

## Evaluating the ADAF1080 Integrated $\pm 8$ mT AMR Magnetic Field Sensor with a Ring Architecture

### FEATURES

- ▶ Contactless current measurement
- ▶  $\pm 200$  A nominal range
- ▶ Up to  $\pm 640$  A extended range
- ▶ Small form factor
- ▶ Low noise
- ▶ Zero-offset over life and temperature
- ▶ Single analog output
- ▶ Plug and play

### EVALUATION KIT CONTENTS

- ▶ EVAL-ADAF1080-3EBZ or EVAL-ADAF1080-6EBZ

### EQUIPMENT NEEDED

- ▶ 5 V power supply
- ▶ An acquisition system compatible with the output voltage
- ▶ Digital lines for control of the features of the [ADAF1080](#) (optional)

### GENERAL DESCRIPTION

The ADAF1080 is a single-axis, high-precision, low-field magnetic sensor with integrated signal conditioning. The device incorporates a low-field anisotropic magnetoresistive (AMR) sensor with an integrated signal conditioning amplifier, a flip coil with a driver and a calibration coil with a driver for measuring magnetic fields precisely. The ADAF1080 enables, low-noise, wide dynamic range measurement with zero electrical offset, wide bandwidth, and low harmonic distortions with integrated functions.

The EVAL-ADAF1080-3EBZ or EVAL-ADAF1080-6EBZ enable the user to simply and quickly achieve precise contactless current measurement using the high performance of the ADAF1080.

A 4-pin connector enables contactless measurement of currents through a wire placed at the center of the ring.

The EVAL-ADAF1080-3EBZ or EVAL-ADAF1080-6EBZ features test points and external pads for the user to access the additional functionality of the ADAF1080.

The EVAL-ADAF1080-3EBZ or EVAL-ADAF1080-6EBZ includes an on-board low dropout (LDO) regulator, multiple ADAF1080 devices, and a summing amplifier to output a single analog voltage.

Analog Devices, Inc., offer two versions of this evaluation board. The EVAL-ADAF1080-3EBZ has three sensors for a cost-effective, current-measurement solution, and the EVAL-ADAF1080-6EBZ has six sensors for cases where higher accuracy and resistance to interference is required.

For full details on the ADAF1080, see the ADAF1080 data sheet, which should be used in conjunction with this user guide when using the EVAL-ADAF1080-3EBZ or EVAL-ADAF1080-6EBZ.

### RING ARCHITECTURE EVALUATION SYSTEMS

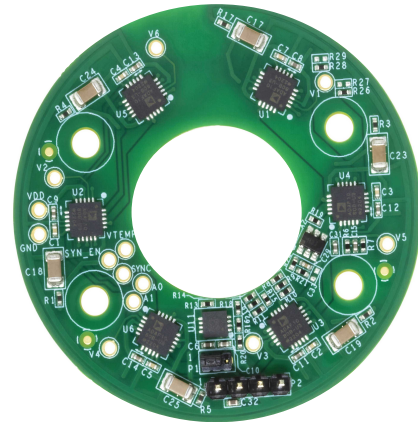


Figure 1. Top Side of the EVAL-ADAF1080-6EBZ



Figure 2. Bottom Side of the EVAL-ADAF1080-6EBZ

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**REVISION HISTORY**

**1/2023—Revision 0: Initial Version**

## EVALUATION BOARD DESIGN

The ADAF1080 is an AMR magnetic field sensor targeted for contactless current-sensing applications. The EVAL-ADAF1080-3EBZ or EVAL-ADAF1080-6EBZ is a design example of how the ADAF1080 can be used in a ring configuration to offer a coreless solution for contactless current measurement.

### MAGNETIC PRINCIPLES

The magnetic field generated by a current into a wire can be expressed with Ampere's Law as follows:

$$\oint \mathbf{B} \times d\mathbf{l} = \mu_0 \times I$$

where:

$\oint \mathbf{B} \times d\mathbf{l}$  is the integration of Magnetic Field  $\mathbf{B}$  around a closed contour.

$\mu_0$  is the permeability of the material.

$I$  is the current flowing into the wire.

A wire can be approximated to an infinitely long cylindrical conductor; therefore, the integral can be simplified, and the Magnetic Field  $\mathbf{B}$  generated by the wire can be expressed by the following equation:

$$B = \frac{\mu_0 \times I}{2 \times \pi \times R}$$

where:

$B$  is the magnetic field generated by the wire for any position external to the conductor.

$\mu_0$  is the magnetic permeability in a vacuum.

$I$  is the current flowing in the wire.

$R$  is the distance from the center of the wire.

Figure 3 shows the resulting magnetic field magnitude generated by a 100 A current flowing in a conductor is equal in magnitude at any point for a fixed radius,  $R$ .

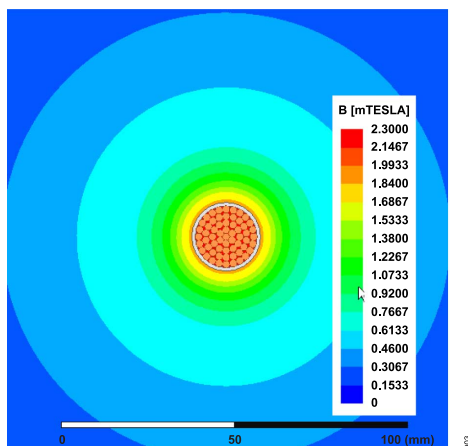


Figure 3. Electromagnetic Simulation of a 100 A Current Flowing into a 16 mm Diameter Wire

With this formula known, a single-sensor solution can be used at a known distance ( $R$ ) and measure  $B$  proportional to the current ( $I$ ). While this can work, a single-sensor solution is impractical in most

applications because of wire placement uncertainty and stray field impact.

### WIRE PLACEMENT UNCERTAINTY

It is recommended to calibrate the sensitivity of the output after placing the wire in the system to account for any placement error. After such calibration, vibration, thermal expansion, and mechanical shift over life are parameters to consider as these parameters directly impact the distance  $R$  between the wire and the sensor. To minimize this error source, it is possible to use multiple sensors around the conductor to reduce the impact of wire placement error in the system.

Figure 4 shows an example of a ring configuration where three sensors are positioned around a wire to minimize the impact of a wire movement error.

