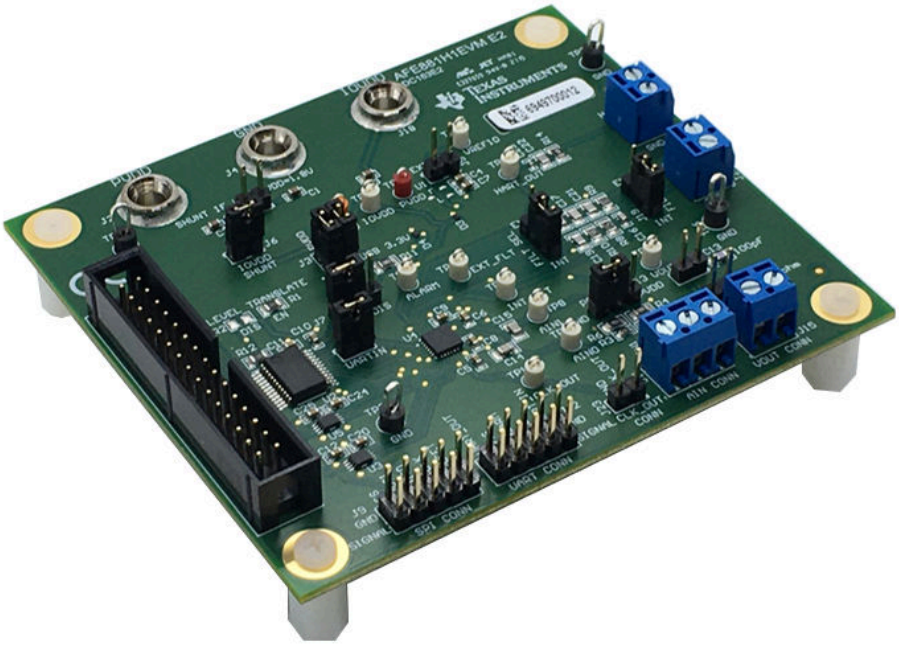
User's Guide

AFE881H1 Evaluation Module

ABSTRACT



This user's guide describes the characteristics, operation, and recommended use cases of the AFE881H1EVM. This document provides examples and instructions on how to use the AFE881H1EVM board and included software. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the AFE881H1EVM. This document also includes a schematic, reference printed circuit board (PCB) layouts, and a complete bill of materials (BOM).

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1 Overview

The AFE881H1 16-bit digital-to-analog converter (DAC) is a highly-integrated, high-accuracy, and extremely low-power device with voltage-outputs designed for HART® enabled sensor transmitter applications. The AFE881H1 includes most of the components required to construct a transmitter for 2-wire (loop-powered), 4-mA to 20-mA sensor transmitter applications. These components include a 16-bit highly accurate DAC, a HART FSK modem, an internal 10-ppm/°C voltage reference, and an internal diagnostic ADC. To accommodate intrinsic and functional safety concerns, external voltage-to-current conversion and power-regulation are required.

1.1 Kit Contents

Table 1-1 details the contents of the EVM kit. Contact the TI Product Information Center at (972) 644-5580 if any component is missing. Download the latest versions of the related software on the TI website, www.ti.com.

Table 1-1. AFE881H1EVM Kit Contents

Item	Quantity
AFE881H1EVM	1

Note

The EVM requires the USB2ANY digital controller. This controller is not included, and must be purchased separately.

1.2 Related Documentation From Texas Instruments

The documents in Table 1-2 provides information regarding Texas Instruments integrated circuits used in the assembly of the AFE881H1EVM. This user's guide is available from the TI web site under literature number SLAU858. Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions may be available from the TI web site at , or call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

Table 1-2. Related Documentation

Document	Literature Number
AFE881H1 product data sheet	SLASEU7
USB2ANY interface adapter user's guide	SNAU228
REF3312 product data sheet	SBOS392
SN74LVC8T245 product data sheet	SCES584
SN74LVC2T45 product data sheet	SCES516

Download the latest version of the EVM graphical user interface (GUI) installer from the *Order and start development* subsection of the AFE881H1EVM web folder on TI.com. Run the GUI installer to install the EVM GUI software on your personal computer (PC).

2 USB2ANY Interface Adapter

The AFE881H1EVM is controlled by a USB2ANY Interface Adapter. A PC runs the software that communicates with the USB2ANY, which provides the power and digital signals used to communicate with the EVM board. Connectors on the EVM board are used to connect the required external power supply. Figure 2-1 shows a diagram of the connections from the PC to the AFE881H1EVM.

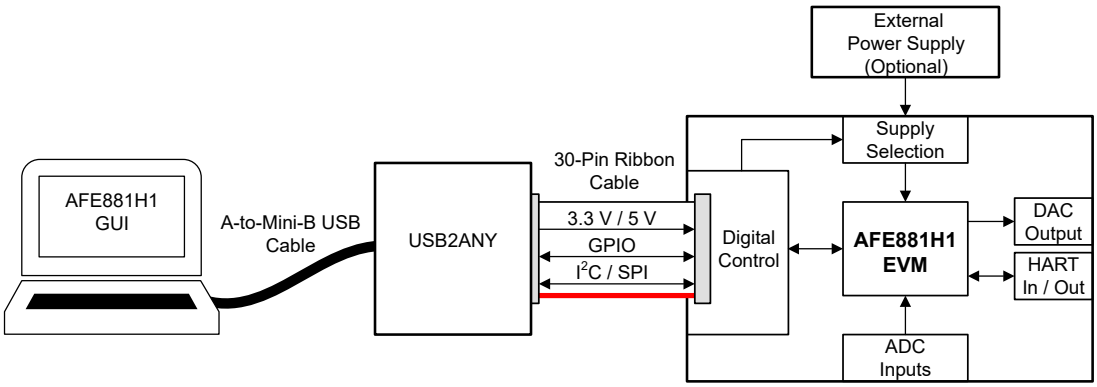

Figure 2-1. AFE881H1EVM Hardware Setup

2.1 Signal Definitions for J10

Table 2-1 shows the pinout for the 30-pin connector socket used to communicate between the EVM and the USB2ANY. Be aware that the I^2C communications lines (I2C_SCL and I2C_SDA1) are not used. Both the connectors and cables from the USB2ANY to the AFE881H1EVM are keyed to make sure the cable is correctly connected.

Table 2-1. USB2ANY Connector AFE881H1EVM (J10) Pinout

Pin on J10	Signal	Definition
4, 6, 8, 16, 27, 28	GND	Ground
11	$\overline{\text{ALARM}}$	Alarm notification; open drain. When an alarm occurs, this pin is held low. Otherwise, this pin goes to Hi-Z.
12	$\overline{\text{CS}}$	SPI communication for AFE881H1 chip select
13	MISO	SPI communication for AFE881H1 digital output
14	MOSI	SPI communication for AFE881H1 digital input
15	3p3V	3.3-V supply voltage
17	CD	Carrier detect. A logic high on this pin indicates a valid carrier is present.
18	SCLK	SPI communication for AFE881H1 digital clock
19	GPIO1	GPIO1 (unused)
20	GPIO2	GPIO2 (unused)
25	$\overline{\text{RTS}}$	Request to send. A logic high on this pin enables the demodulator and disables the modulator. A logic low on this pin enables the modulator and disables the demodulator. Do not leave any digital input pins floating.
26	UARTOUT	UART data output.
29	$\overline{\text{RESET}}$	Reset. A logic low on this pin places the device into power-down mode and resets the device. Logic high returns the device to normal operation. Do not leave any digital input pins floating.
30	UARTIN	UART data input. Do not leave any digital input pins floating.
1, 2, 3, 5, 7, 9, 10, 21, 22, 23, 24	NC	Not connected

2.2 USB2ANY Theory of Operation

Figure 2-2 shows the block diagram for the USB2ANY platform. This platform is a general-purpose data-acquisition system that is used on several different Texas Instruments evaluation modules. The details of operation are included in the USB2ANY Interface Adapter User's Guide.

