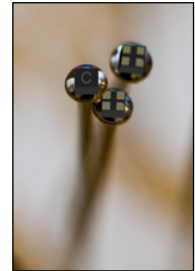


## BD020 Nanopower Medical Magnetic Sensor

### 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.

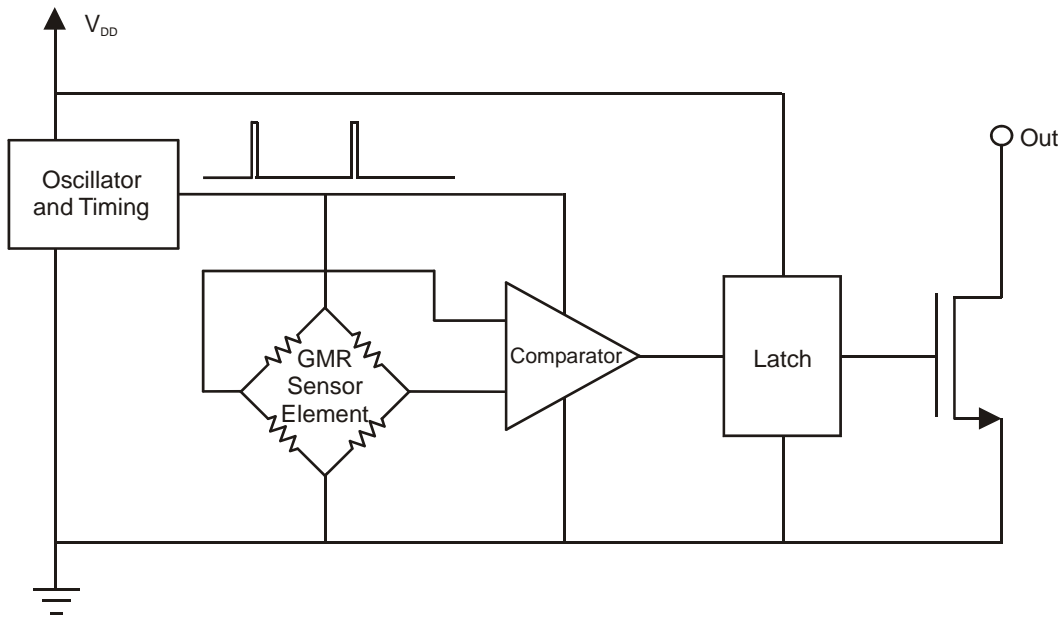
Configured as a magnetic "switch," the output turns on when the magnetic field is applied, and turns off when the field is removed. The applied magnetic field can be of either polarity, and the magnetic operate point is extremely stable over supply voltage and temperature.

