ANALOG DEVICES

EVAL-ADA4571-2 User Guide
UG-1047

One Technology Way • P.O. Box 9106 • Norwood, MA 02062-9106, U.S.A. • Tel: 781.329.4700 • Fax: 781.461.3113 • www.analog.com

Evaluation Board for the ADA4571-2 Integrated AMR Angle Sensor and Signal Conditioner

FEATURES

USB 2.0 interface
Jumper or computer controlled temperature compensation mode enable
Jumper or computer controlled power-down mode enable
Measurement test points and coaxial connectors

EVALUATION KIT CONTENTS

ADA4571-2 magnetic stimulus
- **Dipole magnet**
- **Hand movable mounting**

Read back electronics

ADDITIONAL EQUIPMENT NEEDED

6 V to 12 V bench supply (optional)
SDP-S controller board
USB cable (supplied with the SDP-S controller board)
LabVIEW 2013 software downloadable from ADA4571-2 product page

GENERAL DESCRIPTION

The EVAL-ADA4571-2 shows the ADA4571-2 in an end of shaft magnet configuration. The evaluation kit is composed of an ADA4571-2 motherboard, a magnetic stimulus on a hand turnable mount, a USB interface, and an SDP-S controller board. The required LabVIEW 2013 graphical user interface (GUI) software for Windows® is available on the ADA4571-2 product page.

The EVAL-ADA4571-2 features an on-board 5 V regulator, a 6-channel simultaneous sampling analog-to-digital converter (ADC), and jumpers for enabling the temperature compensation and power-down modes within the ADA4571-2. The motherboard also features test points and unpopulated coaxial connectors for the six outputs of the device.

The SDP-S controller board controls the ADC on the motherboard reading back the ADA4571-2 outputs, to change the digital inputs to the ADA4571-2, interface with the GUI, and to supply power to the evaluation board through the USB connection.

ADA4571-2 END OF SHAFT EVALUATION SYSTEM

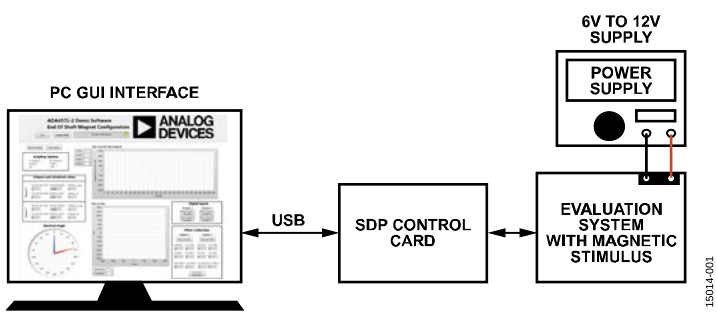


Figure 1.

TABLE OF CONTENTS

REVISION HISTORY

12/2016—Revision 0: Initial Version

GETTING STARTED

SOFTWARE INSTALLATION PROCEDURES

Before using the LabVIEW 2013 GUI, install the SDP-S controller board drivers and LabVIEW 2013 runtime engine.

LabVIEW 2013 Runtime Engine

To install the LabVIEW 2013 runtime engine, follow the instructions on the National Instruments website.

SDP Installation

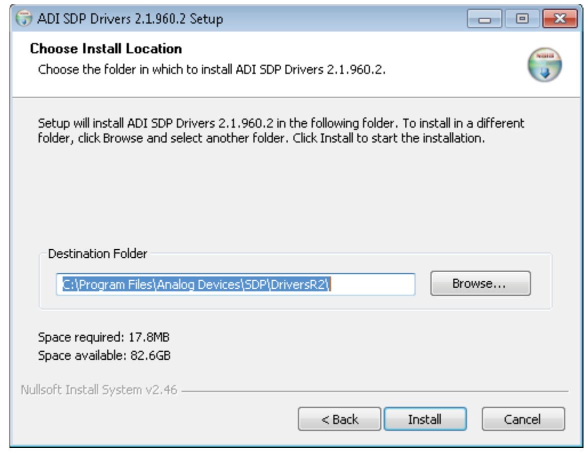
To install the SDP drivers, first download the **SDPDrivers.exe** file from the SDP-S product page and complete the following steps:

1. Initialize installation by running **SDPDrivers.exe**.
2. When the SDP drivers setup wizard appears, click **Next** (see Figure 2).