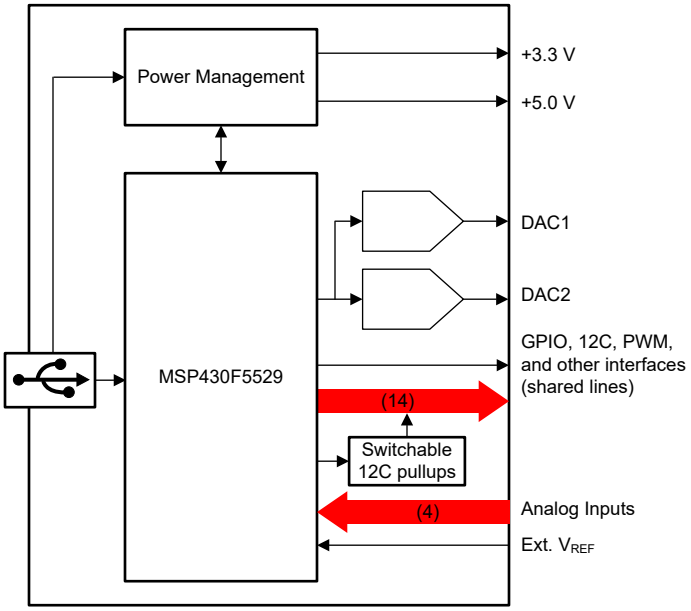

Figure 2-2. USB2ANY Interface Adapter Block Diagram

3 EVM Hardware Overview

To use the EVM hardware, set the jumpers, connect the USB2ANY to the EVM together with the 30-pin ribbon cable, apply external power (optional), and connect the USB cable from the USB2ANY to the PC. This section presents the details of these procedures.

3.1 Electrostatic Discharge Caution

CAUTION

Many of the components on the AFE881H1EVM are susceptible to damage by electrostatic discharge (ESD). Observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

3.2 EVM Block Diagram

A block diagram of the EVM hardware setup is shown in Figure 3-1. This board provides connections and test points for the SPI and UART communication, power, reference, ground connections, ADC inputs, HART modem, and the analog output of the DAC.

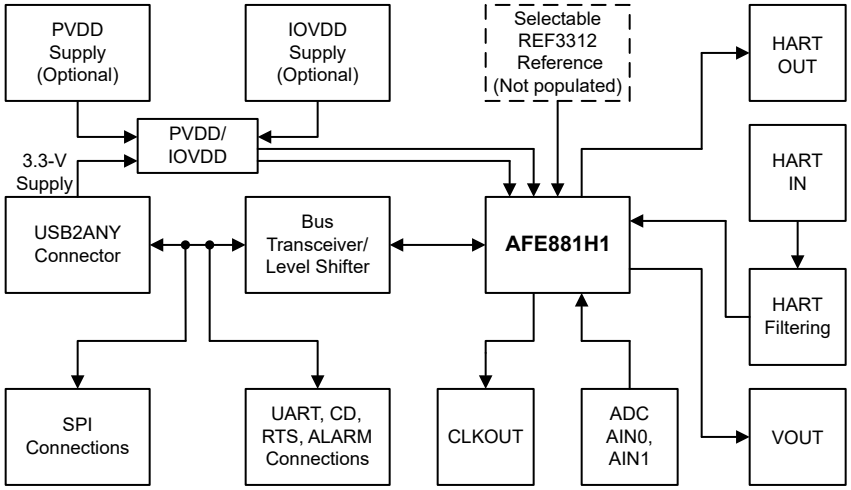

Figure 3-1. AFE881H1EVM Block Diagram

3.3 EVM Jumper Summary

Table 3-1 summarizes all of the EVM jumper functionality.

Table 3-1. AFE881H1EVM Jumper Summary

Header	Name	Function
J2	PVDD to IOVDD	**Short 1-2** – PVDD connected to IOVDD **Open 1-2** – PVDD, IOVDD disconnected (default)
J3	USB 3.3V	**Short 1-2** – PVDD connected to USB2ANY 3p3V (default) **Open 1-2** – PVDD disconnected from USB2ANY 3p3V **Short 3-4** – IOVDD connected to USB2ANY 3p3V (default) **Open 3-4** – IOVDD disconnected from USB2ANY 3p3V
J5	Ext REF	**Short 1-2** – VREFIO connected to external reference **Open 1-2** – VREFIO disconnected from external reference (default)
J6	IOVDD Shunt	**Short 1-2** – IOVDD connected to device (default) **Open 1-2** – IOVDD disconnected from device
J7	REF EN	**Short 1-2** – REFEN connected to IOVDD (default) **Short 2-3** – REFEN connected to GND
J8	UARTIN	**Short 1-2** – UART_IN connected to bus transceiver (default) **Open 1-2** – UART_IN disconnected from bus transceiver
J13	POL SEL	**Short 1-2** – POL_SEL connected to PVDD through 100-kΩ resistor **Short 2-3** – POL_SEL connected to GND through 100-kΩ resistor (default)
J14	Resistor Load	**Short 1-2** – VOUT connected to 10-kΩ load **Open 1-2** – VOUT no resistive load (default)
J17	Cap Load	**Short 1-2** – VOUT connected to 100-pF load **Open 1-2** – VOUT no capacitive load (default)
J19, J20	FILT SEL	**Short 1-2** – HART IN pin external filter selected **Short 2-3** – HART IN pin internal filter selected
J23	Level Translator	**Short 1-2** – Bus transceiver $\overline{OE}$ connected to GND (default) **Short 2-3** – Bus transceiver $\overline{OE}$ connected to IOVDD

Figure 3-2 shows the default jumper settings with the device using USB power. The EVM can be fully operated using only the USB2ANY connector for both power and communication.

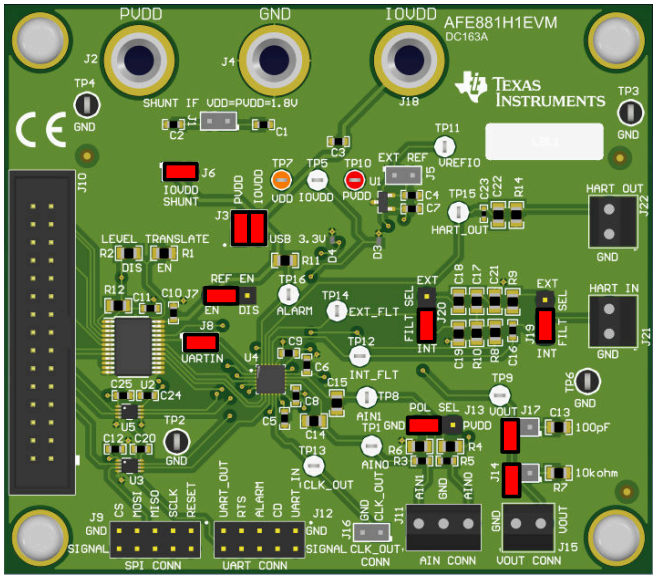

Figure 3-2. Default Header Settings for the AFE881H1EVM

3.4 Terminal and Pin Definitions

Table 3-2 shows the EVM terminal and pin definitions, allowing the user to operate and connect the device to optional power settings and other input and output signals.

