

## Evaluating the **ADPD144RI** PPG Optical Sensor Module with Integrated Red/IR Emitters and AFE

### FEATURES

- Supports the detection of UART
- UDP transfer capability
- ADPD144RI** full configuration
  - Register level
  - High level
- Graph view
  - Time graph
  - Frequency graph

### EVALUATION KIT CONTENTS

EVAL-ADPD144RIZ-SF evaluation boards

### ADDITIONAL EQUIPMENT NEEDED

- PC running Windows® 7 or Windows 10 operating system
- EVAL-ADPUCZ** microcontroller board

### ONLINE RESOURCES

- ADPD144RI** data sheet
- Applications Wavetool software package

### GENERAL DESCRIPTION

The EVAL-ADPD144RIZ-SF provides users with a means of evaluating the **ADPD144RI**, a complete photometric system designed to measure optical signals from ambient light and from synchronous, reflected light emitting diode (LED) pulses. The evaluation system includes the Applications Wavetool graphical user interface (GUI), which provides users with low level and high level configurability; real-time frequency and time domain analysis; and a user datagram protocol (UDP) transfer capability so that the evaluation board can easily connect to the user development system.

The EVAL-ADPD144RIZ-SF is a multiboard evaluation kit consisting of an adapter board and a sensor board connected by a 3 foot cable. The adapter board connects to the **EVAL-ADPUCZ** microcontroller board through a ribbon cable.

The evaluation board is optimized for ear-based photoplethysmography (PPG) measurements.

For additional information on the functionality of the **ADPD144RI**, see the **ADPD144RI** data sheet in conjunction with this user guide when using the EVAL-ADPD144RIZ-SF.

### EVAL-ADPD144RIZ-SF EVALUATION KIT PHOTOGRAPH

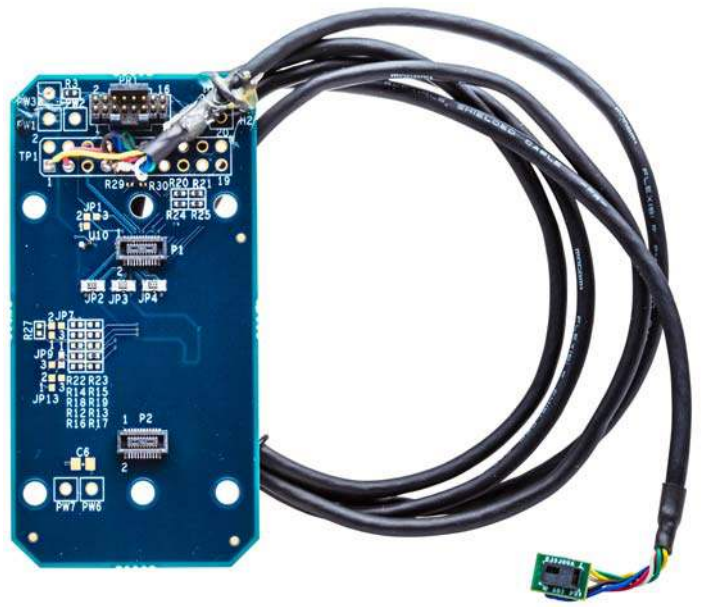


Figure 1.

**TABLE OF CONTENTS**

Features .....	1	Checking the USB Serial Connection in Windows .....	3
Evaluation Kit Contents.....	1	Updating the EVAL-ADPDDUCZ Firmware.....	3
Additional Equipment Needed.....	1	Acquiring Data.....	4
Online Resources .....	1	Running the Applications Wavetool.....	4
General Description .....	1	USB UART Connection.....	4
EVAL-ADPD144RIZ-SF Evaluation Kit Photograph.....	1	Selecting the Proper View .....	4
Revision History .....	2	Load Configuration .....	4
Getting Started .....	3	Optimizing and Running the ADPD144RI .....	5
Installing the Applications Wavetool.....	3	Evaluation Board Schematics and Artwork.....	6
Connecting the EVAL-ADPDUCZ Microcontroller Board and the EVAL-ADPD144RIZ-SF.....	3		

**REVISION HISTORY**

2/2019—Revision 0: Initial Version

## GETTING STARTED

### INSTALLING THE APPLICATIONS WAVETOOL

Download the Applications Wavetool software package from the EVAL-ADPD144RIZ-SF product page. Unzip the folder and run the Applications Wavetool executable file. Follow the prompts, beginning with the **Applications Wavetool Setup** window shown in Figure 2 for software installation. The Applications Wavetool is periodically updated to add features and improve performance. It is recommended that customers use the latest revision to take advantage of new features and performance.



