

EVM User's Guide: DAC80508-04EVM

DAC80508-04 Evaluation Module



Description

The [DAC80508-04EVM](#) is an easy-to-use platform to evaluate the functionality and performance of the [DACx0508](#) and [DACx0504](#) family of devices. The DAC80508-04EVM has optional circuits and jumpers to configure the device for different applications. The DAC80508 is installed on the EVM. The user can replace the DAC80508 with the DAC80504.

The DAC80508 and DAC80504 are 16-bit buffered voltage-output digital-to-analog converters (DAC). The DAC80508 has 8 DACs, and the DAC80504 has 4 DACs. The devices includes a 2.5-V, 5-ppm/°C internal reference and a user-selectable gain configuration giving full-scale output voltages of 1.25 V, 2.5 V, or 5 V. The devices operate from a single 2.7-V to 5.5-V supply, is verified monotonic, and provides exceptional linearity of ± 1 LSB INL.

Get Started

1. Order the [EVM](#).
2. Configure EVM jumpers.

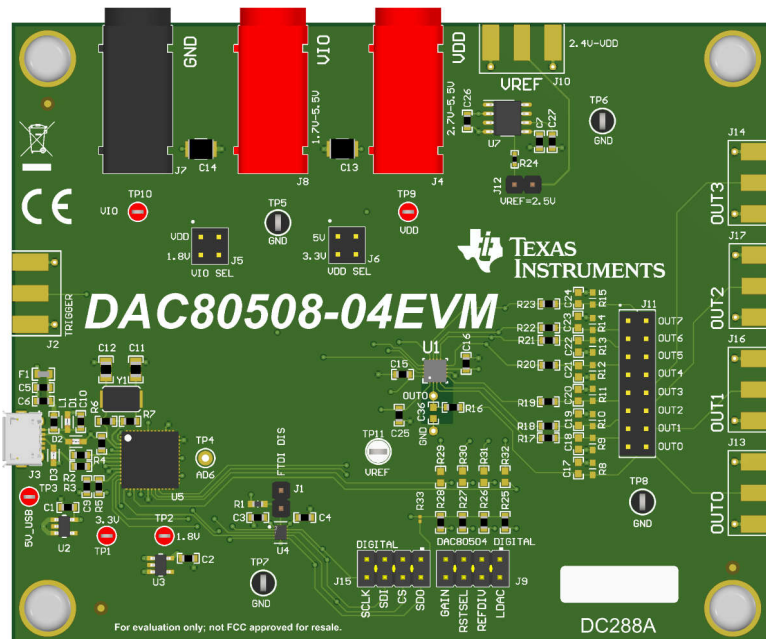
3. Install the DAC805xxEVM GUI from ti.com.
4. Connect USB and external power supplies.
5. Launch the DAC805xxEVM GUI.

Features

- Configurable circuit to evaluate the DACx0508 and DACx0504 family of devices
- Onboard VDD (5-V or 3.3-V) and VIO (5-V, 3.3-V, or 1.8-V) support via USB and on-board voltage regulators
- Option for external reference voltage or on-board 2.5-V reference voltage
- Trigger output is available for synchronous measurement
- FT4232 easily writes to the DAC using the DAC805xxEVM GUI
- External SPI connections available

Applications

- [Optical networking](#)
- [Wireless infrastructure](#)
- [Industrial automation](#)
- [Data acquisition systems](#)



1 Evaluation Module Overview

1.1 Introduction

The DACx050x is a pin-compatible family of low-power, multi-channel, buffered voltage output, digital to-analog converters (DAC). The DACx050x includes a 2.5-V, 5-ppm/°C internal reference, eliminating the need for an external precision reference in most applications. A users-selectable gain configuration provides full-scale output voltages of 1.25 V (gain = ½), 2.5 V (gain = 1) or 5 V (gain = 2). The device operates from a single 2.7-V to 5.5-V supply, is specified monotonic, and provides high linearity of ±1 LSB INL.

Communication to the DACx050x is performed through a serial interface that operates at clock rates up to 50 MHz. The VIO pin enables serial interface operation from 1.7 V to 5.5 V. The DACx050x flexible interface enables operation with a wide range of industry-standard microprocessors and micro-controllers.

The DACx050x incorporates a power-on-reset circuit that powers up and maintains the DAC outputs at either zero-scale or mid-scale until a valid code is written to the device. The devices consume low current of 0.6 mA/channel at 5.5 V, making the devices an excellent choice for battery-operated equipment. A per-channel power down feature reduces the device current consumption to 15 µA.

This user's guide describes the characteristics, operation, and recommended use cases of the DAC80508-04EVM. This document provides examples and instructions on how to use the DAC80508-04EVM board and included software. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the DAC80508-04EVM. This document also includes schematics, the reference printed circuit board (PCB) layouts, and a complete bill of materials (BOM).

1.2 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. DAC80508-04EVM Kit Contents

Item	Quantity
DAC80508-04EVM board	1
USB micro-B plug to USB-A plug cable	1

1.3 Specification

The EVM is intended to provide basic functional evaluation of the device. The layout is not intended to be a model for the target circuit, nor laid out for electromagnetic compatibility (EMC) testing. The EVM consists of a printed-circuit board (PCB), which has the DAC80508 installed.

1.4 Device Information

[Table 1-2](#) lists the devices supported by the DAC80508-04EVM. DACx050x is used as a generic name for these devices. This document focuses on the DAC80508, which comes pre-installed on the EVM, and the DAC80504.

Table 1-2. DAC80508-04EVM Supported Devices

DACx050x	DAC Resolution	Number of DACs
DAC60504	12-bit	4
DAC70504	14-bit	4
DAC80504	16-bit	4
DAC60508	12-bit	8
DAC70508	14-bit	8
DAC80508	16-bit	8

2 Hardware

2.1 Hardware Setup

This section describes the overall system setup for the EVM. A computer runs software that communicates with the FTDI controller onboard using SPI protocol.

2.1.1 Hardware Theory of Operation

The DAC80508-04EVM is connected to the computer through the on-board FTDI digital controller using the USB cable that is supplied with the EVM. The evaluation board features connectors and test points for all communication lines, DAC outputs, and supplies. [Figure 2-1](#) shows a block diagram of the DAC80508-04EVM.

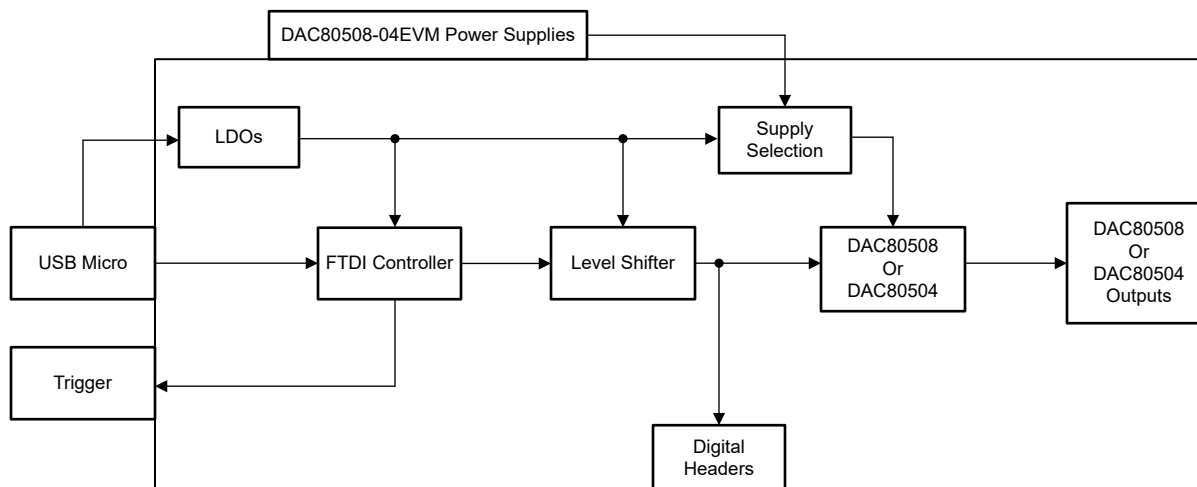


Figure 2-1. Theory of Operation Block Diagram

The USB connection provides the 5-V supply to the EVM. Voltage regulators generate 3.3 V and 1.8 V from the USB 5-V supply. These 3.3-V and 1.8-V supplies are used to power the FTDI controller.

The VDD supply can use the on-board 5-V or 3.3-V supplies depending on the jumper J6 setting. By default, VDD is connected to the on-board 5-V supply. Alternatively, VDD can be supplied externally through banana jack J4. Remove the jumper connector on J6 before connecting external supplies to VDD.