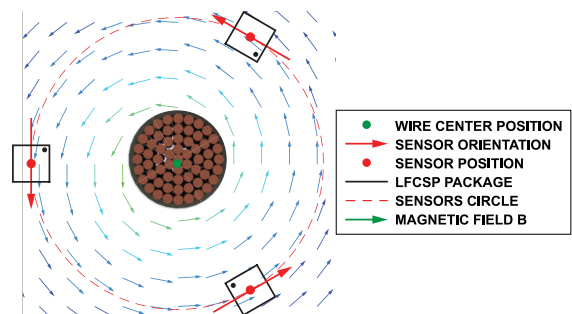


Figure 4. Ring Configuration Example with Three Sensors

In such a configuration, when the wire moves, one or multiple sensors see a stronger magnetic field while the other sensors see a proportionally weaker magnetic field. Therefore, the summed output of these sensors is insensitive to wire movement to a first order.

Various numbers of sensors can be used in such a configuration, and additional sensors can achieve higher robustness to wire movement. Figure 5 and Figure 6 are simulation plots representing the reading error due to the wire movement with three sensors and six sensors, respectively. Each colored pixel represents where the center of a wire can be positioned and the resulting reading error assuming that the evaluation board was calibrated with a perfectly centered wire. The color scale is saturated at 1%, and the error is in absolute terms.

## EVALUATION BOARD DESIGN

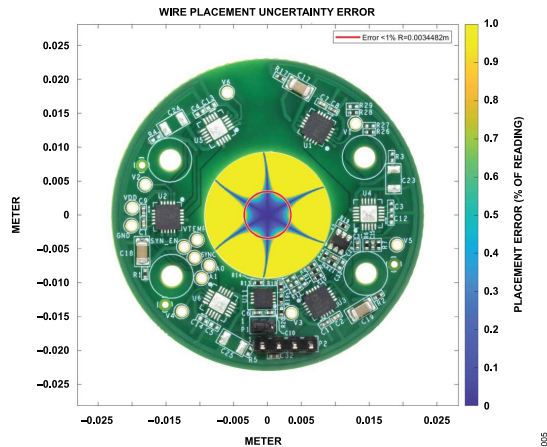


Figure 5. Simulation Plot of the Impact of a Wire Movement with the EVAL-ADAF1080-3EBZ

Figure 5 shows that if the center of the wire to be measured moves by more than 3.448 mm in any direction after calibration then the absolute output reading is incorrect by >1% due to a wire placement induced error.

Figure 6 shows that for a similarly shaped board with six sensors, the output is much more resistant to wire movement. The allowed variance for the position of the wire center is 7.42 mm after calibration to ensure <1% error due to wire placement.

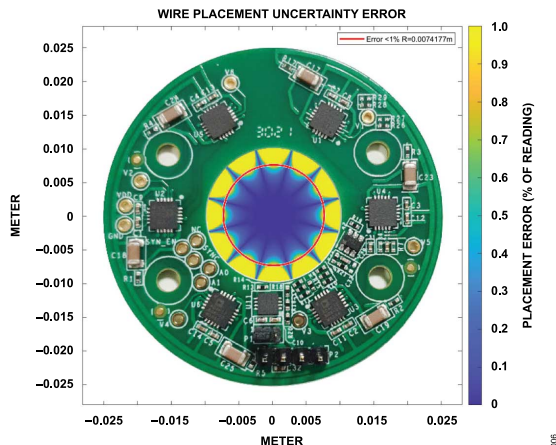


Figure 6. Simulation Plot of the Impact of a Wire Movement with the EVAL-ADAF1080-6EBZ

Figure 5 and Figure 6 do not take in account the diameter of the wire measured. If the wire measured has an 18 mm diameter, the maximum movement of this wire is only 1 mm because the central opening of the evaluation board is 20 mm wide.

Note that the simulation plots shown in Figure 5 and Figure 6 hold true for conductors that are circular in profile. The EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ are intended for use with conductors that are circular in profile.

## OVERCOMING WIRE PLACEMENT UNCERTAINTY

A practical and customizable method of limiting the movement of the wire relative to the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ is the use of a center spacer or sleeve. These spacers or sleeves can be designed to hold the wire fixed in the center of the board and minimize movement. See Figure 7 for an example of a spacer used on a six-sensor board with a small diameter wire. It is important that these spacers are made of a nonconducting and nonmagnetic material. Mechanical drawings of the board are shown in Figure 24 to aid in the design of a spacer.

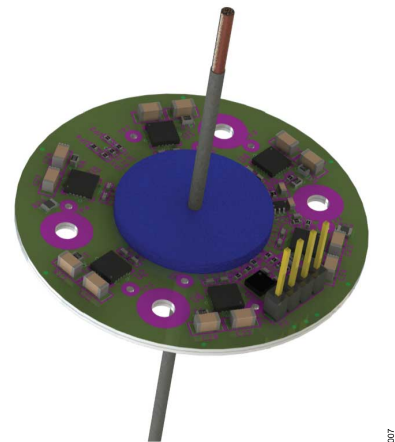


Figure 7. Example of a Wire Spacer for Rigid Position Fixing

Figure 8 summarizes Figure 5 and Figure 6 while highlighting the benefit of using more sensors to reduce the impact of a wire movement.

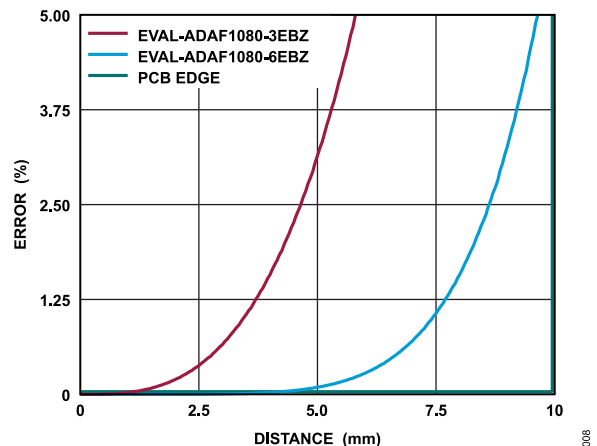


Figure 8. Error Induced by Wire Movement Measured from and Ideal Location

## STRAY FIELDS

Stray fields are defined as an interferer to the magnetic field of interest. Such stray fields can come from the magnetic field of the earth, from another current carrying conductor, from a magnet, or any combination of these.

## EVALUATION BOARD DESIGN

A single magnetic sensor and a perfectly fixed wire with no stray fields can be used to achieve high accuracy measurements. However, using a single absolute magnetic sensor solution is susceptible to stray fields because the sensor cannot distinguish which source the magnetic field is coming from. Therefore, stray fields are also measured by the sensor without distinction and can create a measurement error.

