EVM User's Guide: AMC8V208EVM

AMC8V208 Evaluation Module

Description

The AMC8V208EVM is an easy-to-use platform to evaluate the functionality and performance of the AMC8V208. The AMC8V208EVM has optional circuits and jumpers to configure the AMC8V208 for different applications. This EVM features the AMC8V208, a highly integrated current-output and control device optimized for optical networking applications.

Get Started

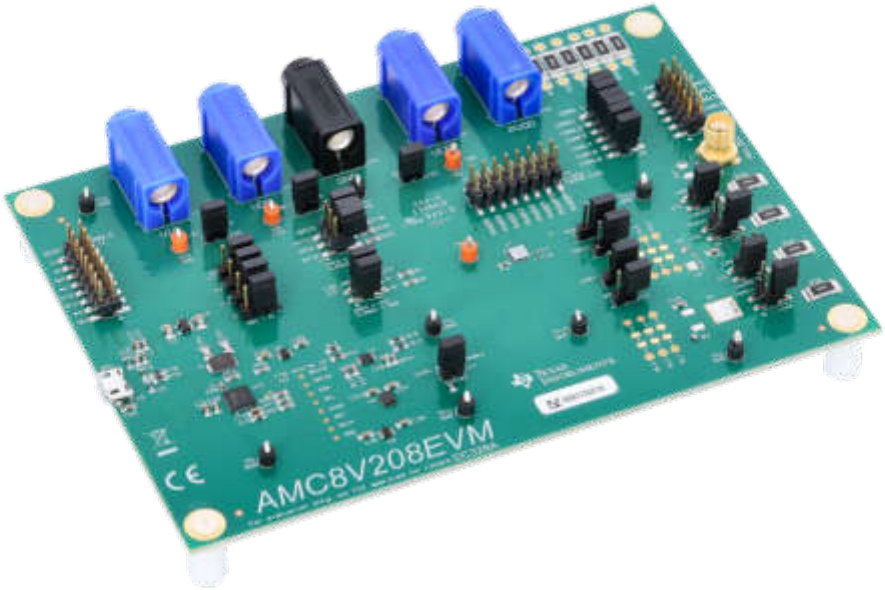
1. Order the AMC8V208EVM on ti.com.
2. Download and install the AMC8V208EVM software.
3. Configure the hardware jumper settings.
4. Connect the USB and external AMC8V208EVM supplies.
5. Launch the AMC8V208EVM GUI.

Features

- Onboard 1.8V VIO supply
- Jumpers to evaluate different device configurations
- Onboard FT4222 controller for SPI or I^2C communication

Applications

- Optical module
- Optical line cards



1 Evaluation Module Overview

1.1 Introduction

The AMC8V208 includes:

- Six dedicated, 16-bit, current output digital-to-analog converters (IDACs)
- Two dedicated 16-bit current output DACs (IDAC+)
- A MUXOUT pin for monitoring the voltage and current on the current output pins

The IDAC+ channels can be configured for the control of high-output current generation circuits.

This user's guide describes the characteristics, operation, and use of the AMC8V208EVM evaluation model (EVM). This document provides examples and instructions on how to use the AMC8V208EVM board and software. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the AMC8V208EVM. This document includes schematics, printed circuit board (PCB) layouts, and a complete bill of materials (BOM).

1.2 Kit Contents

The contents of the EVM kit is shown in Table 1-1. Contact the nearest TI Product Information Center if any component is missing. Make sure to verify the latest versions of the related software at the Texas Instruments website, www.ti.com.

Table 1-1. AMC8V208EVM Kit Contents

Item	Quantity
AMC8V208EVM board	1
USB micro-B plug to USB-A plug cable	1

1.3 Specification

A block diagram of the AMC8V208EVM is shown in Figure 1-1. The AMC8V208EVM is connected to the onboard FTDI digital controller using the USB cable that is supplied with the EVM. The EVM features connectors and test points for all digital communication lines, IDAC outputs, and supplies.