The VIO supply can use the on-board 1.8 V or use the same voltage as VDD depending on the jumper J5 setting. By default, VIO is connected to VDD. Alternatively, VIO can be supplied externally through banana jack J8. Remove the jumper connector on J5 before connecting external supplies to VIO.

The device reference voltage can be supplied via an onboard 2.5-V voltage regulator by shorting jumper J12, or from an external supply with SMA connector J10. Make sure that the internal reference is powered off before connecting any other voltage supply to the REF pin.

Each of the DAC outputs have footprints available for capacitor and resistor loads that are unpopulated by default.

2.1.2 Jumper Definitions

The jumpers must be connected properly to operate the DAC80508-04EVM. [Table 2-1](#) provides the details of the configurable jumper settings of the DAC80508-04EVM. [Figure 2-2](#) shows the default jumper connections on the board.

Table 2-1. DAC80508-04EVM Jumper Definitions

Designator	Name	Positions
J1	FTDI DIS	SHORT 1-2 – FTDI communication is disabled. OPEN – FTDI communication is enabled (default).
J5	VIO SEL	SHORT 1-2 – VIO is connected to VDD (default). SHORT 3-4 – VIO is connected to the 1.8-V voltage regulator. OPEN – VIO is not powered by on-board supplies No other jumper orientation allowed.
J6	VDD SEL	SHORT 1-2 – VDD is connected to the 5 V from the USB power (default). SHORT 3-4 – VSSB is connected to 3.3-V voltage regulator. OPEN – VDD is not powered by on-board supplies. No other jumper orientation allowed.
J12	VREF = 2.5 V	SHORT 1-2 – Connects the DAC80508 REF pin to the on-board 2.5-V reference. Make sure the internal reference is powered off before closing this jumper. OPEN – Open if internal reference or external reference via J10 is used (default) If an external reference is used, then turn off the internal reference.

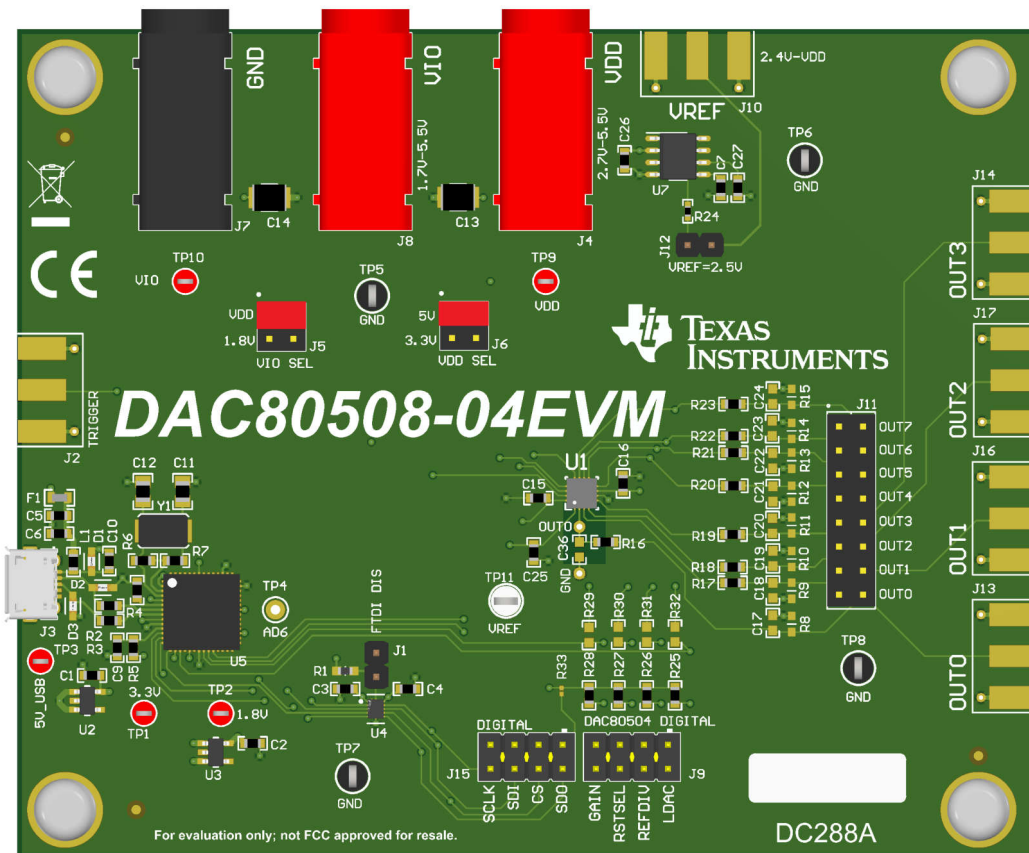


Figure 2-2. DAC80508-04EVM Default Jumper Settings

2.1.3 Connector Definitions

Table 2-2 shows the power connector definitions of the DAC80508-04EVM.

Table 2-2. Power Connector Definitions

Designator	Definition
J2	SMA connector FTDI Trigger Input (unpopulated)
J3	USB connector
J4	DAC80508 VDD supply (2.7 V to 5.5 V)
J7	DAC80508 Ground
J8	DAC80508 VIO supply (1.7 V to 5.5 V)
J10	DAC80508 external REF (unpopulated)

Table 2-3 shows output connector definitions for the DAC80508-04EVM.

Table 2-3. Output Connector Definitions

Designator	Definition
J13	SMA connector for OUT0 (unpopulated)
J14	SMA connector for OUT3 (unpopulated)
J16	SMA connector for OUT1 (unpopulated)
J17	SMA connector for OUT2 (unpopulated)

Table 2-4 shows output header J11 definitions for the DAC80508-04EVM.

Table 2-4. Output Header J11 Definitions

Pin	Definition
2	DAC80508: OUT7 DAC80504: $\overline{\text{LDAC}}$
4	DAC80508: OUT6 DAC80504: REFDIV
6	DAC80508: OUT5 DAC80504: RSTSEL
8	DAC80508: OUT4 DAC80504: GAIN
10	OUT3
12	OUT2
14	OUT1
16	OUT0
1, 3, 5, 7, 9, 11, 13, 15	Ground

2.1.4 Test Points

The DAC80508-04EVM has a variety of test points available for measuring and debugging purposes. [Table 2-5](#) explains the purpose of each test point.

Table 2-5. DAC80508-04EVM Test Points

Test Point	Net	Description
TP1	3p3V	On-board 3.3-V supply
TP2	1p8V	On-board 1.8-V supply
TP3	5V_USB	On-board 5-V USB supply
TP4	AD6	FTDI Trigger test point (unpopulated)
TP5, TP6, TP7, TP8	GND	Ground test points
TP9	VDD	VDD test point
TP10	VIO	VIO test point
TP11	VREF	REF test point
TP12	OUT0	Dedicated OUT0 test point for measuring OUT noise
TP13	GND	Dedicated ground test point for measuring OUT noise

2.2 Hardware Overview

This section details how to configure the EVM for voltage outputs using SPI. The following subsections provide detailed information on the EVM hardware.

2.2.1 Electrostatic Discharge Caution

CAUTION

Many of the components on the DAC80508-04EVM are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

2.2.2 Connecting the FTDI Digital Controller

To connect the FTDI digital controller on the EVM board to the computer, align and firmly connect the USB connector to the J3 connector. Verify the connection is snug; a loose connection can cause intermittent operation. A 100 mil header (J15) is available for external communication. [Table 2-6](#) lists the J15 pin definitions. To use external communication, close jumper J1 to disable the connection to the FTDI controller.

Table 2-6. Digital Header J15 Pin Definitions

Pin	Definition
2	DAC80508: POCI DAC80508C: $\overline{\text{CLEAR}}$ If using the $\overline{\text{CLEAR}}$ version of the DAC80508, then TI recommends to install a pull-up resistor to VIO using R33.
4	$\overline{\text{CS}}$
6	PICO
8	SCLK
1, 3, 5, 7	Ground

Additionally, the board has a dedicated 100 mil header for the DAC80504 digital pins. The DUT connects to this header with 0 Ω resistors, which are unpopulated by default. If the DAC80504 is used, then TI recommends to populate R29, R30, R31, and R32 to connect the GAIN, RSTSEL, REFDIV, and LDAC to the FTDI and digital header. [Table 2-7](#) lists the pin definitions.

Table 2-7. Digital Header J9 Pin Definitions

Pin	Definition
2	GAIN
4	RSTSEL
6	REFDIV
8	LDAC
1, 3, 5, 7	Ground

3 Software

3.1 Software Setup

This section provides the procedure for EVM software installation.