Stray fields can be divided into two categories: homogeneous and nonhomogeneous. Homogeneous stray fields are magnetic fields where the magnitude and direction are not changing at the scale of the measurement. For example, the magnetic field of the earth is considered homogeneous because its amplitude and direction do not change at the centimeter scale.

However, magnets and wires close to sensors can produce a strong nonhomogeneous stray field, where two sensors placed some distance apart experience a magnetic field that varies in magnitude and direction.

### DEALING WITH A HOMOGENEOUS STRAY FIELD

A homogeneous stray field can be canceled in the system by doing a differential measurement. Figure 9 shows how two sensors can be arranged to do such a measurement and to differentiate between a stray field and the magnetic field of interest.

In Figure 9,  $B_{WIRE}$  is the magnetic field generated by the wire at a fixed radius  $R$ , and  $B_H$  is a homogeneous stray magnetic field that is a fixed magnitude and vector at the scale of the solution.

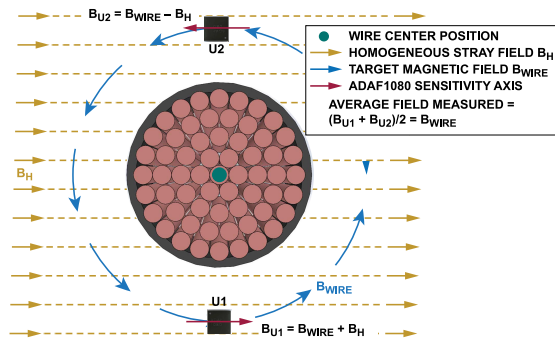


Figure 9. Differential Sensing Principle

In Figure 9, Sensor U1 sees a weaker magnetic field as  $B_{WIRE}$  and  $B_H$  are opposite vectors, while Sensor U2 sees an equally stronger magnetic field because  $B_{WIRE}$  and  $B_H$  are in the same direction. The average value is then only dependent of  $B_{WIRE}$ , and the homogeneous stray field is perfectly rejected.

### DEALING WITH A NONHOMOGENEOUS STRAY FIELD

A nonhomogeneous stray field cannot be canceled as easily as a homogeneous stray field because magnetic field strengths de-

crease with distance from the source. Therefore, only the common measured value of the nonhomogeneous stray field is rejected.

Figure 10 and Figure 11 are simulation plots showing the impact on the output of the evaluation board due to an external wire carrying current for the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ

In Figure 10 and Figure 11, each colored pixel represents the crosstalk error associated with placing the center of an external current-carrying wire in that location external to the evaluation board. Color scale is saturated at 1% crosstalk for ease of reading. Crosstalk is defined as the magnetic field sensed by the ADAF1080 that is generated from a neighboring source as a percentage of the magnetic field measured.

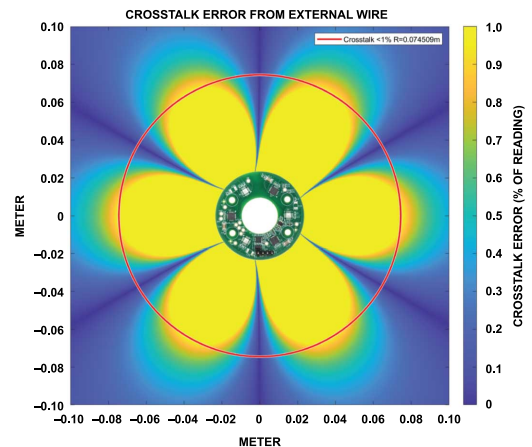


Figure 10. Simulation of Crosstalk from a Secondary Wire with the EVAL-ADAF1080-3EBZ

Figure 10 shows that to ensure that the EVAL-ADAF1080-3EBZ measures <1% of the current of an external wire, the center of the external wire must be at least 74.5 mm away from the center of the evaluation board. A user can also carefully position the wire between two yellow lobes to reduce the impact of this external wire due to the geometry of the magnetic fields and the board.

Note that the simulation plots shown in Figure 10 and Figure 11 hold true for conductors that are circular in profile. The EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ are intended for use with conductors that are circular in profile.



## EVALUATION BOARD DESIGN

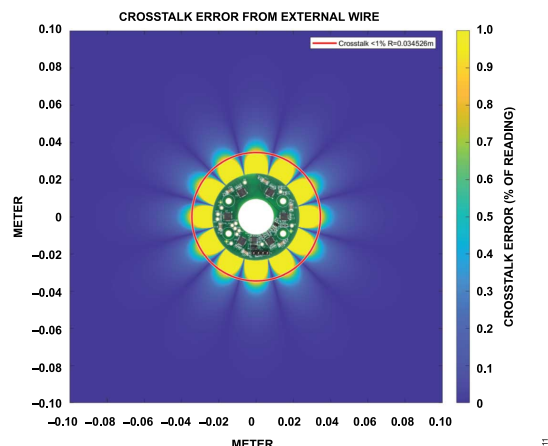


Figure 11. Simulation of Crosstalk from a Secondary Wire with the EVAL-ADAF1080-6EBZ

Figure 11 shows that with six sensors, the EVAL-ADAF1080-6EBZ has better stray-field rejection. The radius at which the crosstalk error drops to <1% is much smaller, 34.53 mm, and this configuration is more resistant to local stray magnetic fields. Figure 12 highlights the difference between the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ, showing that increasing the number of sensors reduces the error due to crosstalk from nearby sources of non homogeneous magnetic fields.

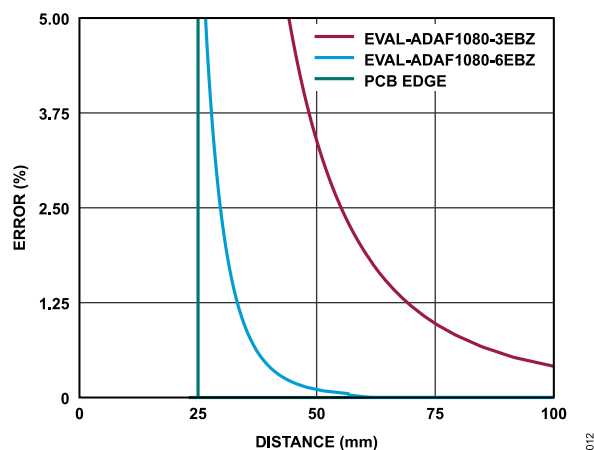


Figure 12. Comparison of the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ for Stray Field Rejection

## EVALUATION BOARD CURRENT LIMIT

The EVAL-ADAF1080-3EBZ or EVAL-ADAF1080-6EBZ was designed to place the [ADAF1080](#) sensors at a radius of  $R = 16$  mm for the measurement of a centrally placed wire. The ADAF1080 is a  $\pm 8$  mT magnetic field sensor; therefore, the maximum current this configuration can measure is  $\pm 640$  A.