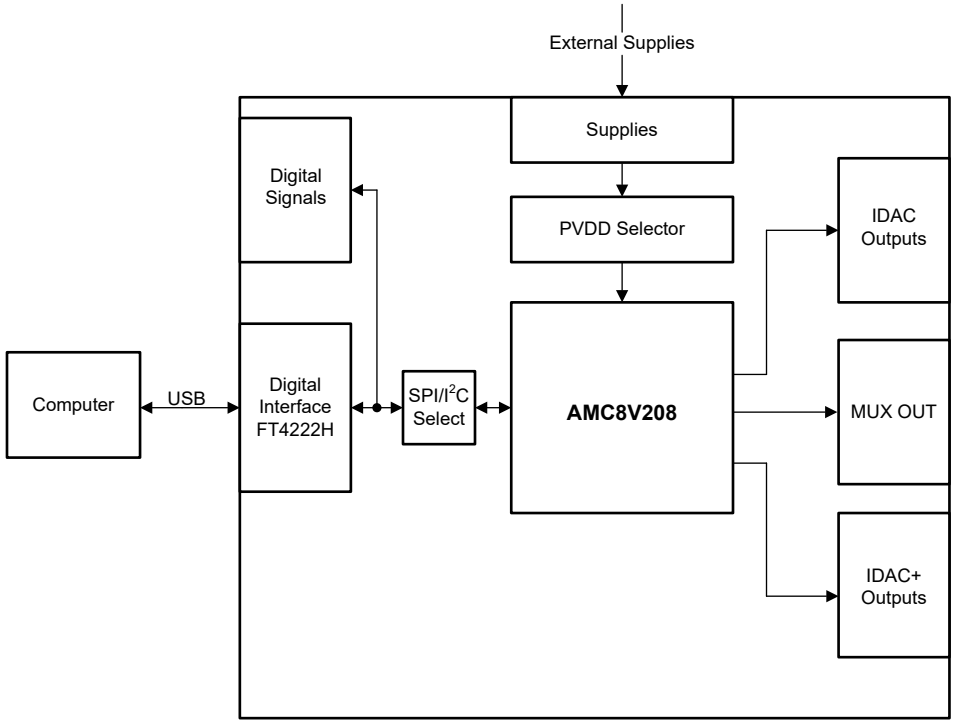


Figure 1-1. Theory of Operation Block Diagram

1.4 Device Information

The AMC8V208 controller consists of eight 16-bit IDACs. The device has six dedicated IDAC outputs that support full-scale output ranges of 250mA, 150mA, and 75mA, as well as an output range of –60mA (sink mode) supported on IDAC1 only. The IDAC+ outputs in internal current-output mode also support full-scale output ranges of 250mA, 150mA, and 75mA. Additionally, the IDAC+ outputs can be configured to operate with an external FET and sense resistor to simplify the design of very high-current outputs. Each IDAC has a dedicated power supply that enables the power consumption optimization of each channel. The AMC8V208 also includes a MUXOUT pin for monitoring the voltage and current on the IDAC output pins. An integrated high-precision internal reference eliminates the need for an external reference in most applications. The AMC8V208 is available in a very-small 3.272mm x 3.272mm, 60-pin DSBGA package. See the *AMC8Vx08 8-Channel, 16-Bit Analog Controller With Current-Output DACs and Mux Output* data sheet for more information.

2 Hardware

2.1 Hardware Setup

This section describes the overall system setup for the EVM. A computer runs the software that provides an interface to the AMC8V208EVM through the onboard controller.

The USB connection generates a 5V supply for the EVM. The onboard controller generates 3.3V of power for the input/output (IO) signals generated by the onboard controller. These IO signals are level translated to the IO supply voltage (VIO) of the AMC8V208. An onboard voltage regulator generates 1.8V for use as the AMC8V208 IO supply voltage.

2.1.1 Electrostatic Discharge Caution

CAUTION

Many of the components on the AMC8V208EVM 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.

2.1.2 Power Configurations and Jumper Settings

The supply connections to the AMC8V208EVM is shown in Table 2-1 and Figure 2-1. Make sure 2V ≤ PVDD1 - VEE ≤ 5.5V.

Remove the jumpers from J30, J31, J32, or J33 before connecting an external supply to VIO, VDD, VEE, or PVDDx respectively.

Table 2-1. Power Supply Inputs

Designator	Supply Name	Voltage Range
J4	VIO	1.1V to 1.95V
J5	VEE	-3V to 0V (2V ≤ PVDD1 - VEE ≤ 5.5V)
J24	VDD	3V to 5.5V
J25	PVDD Common	2V to 5.5V (2V ≤ PVDD1 - VEE ≤ 5.5V)
J26	GND	0V
J33	PVDD1:6, PVDDP1:2	2V to 5.5V (2V ≤ PVDD1 - VEE ≤ 5.5V)

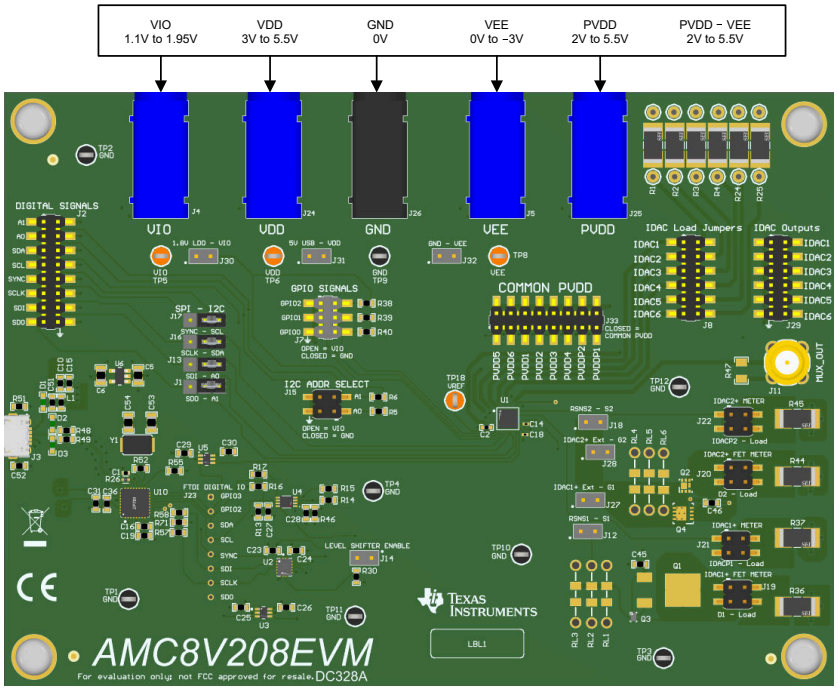


Figure 2-1. Power Supply Inputs

The details of the configurable jumper settings on the AMC8V208EVM are shown in Table 2-2.

Table 2-2. Jumper Definitions

Designator	Default Position	Available Option	Description
J1, J13, J16, J17	All 1-2: I^2C enabled	All 2-3: SPI enabled.	I^2C or SPI selector.
J7	All open: FLEXIO_0, FLEXIO_1, FLEXIO_2 pulled up to VIO	1-2 closed: FLEXIO_2 connected to ground. 3-4 closed: FLEXIO_1 connected to ground. 5-6 closed: FLEXIO_0 connected to ground.	FLEXIO_x control.
J8	All closed: IDAC outputs connected to 4.99Ω load resistors	Open: IDACx output disconnected from 4.99Ω load resistor.	Connects the IDAC outputs to the onboard 4.99Ω load resistor to measure the current as a function of the voltage.
J12	Open: RSNS1 disconnected from source 1	Closed: RSNS1 connected to source 1 (Q1 or Q3).	Connects the sense pin to the high output current FET.
J14	Closed: level shifters enabled	Open: level shifters disabled.	Enables the U2 and U4 level shifters that connect the FTDI I^2C or SPI signals to the I^2C - SPI selector jumpers.
J15	All Open: A0 and A1 pulled up to VIO	1-2 closed: A0 connected to ground. 3-4 closed: A1 connected to ground.	Configures the I^2C address.
J18	Open: RSNS2 disconnected from source 2	Closed: RSNS2 connected to source 2 (Q2 or Q4)	Connects the sense pin to the high output current FET.
J19	All open: IDAC1+_EXT FET output disconnected from 4.99Ω load resistor	1-2 closed: IDAC1+_EXT FET output connected to 4.99Ω load resistor. 3-4: option to connect external meter.	Connects the IDAC1+_EXT FET output to the onboard 4.99Ω load resistor to measure the current as a function of the voltage.
J20	All open: IDAC2+_EXT FET output disconnected from 4.99Ω load resistor	1-2 closed: IDAC2+_EXT FET output connected to 4.99Ω load resistor. 3-4: option to connect external meter.	Connects the IDAC2+_EXT FET output to the onboard 4.99Ω load resistor to measure the current as a function of the voltage.
J21	3-4: closed: IDAC1+ output connected to 4.99Ω load resistor	1-2: option to connect external meter. 3-4 open: IDAC1+ output disconnected from 4.99Ω load resistor.	Connects the IDAC1+ output to the onboard 4.99Ω load resistor to measure the current as a function of the voltage.