3.1.1 Software Installation

Note

Do not connect the EVM to the computer while the software is installing.

Download the latest version of the EVM graphical user interface (GUI) installer from the *Order and start development* subsection of the [DAC80508-04EVM tool folder](#) on TI.com. Run the GUI installer to install the DAC805xxEVM GUI software on your computer. The software installation automatically copies the required LabVIEW™ software files and drivers to the computer.

When the DAC805xx GUI is launched, an installation dialog window opens and prompts the user to select an installation directory. If left unchanged, [Figure 3-1](#) shows that the software location defaults to *C:\Program Files (x86)\Texas Instruments\DAC805xxEVM*.

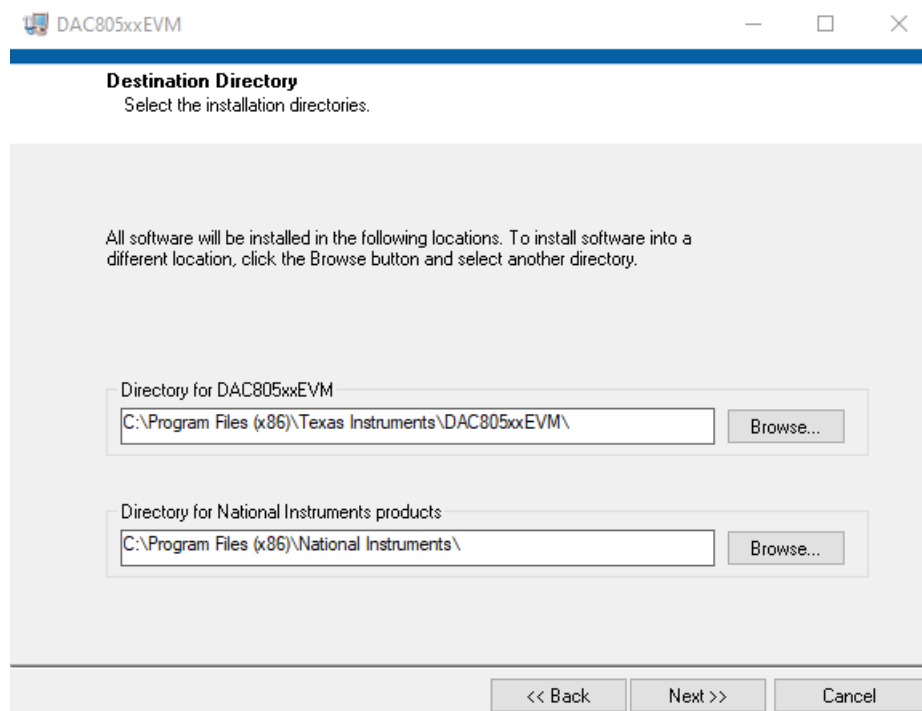


Figure 3-1. Software Installation Path

The EVM software also installs the Future Technology Devices International Limited (FTDI) USB drivers using a separate executable file. [Figure 3-2](#) shows the FTDI USB drivers installation window that is automatically launched after the DAC805xxEVM software installation is complete.

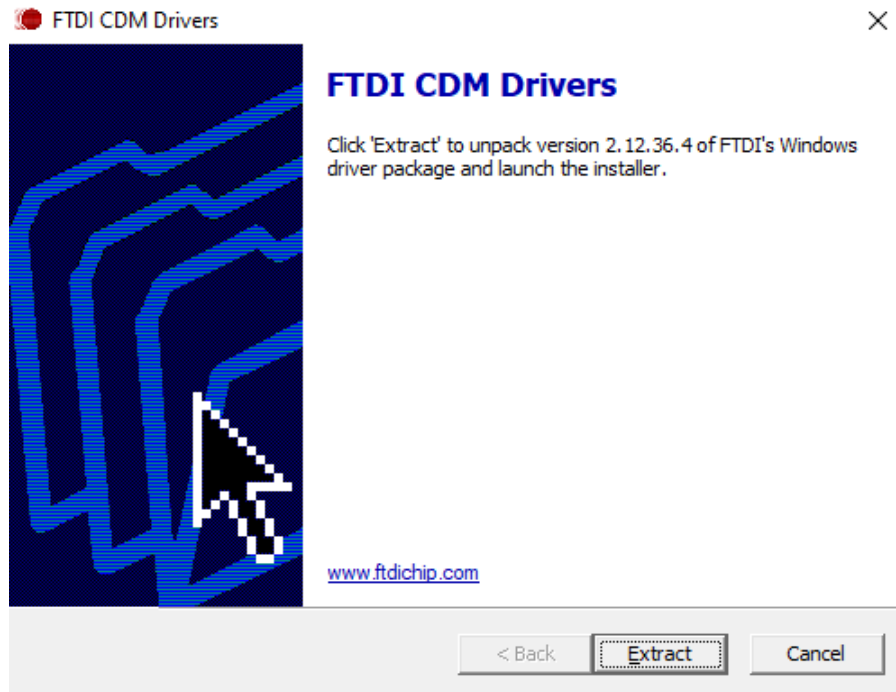


Figure 3-2. FTDI USB Drivers

3.2 Software Overview

This section discusses how to use the DAC805xxEVM software.

3.2.1 Launching the Software

If installed in the default directory, then launch the DAC805xxEVM software by searching for *DAC805xxEVM GUI* in the Windows® *Start* menu.

Figure 3-3 shows the Device Setting configuration menu that is present when the GUI is launched. Select either the DAC80504 or DAC80508 device from the drop-down menu and click **CONFIG**. The software only supports one device at a time.

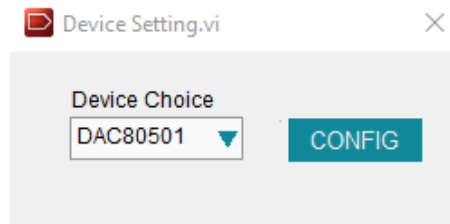


Figure 3-3. DAC805xxEVM GUI Device Settings at Launch

Figure 3-4 shows the GUI after launch with the DAC80504 register map loaded. Figure 3-5 shows the GUI after launch with the DAC80508 register map loaded.