## EVALUATION BOARD HARDWARE

The EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ comprise a printed circuit board (PCB), three or six ADAF1080 devices, an on-board LDO regulator ([ADP7104](#)), and an operational amplifier ([ADA4807-1](#)).

The EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ must be powered through the Main Connector P2. The following two configurations are possible and selectable with the Connector P1:

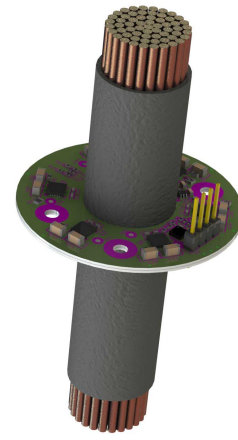
- ▶ A ratiometric supply configuration. For accurate measurement over possible supply variations, ratiometric measurement can be performed by connecting Pin 2 and Pin 3 of the Connector P1. The supply voltage must be between 5 V and 5.5 V and be used as the reference voltage for the acquisition system to be ratiometric.
- ▶ A nonratiometric supply configuration. For quick evaluation with a scope or a multimeter, place a jumper between Pin 1 and Pin 2 of the Connector P1. The supply voltage must be between 5 V and 20 V. This supply voltage is regulated down to 4.6 V by the on-board ADP7104.

It is recommended to use a ratiometric configuration to maximize the analog-to-digital converter (ADC) input resolution and remove the dependency on the supply voltage. If the output is not captured ratiometrically, any change of the supply voltage impacts the output accuracy.

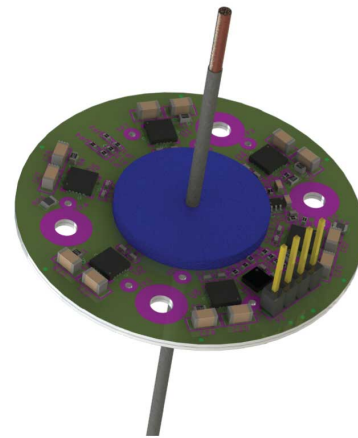
## HARDWARE CONFIGURATION

The EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ include multiple ADAF1080 devices in a ring architecture with an operational amplifier to act as a current transducer. This contactless measurement requires the wire to be centered in the central opening of the EVAL-ADAF1080-3EBZ or EVAL-ADAF1080-6EBZ for maximum accuracy.

Centering adapters made of nonconductive and nonmagnetic materials can be used to hold the wire in the position as shown in [Figure 14](#). The central opening has a 20 mm diameter and allows a wire of that diameter to be centered without requiring an adapter.



**Figure 13. EVAL-ADAF1080-3EBZ/EVAL-ADAF1080-6EBZ Sensing a 20 mm Diameter Wire with No Adapter**



**Figure 14. EVAL-ADAF1080-3EBZ/EVAL-ADAF1080-6EBZ Sensing a 2 mm Diameter Wire with a Centering Adapter (Shown in Blue)**

For further details, see the mechanical drawings in [Figure 24](#).

## EVALUATION BOARD HARDWARE

## BOARD CONFIGURATION

The EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ use a simple analog summing circuit to average the outputs of the ADAF1080 devices. With a single-acquisition channel, the user can sense the current flowing through the conductor placed at the center of the ring. Figure 15 shows how the ADAF1080 and summing amplifier are connected. A similar summing amplifier

circuit is used on the EVAL-ADAF1080-6EBZ evaluation board to average the output of the six ADAF1080 devices.

The EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ also provide test points for the user to monitor individual outputs of the ADAF1080 devices, which allows for the development of more sophisticated algorithms or for use in a redundant configuration.

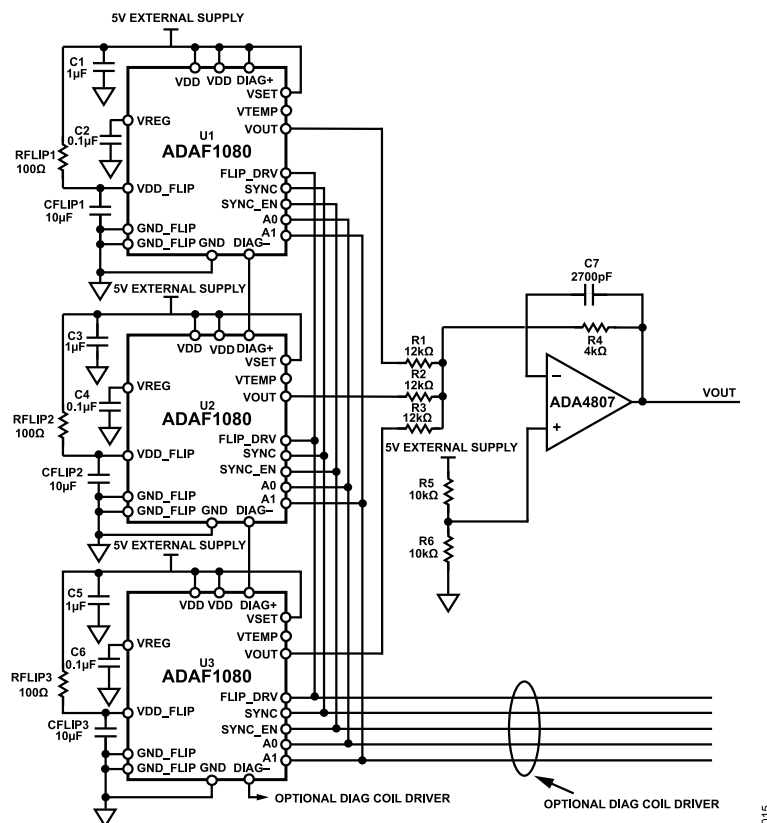


Figure 15. Averaging Amplifier Configuration Implemented on the EVAL-ADAF1080-3EBZ



## EVALUATION BOARD HARDWARE

## OUTPUT CHARACTERISTICS

With no current flowing, the output of the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ is centered at  $V_{DD}/2$ . Electrical offset can be canceled with the flipping functionality of the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ.

The flipping functionality of the ADAF1080 allows the user to control the sense field polarity of the sensor using the integrated flip coil. Changing the sense field polarity of the sensors enable the user to calculate and remove the electrical offset of the system over life and temperature.