Figure 2. Applications Wavetool Setup

### CONNECTING THE EVAL-ADPDCUZ MICROCONTROLLER BOARD AND THE EVAL-ADPD144RIZ-SF

Connect the USB cable to the EVAL-ADPDCUZ and the ribbon cable to the EVAL-ADPD144RIZ-SF. Switch the power switch to the ON position.

When the power switch is in the ON position, the LED near the power switch illuminates, indicating that the EVAL-ADPDCUZ microcontroller board is on. When the USB cable is connected to the EVAL-ADPDCUZ, the second LED near the power switch illuminates, indicating that the on-board battery is charging.

### CHECKING THE USB SERIAL CONNECTION IN WINDOWS

Ensure that the communications port (COM port) driver is installed correctly. To verify proper installation, go to **Control Panel > All Control Panel Items > System > Device Manager**, as shown in Figure 3. In this case, the proper COM port choice is **USB Serial Port (COM16)**.

The EVAL-ADPDCUZ microcontroller board uses an FT232 USB, universal asynchronous receiver transmitter (UART) IC. If the USB driver does not install properly, refer to the FTDI driver installation guide that corresponds with the operating system in use.

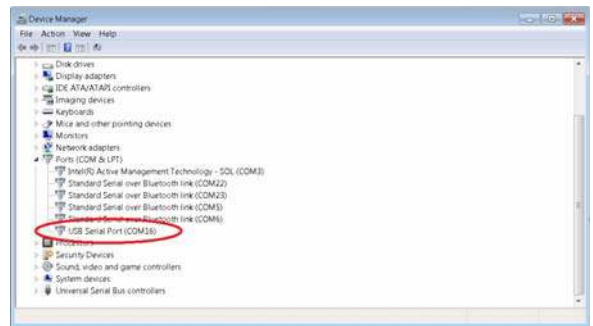


Figure 3. USB Serial Port in Windows 7

### UPDATING THE EVAL-ADPDCUZ FIRMWARE

The EVAL-ADPDCUZ microcontroller board may have an older version of the firmware installed during manufacturing. If the user receives the message shown in Figure 4 when trying to connect to the Applications Wavetool, the EVAL-ADPDCUZ must be updated.



Figure 4. Firmware Out of Date Warning Prompt

Refer to the Applications Wavetool user guide that is provided in the software package download for instructions on updating the EVAL-ADPDCUZ firmware

## ACQUIRING DATA

### RUNNING THE APPLICATIONS WAVETOOL

To start the Applications Wavetool, navigate to the **Start** menu > **Analog Devices** > **ApplicationsWaveTool** and click **ApplicationsWavetool**.

### USB UART CONNECTION

To establish the connection, follow the menu path **Connection** > **Connect** > **UART Bridge**.

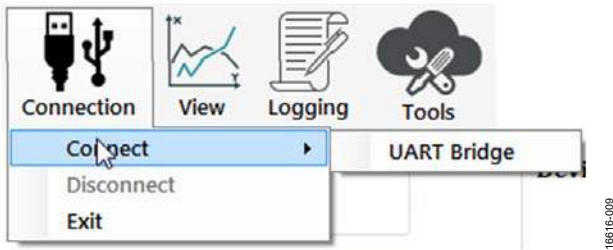


Figure 5. UART Connect

Select the proper COM port to connect the Applications Wavetool to the device. If connection via Bluetooth® is required, or if there are any other connection issues, refer to the Applications Wavetool user guide that is provided in the software package download.

### SELECTING THE PROPER VIEW

The **ADPD144RI** is intended for nonwrist-based PPG measurements. Click the **ADPD Device** data view (see Figure 6) to open a window that allows the user to run the **ADPD144RI** device and collect data (see Figure 7).

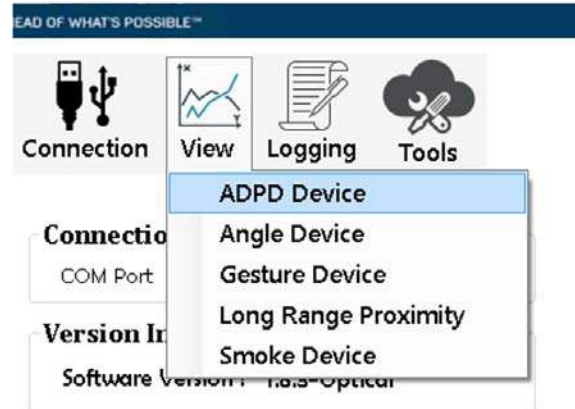


Figure 6. Click ADPD Device

### LOAD CONFIGURATION

In the upper right corner of the data view window, click **ADPD Config** to open the **ADPD Config** window shown in Figure 7. Click **Load DCFG** to choose a configuration file. For PPG measurements, choose the **144RI\_earbud.dcfg** configuration file.