15014-002

Figure 2. SDP Driver Installation

3. When the **Choose Install Location** window appears (see Figure 3), click **Install**. Clicking **Browse** allows the user to select a different destination folder, followed by clicking **Install**.



15014-003

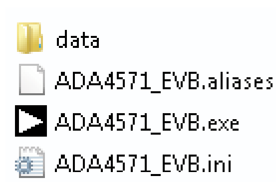
Figure 3. Choose Install Location

4. Click **Finish** to complete the installation of the SDP drivers.
5. Connect the SDP-S controller board to the motherboard and plug the SDP-S controller board into the PC with the supplied USB cable. The computer now recognizes the SDP-S controller board and the LabVIEW GUI can be opened to continue.

Running the GUI

To run the GUI, first download the LabVIEW GUI software from the ADA4571-2 product page and complete the following steps:

1. Place the downloaded executable file and supporting files in a convenient location for use (see Figure 4); it is recommended to place these files on the root C drive of the PC. Do not separate the executable file from the other files that are downloaded or the executable does not run



15014-004

Figure 4. Placing Downloaded Files onto the PC

2. Double-click the executable to launch the evaluation program.

EVALUATION BOARD HARDWARE

The EVAL-ADA4571-2 end of shaft evaluation system comprises of a PCB with the AD7266 ADC and an external mountable magnetic stimulus.

The ADA4571-2 evaluation system can be powered directly from the host PC USB, directly from an external bench supply, or through the on-board 5 V regulator, the ADP3336.

To power the motherboard through an on-board 5 V reference, apply 6 V to 12 V across P3 to P5 and configure the jumpers accordingly. If the bench supply features current-limiting, it is recommended to set the current limit to 100 mA as a precaution.

JUMPER CONFIGURATION

Refer to the ADA4571-2 motherboard schematic, see Figure 13, to understand the purpose of each jumper.

Configure the P10 motherboard default jumper as follows:

- Install a jumper on P10 between VBUS and BRD_SUPPLY to power the evaluation board through the USB connection at the PC.
- Alternatively, install a jumper on P10 between BRD_SUPPLY and _SUPPLY to power the evaluation board through the external bench supply

DEVICE UNDER TEST (DUT) OUTPUTS

The outputs of the ADA4571-2 can be monitored at the test points located on the Evaluation board.

All outputs from the ADA4571-2 are also sampled by the on-board ADC and are available in the GUI.

EVALUATION BOARD SOFTWARE

STARTING UP THE EVALUATION GUI

To power the evaluation board using the ADP3336 on-board 5 V supply install a jumper on P10 connecting SUPPLY and BRD_SUPPLY. Using an external power supply, plug the positive supply for the evaluation board into the red terminal, P3, and the negative terminal into P5 on the motherboard. The evaluation board requires between 6 V to 12 V, which is then regulated to 5 V on the motherboard using the on-board ADP3336. This supply powers both the on-board ADC, AD7266, as well as the ADA4571-2.

To use the EVAL-ADA4571-2 evaluation board with full USB power, install a jumper on P10, connecting VBUS and BRD_SUPPLY. The 5 V USB power supplies the ADC reference pin on the AD7266 as well as the ADA4571-2.

OVERVIEW OF THE MAIN GUI WINDOW

Figure 5 shows the main GUI window after launching the GUI.

When first launching the program, the SDP-S controller board must be recognized by the GUI before proceeding. Clicking the **Connect SDP** button reads the EEPROM identification of the motherboard to ensure the correct program is being used. If the SDP-S controller board is not connected or if the drivers are not installed correctly, an error message appears. Ensure the drivers are installed correctly and the PC recognizes the SDP-S controller board if this occurs.

