EVAL-ADPD1081Z-PPG User Guide
UG-1255

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

Evaluating the ADPD1080/ADPD1081 Photometric Front Ends

FEATURES

- Supports the detection of UART
- UDP transfer capability
- ADPD1080/ADPD1081 full configuration
  - Register level
  - High level
- Graph view
  - Time graph
  - Frequency graph

EVALUATION KIT CONTENTS

- EVAL-ADPD1081Z-PPG evaluation board
- Ribbon cable

ADDITIONAL EQUIPMENT NEEDED

- PC running Windows 7 or Windows 10 operating system
- EVAL-ADPDUCZ microcontroller board

ONLINE RESOURCES

- ADPD1080/ADPD1081 data sheet
- Applications Wavetool software package

GENERAL DESCRIPTION

The EVAL-ADPD1081Z-PPG evaluation board provides users with a simple means of evaluating the ADPD1080/ADPD1081 photometric front end with an optimized discrete optical design for vital signs monitoring applications. The evaluation system includes the Applications Wavetool graphical user interface (GUI) that provides users with low level and high level configurability, real-time frequency and time domain analysis, and user datagram protocol (UDP) transfer capability so the evaluation board can easily interface to the user development system.

The EVAL-ADPD1081Z-PPG is powered through the ribbon cable from the EVAL-ADPDUCZ microcontroller board (obtained separately). The evaluation board provides three green light emitting diodes (LEDs) and a 7 mm^2 photodiode (PD). The design of the evaluation board is optimized for wrist-based photoplethysmography (PPG) measurements.

For additional information on the functionality of the ADPD1080/ADPD1081, refer to the ADPD1080/ADPD1081 data sheet.

EVAL-ADPD1081Z-PPG EVALUATION BOARD PHOTOGRAPH

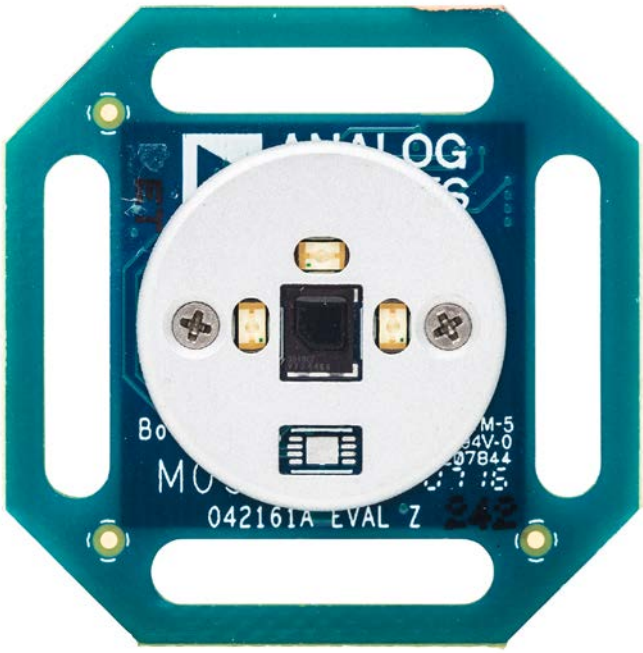

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Figure 1.

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REVISION HISTORY

2/2018—Revision 0: Initial Version

GETTING STARTED

INSTALLING THE APPLICATIONS WAVETOOL

Download the Applications Wavetool software package from the EVAL-ADPD1081Z-PPG product page at www.analog.com/eval-ADPD1081. Unzip the folder and run the Applications Wavetool executable file. Follow the prompts, beginning with the setup window shown in Figure 2 for software installation.