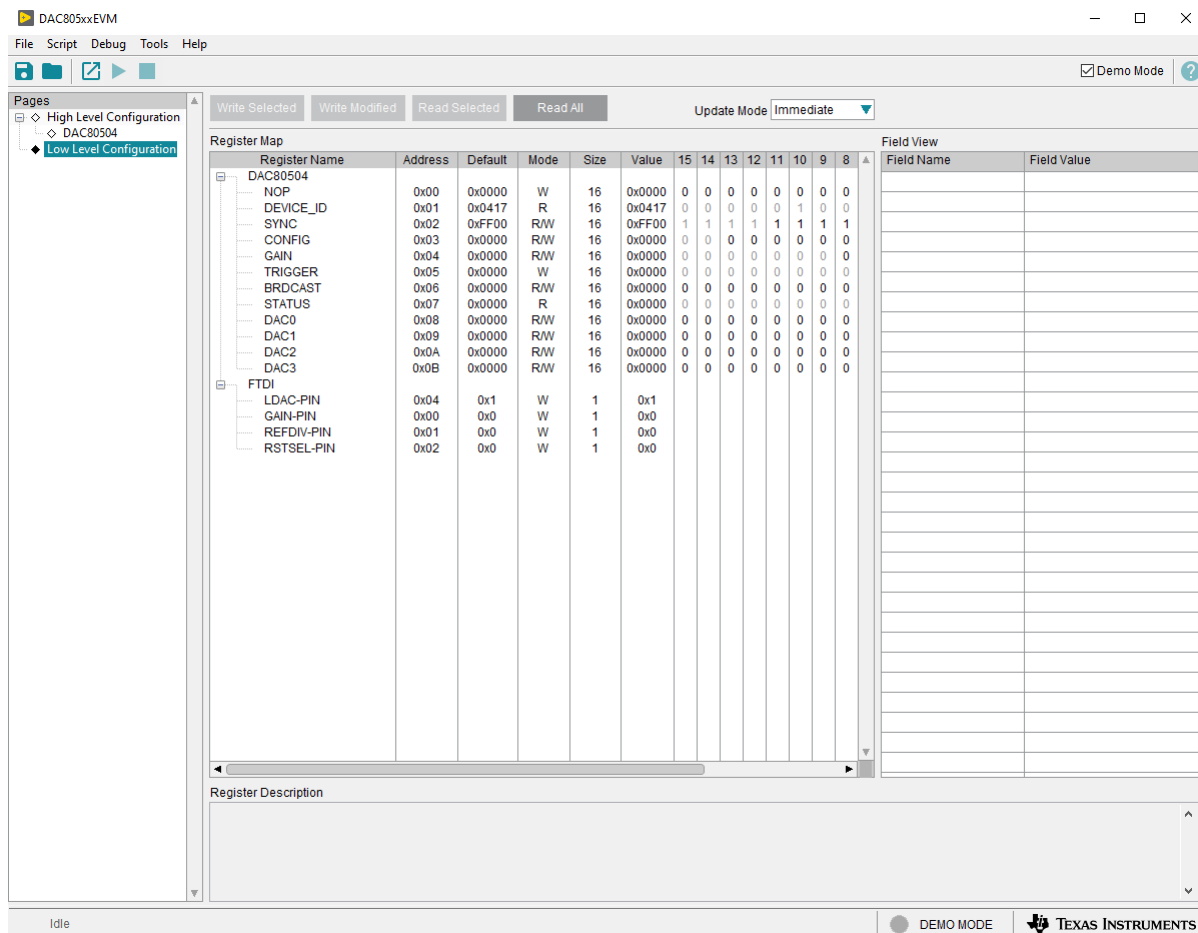


Figure 3-4. DAC805xxEVM GUI DAC80504 Selection at Launch

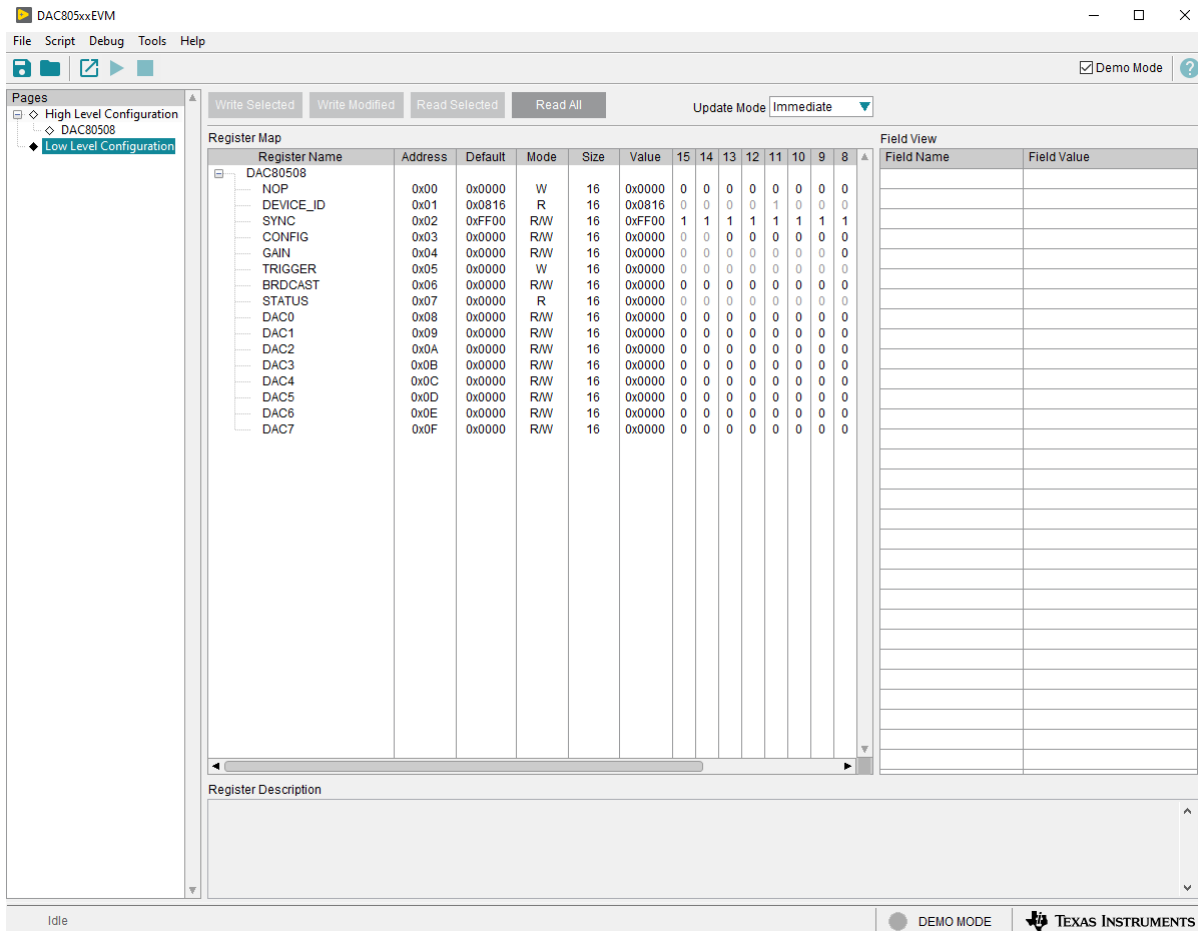


Figure 3-5. DAC805xxEVM GUI DAC80508 Selection at Launch

If the FTDI controller is not connected to the computer when the software is launched, then the GUI defaults to *demo mode*. Figure 3-6 illustrates the bottom-left corner of the GUI that shows the hardware connection status: DEMO MODE or CONNECTED. After the FTDI controller is properly connected to the computer, restart the DAC805xxEVM software to detect the device.



Figure 3-6. FTDI Digital Controller Connection Status

3.2.2 Software Features

The DAC805xxEVM GUI allows for SPI communication to the DAC80508 or DAC80504 and control of the digital pins. Although the entire register map is available for use, some features have been abstracted into user controls in the *High-Level Configuration* page for easy operation.

3.2.2.1 Low Level Configuration Page

Figure 3-7 shows the *Low Level Configuration* page of the DAC805xxEVM GUI with the DAC80504 device selection. This page allows direct access to all registers on the DAC80504. Figure 3-8 shows the *Low Level Configuration* page for the DAC80508.

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

Select a register on the Register Map list to show a description of the values in that register, as well as information on the register address, default value, size, and current value. Data are written to the registers by entering a value in the value column of the GUI.