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**

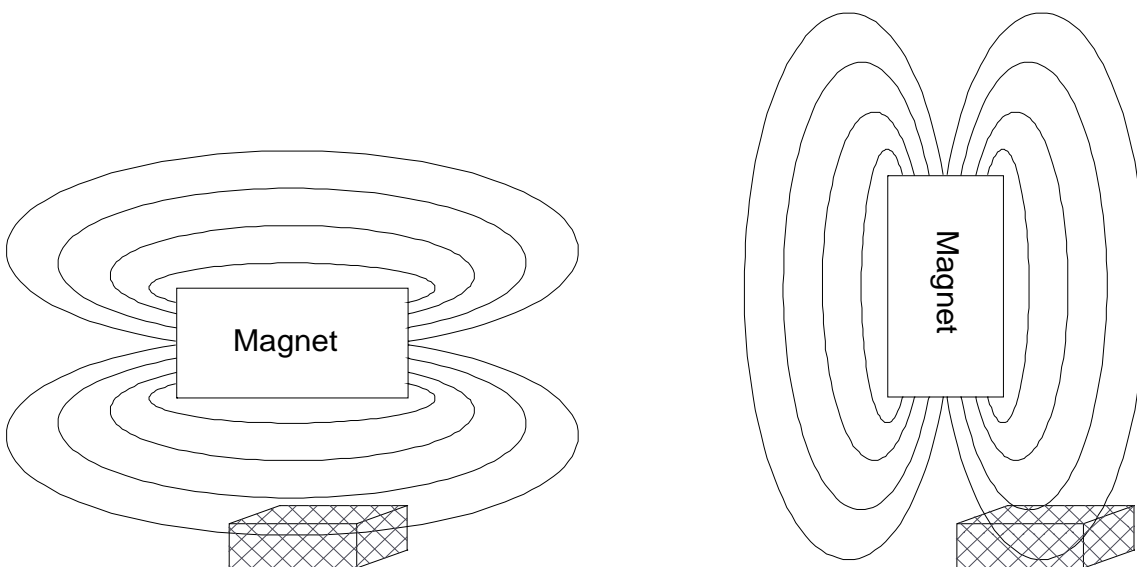


**Operation**

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  <sup>(1)</sup>
Operate/Release Differential	0.5		8	Oersteds  <sup>(3)</sup>
Operating Voltage (V <sub>DD</sub> )	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 <sub>OL</sub> at 100 μA Output Drive Current (V <sub>DD</sub> = 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

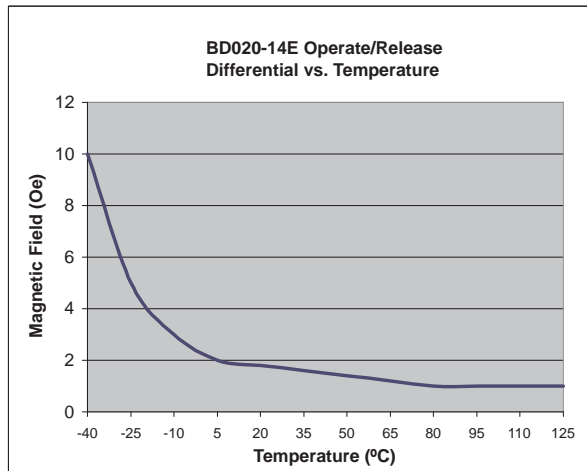
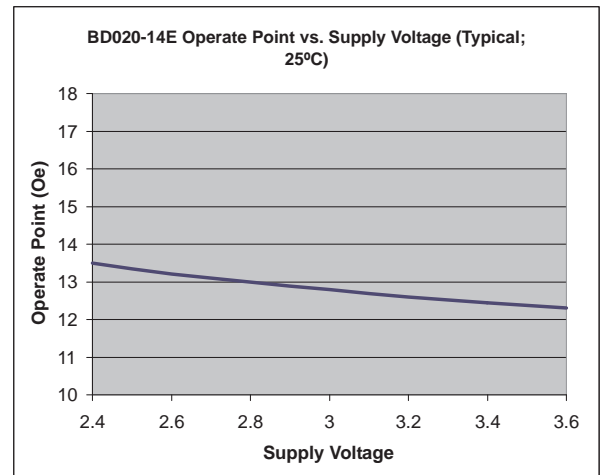
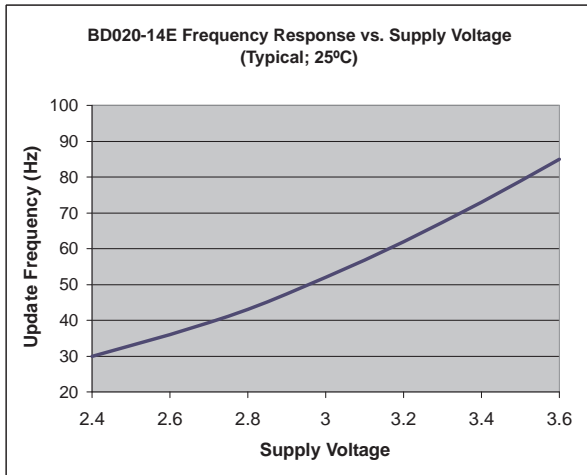
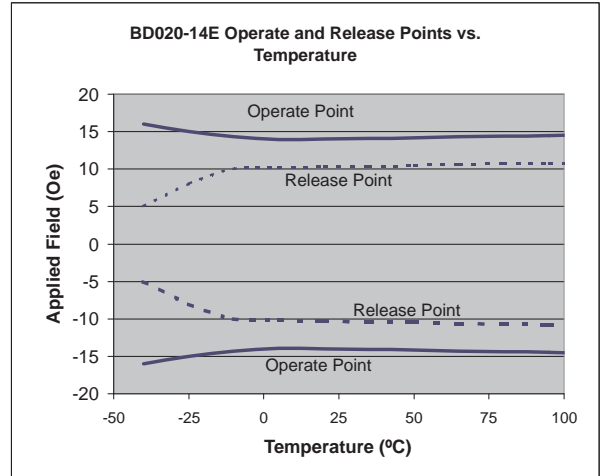
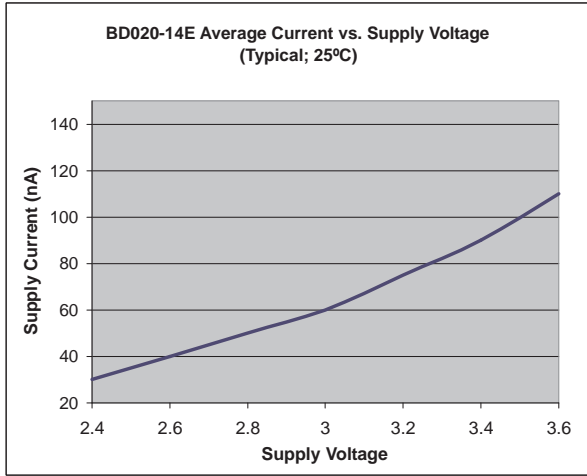
Parameter	Rating	Units
Applied Magnetic Field	Unlimited <sup>(2)</sup>	Oersteds
Supply Voltage	5.5	Volts
Output Off Voltage	5.5	Volts
Output Current	200	μA
Maximum Junction Temperature	+170	°C
Storage Temperature	-65 to +170	°C

