

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

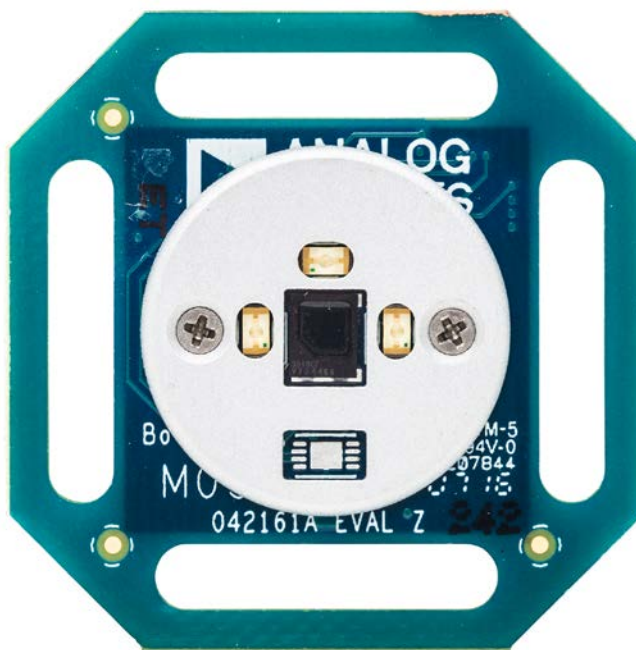
GENERAL DESCRIPTION

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 mm² 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



16616-001

Figure 1.

TABLE OF CONTENTS

Features	1	Checking the USB Serial Connection in Windows®	3
Evaluation Kit Contents.....	1	Running the Applications Wavetool.....	3
Additional Equipment Needed.....	1	Instructions to Load the Firmware	3
Online Resources	1	USB UART Connection.....	4
General Description	1	Acquiring Data.....	5
EVAL-ADPD1081Z-PPG Evaluation Board Photograph	1	Selecting the Proper View	5
Revision History	2	Load Configuration.....	5
Getting Started	3	Optimizing and Running the ADPD1080/ ADPD1081	6
Installing the Applications Wavetool.....	3	Evaluation Board Schematics and Artwork.....	7
Connecting the EVAL-ADPDUCZ Microcontroller Board and the EVAL-ADPD1081Z-PPG Evaluation Board	3		

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.

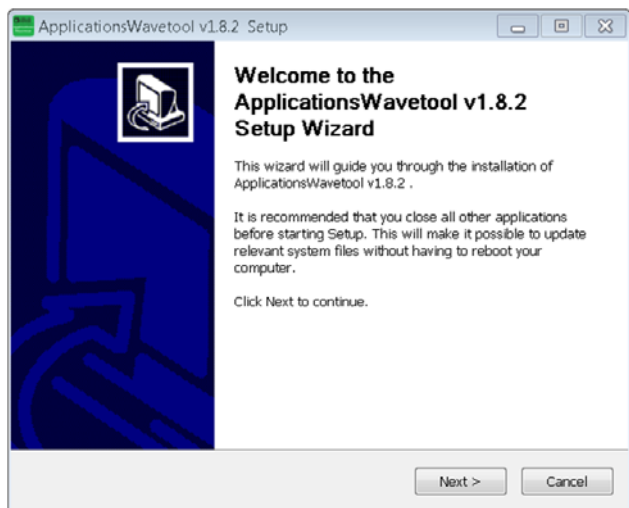


Figure 2. ApplicationsWavetool Setup Window

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.

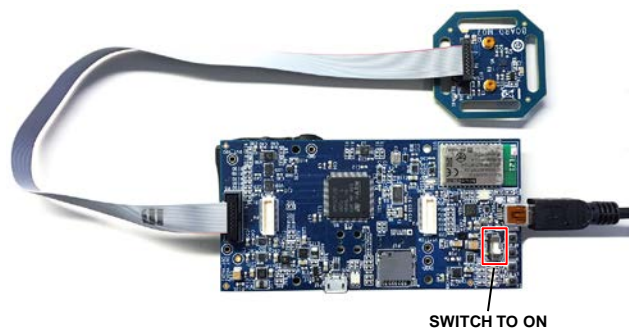


Figure 3. Connect the EVAL-ADPDUCZ to the EVAL-ADPD1081Z-PPG

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.