The FLIP\_DRV pin is shared with all the ADAF1080 devices on the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ; therefore, the total offset of the evaluation boards can be calculated and canceled with only a single digital signal.

Figure 16 shows the output of the EVAL-ADAF1080-3EBZ or the EVAL-ADAF1080-6EBZ for a  $\pm 8$  mT range when the FLIP\_DRV pin is pulled high or low. Consult the ADAF1080 data sheet for more details on the flipping functionality.

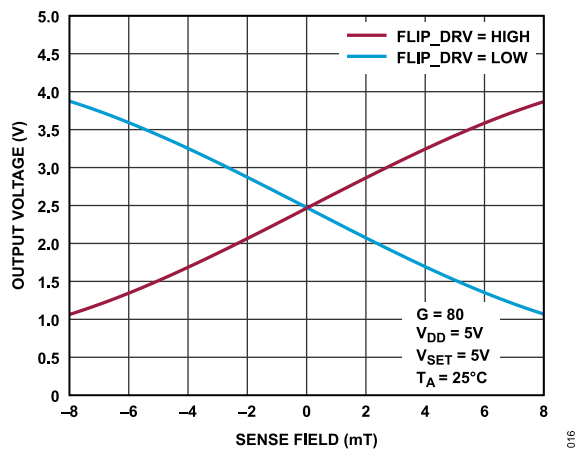


Figure 16. Output Voltage vs. Sense Field for  $\pm 8$  mT Range

With the default gain setting ( $G = 80$ ) for the ADAF1080 devices, the sensors have a sensitivity coefficient ( $S_{COEFF}$ ) of  $(199 \text{ mV/mT} \times (V_{DD}/5))$  over a  $\pm 2$  mT range (see the ADAF1080 data sheet for specific sensitivity coefficient over different field ranges and gain settings). A centered wire is generating a  $12.5 \mu\text{T/A}$  magnetic field as the sensors are placed on a 16 mm radius circle.

Therefore, the output transfer function of the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ is the following:

$$V_{OUT} = -2.5 \text{ mV/A} \times \frac{V_{DD}}{5} + \frac{V_{DD}}{2}$$

where:

$V_{DD}$  is the supply voltage on P2 if Pin 2 and Pin 3 of P1 are shorted together (ratiometric supply configuration), or  $V_{DD} = 4.6 \text{ V}$  if the P1 jumper is set to connect Pin 1 and Pin 2 (nonratiometric supply configuration).

Filtering is applied by the capacitor and feedback resistance of the operational amplifier. The cutoff frequency can be adjusted by changing the value of the Capacitor C29. The Capacitor C29 and feedback resistance,  $R21 + R24$ , create a first-order, low-pass filter at the cutoff frequency.

$$f_{3dB} = \frac{1}{2 \times \pi \times C29 \times (R21 + R24)}$$

See Figure 22 and Figure 23 for evaluation board schematics.

The Main Connector P2 provides access to the filtered analog output ( $V_{OUT}$ ), the ground pin (GND), the supply of the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ, and the FLIP\_DRV pin of all the ADAF1080 devices on the EVAL-ADAF1080-3EBZ and the EVAL-ADAF1080-6EBZ.

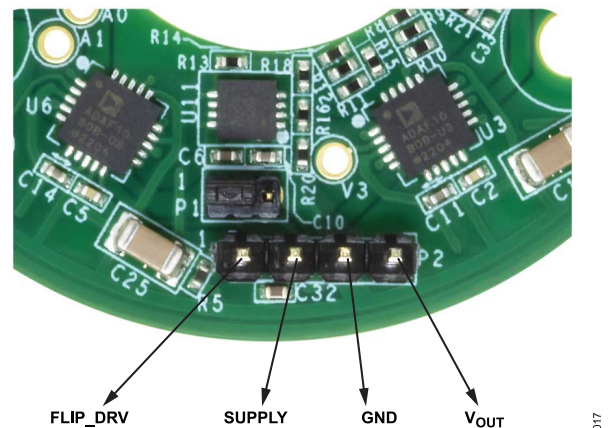


Figure 17. Main Connector P2 on the Top Side of the Evaluation Board

## OPTIONAL FEATURES

The EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ feature multiple ADAF1080 devices in a ring architecture. There are multiple sensors populated on the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ, and the features of each ADAF1080 can be controlled simultaneously by the user. These features can be controlled through the optional test point available on the back of the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ. Refer to the ADAF1080 data sheet for more details about these features.

EVALUATION BOARD HARDWARE

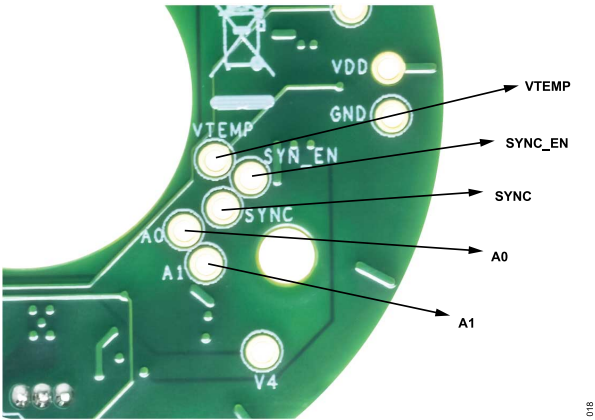


Figure 18. Access to the Optional Features for the ADAF1080 Devices (Back of Board)

Table 1. Optional Features Descriptions of the ADAF1080

| Mnemonic  | Input Type     | Description  |
|-----------|----------------|--|
| A0 and A1 | Digital inputs | Gain control of the integrated instrumentation amplifier. Set by default at 80 by the R26 to R29 jumpers.  |
| SYNC      | Digital input  | Control of the chopping functionality in the integrated amplifier of the ADAF1080 devices. Connect to the sampling clock of the ADC to synchronize the ADC sampling and chopping functionality. It is recommended to use this mode if a higher bandwidth is required. Connect to low to disable the chopping functionality if synchronization is not available and a higher bandwidth is required. Disabling the chopping functionality enables flat band noise up to 2 MHz (G = 20) but results in increased 1/f noise. |
| SYNC_EN   | Digital input  | Set high to enable the synchronization between the ADC sampling and the chopping of the integrated instrumentation amplifier. The conversion signal of the ADC must be provided on the SYNC pin.   |
| VTEMP     | Analog output  | The VTEMP pin can be used to take a temperature measurement from one of the ADAF1080 sensors on the evaluation board. For more information on the temperature sensor, consult the ADAF1080 data sheet.   |

TYPICAL CONNECTION DIAGRAM

Figure 19 shows the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ connected to a microcontroller for evaluation.

