



# DRV421 Integrated Fluxgate Sensor for Closed-Loop Current Sensing

## 1 Features

- High-Precision Integrated Fluxgate Sensor
  - Offset and Drift:  $\pm 3 \mu\text{T}$  max,  $\pm 10 \text{ nT}/^\circ\text{C}$  typ
- Extended Current Measurement Range
  - H-Bridge Output Drive:  $\pm 250 \text{ mA}$  typ at  $5 \text{ V}$
- Precision Differential Amplifier
  - Offset and Drift (max):  $\pm 100 \mu\text{V}$ ,  $\pm 2 \mu\text{V}/^\circ\text{C}$
  - Gain Error and Drift (max):  $\pm 0.3\%$ ,  $\pm 5 \text{ ppm}/^\circ\text{C}$
- Precision Reference
  - Accuracy and Drift (max):  $\pm 2\%$ ,  $\pm 100 \text{ ppm}/^\circ\text{C}$
  - Pin-Selectable Voltage:  $2.5 \text{ V}$  or  $1.65 \text{ V}$
  - Selectable Ratiometric Mode:  $\text{VDD}/2$
- Overrange and Error Flags
- Supply Voltage Range:  $3.0 \text{ V}$  to  $5.5 \text{ V}$
- Package:  $4\text{-mm} \times 4\text{-mm}$ , Thin WQFN-20 with PowerPAD™
- Fully Specified Over the Extended Industrial Temperature Range

## 2 Applications

- Closed-Loop DC- and AC-Current Sensor Modules
- Leakage Current Sensors
- Industrial Monitoring and Control Systems

## 3 Description

The DRV421 is designed for magnetic closed-loop current sensing solutions, enabling isolated, precise dc- and ac-current measurements. The device provides both, a propriately integrated fluxgate sensor, and the required analog signal conditioning, thus minimizing component count and cost. The low offset and drift of the fluxgate sensor, along with an optimized front-end circuit results in unrivaled measurement precision.

The DRV421 provides all the necessary circuit blocks to drive the current-sensing feedback loop. The sensor front-end circuit is followed by a filter that can be configured to work with common current-sensing modules. The integrated  $250\text{-mA}$  H-Bridge drives the compensation coil, while doubling the current measurement range, comparing to conventional single-ended drive methods. The device also provides a precision voltage reference and differential amplifier to generate and drive the analog output signal.

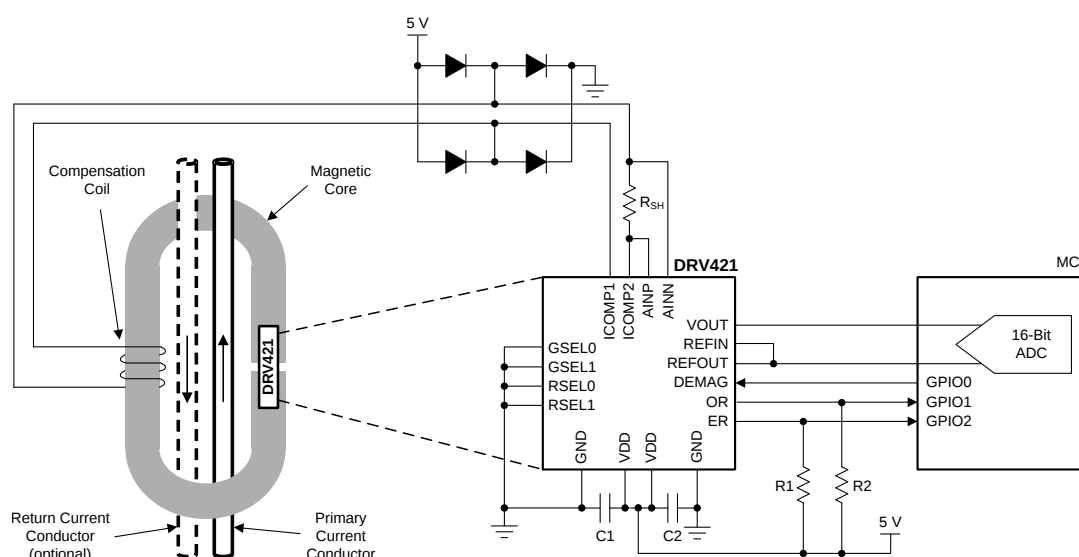
The DRV421 is available in a thermally enhanced  $4\text{-mm} \times 4\text{-mm}$ , thin WQFN package with PowerPAD, and is specified for operation over the extended industrial temperature range of  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ .