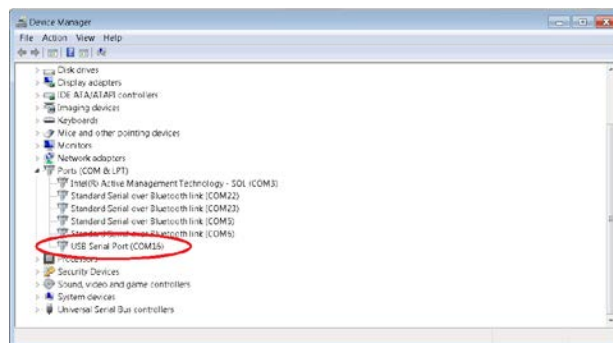


Figure 4. USB Serial Port in Windows 7

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.

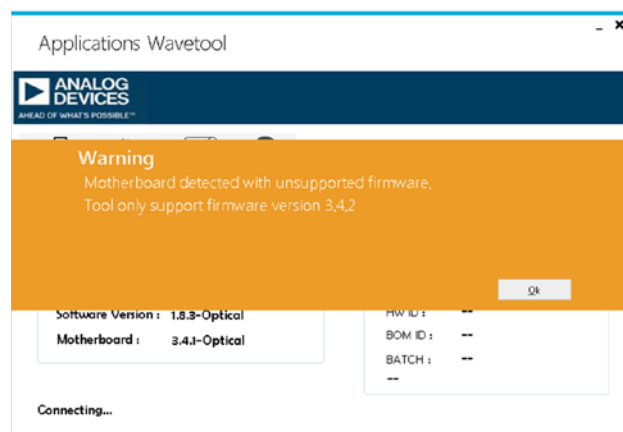


Figure 5. Warning Message for Outdated Firmware

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

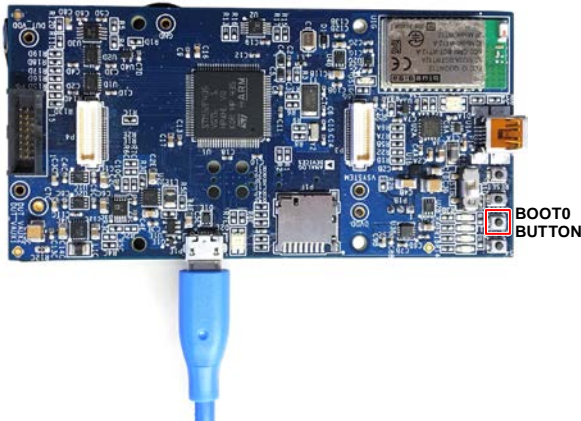


Figure 6. Micro USB Connection and BOOT0 Button Used When Upgrading Firmware

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

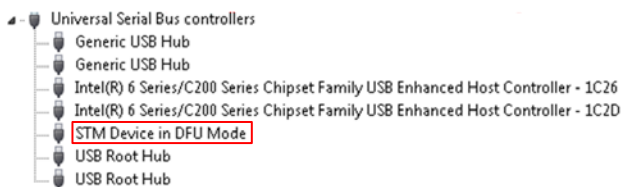


Figure 7. STM Device in DFU Mode Displayed

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.

