# BD020 Nanopower Medical Magnetic Sensor

**Key Features**

- Ultraminiature 1.1 mm x 1.1 mm x 0.45 mm ULLGA package
- Solid-State Reliability
- Precise Detection of Low Magnetic Fields
- Low Voltage Operation to 2.4 V
- Typical Power Consumption 72 nW at 2.4 V

**Description**

BD020 Giant Magnetoresistive (GMR) medical magnetic sensors are designed to run at low voltages and extremely low currents. The devices are manufactured with NVE's patented spintronic GMR technology.

Compared to reed switches, BD020 sensors feature smaller size, more magnetic sensitivity, more precise operate points, and inherent solid state reliability. Ideal applications include battery-powered implantable devices such as pacemakers, ICDs, neurostimulators, and drug pumps.

NVE's new ULLGA leadless package measures just 1.1 mm x 1.1 mm x 0.45 mm. Bare die (0.6 mm x 0.6 mm) are also available for wire bonding assembly.

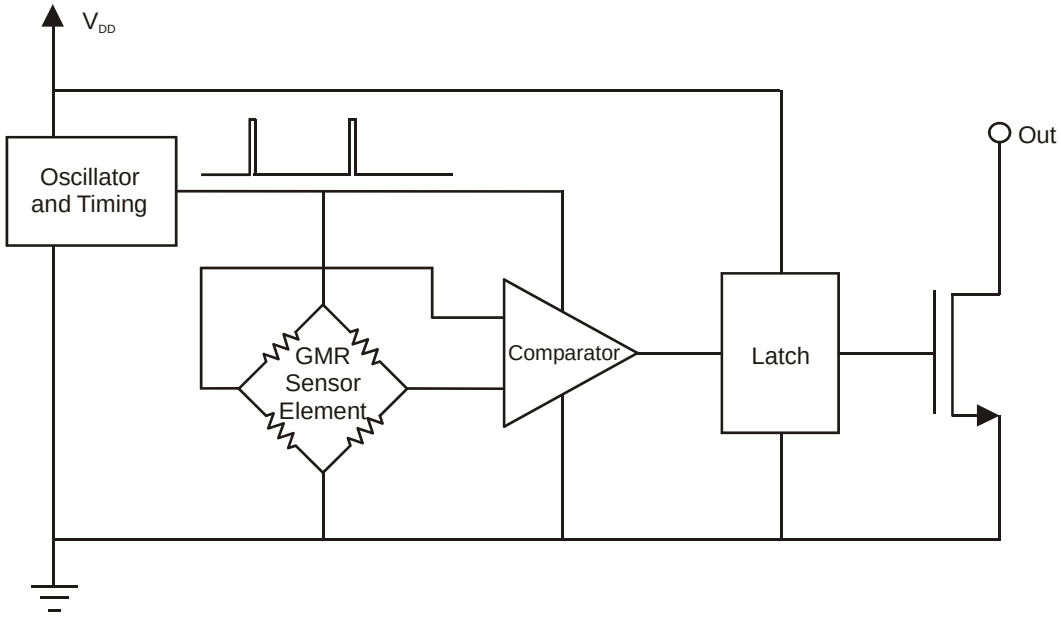
Configured as a magnetic "switch," the output turns on when the magnetic field is applied, and turns off when the field is removed. The applied magnetic field can be of either polarity, and the magnetic operate point is extremely stable over supply voltage and temperature.

The IC consists of a GMR sensor element, CMOS signal processing circuitry to convert the analog sensor element output to a digital output, and oscillator and timing circuitry for power management duty cycling.

Internal duty cycling at approximately 0.1% results in typical power consumption of a remarkable 72 nanowatts at 2.4 volts.

Versions of this part with different magnetic characteristics and duty-cycle update frequencies are available. Please contact NVE for details.

## Functional Block Diagram

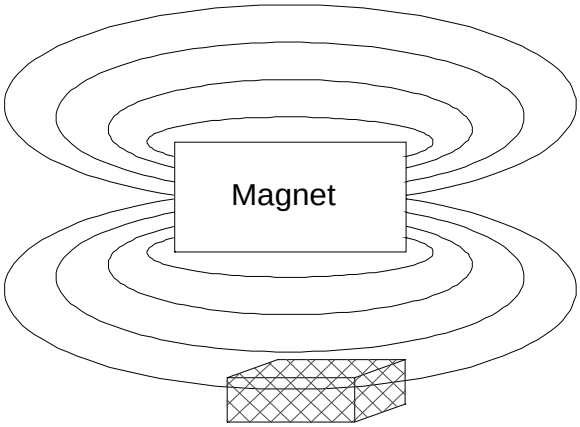


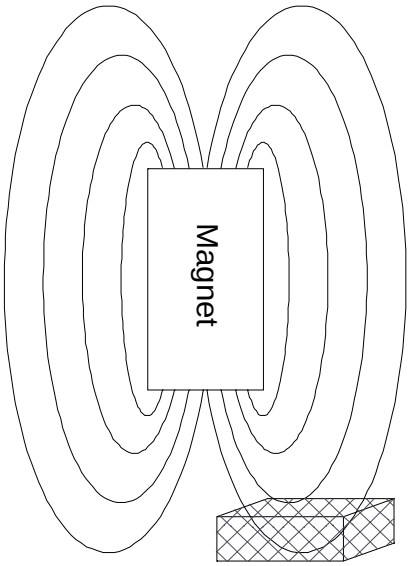

## Operation

The direction of magnetic field sensitivity is planar to the package. As the field varies in intensity, the digital output will turn on and off. The user must provide a pull-up resistor on the output terminal.