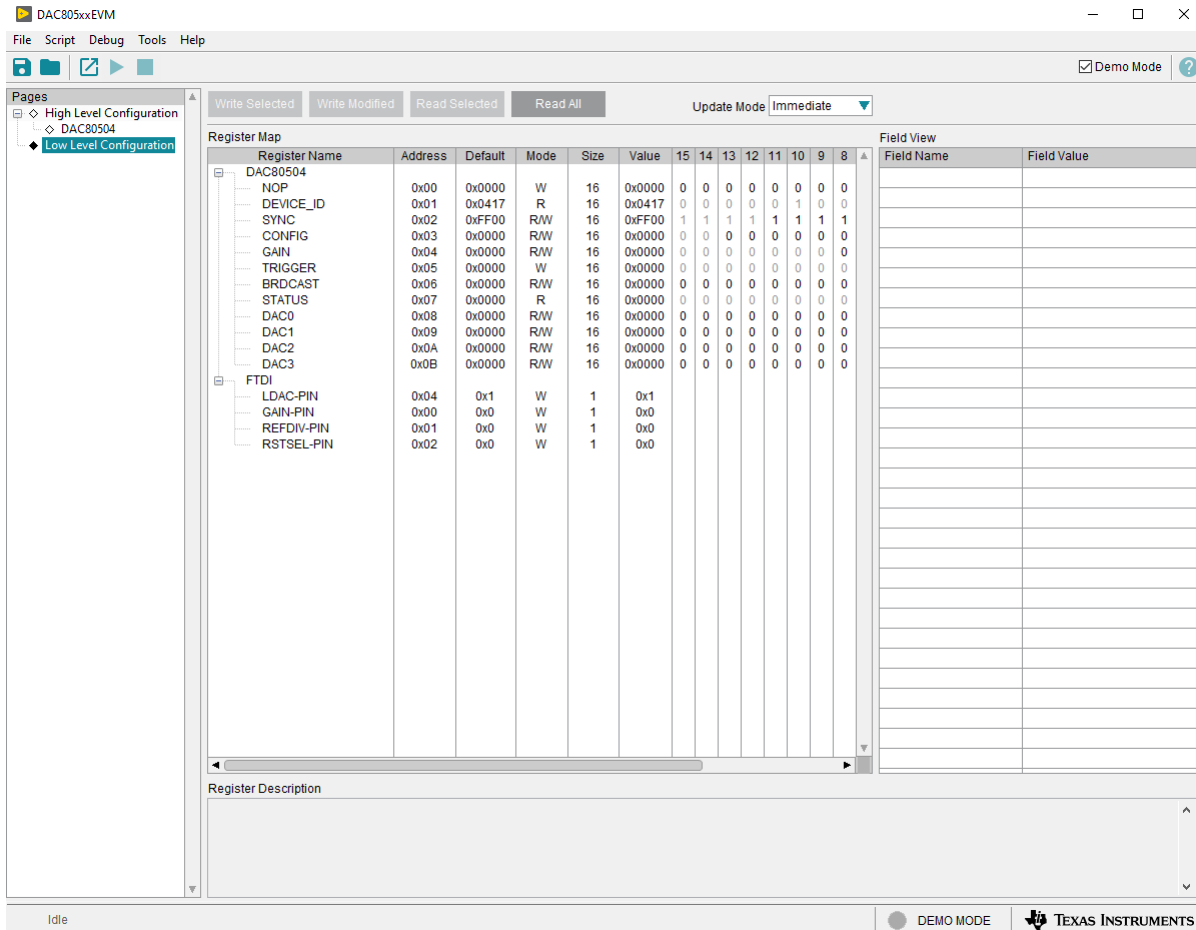


Figure 3-7. DAC80504 Low Level Configuration Page

DAC805xxEVM
 File Script Debug Tools Help
 Write Selected Write Modified Read Selected Read All Update Mode Immediate
 Pages: High Level Configuration, DAC80508, Low Level Configuration
 Register Map:

Register Name	Address	Default	Mode	Size	Value	15	14	13	12	11	10	9	8
DAC80508													
NOP	0x00	0x0000	W	16	0x0000	0	0	0	0	0	0	0	0
DEVICE_ID	0x01	0x0816	R	16	0x0816	0	0	0	0	1	0	0	0
SYNC	0x02	0xFF00	R/W	16	0xFF00	1	1	1	1	1	1	1	1
CONFIG	0x03	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
GAIN	0x04	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
TRIGGER	0x05	0x0000	W	16	0x0000	0	0	0	0	0	0	0	0
BRDCAST	0x06	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
STATUS	0x07	0x0000	R	16	0x0000	0	0	0	0	0	0	0	0
DAC0	0x08	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
DAC1	0x09	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
DAC2	0x0A	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
DAC3	0x0B	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
DAC4	0x0C	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
DAC5	0x0D	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
DAC6	0x0E	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0
DAC7	0x0F	0x0000	R/W	16	0x0000	0	0	0	0	0	0	0	0

Field View: Field Name, Field Value
 Register Description:

Idle DEMO MODE TEXAS INSTRUMENTS

Figure 3-8. DAC80508 Low Level Configuration Page

3.2.2.2 High Level Configuration Page

The *High Level Configuration* page is used to set the configuration of the DAC805xxEVM GUI. The page is comprised of one tab: *DAC80504* if the DAC80504 device was selected, or *DAC80508* if the DAC80508 device was selected. These two tabs act as shortcuts to configure the DAC80504 and DAC80508 for basic functionality and testing.

Figure 3-9 shows the *DAC80504* tab of the *High Level Configuration* page. This tab is used to set the gain and output for the DACs. The DAC80504 digital pins can also be controlled here. To use the digital pin GUI functionality, resistors R29, R30, R31, and R32 are required to be populated with 0 Ω resistors. These resistors connect the digital pins to the FTDI GPIO pins. By default, the GAIN, REFDIV, and RSTSEL GPIOs are set to 0 V. If the GAIN, REFDIV, or RSTSEL options are changed, the DAC80504 needs to go through a power-on-reset for the changes to take effect. Do not unplug the USB cable to reset the power, as this resets the GPIO pins as well. The internal reference and the reference division can also be powered on and off here.

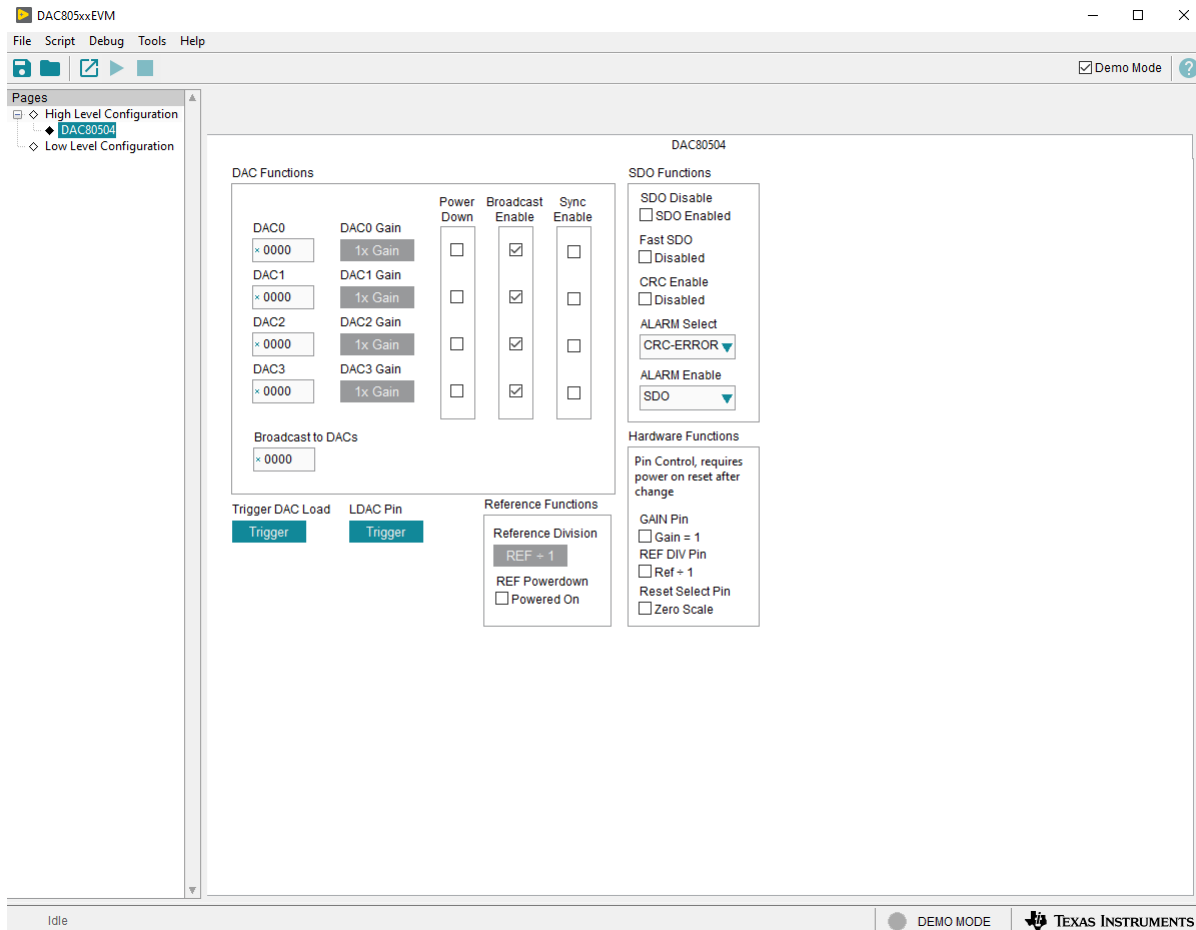


Figure 3-9. DAC80504 Tab of the High Level Configuration Page

Figure 3-10 shows the *DAC80508* tab from the *High Level Configuration* page. This tab is used to set the gain and output for the DACs. The internal reference and the reference division can also be powered on and off here.