After the SDP-S controller board is properly connected and the program recognizes the motherboard, the status bar reads **SDP Board Ready** and the yellow LED turns green.

Initially, all figures are blank. Click the **Start Sampling** button to begin sampling the device.

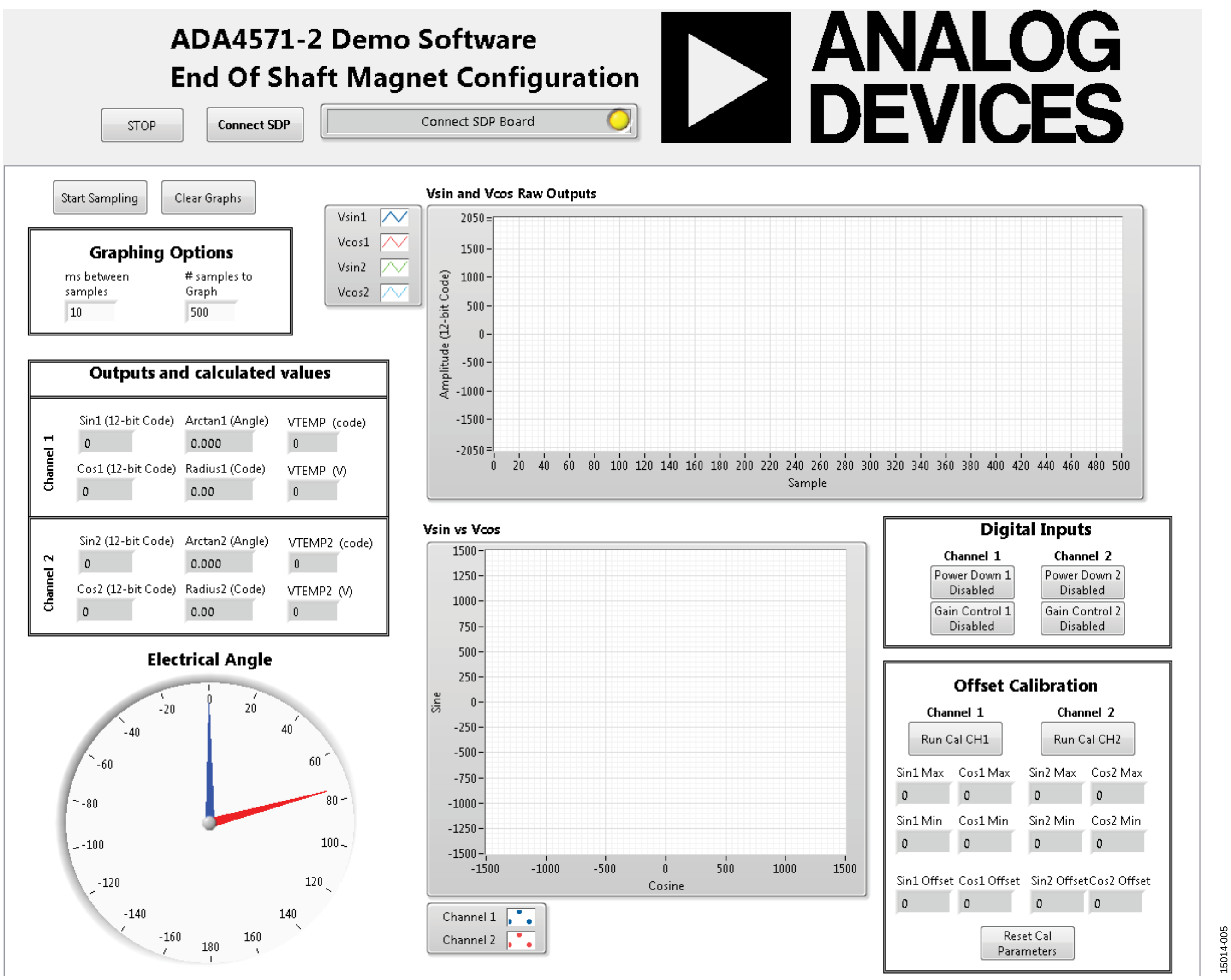


Figure 5. ADA4571-2 Evaluation Board Software Main Window

Vsin, Vcos, and VTEMP Raw Outputs

The **Vsin, Vcos and VTEMP Raw Outputs** graph shows all six outputs from the ADA4571-2 dual-channel magnetic angle sensor (see Figure 6).

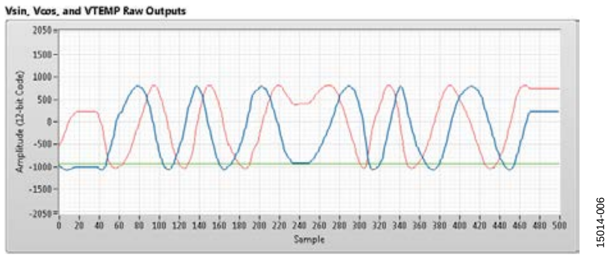


*Figure 6. **Vsin, Vcos, and VTEMP Raw Outputs** Graph*

The blue and red waveforms indicate the V_{SINx} and V_{COSx} outputs, respectively, and the green waveform indicates the VTEMP output. As the magnet is rotated above the ADA4571-2 the V_{SINx} and V_{COSx} outputs change while staying 90° out-of-phase. The two channels report similar results that differ by the relative rotation of the sensor die and the voltage offset differences for the sine and cosine channels.

This plot shows the output waveforms sampled by the AD7266 ADC. The waveforms are plotted in 12-bit code. The AD7266 simultaneously samples V_{SIN1} and V_{COS1} then switches inputs to sample V_{SIN2} and V_{COS2}. An internal reference of 2.5 V is subtracted in the hardware as the readout of the ADC is in twos compliment. Therefore, the two signals center around 0 in the raw waveform plot. In a real application, it is important that these two channels are simultaneously sampled or extra errors introduced from the phase delay between the sampling of the individual channels. Every 50 samples of the V_{SIN1}, V_{COS1}, V_{SIN2}, and V_{COS2}, the AD7266 samples VTEMP1 and VTEMP2.

