

# **BD027-14E**

## **Low-Voltage Nanopower Digital Switch for Medical Devices**

### **Key Features**

- Low Voltage Operation to 0.9 V
- Power Consumption 45 nW Maximum at 0.9 V
- Digital Switch Output
- Precise Detection of Low Magnetic Fields
- Ultraminiature Package

### **Description**

BD027-14E Series sensors are Giant Magnetoresistive (GMR) Digital Switch devices designed to run at low voltages and extremely low currents. The devices are manufactured with NVE's patented spintronic GMR technology for unmatched miniaturization, sensitivity, precision, and low power.

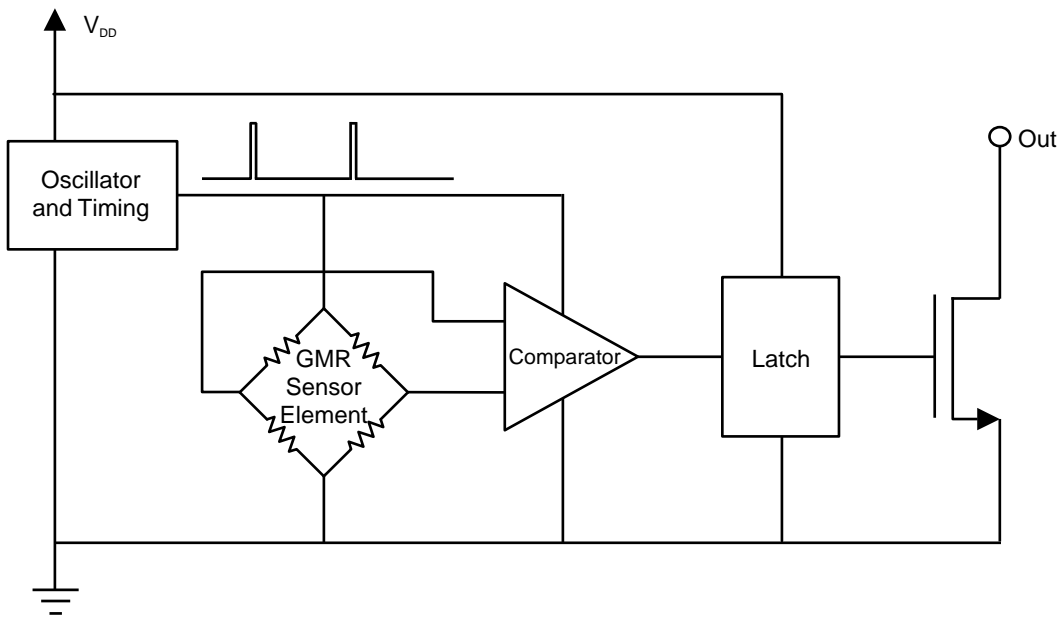
The output is configured as a magnetic "switch" where the output turns on when the magnetic field is applied, and turns off when the field is removed. The IC is available for continuous duty operation, or internally duty cycled at approximately 0.1% to conserve power. An integrated latch ensures the output is available continuously in duty-cycled mode. The part is available in NVE's new ULLGA leadless package measuring just 1.1 mm x 1.1 mm x 0.4 mm.

The BD027-14E parts are ideal for single battery-powered implantable medical devices. The applied magnetic field can be of either polarity, and the part consumes less than 1 microwatt of power. The magnetic operate point is extremely stable over supply voltage and temperature variations. The output is current-sinking, and can sink up to 100 microamps.

The product consists of an approximately 0.6 mm x 0.6 mm die containing a GMR sensor element, CMOS signal processing circuitry to convert the analog sensor element output to a digital output, and an oscillator and timing circuit for duty cycling. The plastic package is ultra-small, ultra-low profile, surface mount, lead-free, and RoHS compliant. Bare die are also available for extremely space-critical applications.

Versions of this part with different magnetic characteristics are available. Please contact NVE for details.