Table 2-2. Jumper Definitions (continued)

Designator	Default Position	Available Option	Description
J22	3-4: closed: IDAC2+ output connected to 4.99Ω load resistor	1-2: option to connect external meter. 3-4 open: IDAC2+ output disconnected from 4.99Ω load resistor.	Connects the IDAC2+ output to the onboard 4.99Ω load resistor to measure the current as a function of the voltage.
J27	Open: IDAC1+_EXT disconnected from gate 1	Closed: IDAC1+_EXT connected to gate 1 (Q1 or Q3).	Connects the external IDAC1+ pin to the high output current FET.
J28	Open: IDAC2+_EXT disconnected from gate 2	Closed: IDAC2+_EXT connected to gate 2 (Q2 or Q4).	Connects the external IDAC2+ to the high output current FET.
J30	Closed: Connects VIO to 1.8V LDO output	Open: VIO disconnected from 1.8V LDO output. Leave J30 open if connecting an external VIO supply.	VIO supply selector.
J31	Closed: Connects VDD to 5V USB supply	Open: VDD disconnected from 5V USB supply. Leave J31 open if connecting an external VDD supply.	VDD supply selector.
J32	Closed: Connects VEE to ground	Closed: VEE disconnected from ground. Leave J32 open if connecting an external VEE supply.	VEE supply selector.
J33	All closed: Connects PVDDx to common PVDD supply	Open: PVDDx disconnected from common PVDD. Leave J33 open if connecting an external PVDDx supply.	PVDD supply selector.

2.1.3 Connecting the Hardware

After the power and jumper configurations are set up as per Section 2.1.2, connect the USB cable from the AMC8V208EVM USB port to the computer.

2.2 Hardware Overview

The following sections provide detailed information on the EVM hardware and signal definitions.

2.2.1 Connector Definitions

The connector definitions of the AMC8V208EVM is shown in Section 2.2.1.

Table 2-3. Connector Definitions

Designator	Definition
J2	AMC8V208 digital signals
J3	USB connector on the EVM
J11	SMA jack for MUX_OUT monitoring
J19	IDAC1+ external mode output
J20	IDAC2+ external mode output
J21	IDAC1+ internal mode output
J22	IDAC2+ internal mode output
J23	FT4222 digital signals
J29	IDAC outputs
J33	PVDD inputs

3 Software

3.1 Software Setup

This section provides the procedure for EVM software installation.

3.1.1 Operating Systems

The EVM software is compatible with the Windows® 10 and 11 operating systems.

3.1.2 Software Installation

Make sure the AMC8V208EVM is not connected to the computer during software installation.

Download the AMC8V208EVM software from the provided mySecure link. After the software is downloaded, navigate to the download folder, and run the AMC8V208EVM-GUI installer executable.

When the AMC8V208EVM-GUI installer is launched, an installation dialog window opens and prompts the user to select an installation directory. The default software path is C:\Program Files (x86)\Texas Instruments\AMC8V208EVM.

The software installation also installs the FTDI USB drivers. The FTDI USB drivers install in a second executable.

3.2 Software Overview

This section discusses the features of the AMC8V208EVM software and how to use these features. The software provides basic control of all the AMC8V208 registers and functions.

3.2.1 Starting the Software

To launch the software, navigate to the Texas Instruments folder in the *Start* menu, and select the *AMC8V208EVM* icon.

If the onboard controller is connected correctly, then the status bar at the bottom of the screen displays *CONNECTED* as shown in Figure 3-1. If the status bar displays *DEMO*, then uncheck the *Demo Mode* checkbox in the upper-right corner as shown in Figure 3-3. If the controller is not properly connected or not connected at all, then the status displays *DEMO*. If the GUI is not displaying the *CONNECTED* status while the EVM is connected and the *Demo Mode* checkbox is unchecked, then unplug and reconnect the EVM, and then relaunch the GUI software.

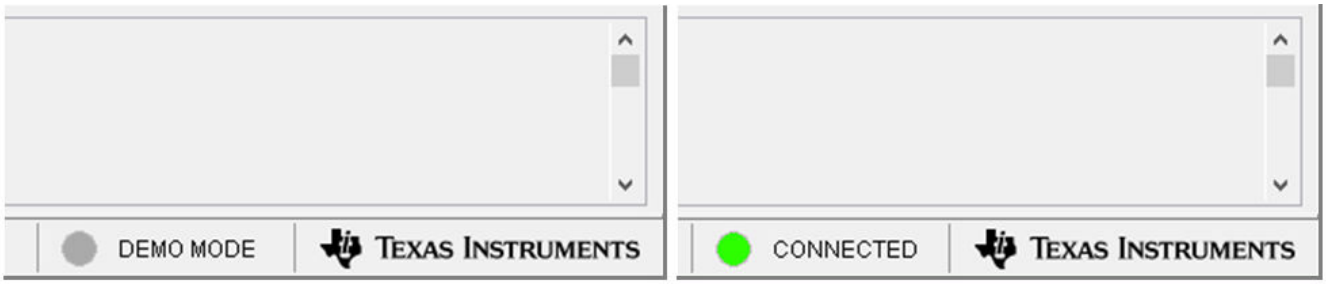


Figure 3-1. AMC8V208EVM GUI Connection Detection

The *Interface Settings* window is shown in Figure 3-2. When the GUI starts, the *Interface Settings* window pops up. This window contains drop-down menus that select protocol (SPI or I^{2}C) and, if I^{2}C protocol is selected, the I^{2}C device address. The menu does not pop up if the GUI starts in Demo mode. In this case, uncheck the *Demo Mode* checkbox. If the interface must be updated again, then toggle the *Demo Mode* checkbox for the menu to reappear.