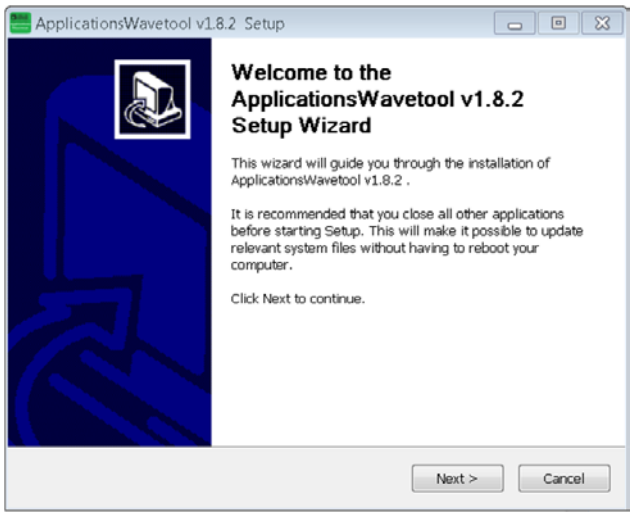

*Figure 2. **ApplicationsWavetool** Setup Window*

CONNECTING THE EVAL-ADPDUCZ MICROCONTROLLER BOARD AND THE EVAL-ADPD1081Z-PPG EVALUATION BOARD

Connect the USB cable to the EVAL-ADPDUCZ evaluation board, connect the ribbon cable to the EVAL-ADPD1081Z-PPG board, and switch the power switch to the **ON** position (see Figure 3).

When the USB cable is connected, the second LED below the power switch illuminates, indicating that the on-board battery is being charged. When the power switch is turned to the **ON** position, the LED immediately below the power switch illuminates, indicating that the EVAL-ADPDUCZ microcontroller board is on.

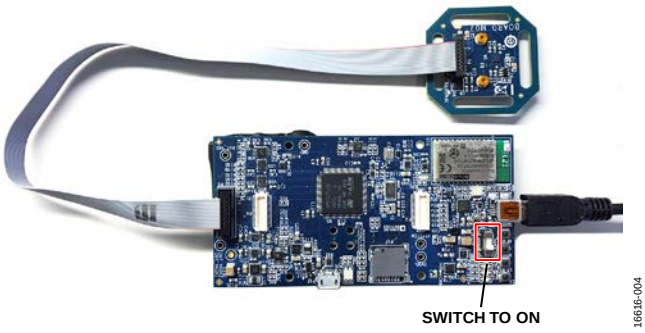

Figure 3. Connect the EVAL-ADPDUCZ to the EVAL-ADPD1081Z-PPG

CHECKING THE USB SERIAL CONNECTION IN WINDOWS®

Ensure that the 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 4. In this case, the proper COM port selection is **USB Serial Port (COM16)**.

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

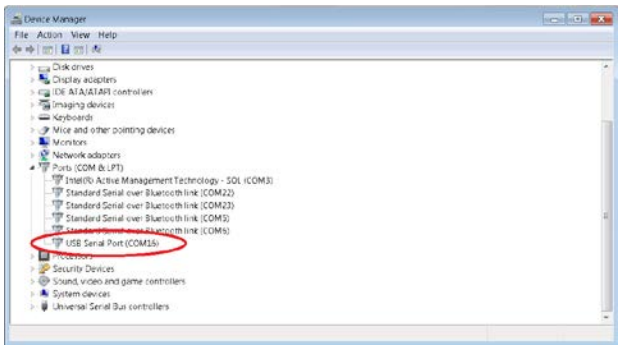

Figure 4. USB Serial Port in Windows 7

RUNNING THE APPLICATIONS WAVETOOL

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

INSTRUCTIONS TO LOAD THE FIRMWARE

The EVAL-ADPDUCZ microcontroller board may have an older version of the firmware installed during manufacture. In this situation, the user receives the message shown in Figure 5 when trying to connect to the Applications Wavetool.