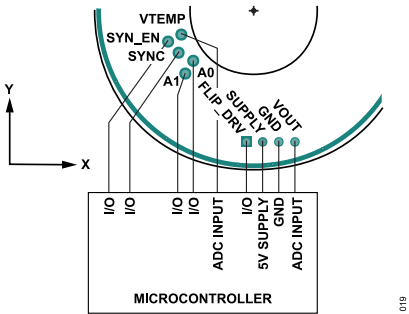


Figure 19. Typical Connection Diagram

CALIBRATION PROCEDURE

Sensitivity calibration can be performed by the user to remove external sources of error for a given board, such as discrete component tolerances, mechanical misalignment, and supply drift.

To optimize accuracy, perform this calibration only on the range of current in which the user is interested. After realizing a sweep over that current range, coefficients can be extracted from the best-fit straight line for the measured output voltages on the VOUT pin of the evaluation board, and sensitivity can be adjusted.

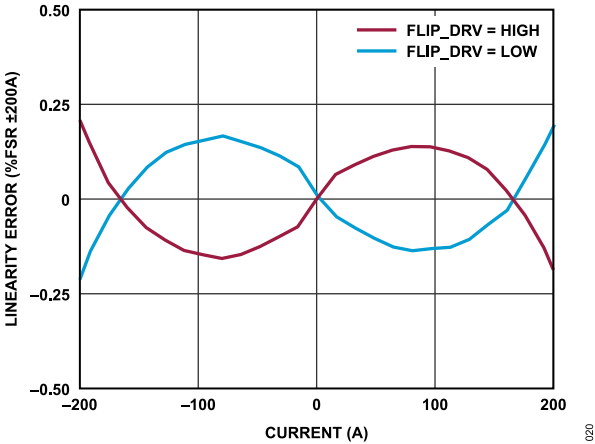
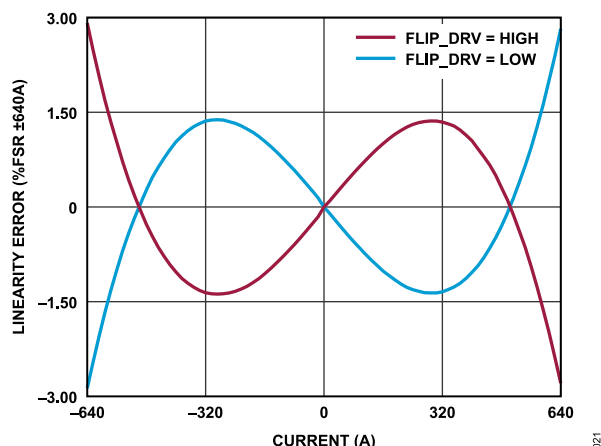


Figure 20. Linearity Error for a Full Scale of ±200 A

## EVALUATION BOARD HARDWARE

Figure 21. Linearity Error for a Full Scale of  $\pm 640$  A

## TYPICAL OUTPUT

Table 2 and Table 3 present a short summary of the expected performance of the EVAL-ADAF1080-3EBZ and EVAL-ADAF1080-6EBZ. For a more complete outline of performance characteristics, consult the [ADAF1080](#) data sheet.

## EVAL-ADAF1080-3EBZ Expected Performance

$T_A = 25^\circ\text{C}$ , supply voltage ( $V_{\text{SUPPLY}}$ ) = 5 V to 5.5 V, wire centered.

Table 2. EVAL-ADAF1080-3EBZ Expected Performance

| Parameter                               | Comments   | Typical     |
|---|--|-------------|
| Current                                 |  |             |
| Quiescent Supply                        | $V_{\text{SUPPLY}} = 5$ V  | 23 mA       |
| Nominal Range                           | $\pm 2.5$ mT range   | $\pm 200$ A |
| Extended Range                          | $\pm 8$ mT range   | $\pm 640$ A |
| Sensitivity                             | Measured at $\pm 80$ A   | 2.51 mV/A   |
| Linearity Error                         | Deviation from best fit straight line, nominal current range, full-scale range = $\pm 200$ A | 0.35%       |
| Cutoff Frequency of the Low-Pass Filter | C29 = 2700 pF, R24 + R21 = 4 k $\Omega$  | 14.7 kHz    |

## EVAL-ADAF1080-6EBZ Expected Performance

$T_A = 25^\circ\text{C}$ ,  $V_{\text{SUPPLY}} = 5$  V to 5.5 V, wire centered.

Table 3. EVAL-ADAF1080-6EBZ Expected Performance

| Parameter                               | Comments   | Typical     |
|---|--|-------------|
| Current                                 |  |             |
| Quiescent Supply                        | $V_{\text{SUPPLY}} = 5$ V  | 37 mA       |
| Nominal Range                           | $\pm 2.5$ mT range   | $\pm 200$ A |
| Extended Range                          | $\pm 8$ mT range   | $\pm 640$ A |
| Sensitivity                             | Measured at $\pm 80$ A   | 2.51 mV/A   |
| Linearity Error                         | Deviation from best fit straight line, nominal current range, full-scale range = $\pm 200$ A | 0.35%       |
| Cutoff Frequency of the Low-Pass Filter | C29 = 5600 pF, R24 + R21 = 2 k $\Omega$  | 14.2 kHz    |