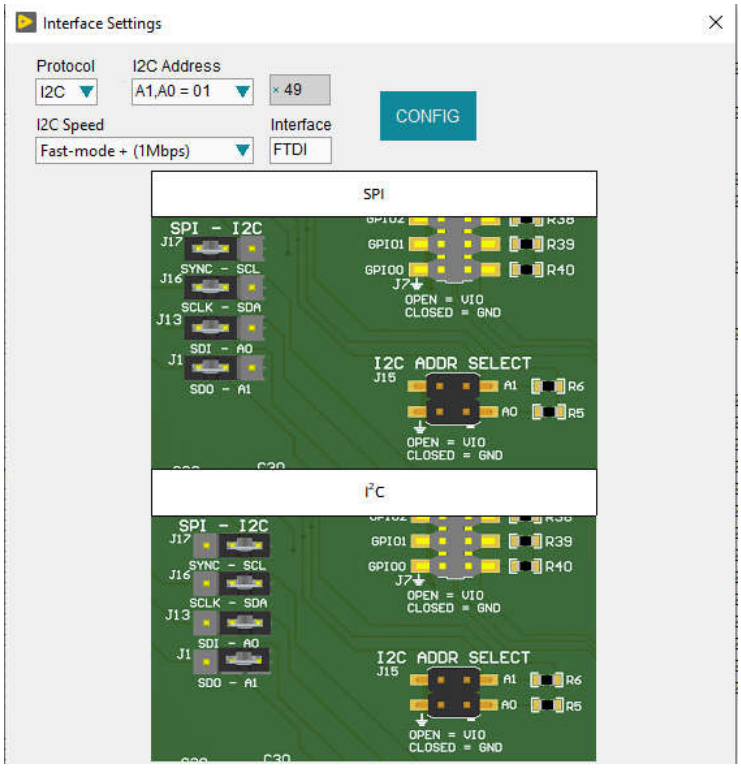


Figure 3-2. AMC8V208EVM Interface Settings

3.2.2 Software Features

The AMC8V208EVM GUI uses I^{2}C or SPI communication to control the AMC8V208. These functions are built into several GUI pages, as shown in the following subsections. The menu bar on the far left of the GUI allows the user to switch between pages. The menu bar displays the *High Level Configuration* page with the *AMC Control* subpage, and the *Low Level Configuration* page.

Before using the GUI, see the respective device data sheet for detailed AMC8V208 programming instructions.

3.2.2.1 High Level Configuration Page

The *High Level Configuration* page that provides an interface to quickly configure the parameters and relevant register settings for the respective AMC8V208 device is shown in Figure 3-3. The *High Level Configuration* page is comprised of the *AMC Control* subpage. The *AMC Control* subpage is used to set the range and outputs for the IDACs. Alarms and status information is also displayed on this tab.

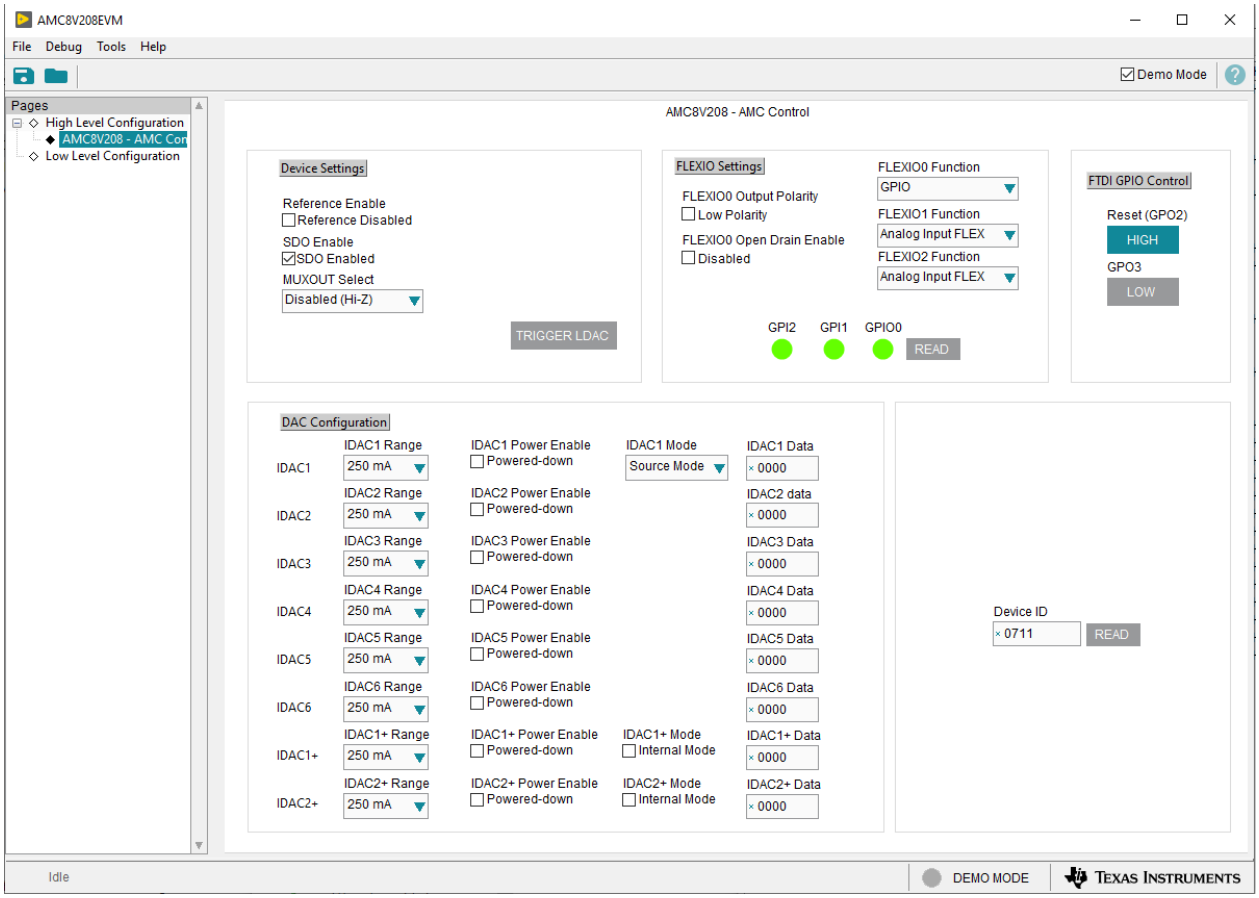


Figure 3-3. High Level Configuration Page

3.2.2.2 Low Level Configuration Page

The *Low Level Configuration* page of the AMC8V208EVM GUI is shown in Figure 3-4. This page allows access to low-level communication directly with the respective AMC8V208 device registers.