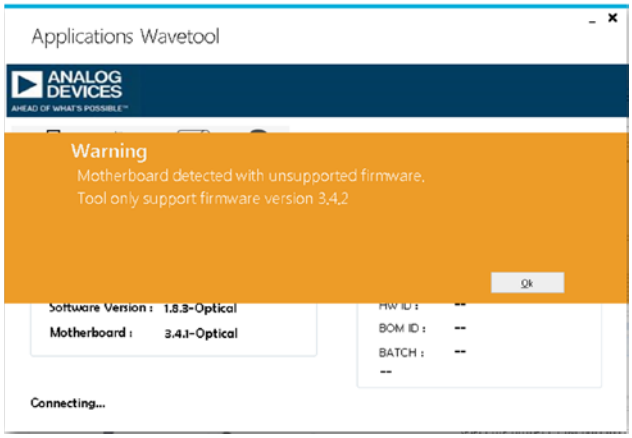

Figure 5. Warning Message for Outdated Firmware

If the firmware must be updated, take the following steps:

1. Download and install the latest DfuSe USB device firmware upgrade software.
2. Plug in a micro USB cable between the EVAL-ADPDUCZ and the PC with the power to the EVAL-ADPDUCZ turned off (see Figure 6).
3. Press and hold the **BOOT0** button, and switch the power switch to the **ON** position

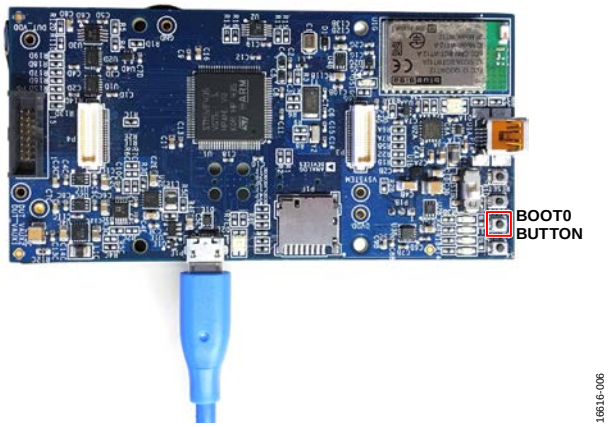

Figure 6. Micro USB Connection and BOOT0 Button Used When Upgrading Firmware

4. Go to **Device Manager** > **Universal Serial Bus controllers** and wait until the PC detects **STM Device in DFU Mode** (see Figure 7).

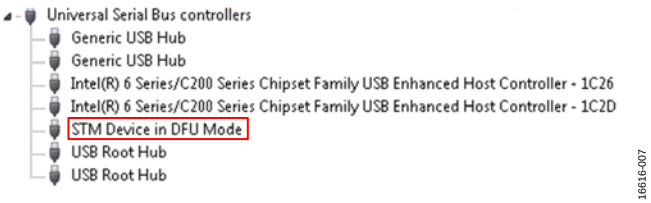

*Figure 7. **STM Device in DFU Mode** Displayed*

5. Release the **BOOT0** button.
6. Open the **DfuSe Demo** by going to **Start** > **All Programs** > **STMicroelectronics** > **DfuSe** > **DfuSe Demo**. Figure 8 shows the **DfuSe** demo settings at startup.
7. In the **Upgrade or Verify Action** section, click the **Choose** button, and select the **Adpd_M4_uC.dfu** from the **Firmware** folder of the downloaded software package.
8. Click the **Upgrade** button and follow the prompts to upgrade the firmware of the EVAL-ADPDUCZ microcontroller board.

After the firmware is updated, connection to the Applications Wavetool can be completed.