## EVALUATION BOARD SCHEMATICS

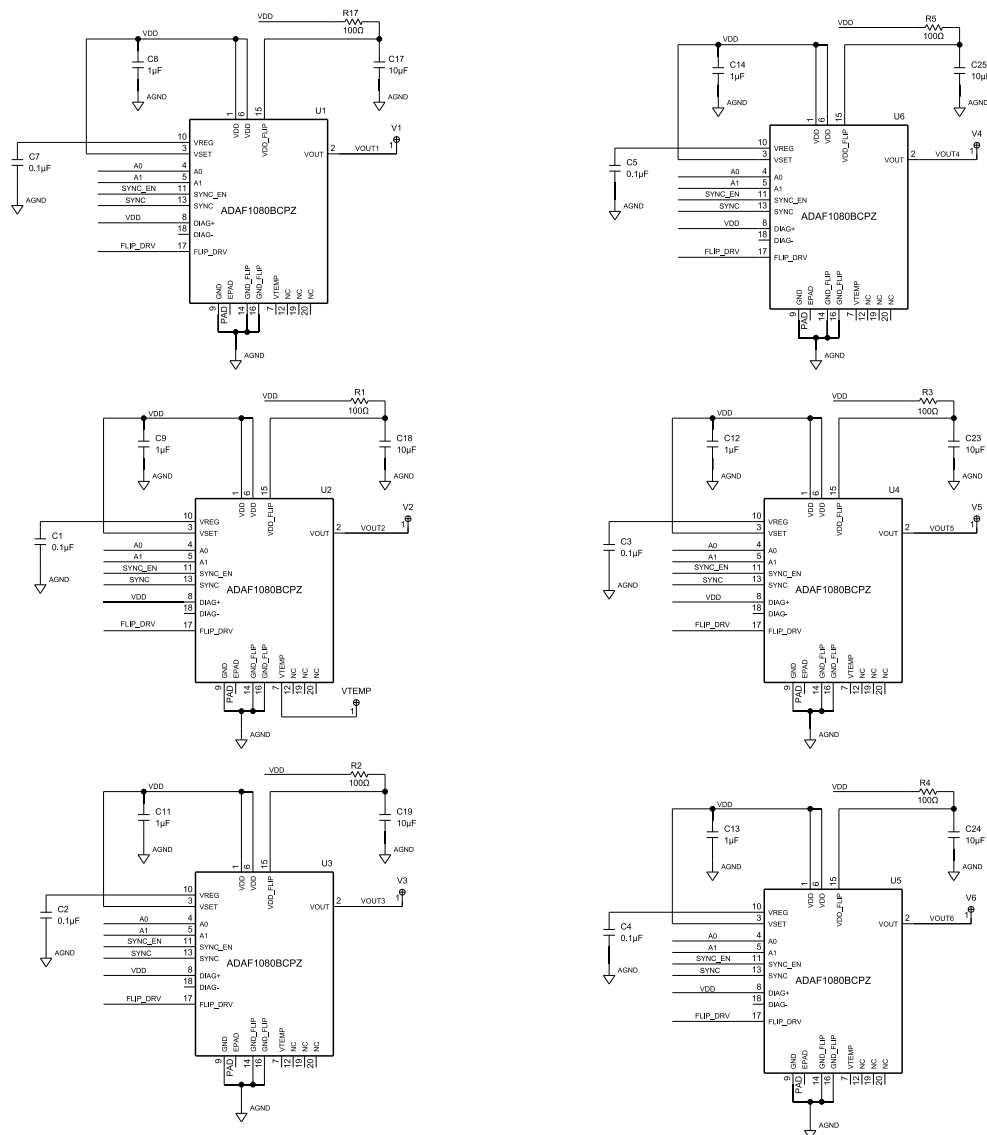


Figure 22. EVAL-ADAF1080-3EBZ/EVAL-ADAF1080-6EBZ Evaluation Board Schematic Page 1

## EVALUATION BOARD SCHEMATICS

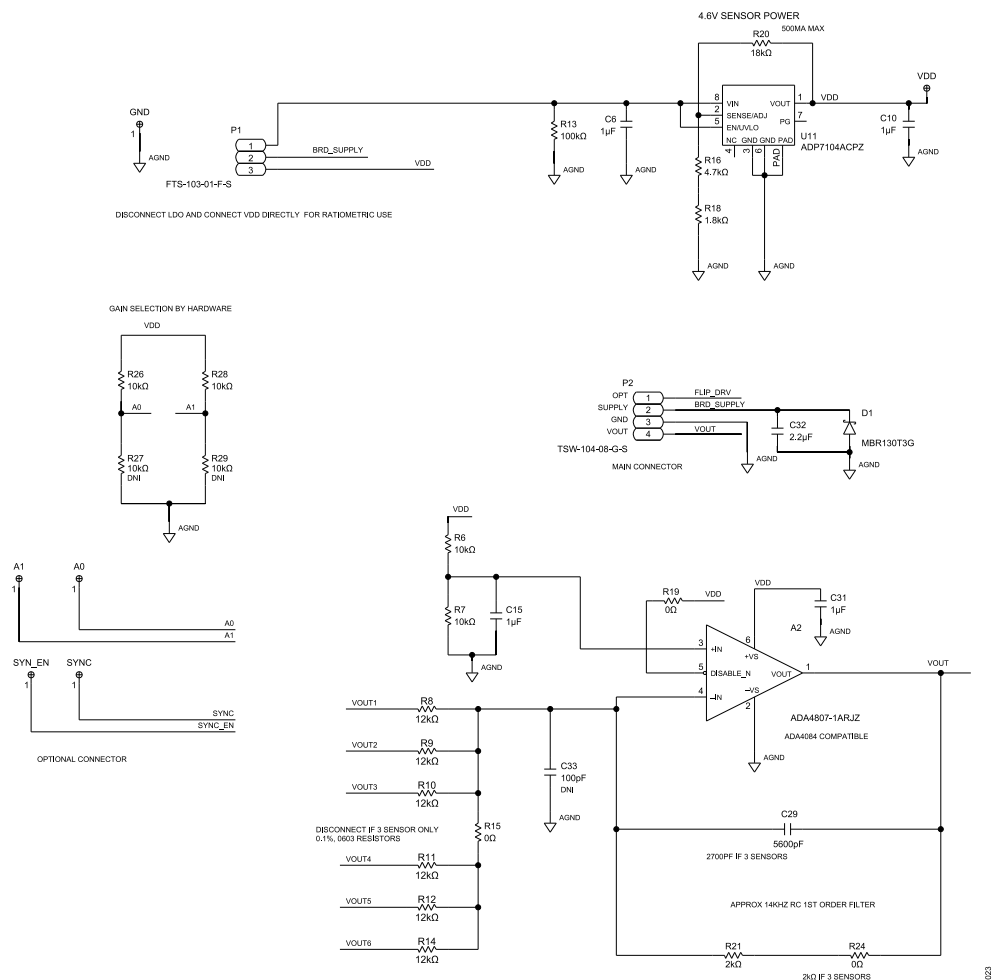


Figure 23. EVAL-ADAF1080-3EBZ/EVAL-ADAF1080-6EBZ Evaluation Board Schematic Page 2