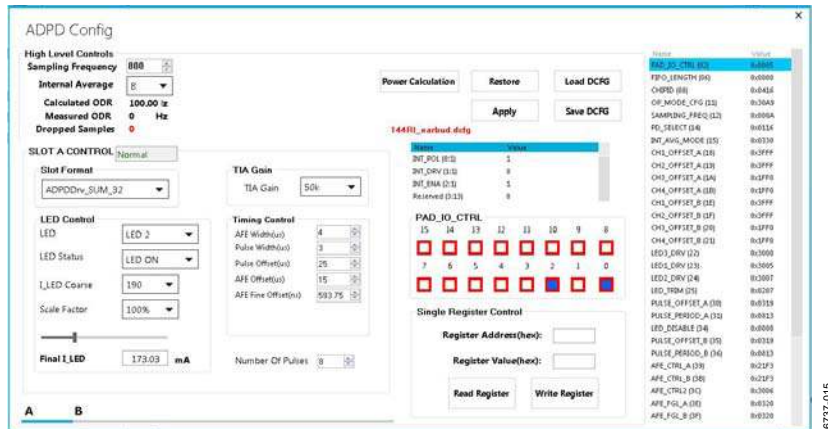


Figure 7. ADPD Config View

**OPTIMIZING AND RUNNING THE ADPD144RI**

After the configuration file is loaded, the settings can be further optimized using the **ADPD Config** window shown in Figure 7. Typically, the device is set up under a certain set of conditions, such as measuring the response from a fixed reflector or measuring a PPG signal from the ear (see Figure 8). Settings can be optimized for any set of conditions by manipulating LED drive currents, transimpedance amplifier (TIA) gain, and

analog front end (AFE) timing. Another option is to use different operating modes that can be more optimal for a specific set of conditions, such as using float mode for a low current transfer ratio (CTR). For information on optimization of the **ADPD144RI**, refer to the **ADPD144RI** data sheet. For functional descriptions of the Applications Wavetool, refer to the Applications Wavetool user guide provided in the software package download.