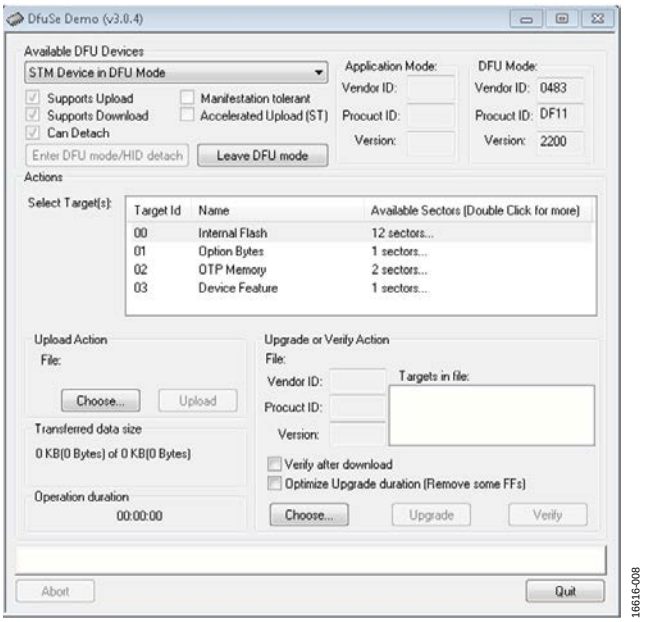

*Figure 8. **DfuSe Demo** Settings*

USB UART CONNECTION

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

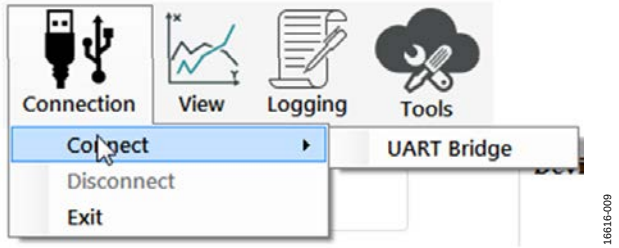

Figure 9. UART Connect

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.

ACQUIRING DATA

SELECTING THE PROPER VIEW

The EVAL-ADPD1081Z-PPG is intended for wrist-based PPG measurements. Select the **ADPD Device** data view (see Figure 10). This view opens a window that allows the user to run the ADPD1080/ADPD1081 device and collect data (see Figure 12).

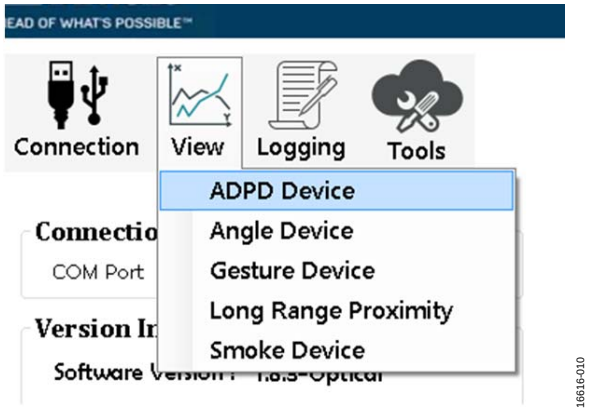

*Figure 10. Select **ADPD Device***

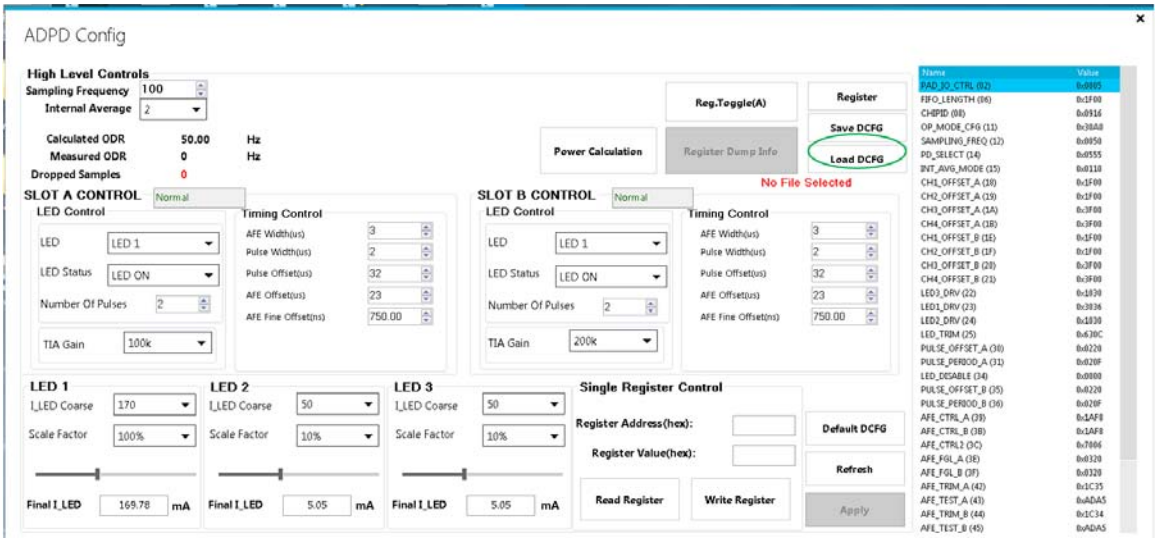

*Figure 11. **ADPD Config** View*

LOAD CONFIGURATION

In the upper right corner of the data view window, click the **ADPD Config** button to open the **ADPD Config** (see Figure 11). Click Load DCFG to select a configuration file. For PPG measurements, select the **ADPD108_M07.dcfg** configuration file.