**Functional Block Diagram**

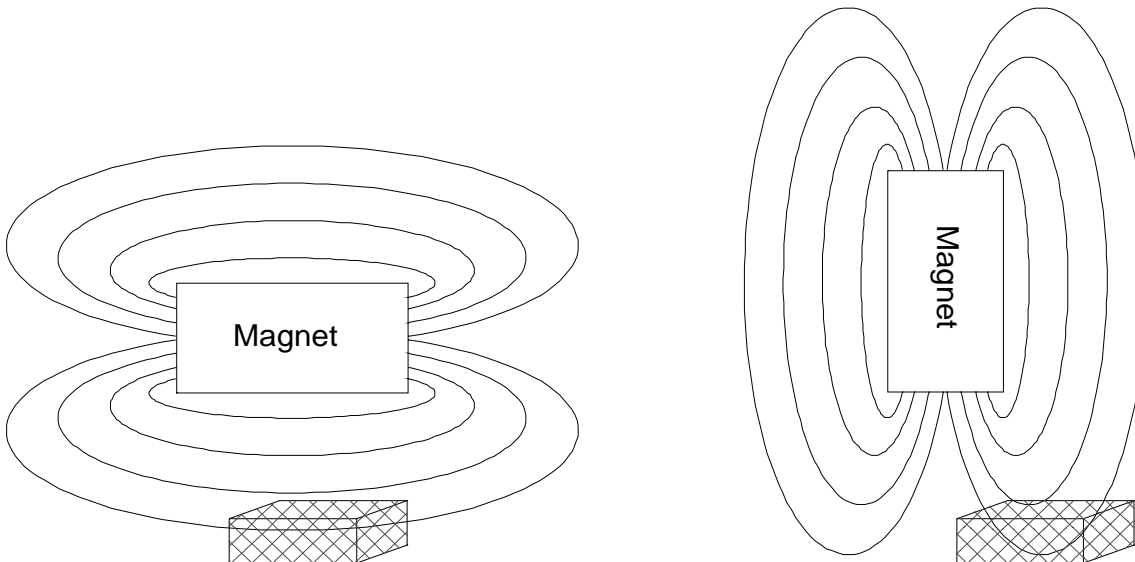


**Operation**

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):

Parameter	Min.	Typ.	Max.	Units
Magnetic Operate Point	11	15	19	Oersteds <sup>(1)</sup>
Magnetic Release Point	4.5			Oersteds <sup>(1)</sup>
Hysteresis	0.25		6.5	Oersteds <sup>(1)</sup>
Operating Voltage ( $V_{DD}$ ) <sup>(3)</sup>	0.9	1.25	2.4	Volts
Quiescent Current at 0.9 V		0.032	0.060	$\mu$ A
Quiescent Current at 1.4 V		0.095	0.150	$\mu$ A
Quiescent Current at 2.4 V		0.460	0.650	$\mu$ A
Peak Current During Sensor Sampling (1.4 V)		35	55	$\mu$ A
Output Drive Current	100			$\mu$ A
$V_{OL}$ at 100 $\mu$ A Output Drive Current ( $V_{DD} = 1.25$ V)			0.20	Volts
Output Leakage Current			0.5	$\mu$ A
Frequency Response at 0.9V	30	40	60	Hz
Frequency Response at 1.4V	80	110	160	Hz
Frequency Response at 2.4V	120	260	375	Hz
Temperature Range of Operation <sup>(3)</sup>	-40		85	$^{\circ}$ C