When powering the board through the USB connector attached to the SDP-S controller board there is some variation in the supply voltage of the ADA4571-2. Due to the readout of the AD7266 in twos compliment form, with respect to the internal 2.5 V reference, the offset of these waveforms are higher than the inherent offset of the ADA4571-2. After offset correction of the sine and cosine signals, which is recommended for the end use of the sensor, the offsets due to the ADC reference as well as the sensor offset are removed.

Graphing Options

When running, the evaluation board constantly samples the V_{SIN1},V_{COS1},$V_{SIN2,}$ and V_{COS2} before sampling the VTEMP1 and VTEMP2 channel every 50 iterations.

The interval between sampling is chosen by inputting different values into the **ms between samples** field (see Figure 7). The default is 10 ms. This is a delay set after information is transferred from the AD7266.

The **# samples to graph** field sets the number of samples to save and show in the graphs. The default is 200 samples.

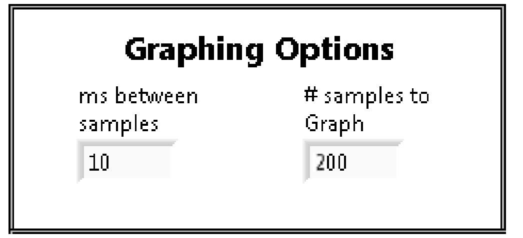


*Figure 7. **Graphing Options** Pane*

Outputs and Calculated Values

Output and calculated values give the sensor information in number format (see Figure 8). Again, the V_{SINx}, V_{COSx}, and VTEMP outputs are in 12-bit twos compliment form with respect to the 2.5 V internal reference of the AD7266 ADC.