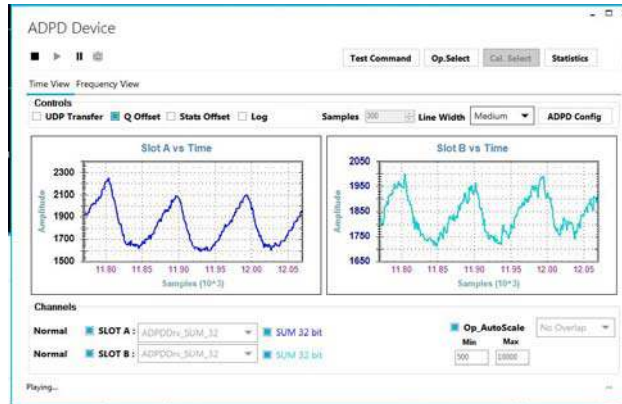


Figure 8. Example of a PPG Signal

EVALUATION BOARD SCHEMATICS AND ARTWORK

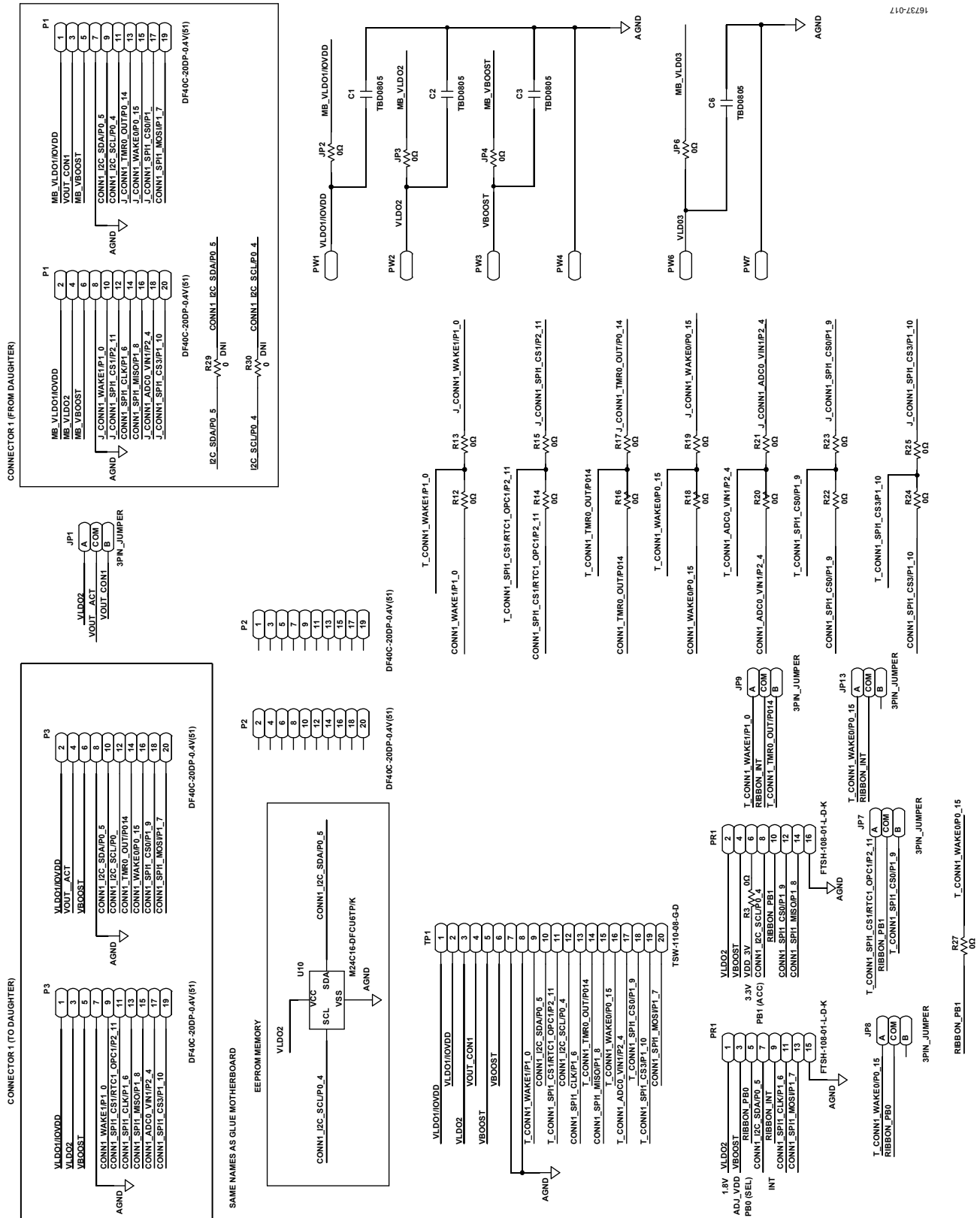


Figure 9. EVAL-ADPD144RIZ-SF BR-048862 Schematic

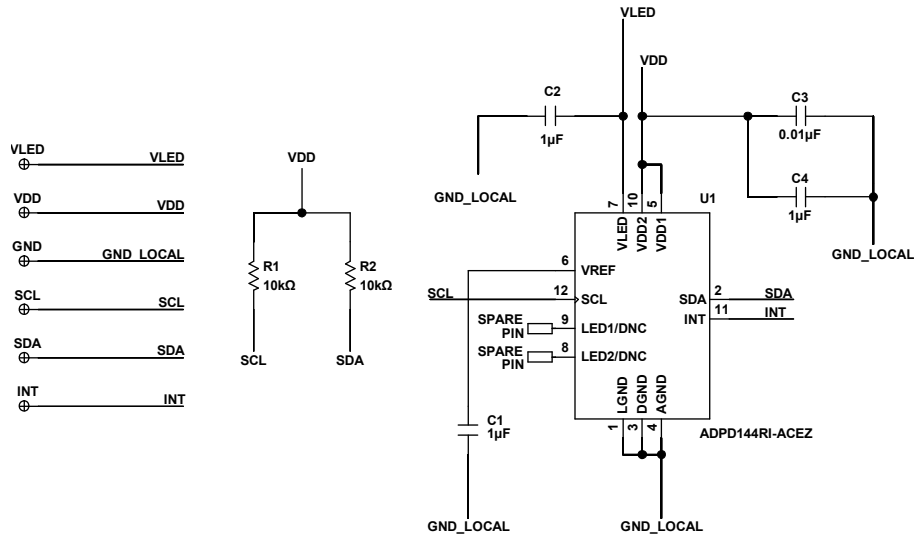


Figure 10. EVAL-ADPD144RIZ-SF BR-048911 Schematic

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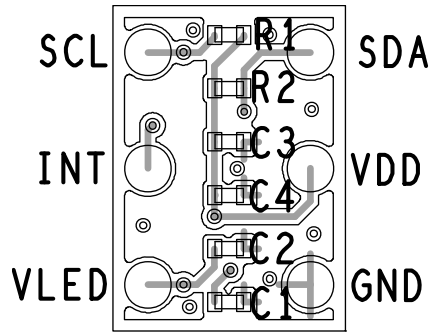