## Absolute Maximum Ratings

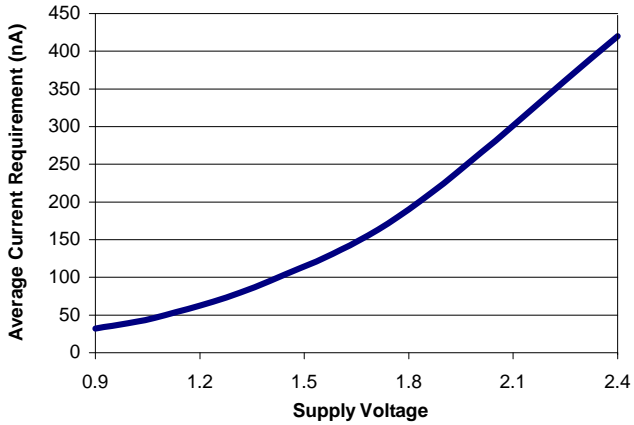
Parameter	Rating	Units
Applied Magnetic Field	Unlimited <sup>(2)</sup>	Oersteds
Supply Voltage	5.5	Volts
Output Off Voltage	5.5	Volts
Output Current	200	$\mu$ A
Maximum Junction Temperature	+170	$^{\circ}$ C
Storage Temperature	-65 to +170	$^{\circ}$ C

### Notes:

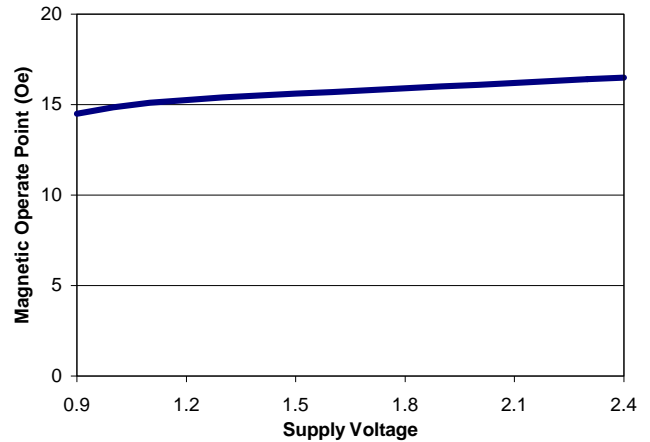
- 1 Oe (Oersted) = 1 Gauss in air = 0.1 mT
2. Large magnetic fields WILL NOT damage NVE GMR sensors
3. Operation from  $-20^{\circ}$ C to  $-40^{\circ}$ C at supply voltages less than 1.0 V may not meet specifications.

**Typical Performance Characteristics**

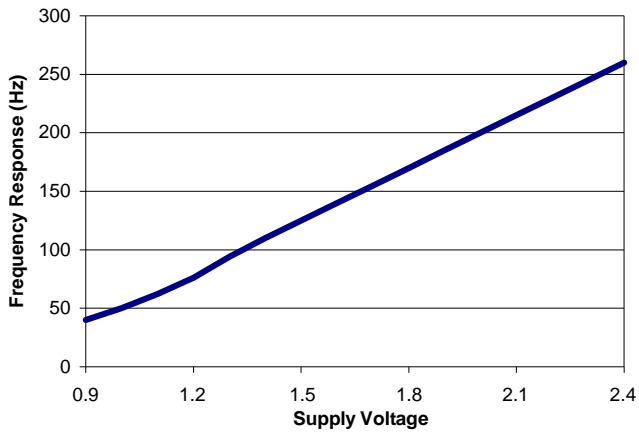
**Average Supply Current vs. Supply Voltage, 25°C**



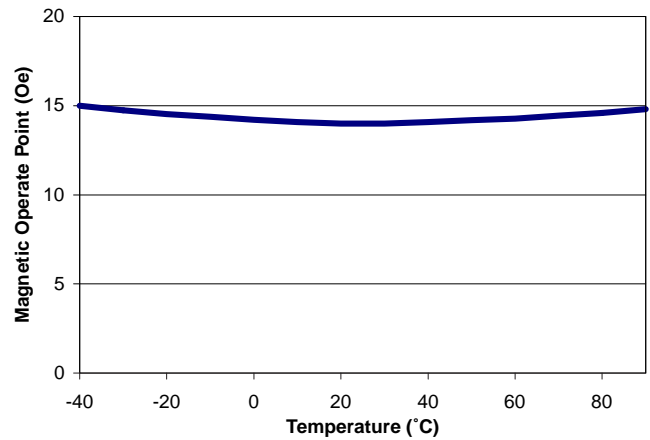
**Magnetic Operate Point vs. Voltage Supply, 25°C**