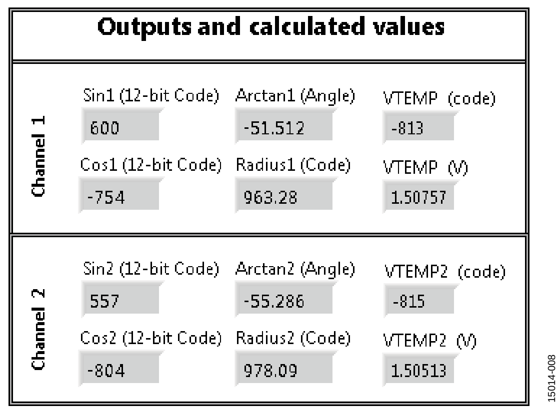


*Figure 8. **Outputs and calculated values** Pane for Channel 1 and Channel 2*

A calculated angle value is also shown, given by the **Arctan1 (Angle)** and **Arctan2 (Angle)** function field, and a calculated radius, given by the square root of the sum of squares for each V_{SINx} and V_{COSx} channel in the **Radius1 (Code)** and **Radius2 (Code)** field.

Electrical Angle

The electrical angle plot gives the calculated **Arctan1 (Angle)** and **Arctan2 (Angle)** values in a visual format seen in Figure 9. As the magnetic field angle changes at the anisotropic magneto resistive (AMR) sensors, the electrical angle changes. Both channels give approximately the same information.

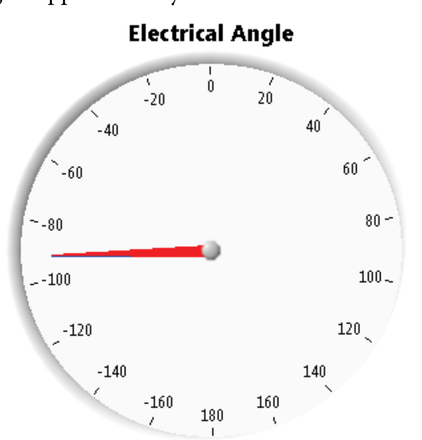


Figure 9. Electrical Angle

Vsin vs Vcos

The **Vsin vs Vcos** graph is another way to visualize the electrical angle from the ADA4571-2. However, there is more information given in Figure 10, showing the radius of the output values which can give further diagnostic information to system. As long as the sensor is fully saturated, or the applied magnetic field strength exceeds 25 kA/m, the radius value remains unchanged at a constant temperature. As the AMR effect is smaller at high temperatures the radius value changes with respect to temperature. See the ADA4571-2 data sheet for the temperature coefficient values for the output amplitude for the V_{SINx} and V_{COSx} channels.

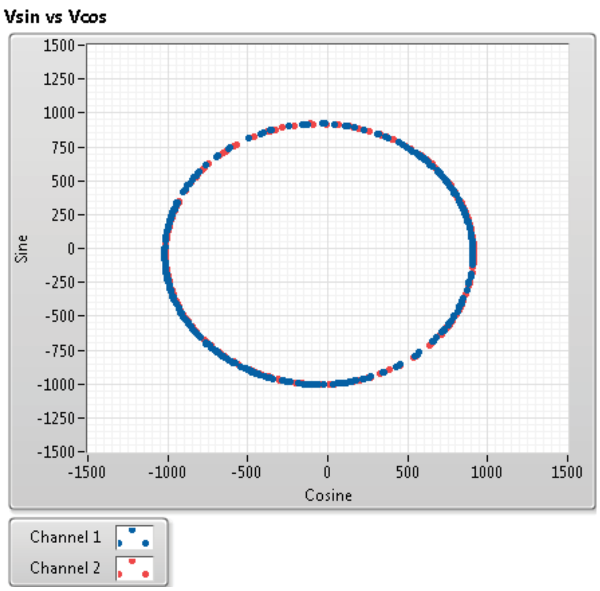


Figure 10. ***Vsin vs Vcos*** *Graph*

Digital Inputs

Four digital inputs on the ADA4571-2 can be toggled using the **Digital Inputs** buttons.