The *Register Map* section in the center of the page lists all the registers, grouped by the pages in the device. The GUI automatically addresses the correct page based on the register selected. Selecting a register on the *Register Name* list shows 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.

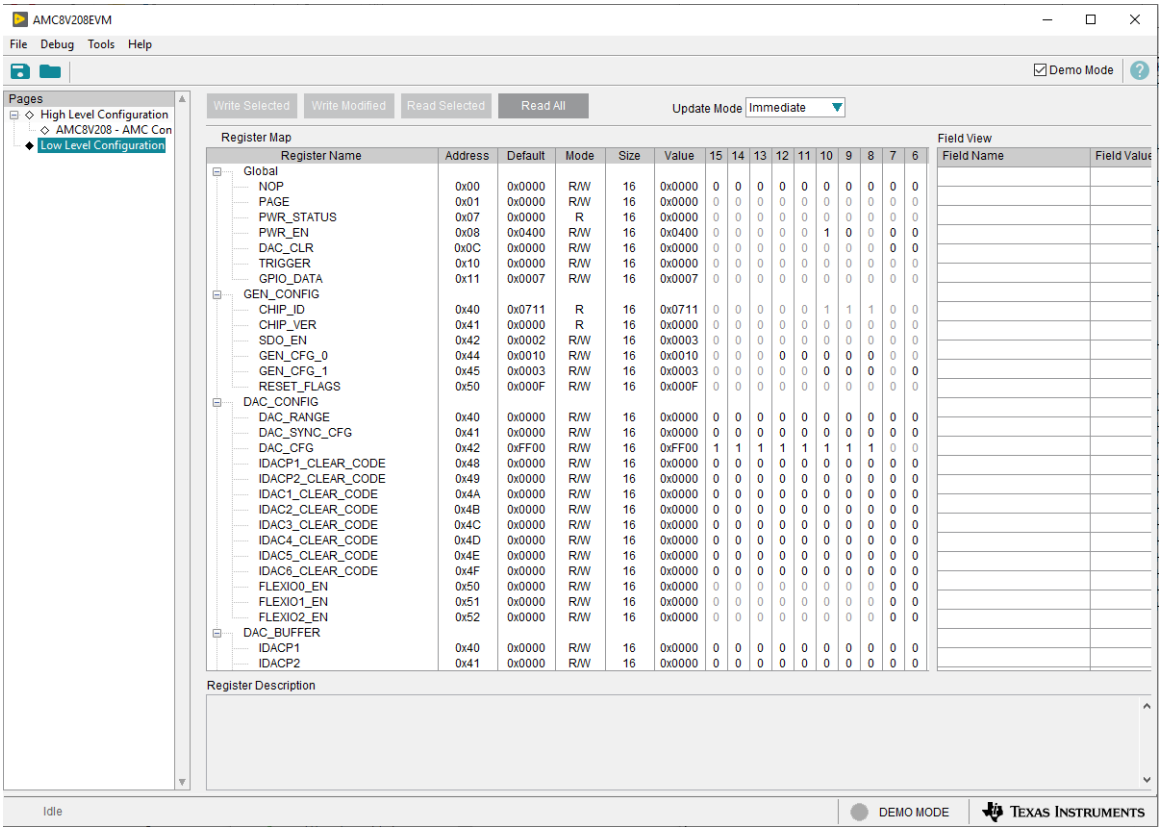


Figure 3-4. Low Level Configuration Page

To store the values of the register map locally, select *Save Configuration* under the *File* menu option. The stored configuration files can be recalled and loaded by selecting *Open Configuration.*

The four configuration buttons provided on the *Low Level Configuration* page that allow the user to read from and write to the device registers are shown in Figure 3-5.

- Write Selected
- Write Modified
- Read Selected
- Read All

The *Write Modified* button is enabled only in *Deferred Update Mode*. *Deferred Update Mode* initiates a write operation only when the *Write Selected* or *Write Modified* buttons are pressed. By default, *Immediate Update Mode* is selected for the *Low Level Configuration* page write operations.

The AMC8V208 SDO pin must be enabled in the SDO_EN register before reading any device registers.