Table 3-2. AFE881H1EVM Terminal and Pin Definitions

Terminal or Pin	Name	Function
J1	VDD	**Shunt 1-2:** Connect VDD to PVDD for use when VDD = PVDD = 1.8 V **Open 1-2:** Disconnects VDD when PVDD > 1.8 V
J2	PVDD	**Banana Jack:** Optional for external PVDD
J3	3p3V	**Shunt 1-2:** Connect PVDD to USB2ANY 3.3-V supply **Shunt 3-4:** Connect IOVDD to USB2ANY 3.3-V supply
J4	GND	**Banana Jack:** Optional for external GND
J5	VREFIO	**Shunt 1-2:** Connect REF3312 to VREFIO for external reference **Open 1-2:** Open for device internal reference
J6	IOVDD	**Shunt 1-2:** Connect IOVDD to power
J7	REF EN	**Shunt 1-2:** Enable device internal reference **Shunt 2-3:** Disable device internal reference
J8	UARTIN	**Shunt 1-2:** Connect UARTIN to device from USB2ANY through voltage level shifter
J9	SPI Conn	**Pin 1:** $\overline{\text{RESET}}$ **Pin 3:** SCLK **Pin 5:** SDI **Pin 7:** $\overline{\text{CS}}$ **Pin 9:** SDO **Pin 2, 4, 6, 8, 10:** GND
J10	USB2ANY	30-pin ribbon cable connection, see Table 2-1
J11	ADC	**Terminal 1:** AIN0 **Terminal 2:** GND **Terminal 3:** AIN1
J12	UART Conn	**Pin 1:** UART_IN **Pin 3:** UART_OUT **Pin 5:** $\overline{\text{RTS}}$ **Pin 7:** CD **Pin 9:** $\overline{\text{ALARM}}$ **Pin 2, 4, 6, 8, 10:** GND
J13	POL_SEL	**Shunt 1-2:** Pull up to PVDD **Shunt 2-3:** Pull down to GND **Open:** Connection to AIN1 terminal of J11
J14	RES_LOAD	**Shunt 1-2:** Connect 10-kΩ load to VOUT
J15	VOUT	**Terminal 1:** GND **Terminal 2:** VOUT
J16	CLK_OUT	**Pin 1:** CLK_OUT **Pin 2:** GND
J17	CAP_LOAD	**Shunt 1-2:** Connect 150-pF load to VOUT
J18	IOVDD	**Banana Jack:** Optional for external IOVDD
J19, J20	FILT_SEL	**Shunt 1-2:** HART IN terminal internal filter selected **Shunt 2-3:** HART IN terminal external filter selected
J21	HART_IN	**Terminal 1:** GND **Terminal 2:** HART input
J22	HART_OUT	**Terminal 1:** GND **Terminal 2:** HART output

Figure 3-3 shows the terminal and pin locations on the EVM.

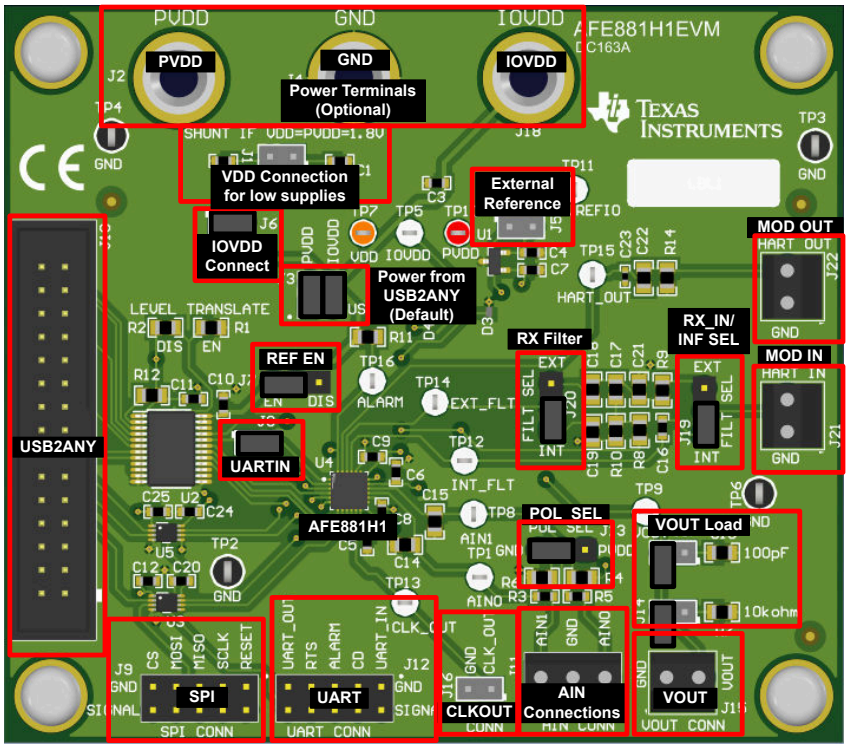

Figure 3-3. Terminal and Pin Locations for the AFE881H1EVM

3.5 Connecting the USB2ANY

To connect the EVM board and the USB2ANY Interface Adapter together, firmly slide the cable ends of the 30-pin ribbon cable into the USB2ANY Interface Adapter and the AFE881H1EVM, as shown in Figure 3-4. Make sure that the connectors are completely pushed together. Loose connections between the USB2ANY and the EVM may cause intermittent operation.

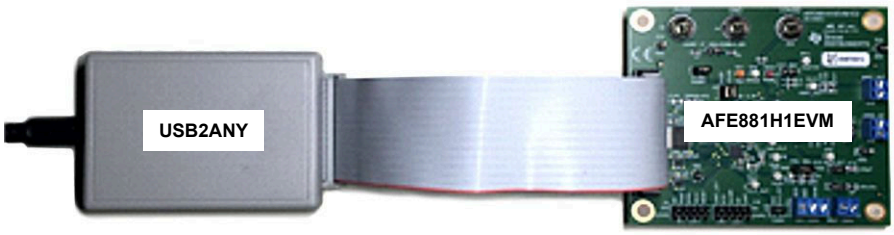

Figure 3-4. USB2ANY Connection to the AFE881H1EVM

3.6 Connecting the USB Cable to the USB2ANY Interface Adapter

Figure 3-5 shows the typical response to connecting the USB2ANY Interface Adapter board to a USB port for the first time. Typically, the PC responds with a *Found New Hardware, USB Device* pop-up dialog window. The pop-up window then changes to *Found New Hardware, USB Human Interface Device*. This pop-up indicates that the device is ready to be used. The USB2ANY Interface Adapter uses the human interface device drivers that are included in the Windows® operating system (OS).

In some cases, the *Add Hardware Wizard* appears. If this prompt occurs, allow the system device manager to install the human interface drivers by clicking *Yes* when requested to install drivers.

Figure 3-5. Confirmation of USB2ANY Driver Installation

CAUTION

The EVM default configuration does not require external power supplies, and power is sourced from the USB2ANY. If external supplies are used, disconnect the supply connection from the 3p3V line coming from the USB2ANY before attaching external supplies.

3.7 Optional EVM Operations

This section describes the various operational options that can be used by the EVM.

3.7.1 Power Configuration

The default configuration of the AFE881H1EVM allows the board to be powered from the 3p3V line coming from the USB2ANY. Jumper J3 connects power from the 3p3V line to the PVDD and IOVDD pins of the device. To use external power supplies, remove the jumpers in J3 to connect supplies to J1 and J4 for connections to PVDD and IOVDD. When the external supply is 1.8 V, install R1 on the board; this resistor is not installed by default. Provide the external 1.8-V supply to PVDD, VDD, and IOVDD through J1 and J4.

3.7.2 External SPI and UART Controllers

To use an external SPI or UART controller with EVM board, disconnect the USB2ANY controller, and disable the U2 level shifter by uninstalling R13 and installing R2.

4 Software Overview

This section discusses how to use the AFE881H1EVM software.

4.1 Software Installation

Before starting software installation, verify that the USB2ANY controller is not connected or else the driver may not properly install.