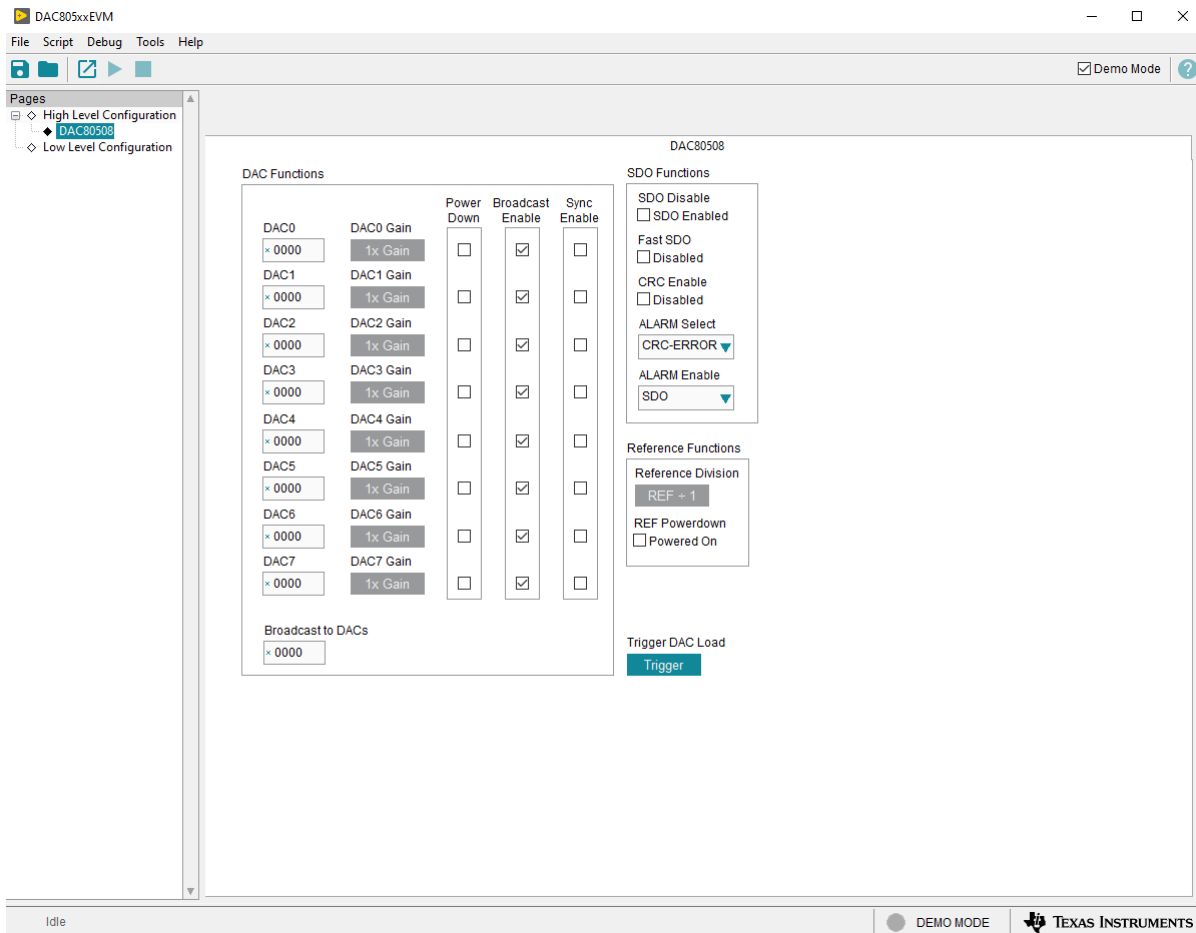


Figure 3-10. DAC80508 Tab of the High Level Configuration Page

4 Hardware Design Files

4.1 Schematics

The DAC80508-04EVM schematics are shown in [Figure 4-1](#) through [Figure 4-2](#).

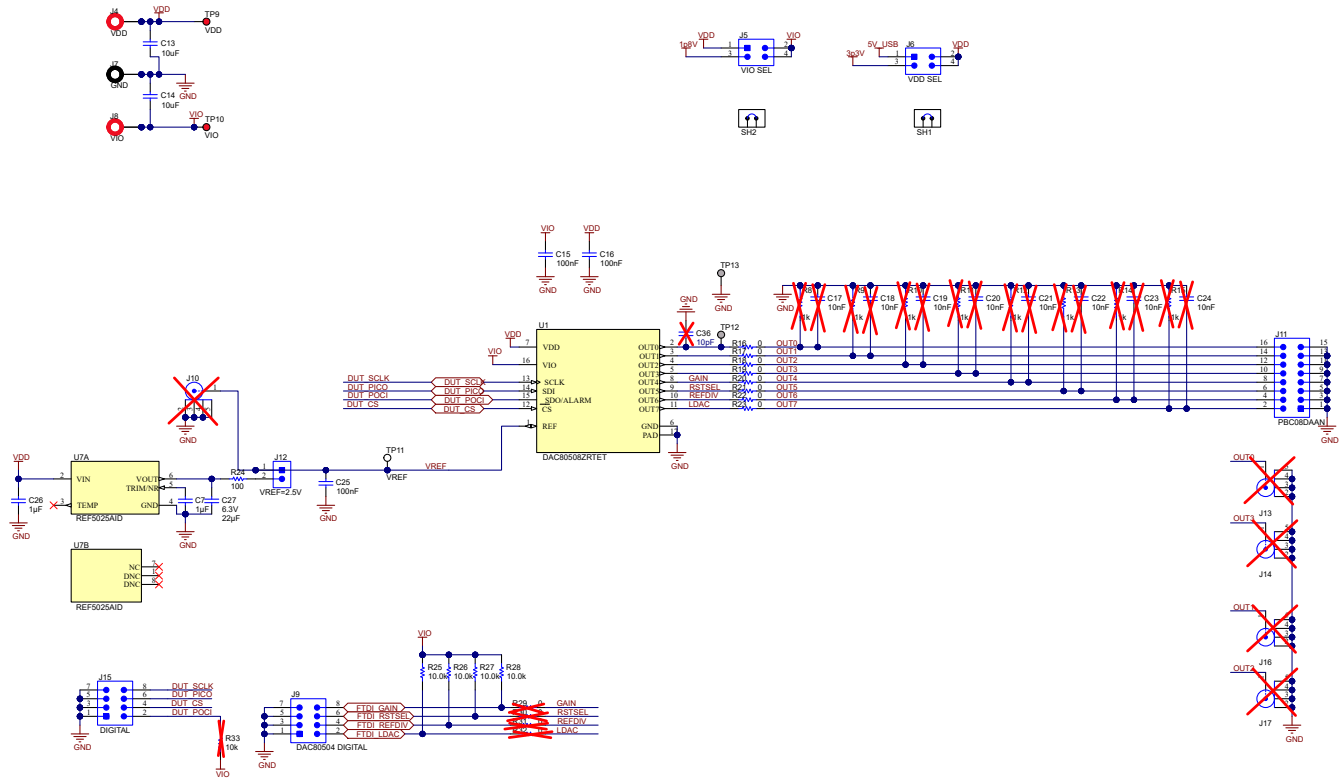


Figure 4-1. DAC80508-04EVM DUT Schematic

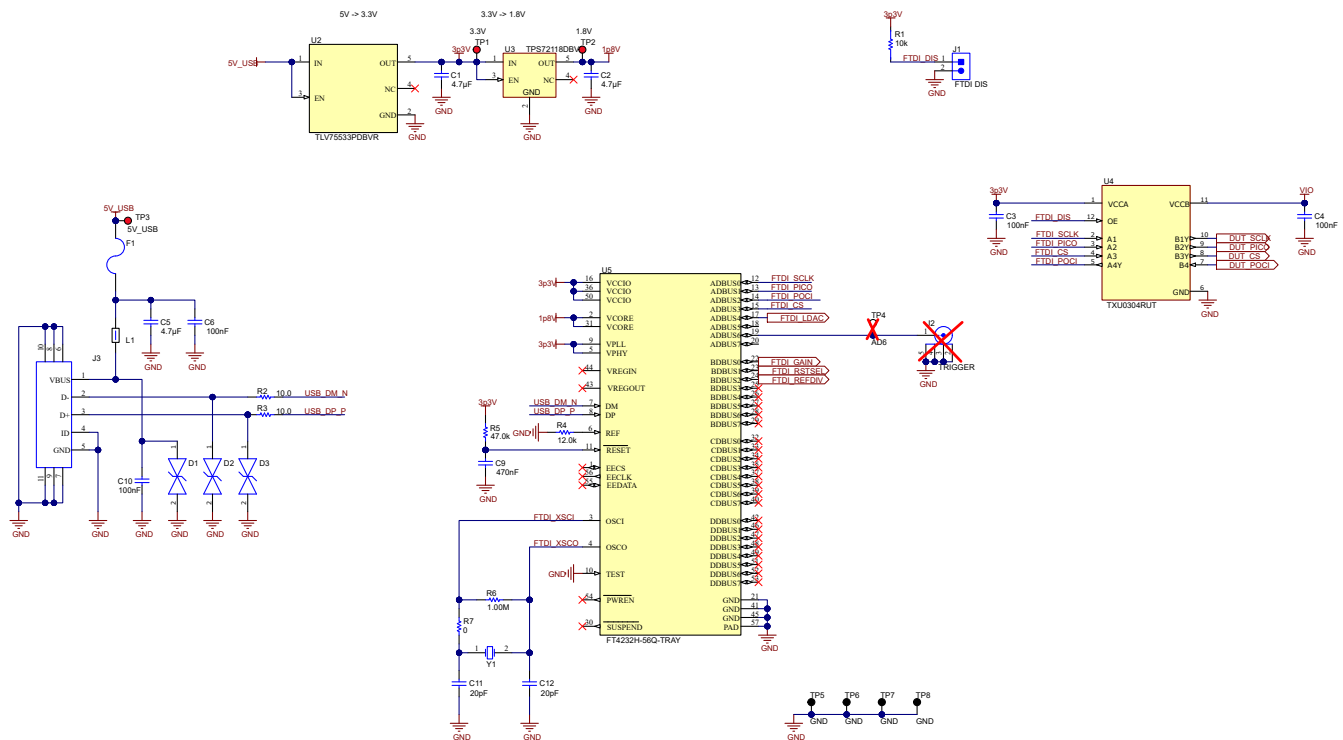


Figure 4-2. DAC80508-04EVM FTDI Schematic

4.2 PCB Layout

Figure 4-3 through Figure 4-6 show the board layout for the DAC80508-04EVM.