Figure 11. EVAL-ADPD144RIZ-SF BR-048911 Primary Layer

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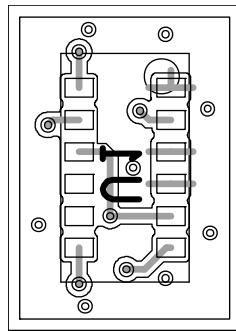


Figure 12. EVAL-ADPD144RIZ-SF BR-048911 Secondary Layer

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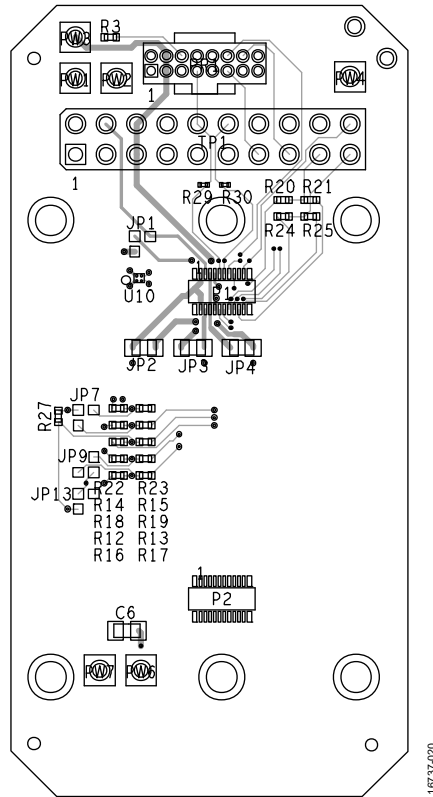


Figure 13. EVAL-ADPD144RIZ-SF BR-048862 Primary Layer

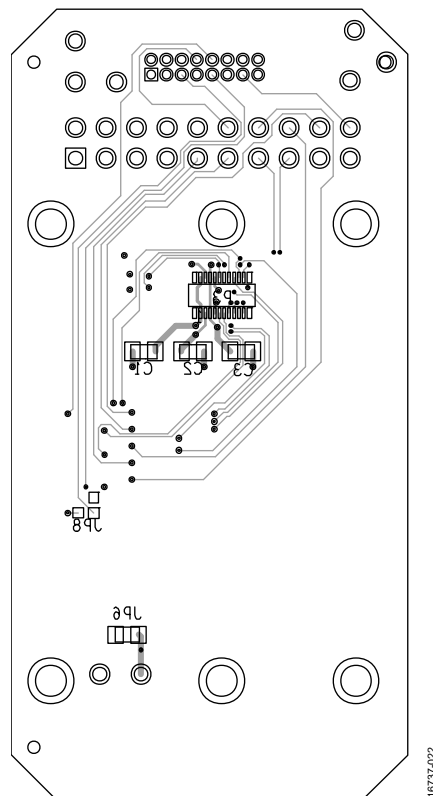
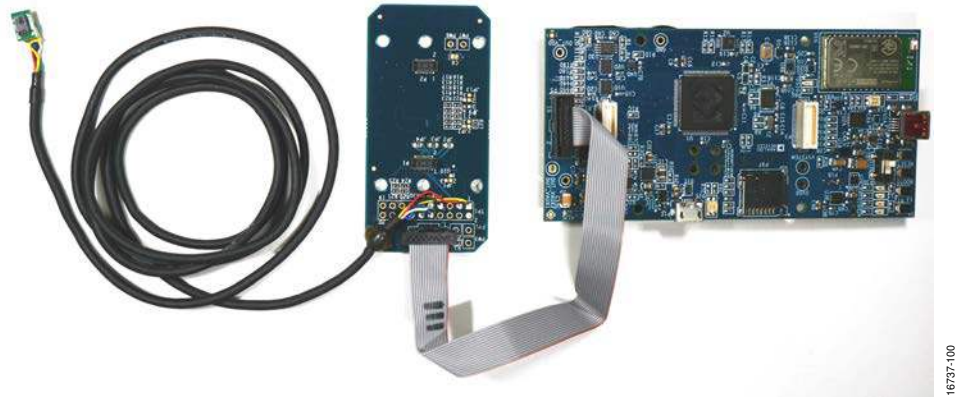


Figure 14. EVAL-ADPD144RIZ-SF BR-048862 Secondary Layer





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Figure 15. EVAL-ADPD144RIZ-SF Connected to the EVAL-ADPDUCZ Microcontroller Board

## 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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