Download and run the latest version of the EVM GUI installer from the *Tools and Software* section of the AFE881H1EVM web folder to install the EVM GUI software on your PC. The software installation automatically copies the required LabVIEW™ software files and drivers to the local machine. The AFE881H1EVM installer installs all the driver files necessary to operate the USB2ANY controller.

Choose the destination directory for the GUI software, accept the license agreements, and follow the on-screen instructions shown in Figure 4-1 to complete the installation.

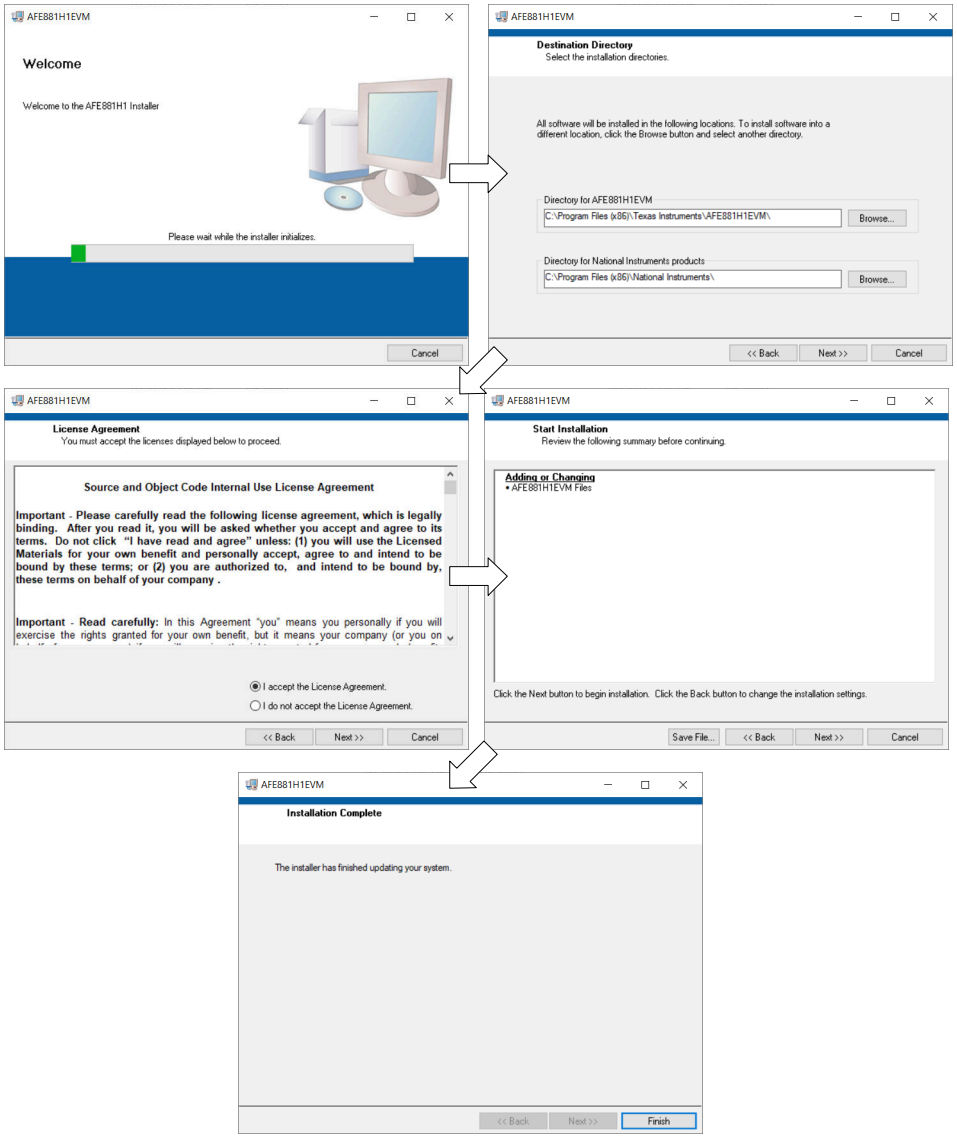

Figure 4-1. AFE881H1EVM Software Installation Prompts

To use the scripting tool, the Python™ programming environment must also be installed. Download the latest x86 version of Python 2.7 at https://www.python.org/downloads/.

4.2 Launching the Software

After installation, a shortcut to launch the GUI can be found in the *Start* menu. If installed in the default directory, the AFE881H1EVM software can also be launched by navigating to the *Texas Instruments* folder in the *Program Files (x86)* directory, as Figure 4-2 shows.

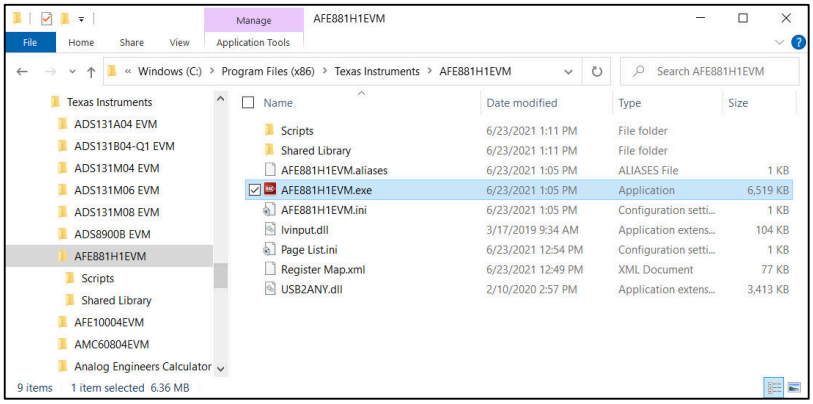

Figure 4-2. Launching the AFE881H1EVM GUI

Figure 4-3 shows the GUI after launch. If the USB2ANY controller is not connected to the PC when the software is launched, the GUI defaults to *demo* mode. Figure 4-4 illustrates the bottom-left corner of the GUI showing the hardware connection status: DEMO MODE or CONNECTED. After the USB2ANY controller is properly connected to the PC, close and reopen the AFE881H1EVM software to detect the device.

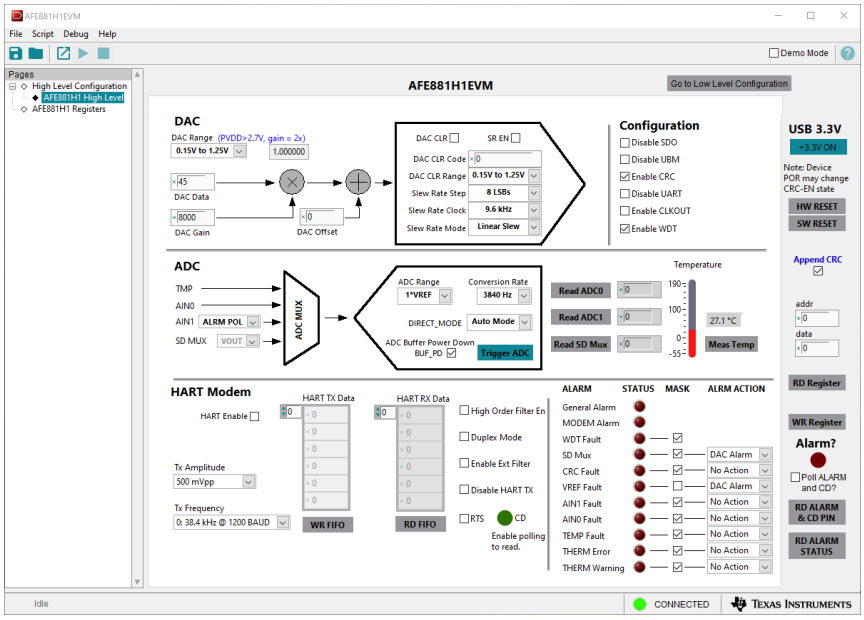

Figure 4-3. AFE881H1EVM GUI at Launch

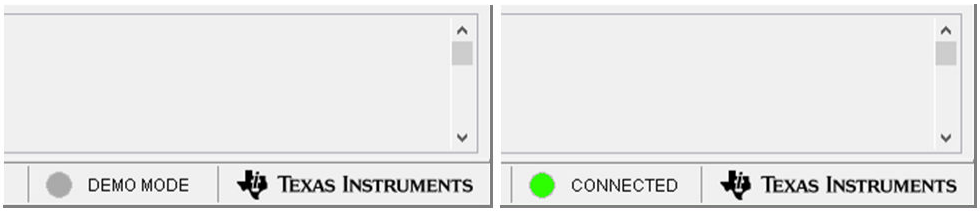

Figure 4-4. USB2ANY Digital Controller Connection Status

4.3 Software Features

The AFE881H1EVM GUI allows for SPI communication with the AFE881H1 and control of the device. While the entire register map is available to the user, some features have been integrated into user controls for easy operation.