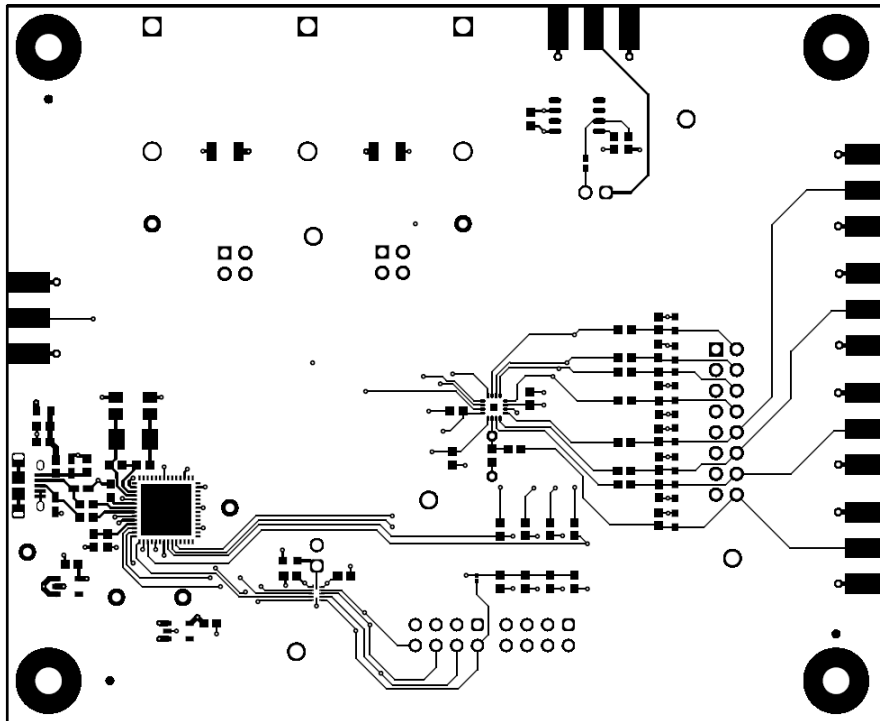


Figure 4-3. DAC80508-04EVM PCB Top Layer Layout

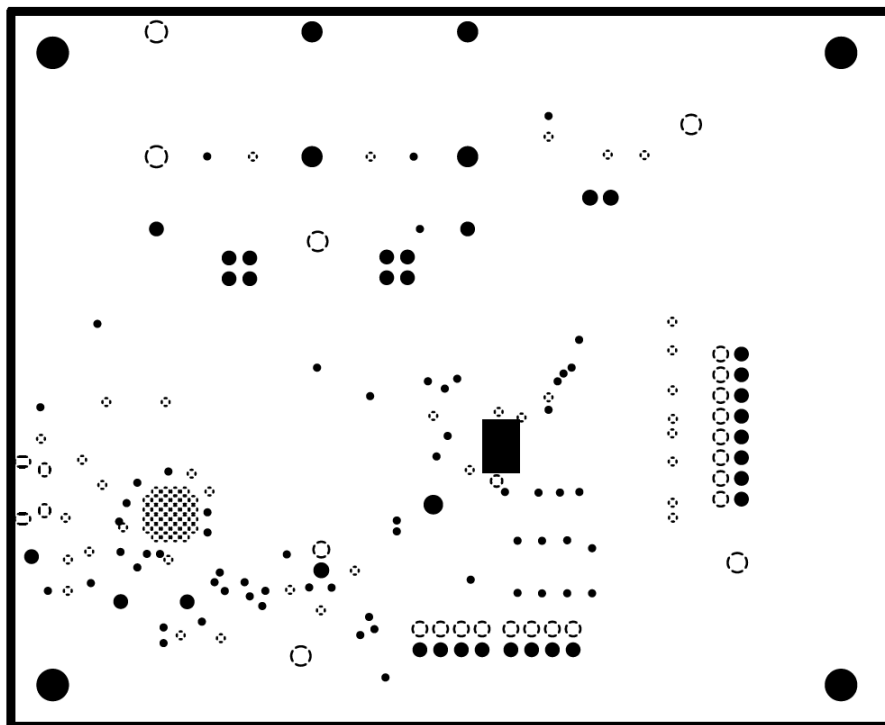


Figure 4-4. DAC80508-04EVM PCB Mid Layer 1 Layout (Ground Plane)

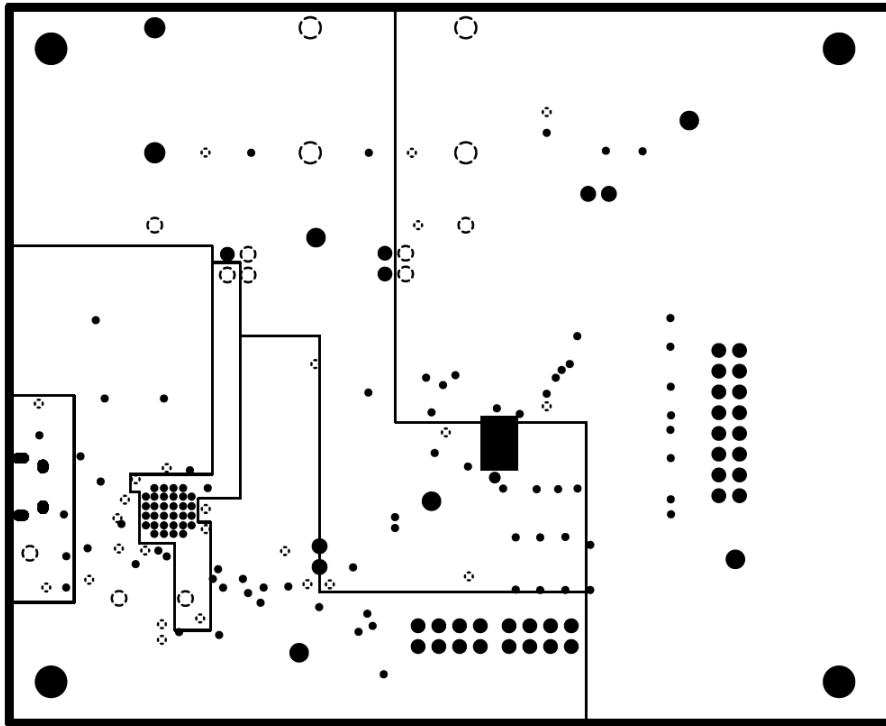


Figure 4-5. DAC80508-04EVM PCB Mid Layer 2 Layout (Power Plane)

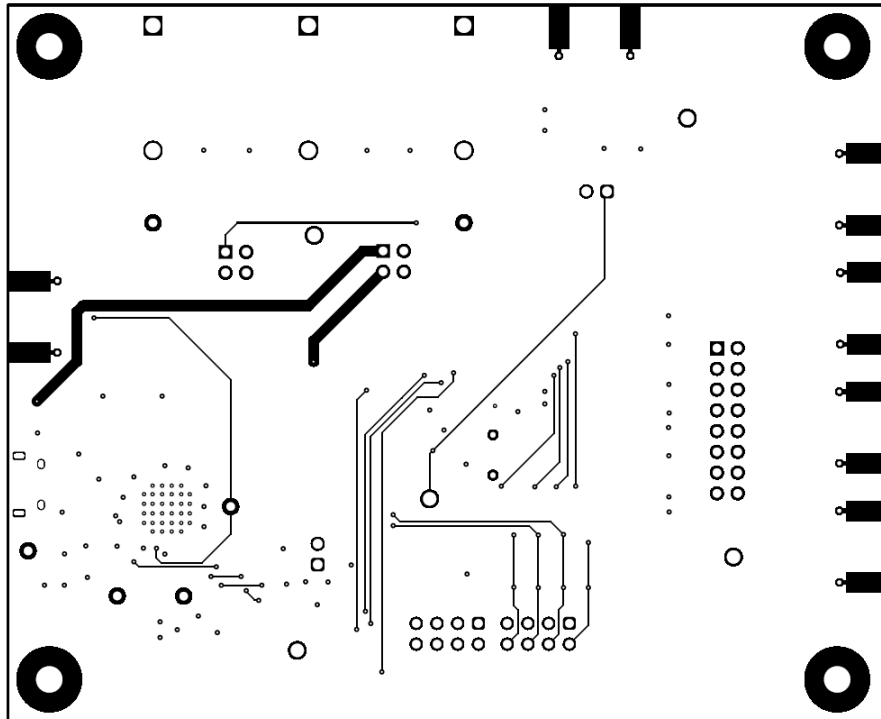


Figure 4-6. DAC80508-04EVM PCB Bottom Layer Layout

4.3 Bill of Materials

Table 4-1 lists the DAC80508-04EVM BOM.