## Sensor Activation With a Permanent Magnet

The diagrams below show two permanent magnet orientations that will activate the sensor in the direction of sensitivity (planar to the package):



## Electrical and Magnetic Specifications

(specifications valid over all operating voltage and temperature ranges, except as noted):

| Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| Magnetic Operate Point | 10 | 13 | 16 | \|Oersteds\|(1) |
| Operate/Release Differential | 0.5 | | 8 | \|Oersteds\|(3) |
| Operating Voltage ($V_{DD}$) | 2.4 | 3.0 | 3.6 | Volts |
| Quiescent Current at 2.4 V | | 0.030 | 0.060 | µA |
| Quiescent Current at 3.6 V | | 0.115 | 0.160 | µA |
| Peak Current During Sensor Sampling (3.0 V) | | 60 | 100 | µA |
| Output Drive Current | 100 | | | µA |
| $V_{OL}$ at 100 µA Output Drive Current ($V_{DD}$ = 3.6 V) | | | 0.20 | Volts |
| Output Leakage Current | | | 0.005 | µA |
| Update Frequency | 10 | 30 | | Hz |
| Temperature Range of Operation | −40 | | 125 | °C |

## Absolute Maximum Ratings

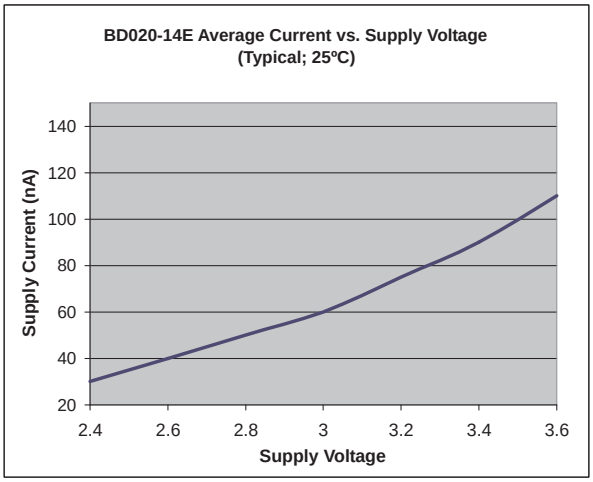
| Parameter | Rating | Units |
|---|---|---|
| Applied Magnetic Field | Unlimited(2) | \|Oersteds\| |
| Supply Voltage | 5.5 | Volts |
| Output Off Voltage | 5.5 | Volts |
| Output Current | 200 | µA |
| Maximum Junction Temperature | +170 | °C |
| Storage Temperature | −65 to +170 | °C |

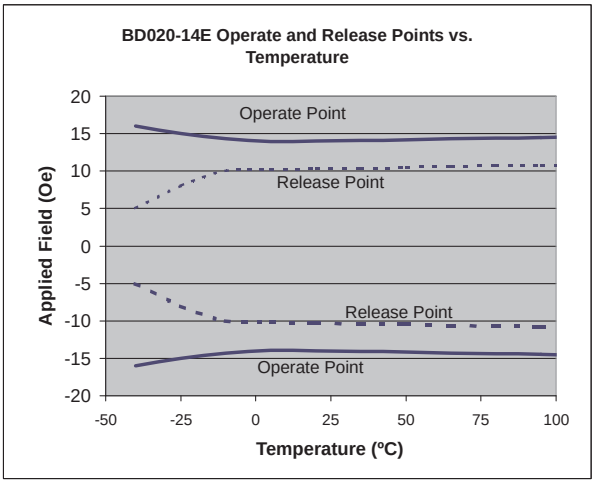
**Notes:**

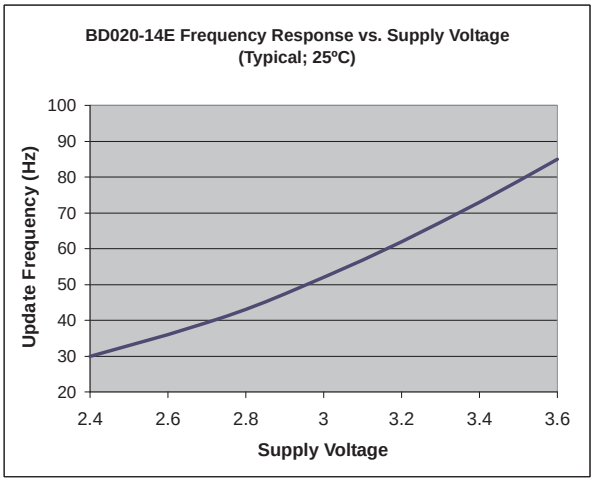
1. 1 Oe (Oersted) = 1 Gauss in air = 0.1 mT
2. Large Magnetic Fields WILL NOT damage NVE GMR Sensors.
3. Valid from −20°C to +125°C; see curve on following page for operate/release differential vs. temperature.