#### Notes:

- 1 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**

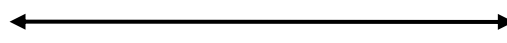
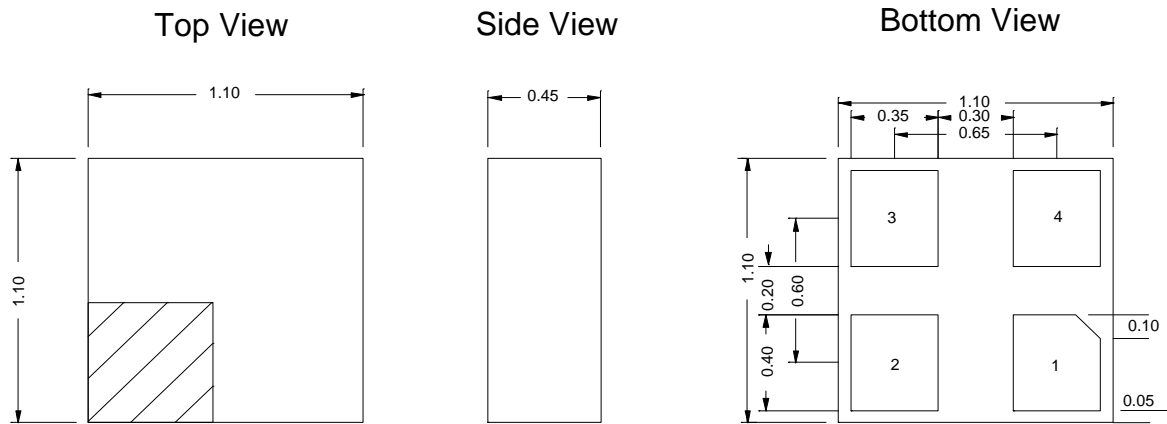
Average current increases, but remains extremely low, over variations in supply voltage. The magnetic operate and release points are very stable over temperature and supply voltage. Update frequency increases as supply voltage increases.



**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  $\pm 0.10$  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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