4.3.1 AFE881H1 Register Page

Figure 4-5 shows the *AFE881H1 Register* page of the AFE881H1EVM GUI. This page allows direct access to all registers on the AFE881H1. The GUI handles page address management, allowing seamless access to registers.

The *Register Map* section in the center of the page lists all the registers, grouped by the pages in the device. Directly above the *Register Map* section are four buttons that allow read and write access to all registers.

The *Field View* section on the right side of the page shows the various fields in the currently selected register. Select a register name to highlight the register. The *Field View* section displays the register contents as described in the data sheet.

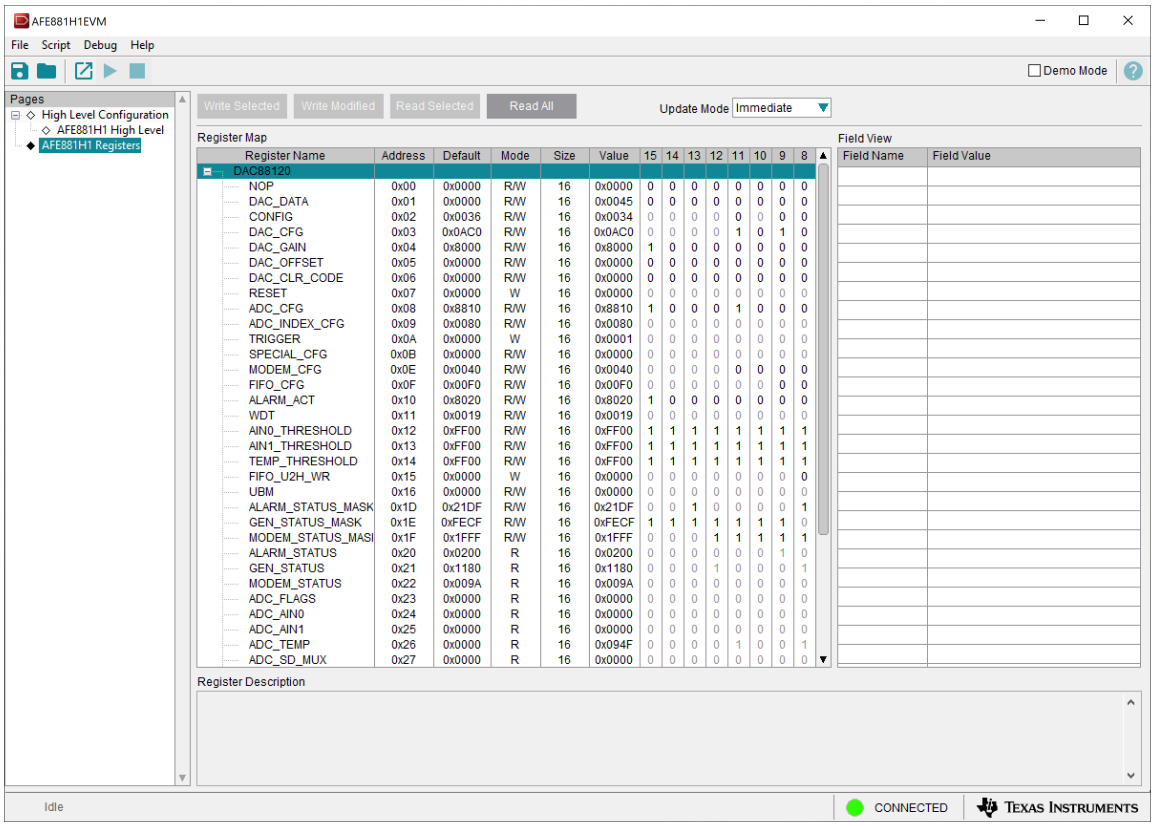

Figure 4-5. AFE881H1 Register Page

4.3.2 High Level Configuration Page

The *High Level Configuration* page is used to set the configuration of the AFE881H1EVM GUI. Figure 4-6 shows the *AFE881H1 High Level* tab of the *High Level Configuration* Page. This tab is used to set the DAC range and outputs, ADCs controls and settings, and HART modem functions for the device. Alarms and status information are also displayed on this tab.

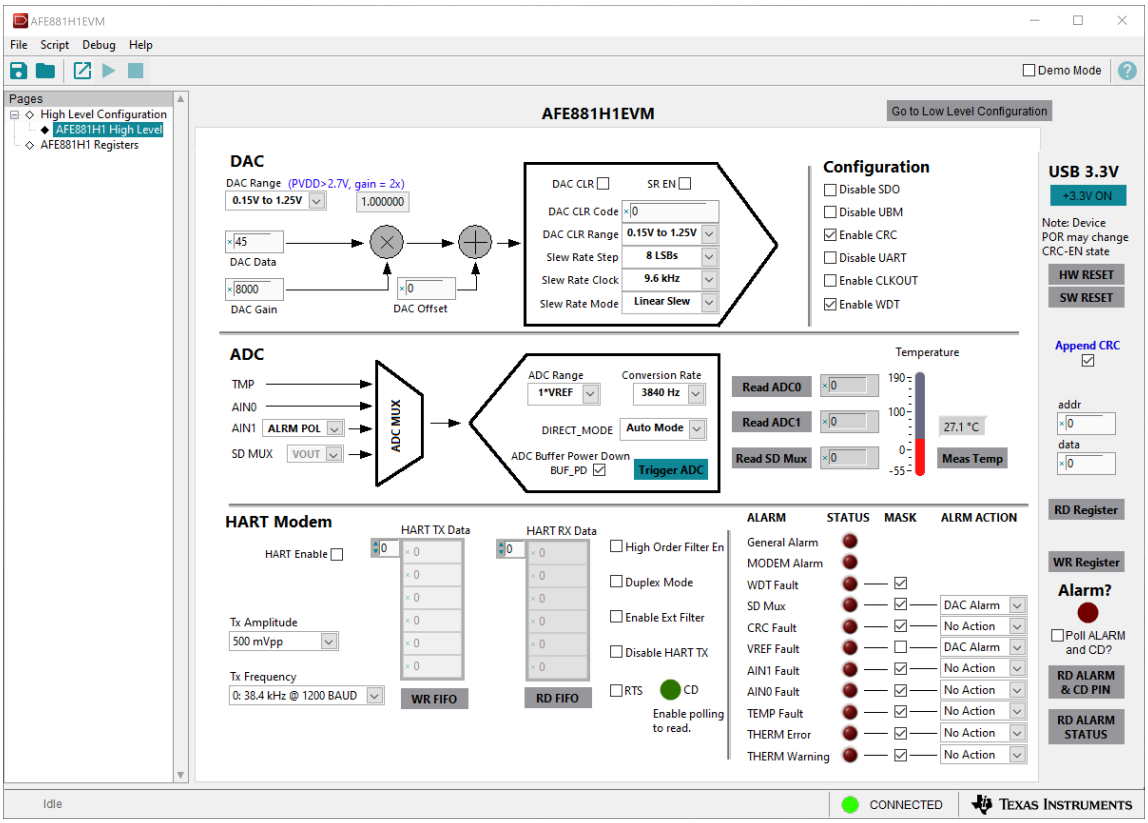

Figure 4-6. AFE881H1 High Level Tab

4.3.3 Using the Python Scripting Tool

The AFE881H1EVM software provides a scripting tool to automate register reads and writes for reuse. To use the scripting tool, the Python™ programming environment must be installed. Download the latest x86 version of Python 2.7 at https://www.python.org/downloads/. To launch the scripting tool, click *Script* > *Launch Window*, as shown in Figure 4-7.