**Device Information<sup>(1)</sup>**

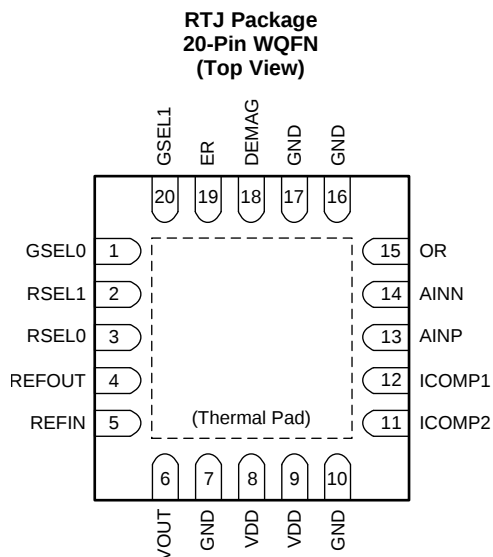
| PART NUMBER | PACKAGE   | BODY SIZE (NOM)                          |
|-------------|-----------|------------------------------------------|
| DRV421      | WQFN (20) | $4.00 \text{ mm} \times 4.00 \text{ mm}$ |

(1) For all available packages, see the package option addendum at the end of the datasheet.

## Typical Application



## 4 Pin Configuration and Functions



**Pin Functions**

| PIN                  |               | I/O | DESCRIPTION                                                                                                                            |
|----------------------|---------------|-----|----------------------------------------------------------------------------------------------------------------------------------------|
| NAME                 | NO.           |     |                                                                                                                                        |
| AINN                 | 14            | I   | Inverting input of differential amplifier                                                                                              |
| AINP                 | 13            | I   | Noninverting input of differential amplifier                                                                                           |
| DEMAG                | 18            | I   | Degauss control input                                                                                                                  |
| ER                   | 19            | O   | Error output flag, open-drain                                                                                                          |
| GND                  | 7, 10, 16, 17 | —   | Ground reference                                                                                                                       |
| GSEL0                | 1             | I   | Gain and bandwidth selection input 0                                                                                                   |
| GSEL1                | 20            | I   | Gain and bandwidth selection input 1                                                                                                   |
| ICOMP1               | 12            | O   | Output 1 of compensation coil driver                                                                                                   |
| ICOMP2               | 11            | O   | Output 2 of compensation coil driver                                                                                                   |
| OR                   | 15            | O   | Overrange indication output of the differential amplifier, open-drain, low-active                                                      |
| REFIN                | 5             | I   | Common-mode reference input for the differential amplifier                                                                             |
| REFOUT               | 4             | O   | Voltage reference output                                                                                                               |
| RSEL0                | 3             | I   | Voltage reference mode selection input 0                                                                                               |
| RSEL1                | 2             | I   | Voltage reference mode selection input 1                                                                                               |
| VDD                  | 8, 9          | —   | Supply voltage, 3.0 V to 5.5 V. Both pins should be decoupled using 1-μF ceramic capacitors placed as close as possible to the device. |
| VOUT                 | 6             | O   | Differential amplifier output                                                                                                          |
| PowerPAD thermal pad |               | —   | Connect thermal pad to GND                                                                                                             |

## 5 Device and Documentation Support

### 5.1 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

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**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 5.2 Trademarks

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### 5.3 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 5.4 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 6 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|-------------------------|----------------------|--------------|-------------------------|---------|
| DRV421RTJR       | PREVIEW       | QFN          | RTJ                | 20   | 3000           | TBD             | Call TI                 | Call TI              | -40 to 125   | -----><br>D421XXX       |         |
| DRV421RTJT       | PREVIEW       | QFN          | RTJ                | 20   | 250            | TBD             | Call TI                 | Call TI              | -40 to 125   | -----><br>D421XXX       |         |
| PDRV421RTJT      | PREVIEW       | QFN          | RTJ                | 20   | 250            | TBD             | Call TI                 | Call TI              | -40 to 125   |                         |         |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

