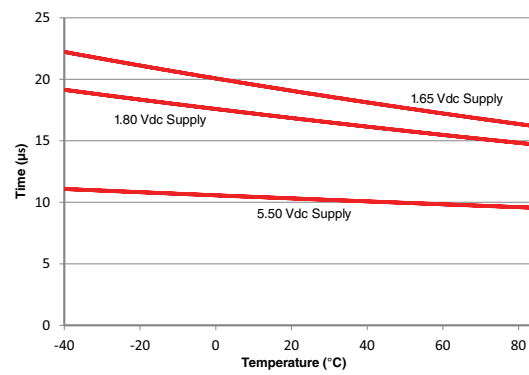
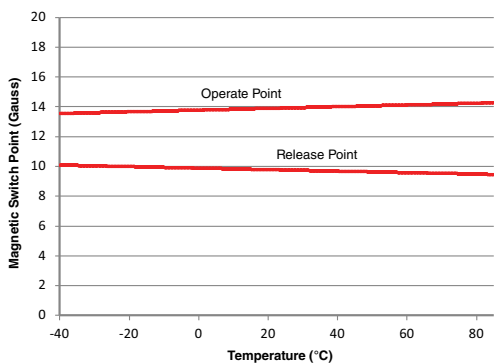
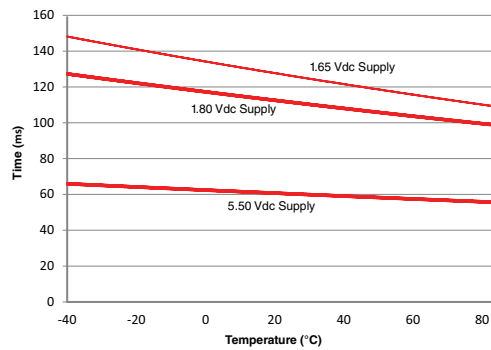


Figure 4. SM353LT Typical Performance Characteristics

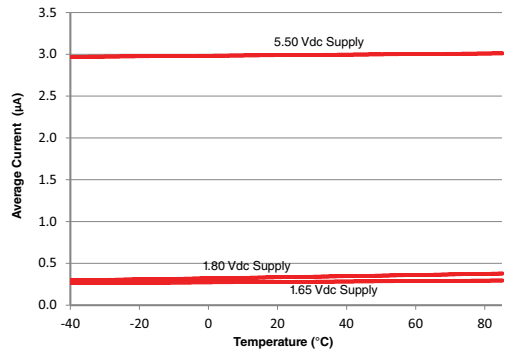
Magnetic Performance vs Temperature ($V_s = 1.8\text{ V}$)



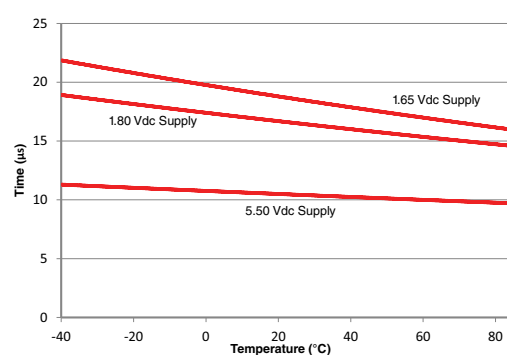
Period vs Temperature



Average Current vs Temperature



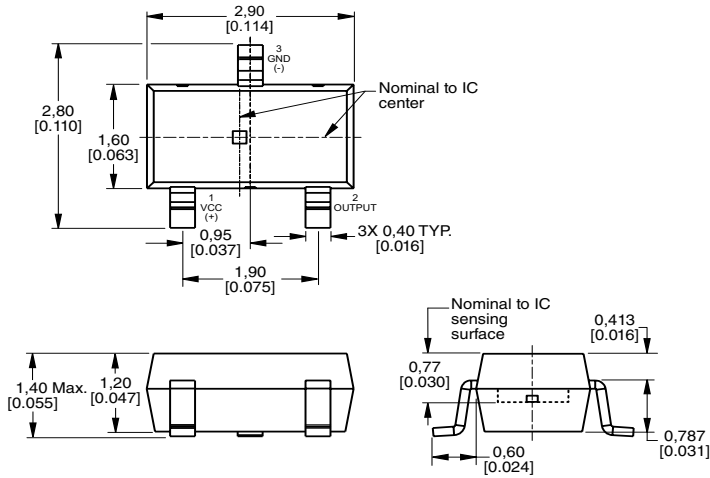
Active Mode Time vs Temperature



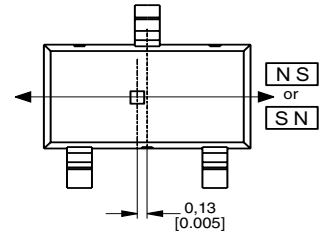
Magnetoresistive Sensor ICs, Nanopower Series

Figure 5. Mounting and Tape/Reel Dimensions (For reference only. mm/[in.])