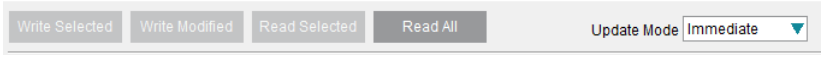


Figure 3-5. Low Level Configuration Page Options

4 Hardware Design Files

4.1 EVM Schematics

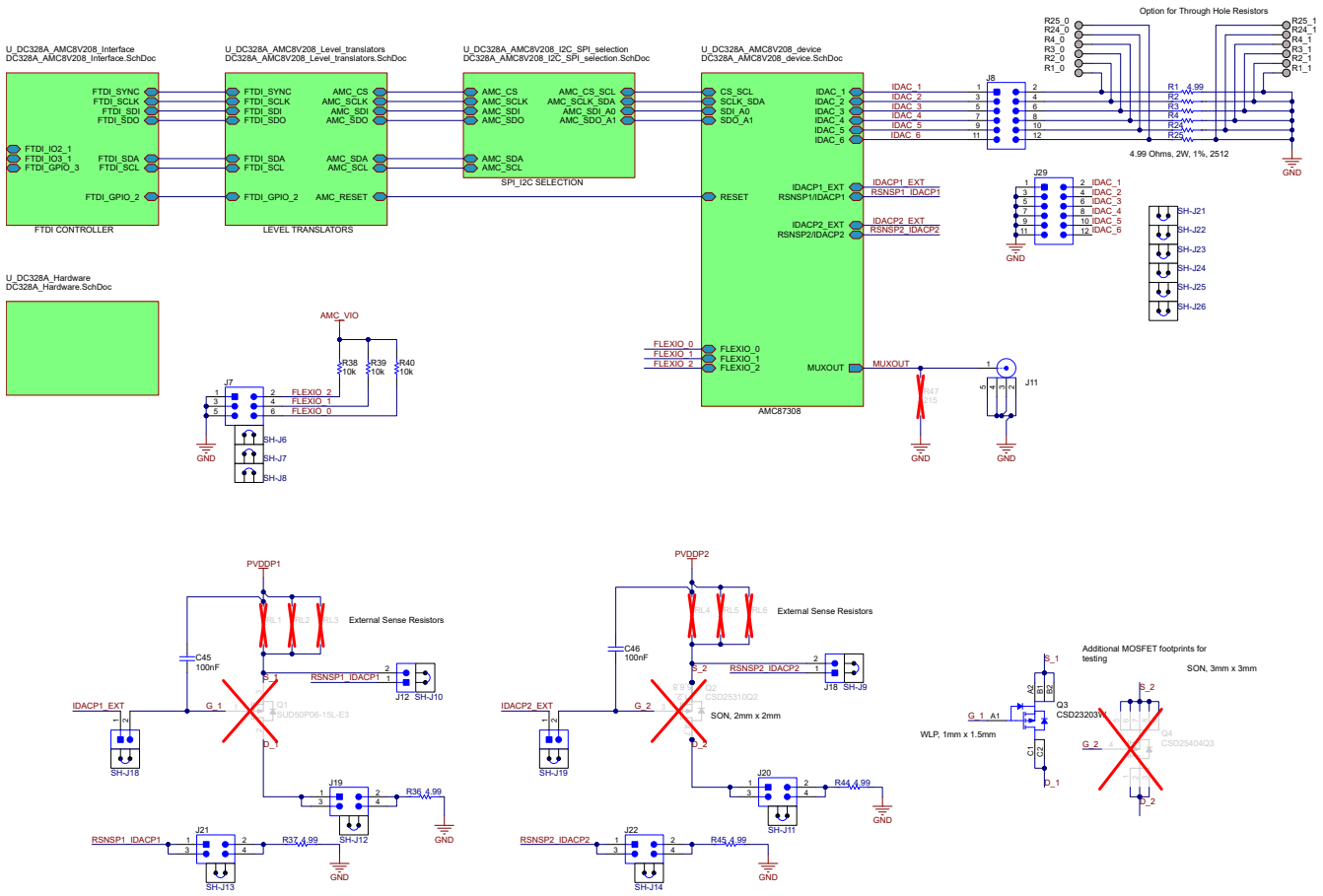


Figure 4-1. AMC8V208EVM Schematic Page 1

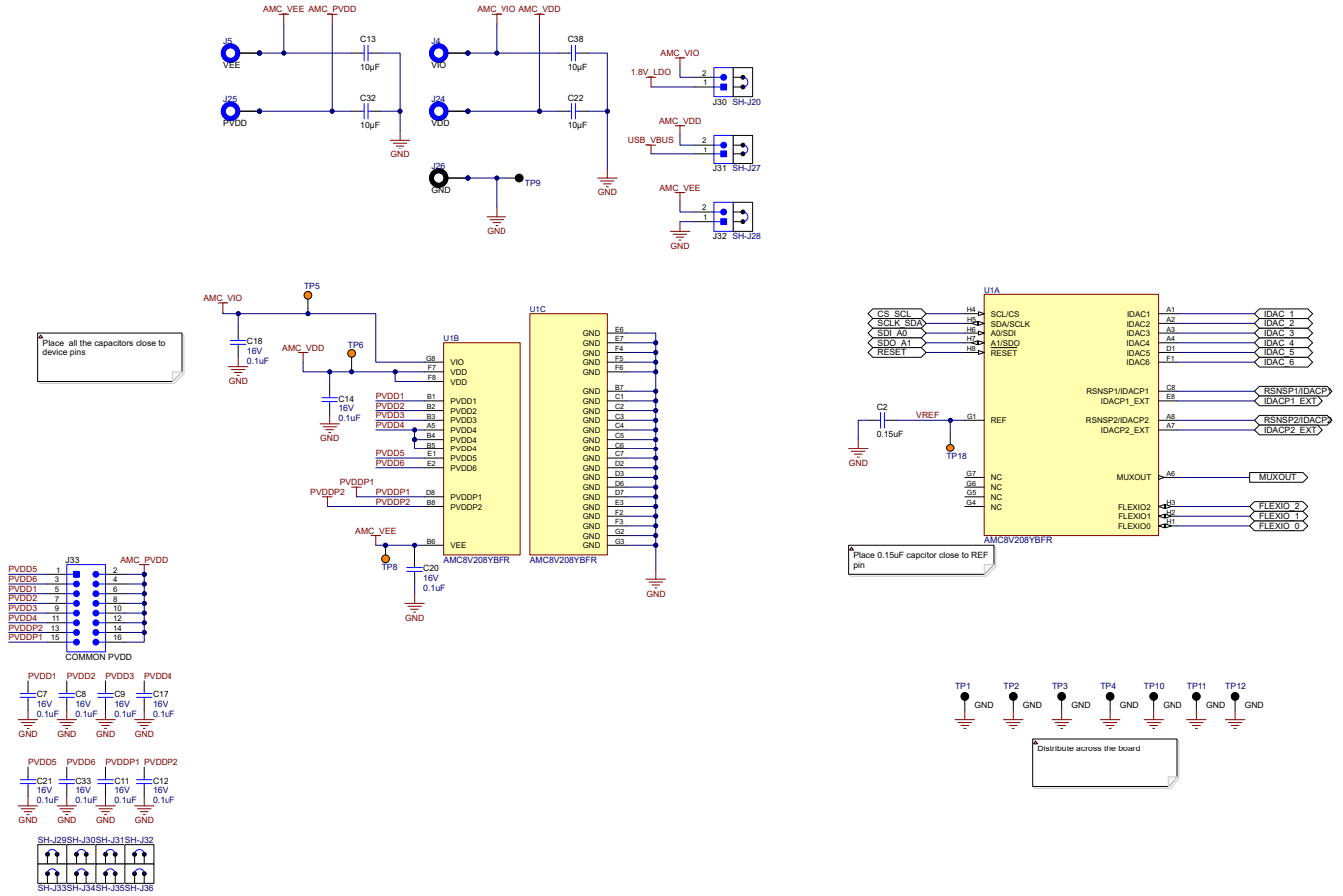