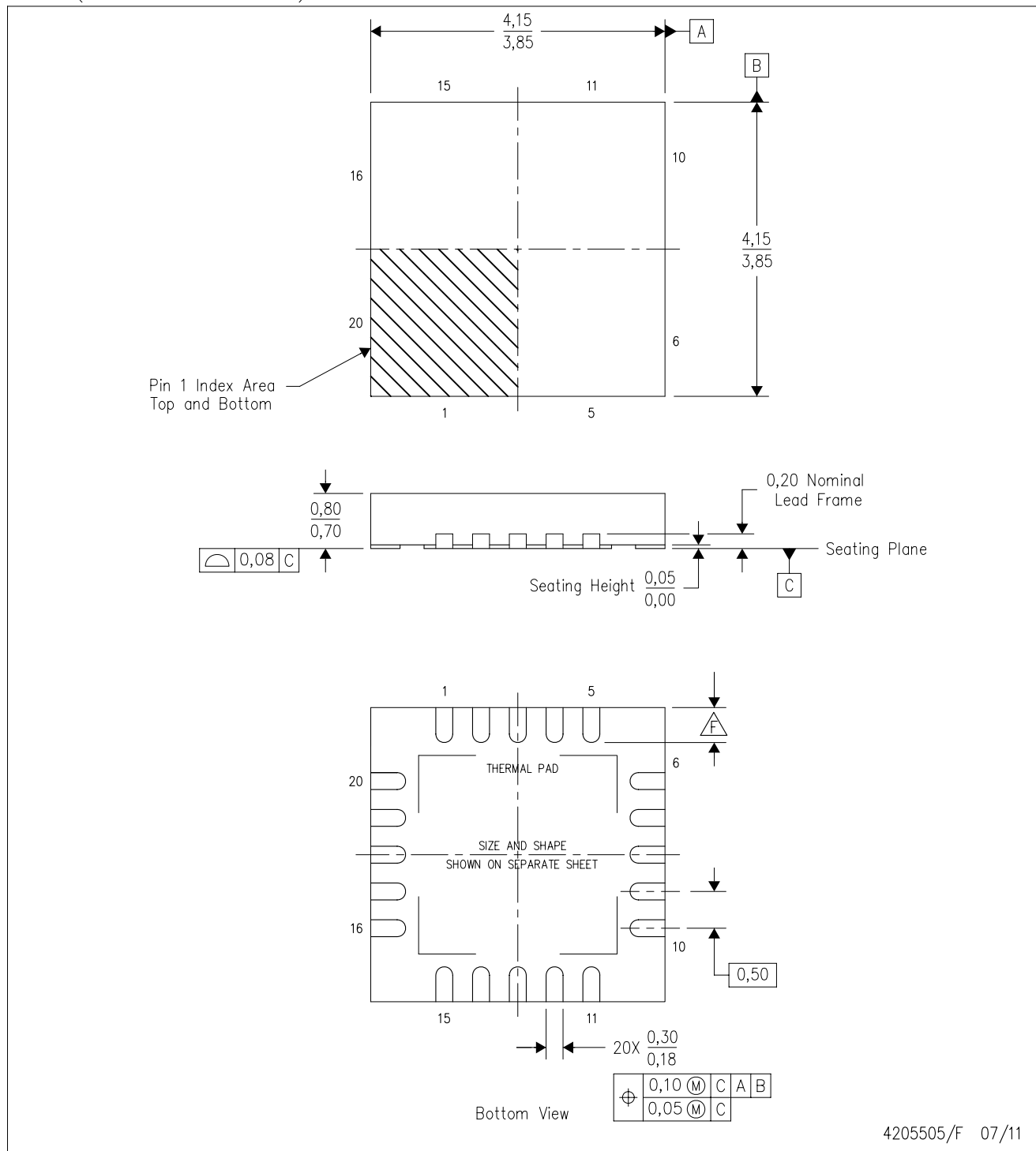
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RTJ (S-PWQFN-N20)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5-1994.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) package configuration.
  - D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
  - △ Check thermal pad mechanical drawing in the product datasheet for nominal lead length dimensions.

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### Products

|                              |                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------|
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| Amplifiers                   | <a href="http://amplifier.ti.com">amplifier.ti.com</a>                               |
| Data Converters              | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>                       |
| DLP® Products                | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
| DSP                          | <a href="http://dsp.ti.com">dsp.ti.com</a>                                           |
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| Interface                    | <a href="http://interface.ti.com">interface.ti.com</a>                               |
| Logic                        | <a href="http://logic.ti.com">logic.ti.com</a>                                       |
| Power Mgmt                   | <a href="http://power.ti.com">power.ti.com</a>                                       |
| Microcontrollers             | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a>                   |
| RFID                         | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Applications Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
| Wireless Connectivity        | <a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a> |

### Applications

|                               |                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------|
| Automotive and Transportation | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>                         |
| Communications and Telecom    | <a href="http://www.ti.com/communications">www.ti.com/communications</a>                 |
| Computers and Peripherals     | <a href="http://www.ti.com/computers">www.ti.com/computers</a>                           |
| Consumer Electronics          | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
| Energy and Lighting           | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
| Industrial                    | <a href="http://www.ti.com/industrial">www.ti.com/industrial</a>                         |
| Medical                       | <a href="http://www.ti.com/medical">www.ti.com/medical</a>                               |
| Security                      | <a href="http://www.ti.com/security">www.ti.com/security</a>                             |
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