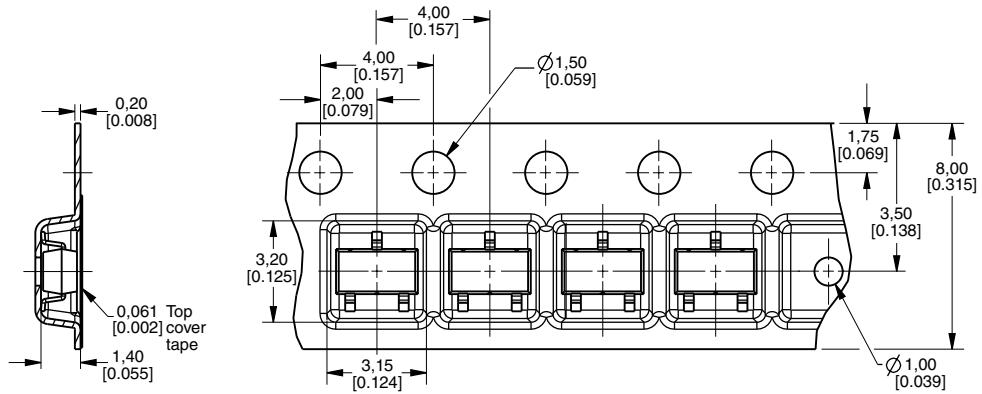
Sensor



Sensor Showing Polarity



Tape



Reel

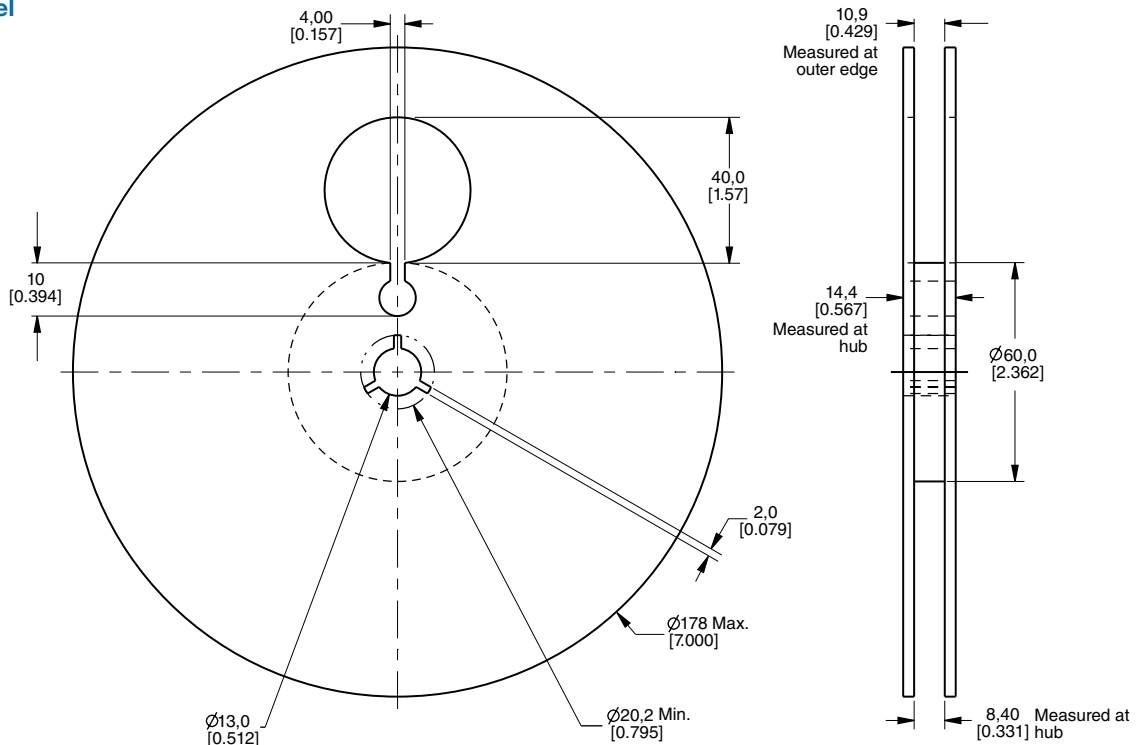




Table 4. Order Guide

| Catalog Listing | Description | |
|-----------------|--|---|
| SM351LT | Magnetoresistive sensor IC, high sensitivity (7 G typ.), nanopower, SOT-23 package, tape and reel packaging (3000 units per reel) |  |
| SM353LT | Magnetoresistive sensor IC, high sensitivity (14 G typ.), nanopower, SOT-23 package, tape and reel packaging (3000 units per reel) |  |

ADDITIONAL INFORMATION

The following associated literature is available at sensing.honeywell.com:

- Product line guide
- Product range guide
- Product installation instructions
- Application note

⚠ WARNING
PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

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

⚠ WARNING
MISUSE OF DOCUMENTATION

- The information presented in this datasheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

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

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