Figure 4-2. AMC8V208EVM Schematic Page 2

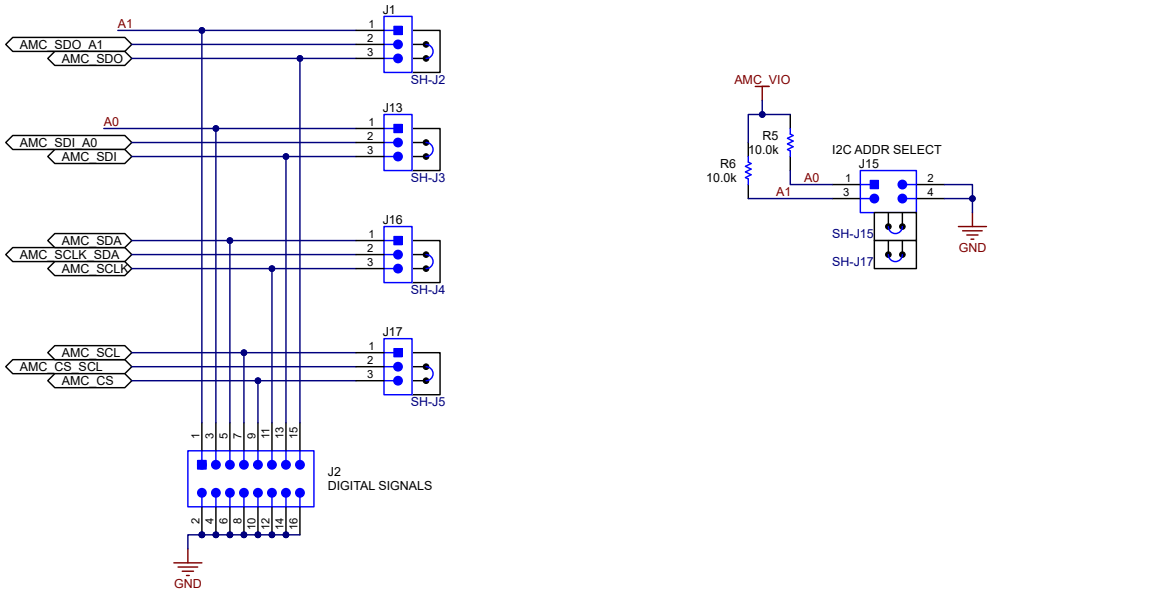


Figure 4-3. AMC8V208EVM Schematic Page 3

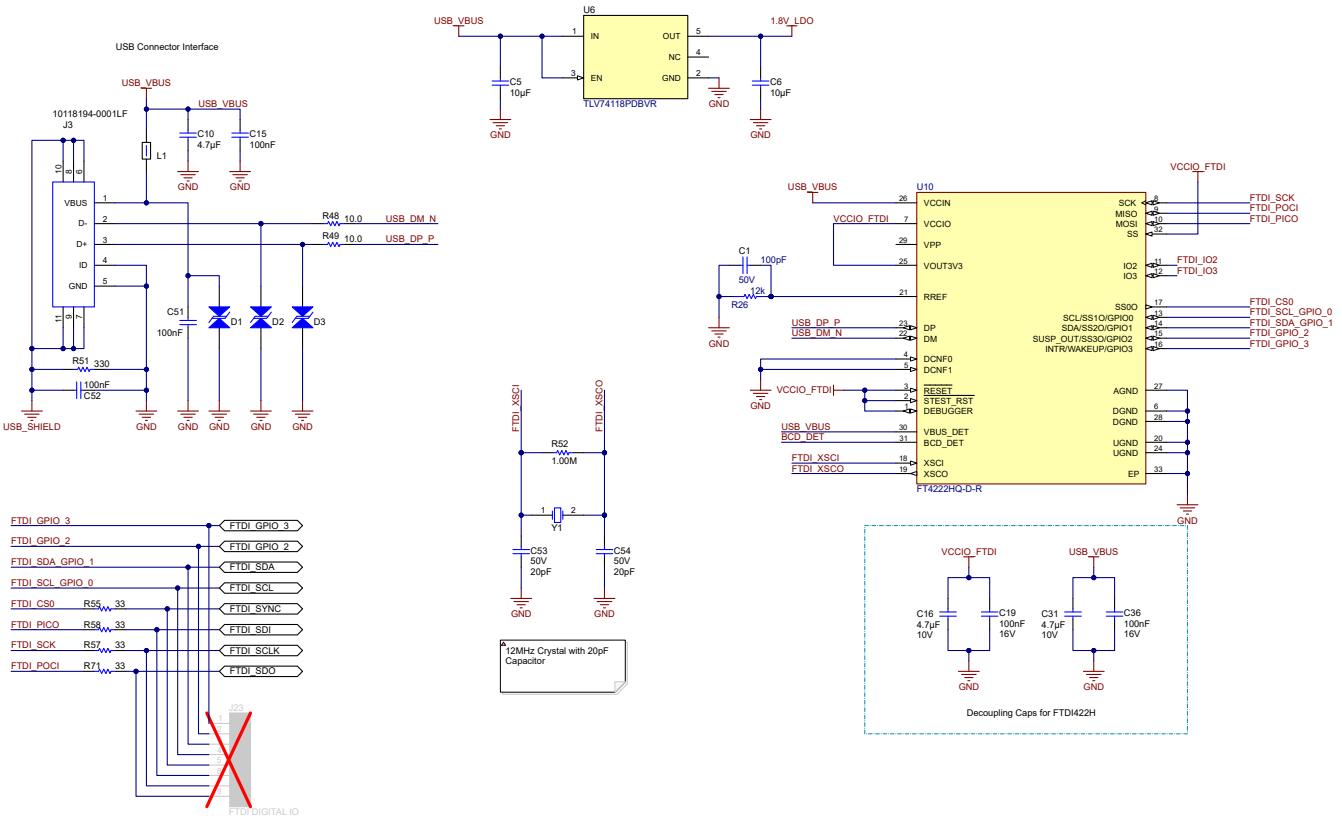


Figure 4-4. AMC8V208EVM Schematic Page 4

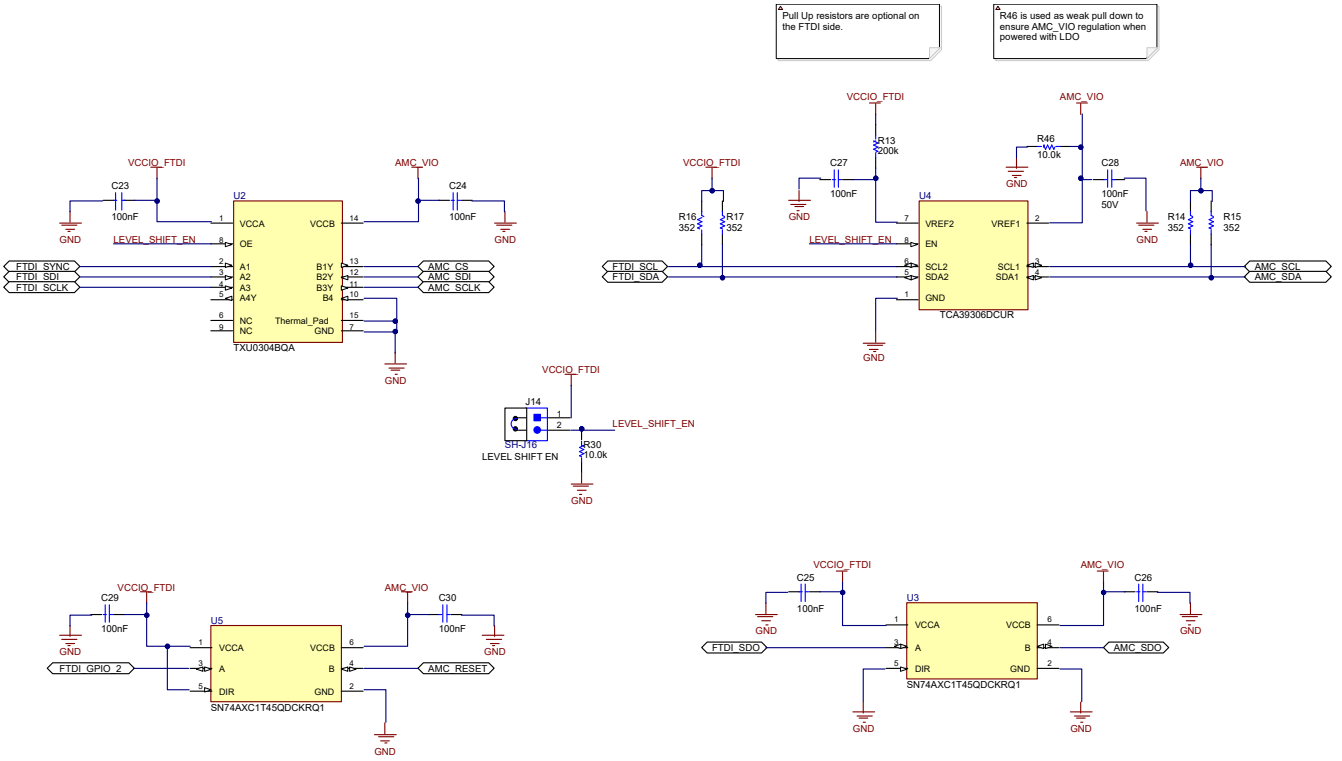