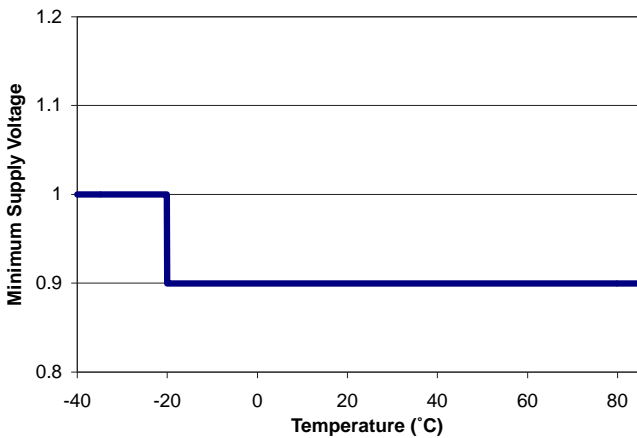
**Frequency Response vs. Supply Voltage, 25°C**



**Magnetic Operate Point vs. Temperature, 1.15V**



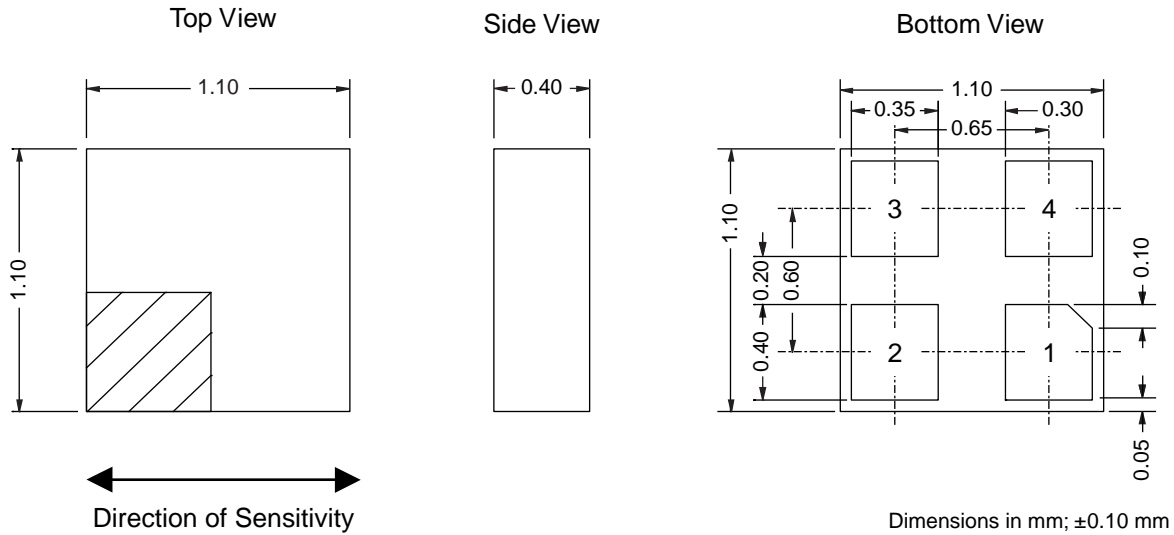
**Supply Voltage vs. Temperature Derating Curve**



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

**4-Lead ULLGA Package**

1.1 mm x 1.1 mm x 0.40 mm; Lead Pitch 0.65 mm



**Pinout:**

Pin 1	No Connect
Pin 2	V <sub>DD</sub>
Pin 3	Out
Pin 4	Ground

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