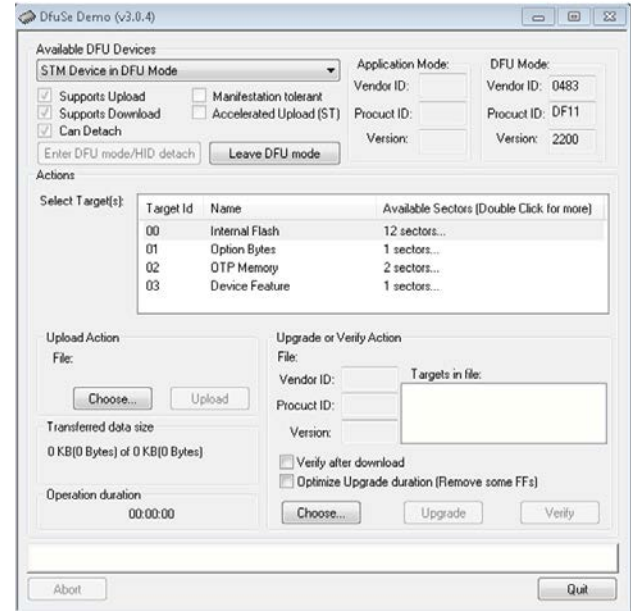


Figure 8. DfuSe Demo Settings

USB UART CONNECTION

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

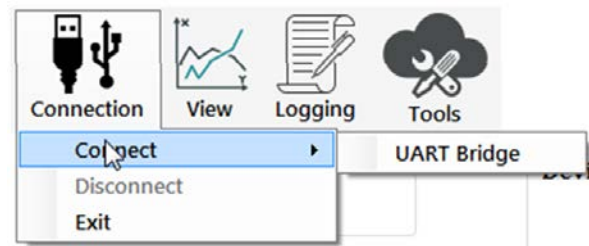


Figure 9. UART Connect

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).

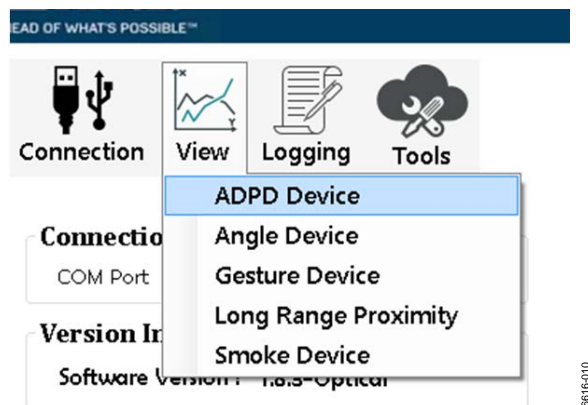


Figure 10. Select **ADPD Device**

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.

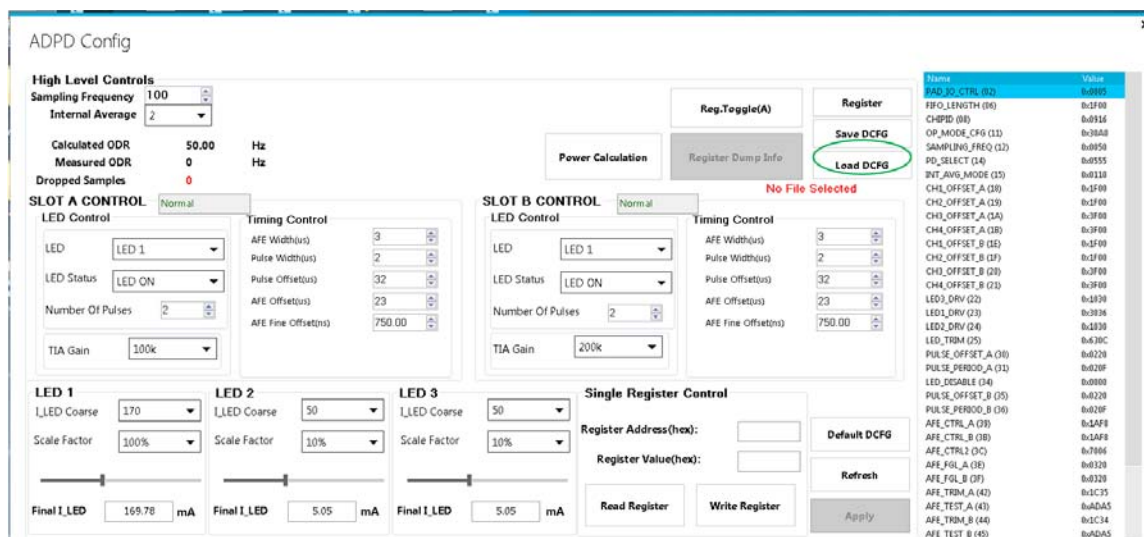


Figure 11. **ADPD Config** View

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.