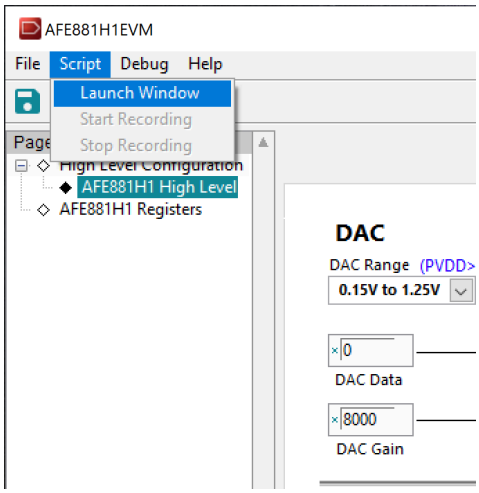

Figure 4-7. Launch Script Window

The scripting tool launches a Python IDLE window. This window lists any register interaction when recording a macro. To record a macro, find the *Launch Window* function in the *Scripting* tab. Figure 4-8 shows the scripting tool recording a macro. After the actions are recorded, use the **Stop** button to end the script. This script can be saved and reused as desired.

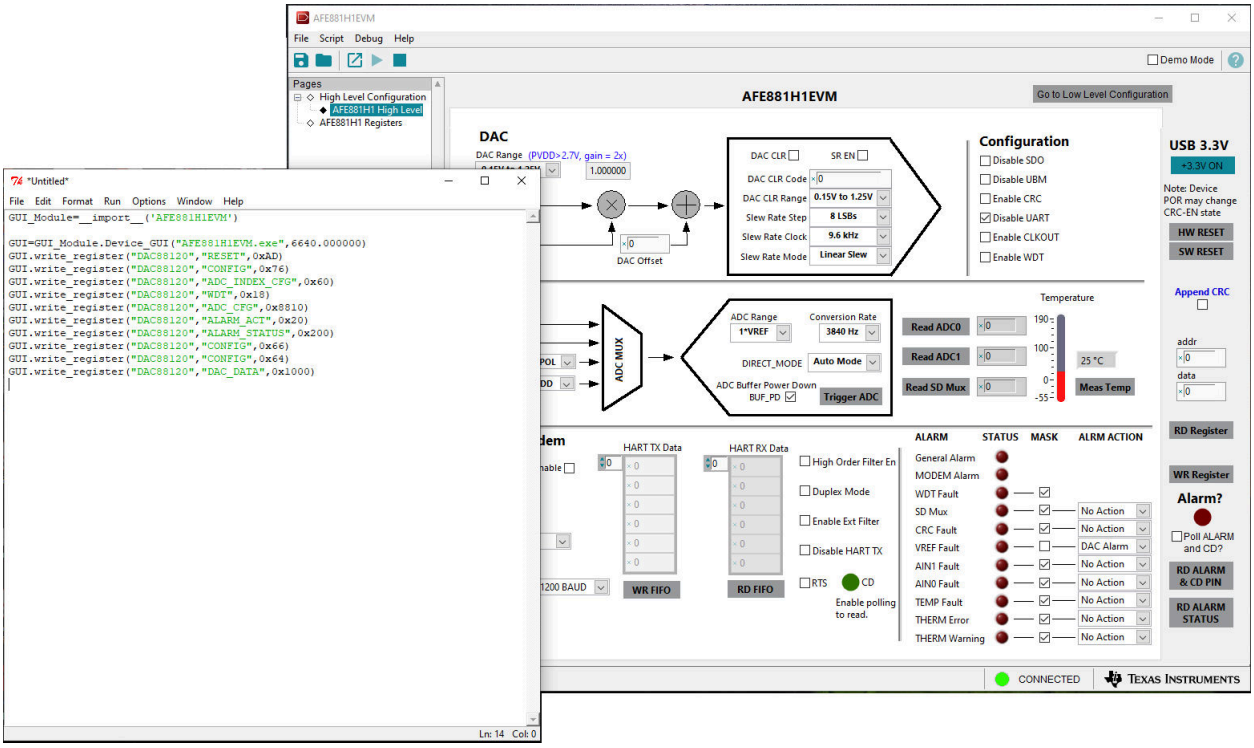

Figure 4-8. Scripting Tool Recording a Macro

If the python IDLE window does not appear, check the settings for application execution aliases. To do so, open the Windows *Settings*, and then select *Apps*. In the resulting *Apps* window, select *Apps & features*, and then click on the *Manage app execution aliases* link. The next page loads a list of apps. Deselect both application installers for python.exe and python3.exe. Figure 4-9 shows the windows settings for managing application execution aliases.

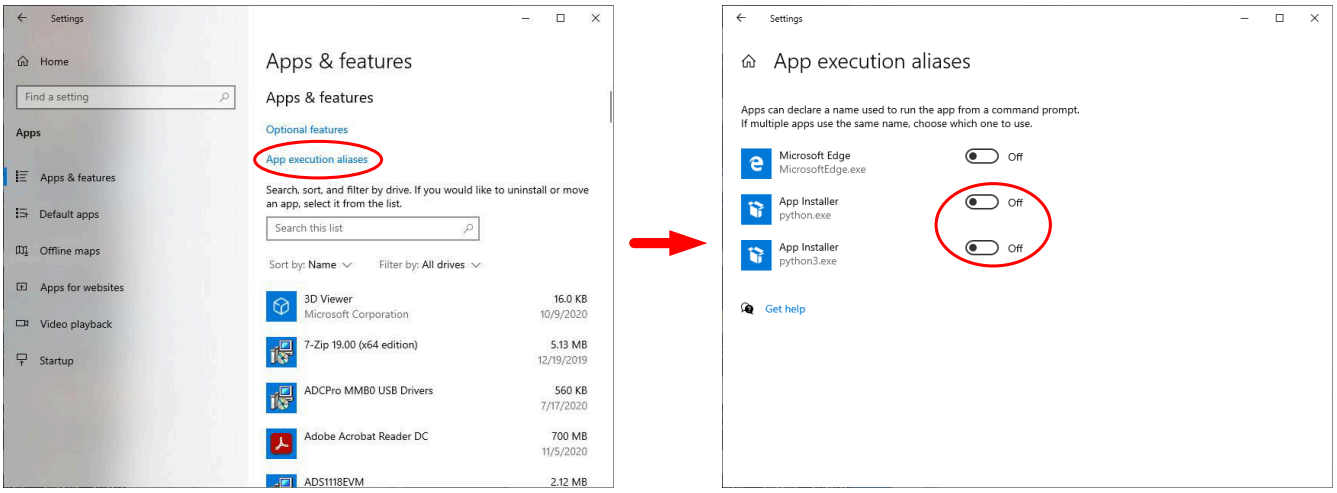

Figure 4-9. Deselecting App Execution Aliases

5 Schematics, PCB Layout, and Bill of Materials

5.1 Board Schematic

The AFE881H1EVM schematic is shown in Figure 5-1.