The power-down button for each channel puts the devices into a low power state by disabling the internal circuitry for that channel and placing the outputs into a high impedance mode. See the ADA4571-2 data sheet for the power-down current per channel in the device. The power-down function of each channel can be toggled separately.

The **Gain Control 1 Disabled** and **Gain Control 2 Disabled** buttons put the device into the gain control mode (see Figure 11). This mode alters bridge supply voltage based on the internal temperature value of the device.

Through this mode, the output amplitude temperature coefficient of the ADA4571-2 reduces. See the ADA4571-2 data sheet for output amplitude vs. temperature with the gain control enabled and disabled.

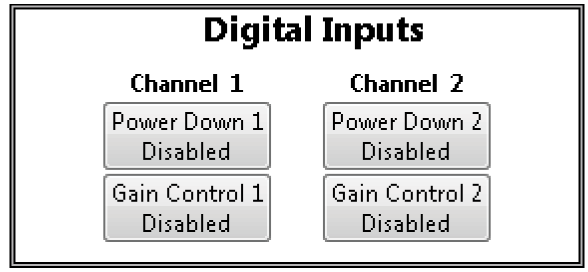


Figure 11. ***Digital Inputs*** *Pane*

Offset Calibration

An offset calibration is required to maximize the accuracy of the ADA4571-2. The V_{SIN1}, V_{COS1}, V_{SIN2}, and V_{COS2} channels have inherent voltage offsets due to resistor mismatch within the AMR sensor bridges. See the ADA4571-2 data sheet offset voltage ranges for the outputs.

There are a few methods that can null the offsets for the outputs. To run an offset calibration on Channel 1, click **Run Cal CH1** (see Figure 12). Once clicked, rotate the magnetic stimulus slowly through an entire mechanical rotation. This ensures the maximum and minimum output voltages are found for each channel.