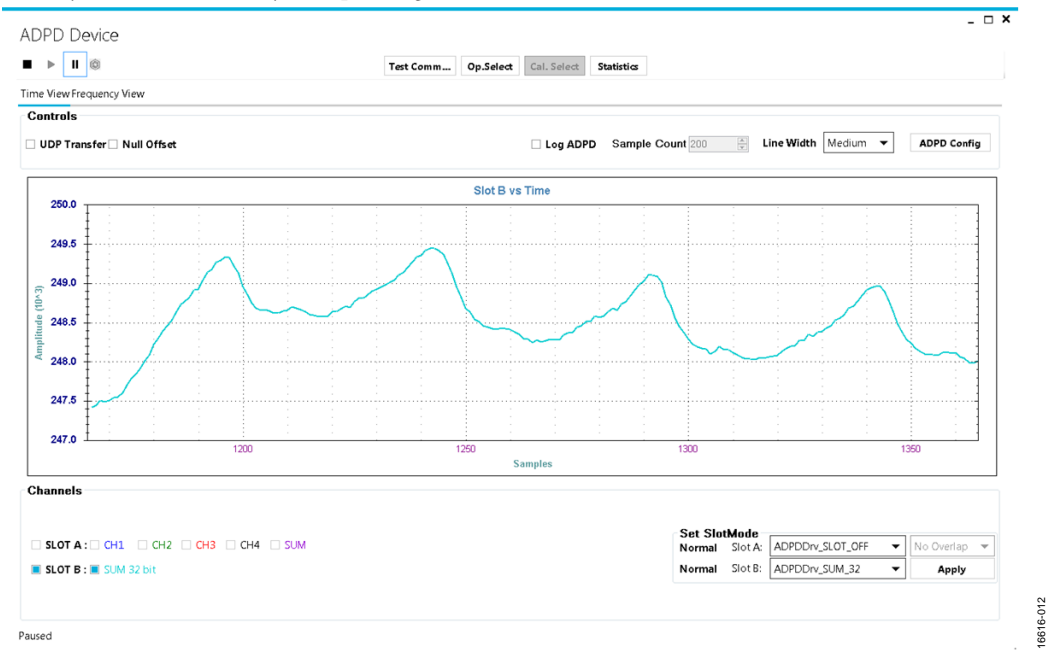


Figure 12. Example of a PPG Signal Measured from the Wrist

EVALUATION BOARD SCHEMATICS AND ARTWORK

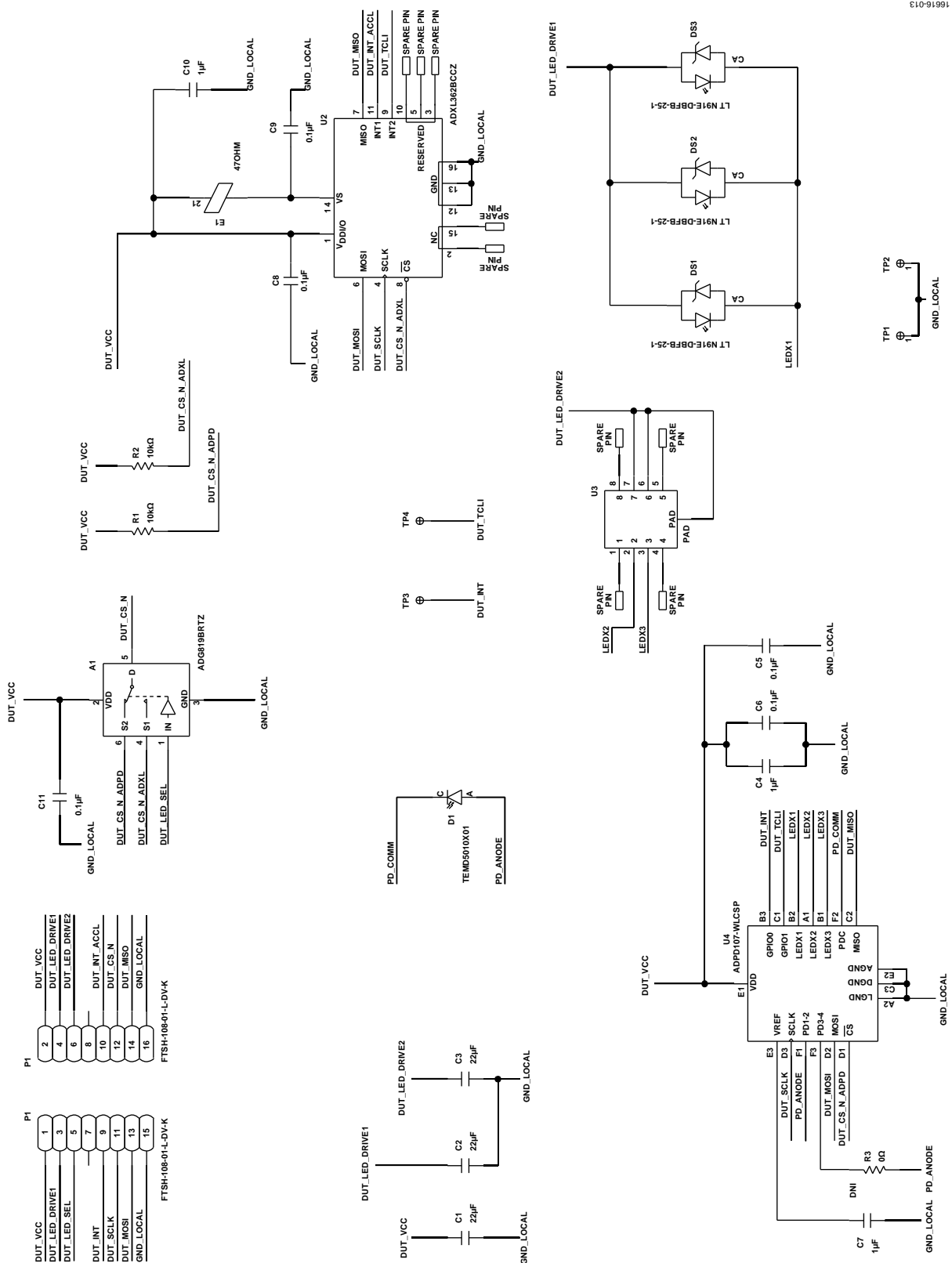
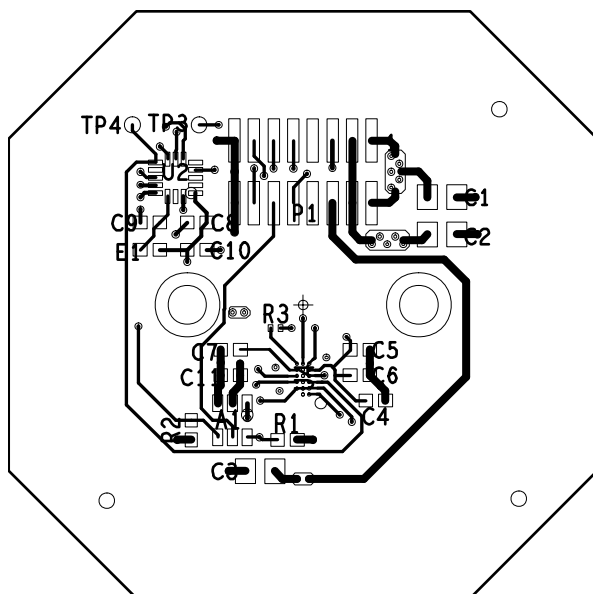
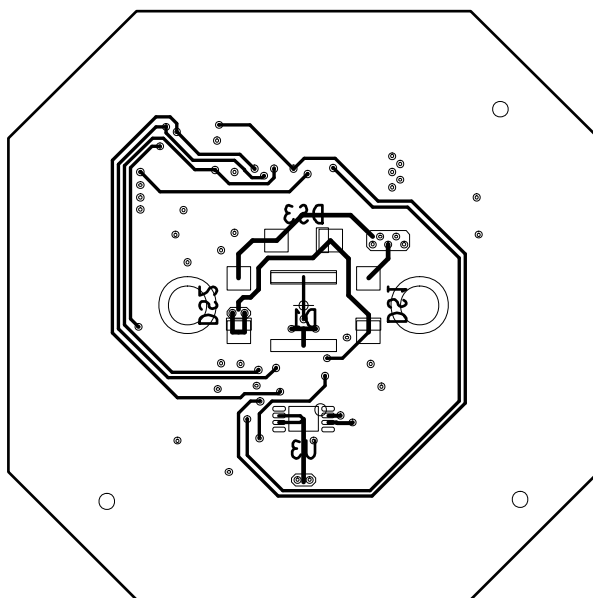


Figure 13. EVAL-ADPD1081Z-PPG Schematic



16016-014

Figure 14. EVAL-ADPD1081Z-PPG Primary Layer



16016-015

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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. **CONFIDENTIALITY.** This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. **ADDITIONAL RESTRICTIONS.** Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. **TERMINATION.** ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. **LIMITATION OF LIABILITY.** THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). **EXPORT.** Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. **GOVERNING LAW.** This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.