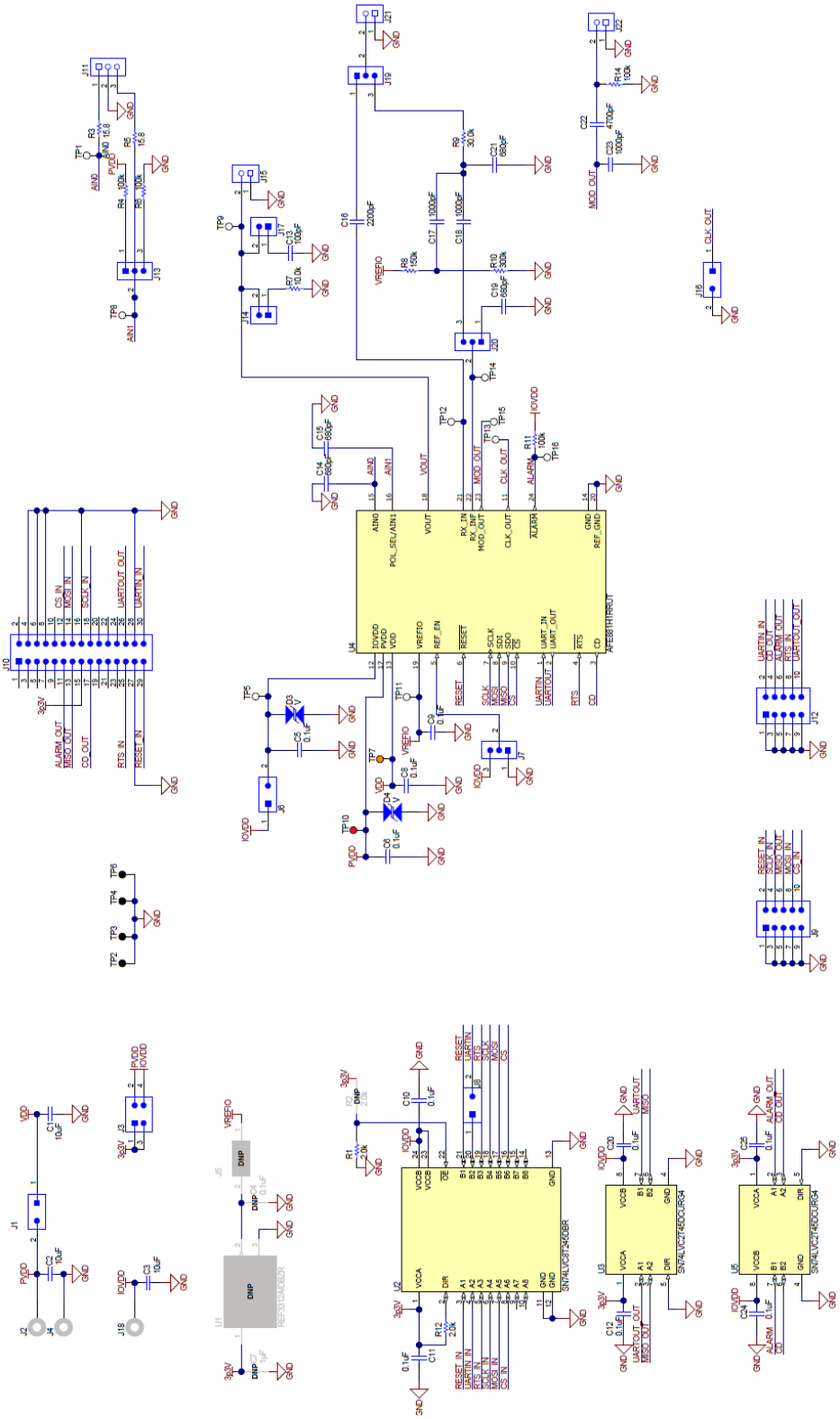

Figure 5-1. AFE881H1EVM Schematic

5.2 PCB Components Layout

Figure 5-2 through Figure 5-5 show the board layout for the AFE881H1EVM.