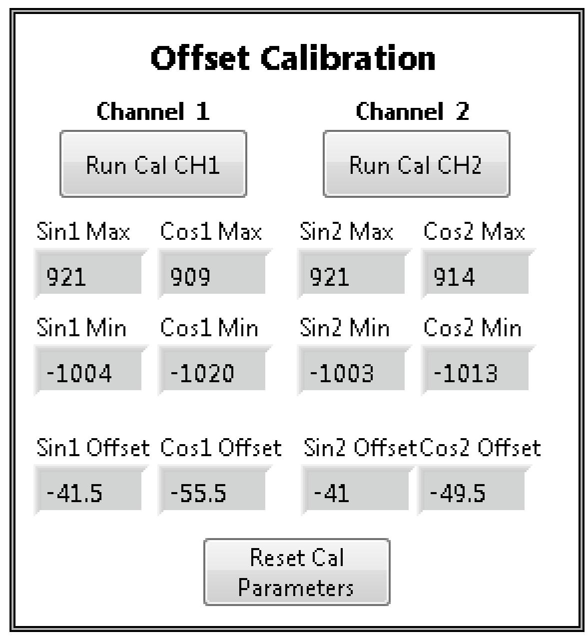


Figure 12. ***Offset Calibration*** *Pane*

EVALUATION BOARD SCHEMATIC AND ARTWORK

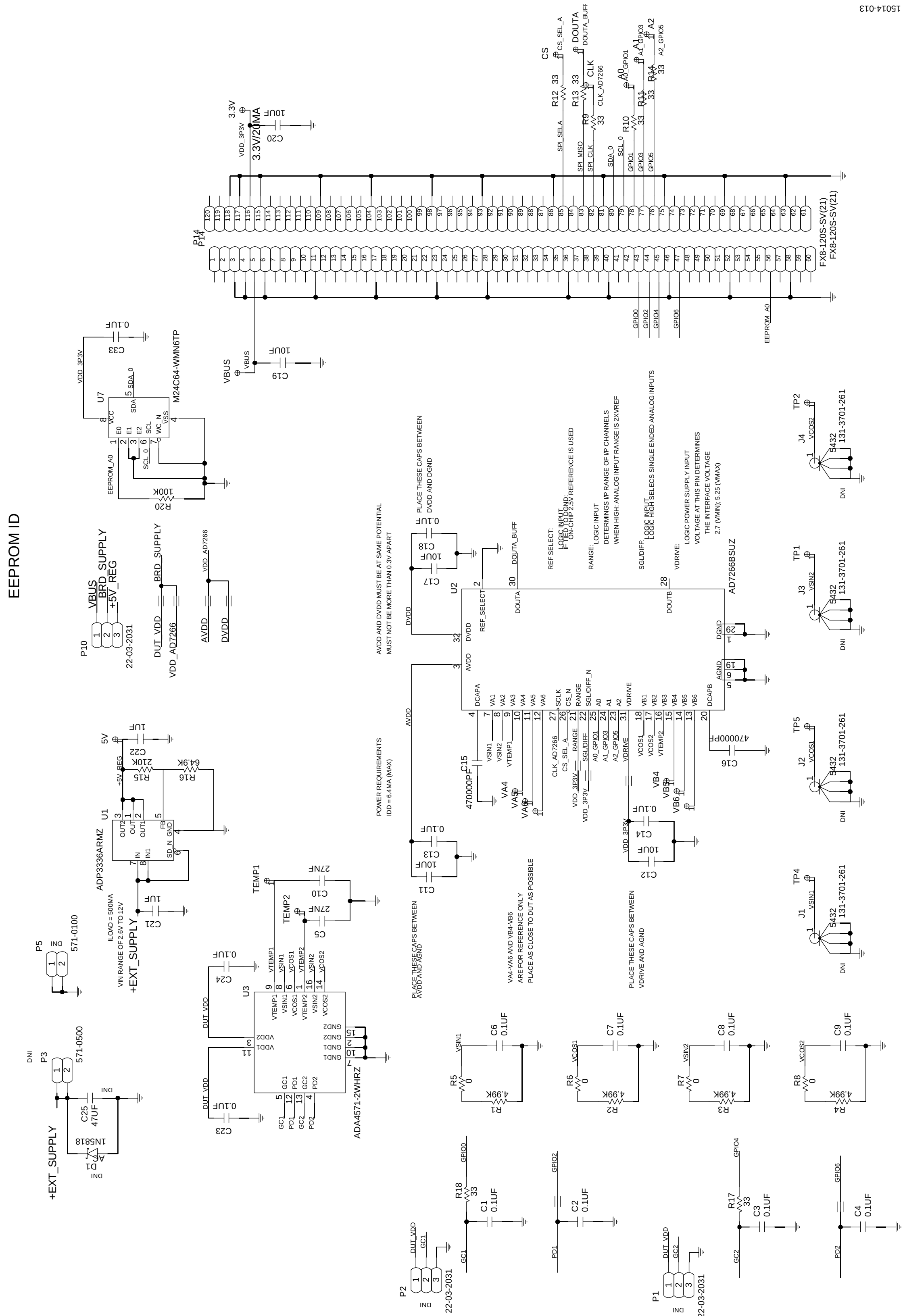


Figure 13. ADA4571-2 Evaluation Motherboard Schematic

ORDERING INFORMATION

RELATED LINKS

Resource	Description
ADA4571-2	Integrated AMR Angle Sensor and Signal Conditioner
ADP3336	High Accuracy Ultralow I_Q, 500 mA anyCAP® Adjustable Low Dropout Regulator
AD7266	Differential/Single-Ended Input, Dual 2 MSPS, 12-Bit, 3-Channel SAR ADC

UG15014-0-12/16(0)

ANALOG DEVICES

www.analog.com