Table 4-1. Bill of Materials for the DAC80508-04EVM

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
C1, C2, C5	3	4.7 μ F	CAP, CERM, 4.7 μ F, 16 V,+/- 10%, X7R, 0603	0603	GRM188Z71C475KE21D	MuRata
C3, C4, C6, C10, C15, C16, C25	7	0.1 μ F	CAP, CERM, 0.1 μ F, 50 V,+/- 10%, X7R, AEC-Q200 Grade 0, 0603	0603	06035C104K4Z4A	AVX
C7, C26	2	1 μ F	CAP, CERM, 1 μ F, 25 V,+/- 20%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E1X7R1E105M080AC	TDK
C9	1	0.47 μ F	CAP, CERM, 0.47 μ F, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E474KA12D	MuRata
C11, C12	2	20 pF	CAP, CERM, 20 pF, 100 V, +/- 5%, C0G/NP0, 0805	0805	08051A200JAT2A	AVX
C13, C14	2	10 μ F	CAP, CERM, 10 μ F, 25 V, +/- 10%, X7R, 1210	1210	C1210C106K3RACTU	Kemet
C27	1	22 μ F	CAP, CERM, 22 μ F, 6.3 V,+/- 20%, X5R, 0603	0603	GRM186R60J226ME15D	MuRata
D1, D2, D3	3		150 V (Typ) Clamp Ipp Tvs Diode Surface Mount 0603 (1608 Metric)	0603	PGB1010603MRHF	Littelfuse Inc
F1	1		Fuse, 0.5 A, 50 VDC, SMD	0603	SF-0603F050-2	Bourns
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, J12	2		Header, 2.54 mm, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	61300211121	Würth Elektronik
J3	1		Receptacle, USB 2.0, Micro-USB Type B, R/A, SMT	USB-micro B USB 2.0, 0.65mm, 5 Pos, R/A, SMT	10118194-0001LF	FCI
J4, J8	2		Standard Banana Jack, insulated, 10 A, red	571-0500	571-0500	DEM Manufacturing
J5, J6	2		Header, 100mil, 2x2, Gold, TH	2x2 Header	TSW-102-07-G-D	Samtec
J7	1		Standard Banana Jack, insulated, 10 A, black	571-0100	571-0100	DEM Manufacturing
J9, J15	2		Header, 2.54mm, 4x2, Gold, TH	Header, 2.54mm, 4x2, TH	TSW-104-08-L-D	Samtec
J11	1		Header, 100mil, 8x2, Gold, TH	PBC08DAAN	PBC08DAAN	Sullins Connector Solutions
L1	1	600 Ω	Ferrite Bead, 600 Ω @ 100 MHz, 1 A, 0603	0603	782633601	Würth Elektronik

Table 4-1. Bill of Materials for the DAC80508-04EVM (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady
R1	1	10 k Ω	10 k Ω \pm 0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Current Sense Thin Film	0603	CRT0603-BY-1002ELF	Bourns Inc.
R2, R3	2	10 Ω	RES, 10.0 Ω , 1%, 0.1 W, 0603	0603	RC0603FR-0710RL	Yageo
R4	1	12.0 k Ω	RES, 12.0 k Ω , 1%, 0.1 W, 0603	0603	RC0603FR-0712KL	Yageo
R5	1	47.0 k Ω	RES, 47.0 k Ω , 1%, 0.1 W, 0603	0603	RC0603FR-0747KL	Yageo
R6	1	1.00 M Ω	RES, 1.00 M Ω , 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603FG1M00	Stackpole Electronics Inc
R7, R16, R17, R18, R19, R20, R21, R22, R23	9	0 Ω	RES, 0 Ω , 5%, 0.1 W, 0603	0603	RC0603JR-070RL	Yageo
R24	1	100 Ω	RES, 100 Ω , 1%, 0.063 W, 0402	0402	RC0402FR-07100RL	Yageo America
R25, R26, R27, R28	4	10.0 k Ω	RES, 10.0 k Ω , 1%, 0.1 W, 0603	0603	M55342K12B10E0T	TT Electronics/IRC
SH1, SH2	2		Shunt, 100mil, Gold plated, Black	Shunt 2 pos. 100 mil	881545-2	TE Connectivity
TP1, TP2, TP3, TP9, TP10	5		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone, Keystone Electronics
TP5, TP6, TP7, TP8	4		Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint	5011	Keystone Electronics
TP11	1		Test Point, Compact, White, TH	White Compact Testpoint	5007	Keystone Electronics
U1	1		Octal, 16--Bit, SPI, Voltage Output DAC with Internal Reference, RTE0016D (WQFN-16)	RTE0016D	DAC80508ZRTET	Texas Instruments
U2	1		500-mA, Low IQ, Small Size, Low Dropout Regulator, DBV0005A (SOT-23-5)	DBV0005A	TLV75533PDBVR	Texas Instruments
U3	1		Single Output Low Input Voltage Requirement LDO, 150 mA, Fixed 1.8 V Output, 1.8 to 5.5 V Input, with Low IQ, 5-pin SOT-23 (DBV), -40 to 125 degC, Green (RoHS & no Sb/Br)	DBV0005A	TPS72118DBVR	Texas Instruments

Table 4-1. Bill of Materials for the DAC80508-04EVM (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
U4	1		Automotive 4-Bit Fixed Direction Voltage-Level Translator with Schmitt-Trigger Inputs, and Tri-State Outputs	UQFN12	TXU0304RUT	Texas Instruments
U5	1		Future Technology Devices International Ltd FT4232H Quad High Speed USB to Multipurpose UART/MPSSE IC, VQFN-56	VQFN-56	FT4232H-56Q-TRAY	FTDI
U7	1		Low Noise, Very Low Drift, Precision Voltage Reference, -40 to 125 degC, 8-pin SOIC (D), Green (RoHS & no Sb/Br)	D0008A	REF5025AID	Texas Instruments
Y1	1		Crystal, 12 MHz, 18 pF, SMD	ABM3	ABM3-12.000MHZ-B2-T	Abracon Corporation
C17, C18, C19, C20, C21, C22, C23, C24	0			0603		
C36	0			0603		
J2, J10, J13, J14, J16, J17	0		Connector, End launch SMA, 50 Ω , SMT	End Launch SMA	142-0701-801	Cinch Connectivity
R8, R9, R10, R11, R12, R13, R14, R15	0			0603		
R29, R30, R31, R32	0	0 Ω		0603	RC0603JR-070RL	Yageo
R33	0	10 k Ω	RES, 10 k Ω , 5%, 0.05 W, 0201	0201	RC0201JS-7D10KL	Yageo America

5 Additional Information

Trademarks

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All trademarks are the property of their respective owners.

6 Related Documentation

The documents in [Table 6-1](#) provide information regarding Texas Instruments integrated circuits used in the assembly of the DAC80508-04EVM. This user's guide is available from the TI web site under literature number SLAU920. 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 are available from the TI web site at www.ti.com, 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 6-1. Related Device Documentation

Document	Literature Number
DAC80508 product data sheet	SLASEL1
DAC80504 product data sheet	SBAS871

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 <https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

-
4. *EVM Use Restrictions and Warnings:*
 - 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
 - 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
 - 4.3 *Safety-Related Warnings and Restrictions:*
 - 4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.
 - 4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.
 - 4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.
 5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
 6. *Disclaimers:*
 - 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

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