OPTIMIZING AND RUNNING THE ADPD1080/ ADPD1081

After the configuration file is loaded, the settings can be further optimized using the **ADPD Config** window shown in Figure 11. Typically, the device is set up under some set of conditions, for example, measuring the response from a fixed reflector or measuring a PPG signal from the wrist (see Figure 12). Settings can be optimized for any set of conditions by manipulating LED drive currents, TIA gain, and AFE timing or by using different operating modes that may be more optimal for a specific set of conditions, for example, using float mode for very low current transfer ratio (CTR). For information on optimization of the ADPD1080/ADPD1081, refer to the ADPD1080/ADPD1081 data sheet. For functional descriptions of the Applications Wavetool, refer to the Applications Wavetool user guide that is provided in the software package download.

Figure 12. Example of a PPG Signal Measured from the Wrist

EVALUATION BOARD SCHEMATICS AND ARTWORK

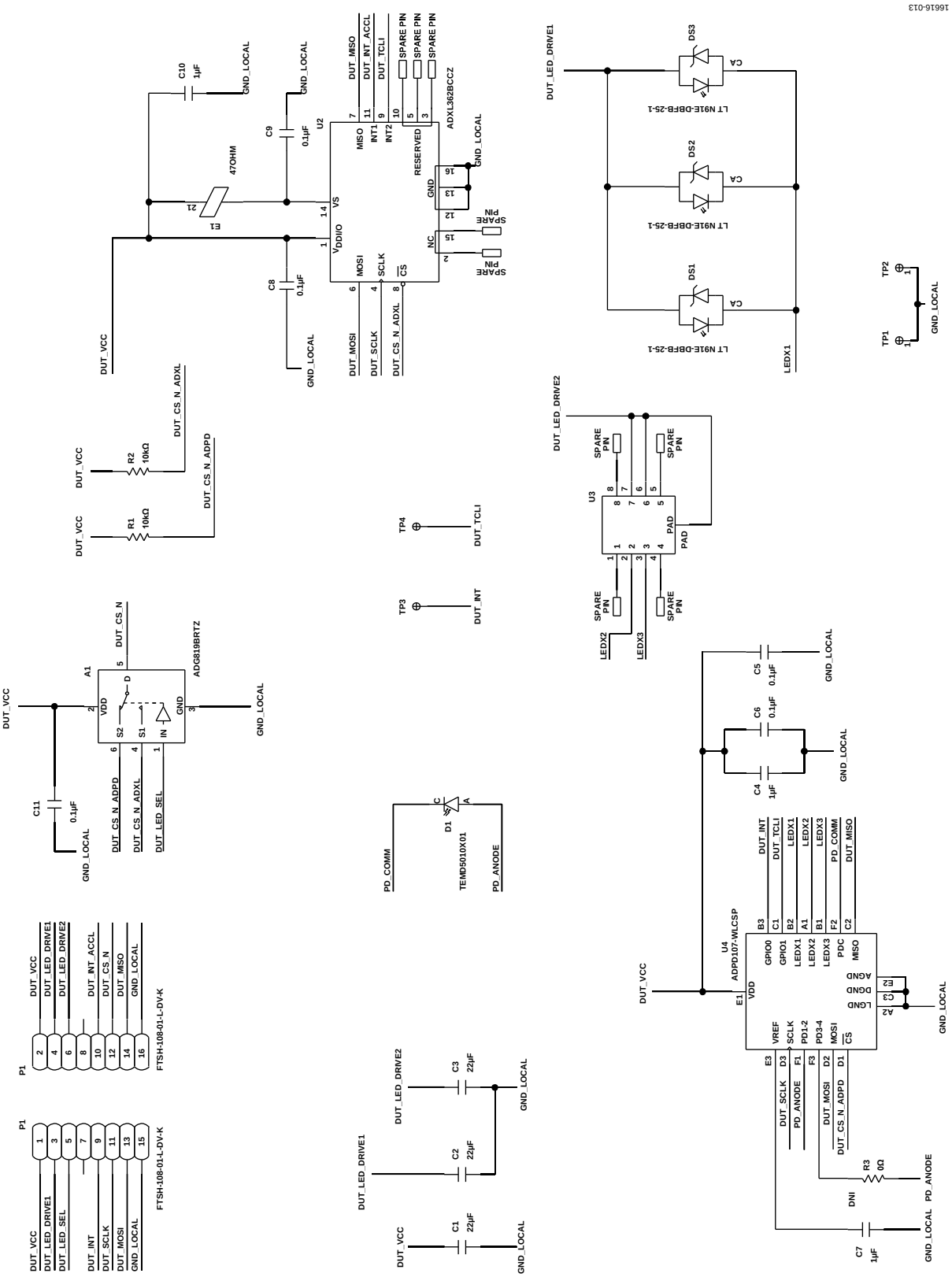

Figure 13. EVAL-ADPD1081Z-PPG Schematic

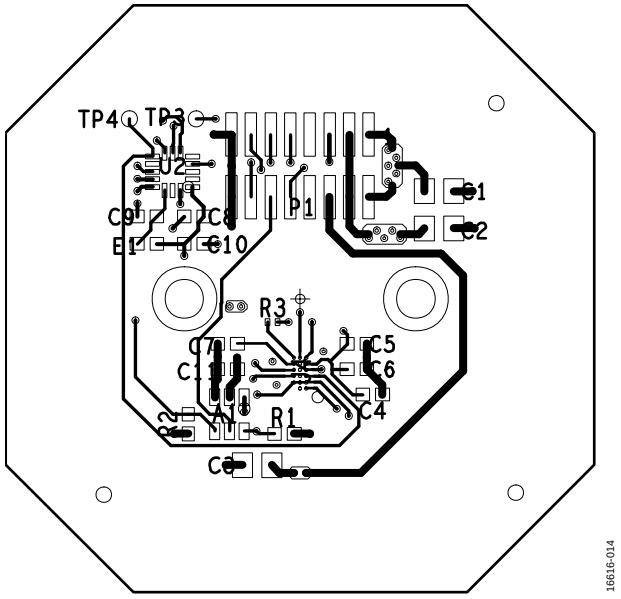

Figure 14. EVAL-ADPD1081Z-PPG Primary Layer

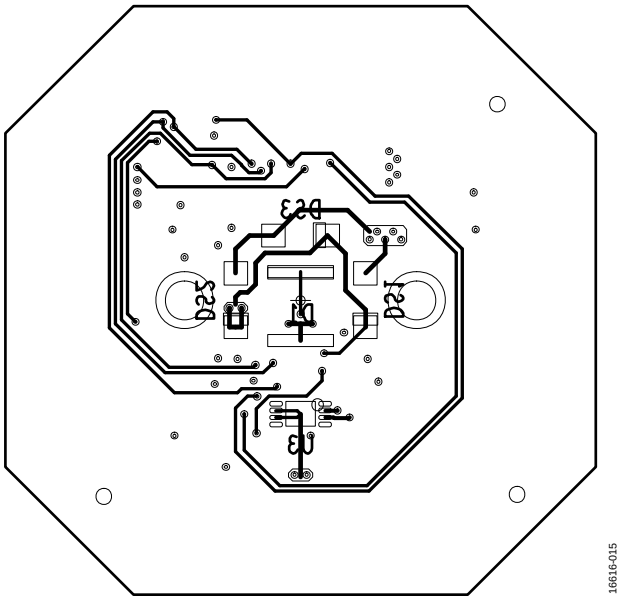

Figure 15. EVAL-ADPD1081Z-PPG Secondary Layer

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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