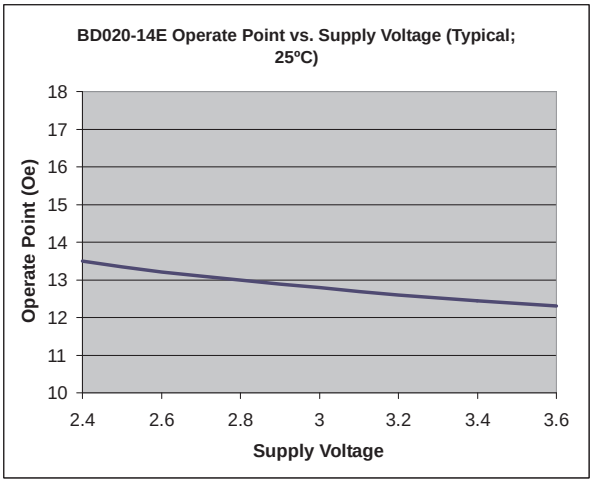
## Performance Over Temperature and Power Supply Range

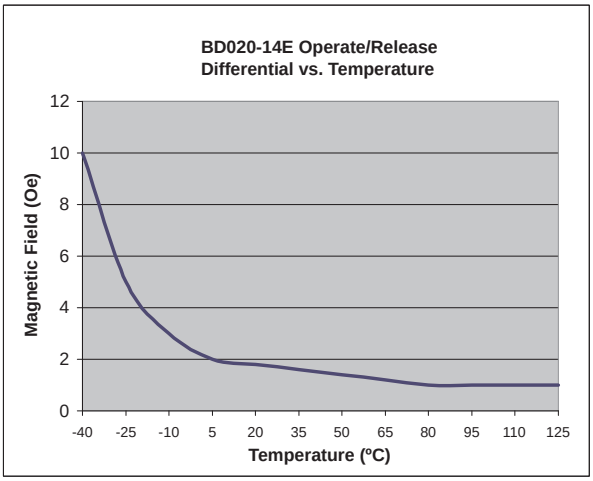
Average current increases, but remains extremely low, over variations in supply voltage. The magnetic operate and release points are very stable over temperature and supply voltage. Update frequency increases as supply voltage increases.



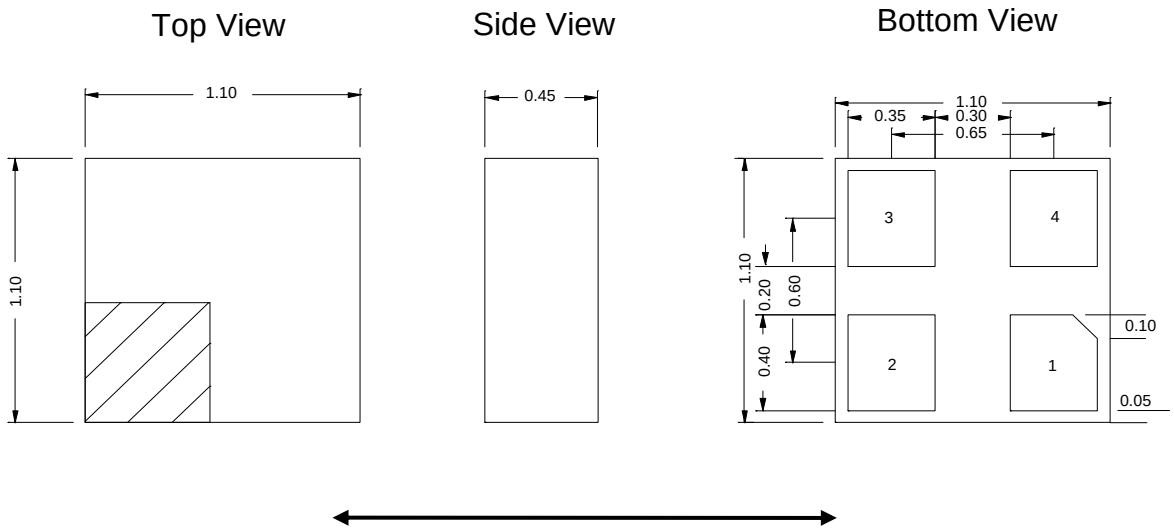



**Package Drawings, Dimensions, and Specifications:**

# 4 Lead ULLGA Package

1.1 mm x 1.1 mm x 0.45 mm; Lead Pitch 0.65 mm




Direction of Sensitivity

Package dimensions are ±0.10 mm

**Pinout:**

| | |
|---|---|
| Pin 1 | No Connect |
| Pin 2 | $V_{DD}$ |
| Pin 3 | Out |
| Pin 4 | Ground |

**Part Numbering:**

| Part Number | Package |
|---|---|
| BD020-01 | 0.625 mm x 0.625 mm bare die |
| BD020-14E | 1.1 mm x 1.1 mm RoHS ULLGA |

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