## EVALUATION BOARD DRAWINGS

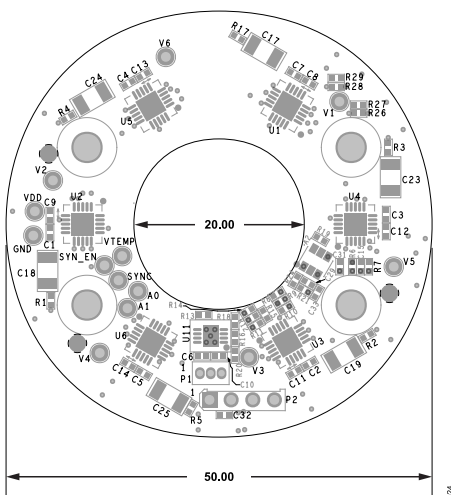


Figure 24. EVAL-ADAF1080-3EBZ/EVAL-ADAF1080-6EBZ Mechanical Drawings Top

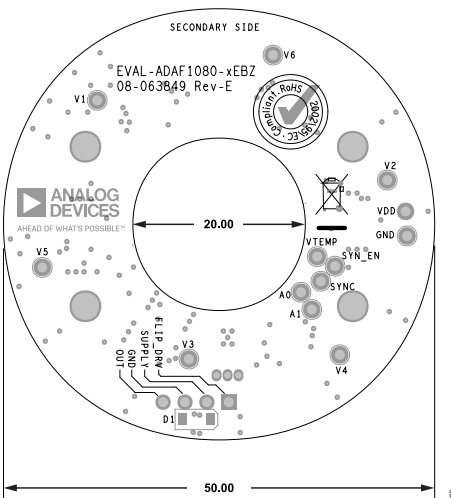


Figure 25. EVAL-ADAF1080-3EBZ/EVAL-ADAF1080-6EBZ Mechanical Drawings Bottom

## ORDERING INFORMATION

## BILL OF MATERIALS

Table 4. Bill of Materials for Revision D

| Reference Designator                 | Description  | Manufacturer         | Part Number                      | Comments  |
|--------------------------------------|--|----------------------|----------------------------------|---|
| U1, U2, U3, U4, U5, U6               | Integrated AMR magnetic field sensor and signal conditioner, $\pm 8$ mT                    | Analog Devices, Inc. | <a href="#">ADAF1080BCPZ</a>     | Three or six sensors populated according to the version |
| U11                                  | 20 V, 500 mA, low noise, complementary metal-oxide semiconductor (CMOS), low dropout (LDO) | Analog Devices       | <a href="#">ADP7104ACPZ-R7</a>   |   |
| A2                                   | 3.1 nV/ $\sqrt{\text{Hz}}$ , 1 mA, 180 MHz, rail-to-rail input/output amplifier            | Analog Devices       | <a href="#">ADA4807-1ARJZ-R2</a> |   |
| C1, C2, C3, C4, C5, C7               | 0.1 $\mu\text{F}$ capacitors, 35 V, 10%, X7R, 0402   | TDK                  | CGA2B3X7R1V104K050BB             | Do not install (DNI) for the sensors not populated      |
| C8, C9, C10, C11, C12, C13, C14, C31 | 1 $\mu\text{F}$ capacitors, 10 V, 20%, X5R, 0402   | Taiyo Yuden          | LMK105BJ105MV-F                  |   |
| C15                                  | 1 $\mu\text{F}$ capacitors, 6.3 V, 10%, X5R, 0402  | AVX                  | 04026D105KAT2A                   |   |
| C17, C18, C19, C23, C24, C25         | 10 $\mu\text{F}$ capacitors, 35 V, 10%, X7R, 1206  | Taiyo Yuden          | GMK316AB7106KL-TR                | DNI for the sensors not populated                       |
| C29                                  | For the EVAL-ADAF1080-3EBZ, 2700 pF capacitor, 50 V  | Yageo                | CC0402JRX7R9BB272                | Component determined by board version                   |
|                                      | For the EVAL-ADAF1080-6EBZ, 5600 pF capacitor, 25 V, X7R, 0402                             | AVX Corporation      | 04023C562KAT4A                   | Component determined by board version                   |
| C32                                  | 2.2 $\mu\text{F}$ capacitor, 25 V, 20%, X5R, 0402  | Murata               | GRM155R61E225ME15D               |   |
| C6                                   | 1 $\mu\text{F}$ capacitor, 25 V, 10%, X5R, 0402  | TDK                  | C1005X5R1E105K050BC              |   |
| D1                                   | Diode Schottky power rectifier   | On Semiconductor     | MBR130T3G                        |   |
| P1                                   | CONN-PCB, micro low profile term strips  | Samtec               | FTS-103-01-F-S                   |   |
| P2                                   | CONN-PCB, BERG, header, straight, male, 4 position   | Samtec               | TSW-104-08-G-S                   |   |
| R1, R2, R3, R4, R5, R17              | 100 $\Omega$ resistors, 1%, 1/16 W, 0402   | Venkel               | CR0402-16W-1000FPT               | DNI for the sensors not populated                       |
| R8, R9, R10, R11, R12, R14           | 12 k $\Omega$ resistors, 0.1%, 1/16 W, 0402, high reliability                              | Panasonic            | ERA-2AEB123X                     | DNI for the sensors not populated                       |
| R13                                  | 100 k $\Omega$ resistor, 5%, 1/10 W, 0402  | Panasonic            | ERJ-2GEJ104X                     |   |
| R15, R24                             | For the EVAL-ADAF1080-6EBZ, 0 $\Omega$ resistors, jumper, 1/10 W, 0402                     | Panasonic            | ERJ-2GE0R00X                     | R24 identical to R15                                    |
| R16                                  | 4.7 k $\Omega$ resistor, 1%, 1/10 W, 0402  | Panasonic            | ERJ-2RKF4701X                    |   |
| R18                                  | 1.8 k $\Omega$ resistor, 1%, 1/10 W, 0402  | Panasonic            | ERJ-2RKF1801X                    |   |
| R19                                  | 0 $\Omega$ , resistor, jumper, 1/16 W, 0402  | Yageo                | RC0402JR-070RL                   |   |
| R20                                  | 18 k $\Omega$ resistor, 1%, 1/16 W, 0402   | Yageo                | RC0402FR-0718KL                  |   |
| R21, R24                             | For the EVAL-ADAF1080-3EBZ, 2 k $\Omega$ resistors, 0.1%, 1/16 W, 0402                     | Panasonic            | ERA-2AEB202X                     | R24 identical to R21                                    |
| R26, R28                             | 10 k $\Omega$ resistors, 5%, 1/16 W, 0402  | Vishay               | CRCW040210K0JNED                 |   |
| R6, R7                               | 10 k $\Omega$ resistors, 0.1%, 1/16 W, 0402  | Vishay               | TNPW040210K0BEED                 |   |

## ORDERING INFORMATION

## NOTES

**ESD Caution**

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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