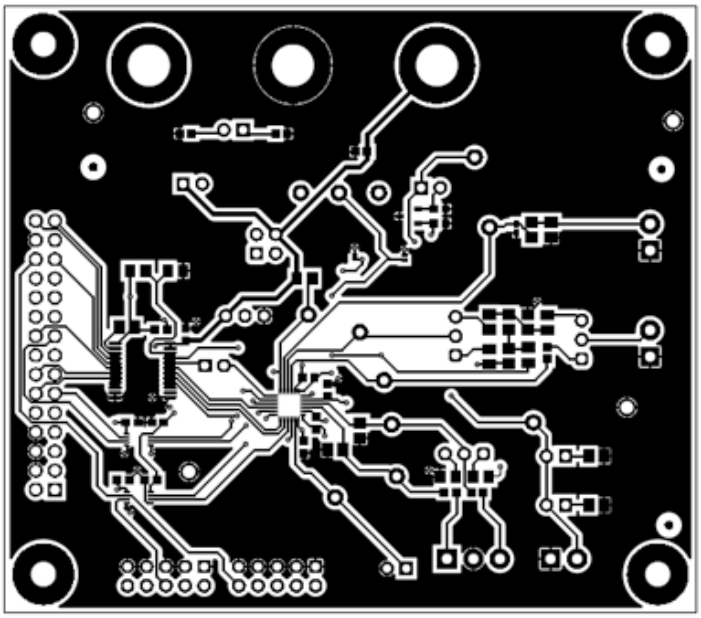

Figure 5-2. AFE881H1EVM PCB Top Layer Layout

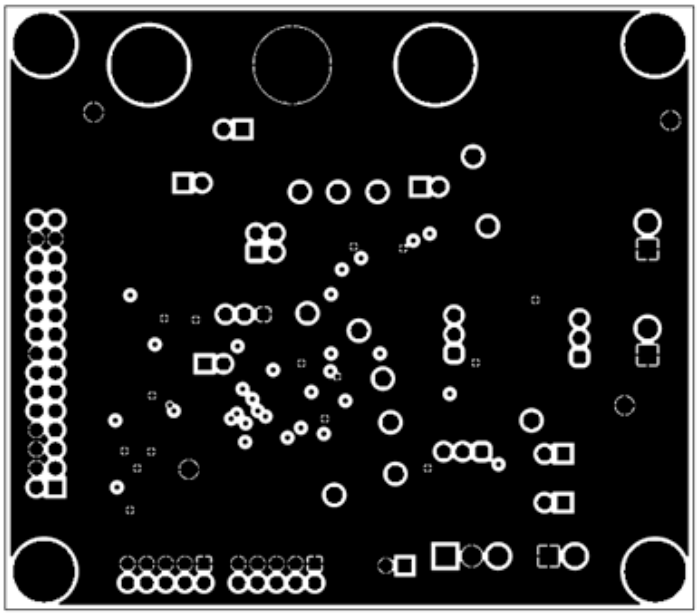

Figure 5-3. AFE881H1EVM PCB Mid Layer 1 Layout

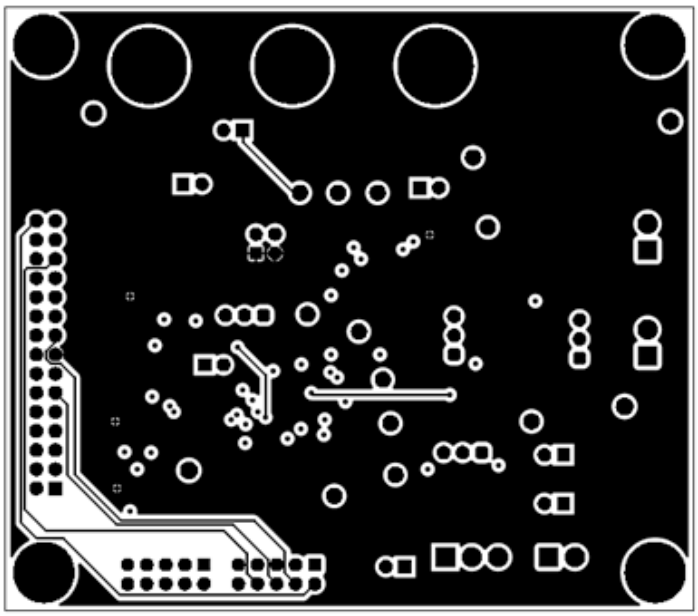

Figure 5-4. AFE881H1EVM PCB Mid Layer 2 Layout

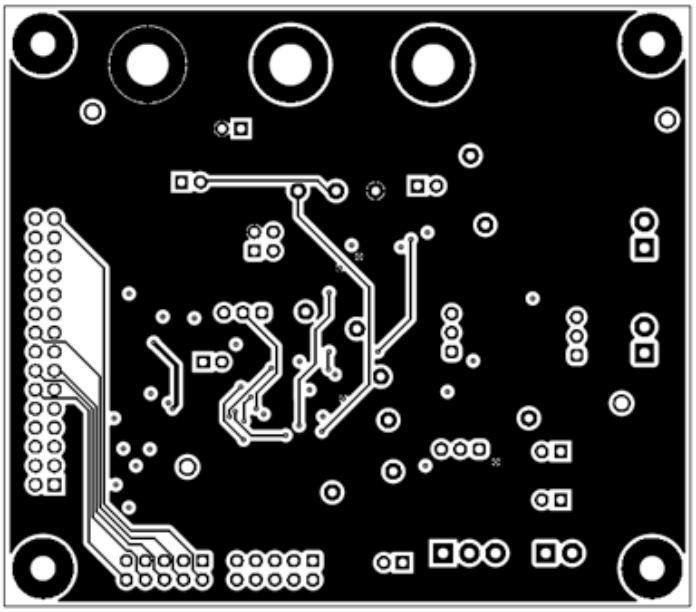

Figure 5-5. AFE881H1EVM PCB Bottom Layer Layout

5.3 Bill of Materials

Table 5-1 lists the AFE881H1EVM BOM.

Table 5-1. Bill of Materials for the AFE881H1EVM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
PCB	1		Printed Circuit Board		DC163	Any
C1, C2, C3	3	10uF	CAP, CERM, 10 uF, 25 V, +/- 20%, X5R, 0603	0603	GRT188R61E106ME13D	MuRata
C5, C6, C8, C9, C10, C11, C12, C20, C24, C25	10	0.1uF	CAP, CERM, 0.1 uF, 25 V, +/- 5%, X7R, 0603	0603	06033C104JAT2A	AVX
C13	1	100pF	CAP, CERM, 100 pF, 100 V, +/- 5%, X7R, 0805	0805	C0805C101J1RACTU	Kemet
C14, C15	2	680pF	CAP, CERM, 680 pF, 25 V, +/- 10%, X7R, 0805	0805	885012207085	Würth Elektronik
C16	1	2200pF	CAP, CERM, 2200 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H222JA01D	MuRata
C17, C18	2	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 1%, C0G/NP0, 0805	0805	08055A102FAT2A	AVX
C19, C21	2	680pF	CAP, CERM, 680 pF, 100 V, +/- 5%, C0G/NP0, 0805	0805	08051A681JAT2A	AVX
C22	1	4700pF	CAP, CERM, 4700 pF, 25 V, +/- 5%, C0G/NP0, 0805	0805	08053A472JAT2A	AVX
C23	1	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 5%, C0G/NP0, AEC-Q200 Grade 1, 0402	0402	CGA2B2C0G1H102J050BA	TDK
D3, D4	2	V	Diode, TVS, Bi, 5.5 V, 14 Vc, 1x0.6mm	1x0.6mm	ESD105B102ELE6327XTMA1	Infineon Technologies
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J6, J8, J14, J16, J17	6		Header, 100mil, 2x1, Tin, TH	Header, 2x1, 100mil, TH	5-146278-2	TE Connectivity
J2, J4, J18	3		Standard Banana Jack, Uninsulated, 5.5mm	Keystone_575-4	575-4	Keystone
J3	1		Header, 100mil, 2x2, Gold, TH	2x2 Header	TSW-102-07-G-D	Samtec
J7, J13, J19, J20	4		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
J9, J12	2		Header, 100mil, 5x2, Gold, TH	5x2 Header	TSW-105-07-G-D	Samtec
J10	1		Header(shrouded), 2.54mm, 15x2, Gold, TH	Header(shrouded), 2.54mm, 15x2, TH	302-S301	On-Shore Technology
J11	1		Terminal Block, 3.5mm Pitch, 3x1, TH	10.5x8.2x6.5mm	ED555/3DS	On-Shore Technology
J15, J21, J22	3		Terminal Block, 3.5mm Pitch, 2x1, TH	7.0x8.2x6.5mm	ED555/2DS	On-Shore Technology
R1, R12	2	2.0k	RES, 2.0 k, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	ERJ-6GEYJ202V	Panasonic

Table 5-1. Bill of Materials for the AFE881H1EVM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R3, R5	2	15.8	RES, 15.8, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060315R8FKEA	Vishay-Dale
R4, R6, R11, R14	4	100k	RES, 100 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW0805100KFKEA	Vishay-Dale
R7	1	10.0k	RES, 10.0 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW080510K0FKEA	Vishay-Dale
R8	1	150k	RES, 150 k, 0.1%, 0.125 W, 0805	0805	RG2012P-154-B-T5	Susumu Co Ltd
R9	1	30.0k	RES, 30.0 k, 0.1%, 0.125 W, 0805	0805	RG2012P-303-B-T5	Susumu Co Ltd
R10	1	300k	RES, 300 k, 0.1%, 0.125 W, 0805	0805	RG2012P-304-B-T5	Susumu Co Ltd
TP1, TP5, TP8, TP9, TP11, TP12, TP13, TP14, TP15, TP16	10		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
TP2, TP3, TP4, TP6	4		Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint	5011	Keystone
TP7	1		Test Point, Miniature, Orange, TH	Orange Miniature Testpoint	5003	Keystone
TP10	1		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone
U2	1		8-Bit Dual-Supply Bus Transceiver with Configurable Voltage-Level Shifting and Three-State Outputs, DB0024A (SSOP-24)	DB0024A	SN74LVC8T245DBR	Texas Instruments
U4	1		16-Bit, Low-Power DACs With Internal HART Modem, Voltage Reference, and Diagnostic ADC for 4-20mA Loop-Powered Applications, UQFN24	UQFN24	AFE881H1RRUT	Texas Instruments
U3, U5	2		2-Bit Dual Supply Transceiver with Configurable Voltage-Level Shifting and 3-State Outputs, DCU0008A (VSSOP-8)	DCU0008A	SN74LVC2T45DCURG4	Texas Instruments
C4	0	0.1uF	CAP, CERM, 0.1 uF, 25 V, +/- 5%, X7R, 0603	0603	06033C104JAT2A	AVX
C7	0	1uF	CAP, CERM, 1 uF, 50 V, +/- 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden
J5	0		Header, 100mil, 2x1, Tin, TH	Header, 2x1, 100mil, TH	5-146278-2	TE Connectivity
R2	0	2.0k	RES, 2.0 k, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	ERJ-6GEYJ202V	Panasonic
U1	0		30 ppm / degC Drift, 3.9 uA, Voltage Reference, -40 to 125 degC, 3-pin SOT-23 (DBZ), Green (RoHS & no Sb/Br)	DBZ0003A	REF3312AIDBZR	Texas Instruments

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