Figure 4-5. AMC8V208EVM Schematic Page 5

4.2 PCB Layout

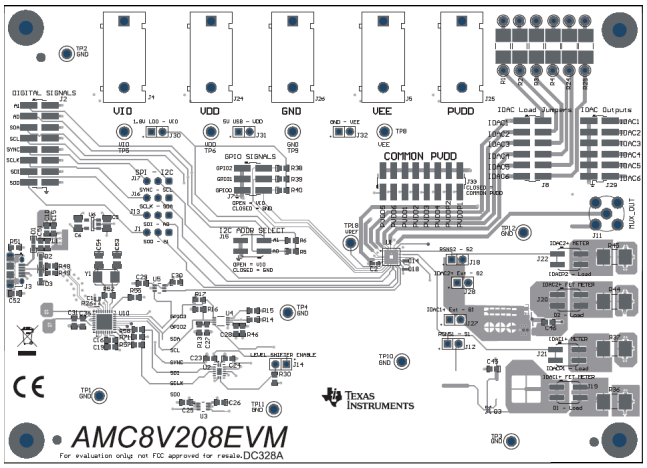


Figure 4-6. AMC8V208EVM PCB Top Layer Layout

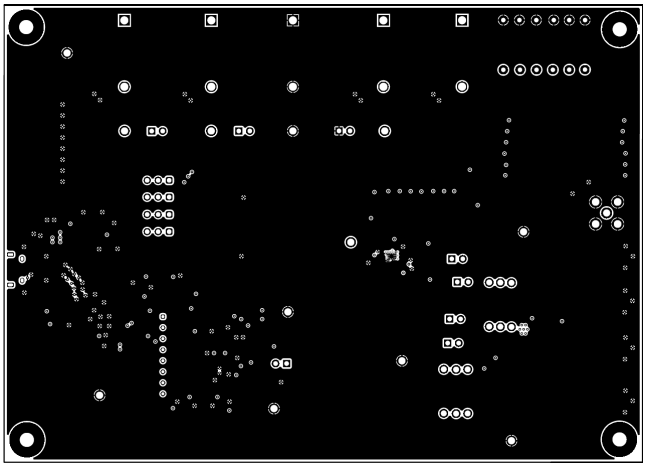


Figure 4-7. AMC8V208EVM PCB Mid Layer 1 Layout (Ground Plane)

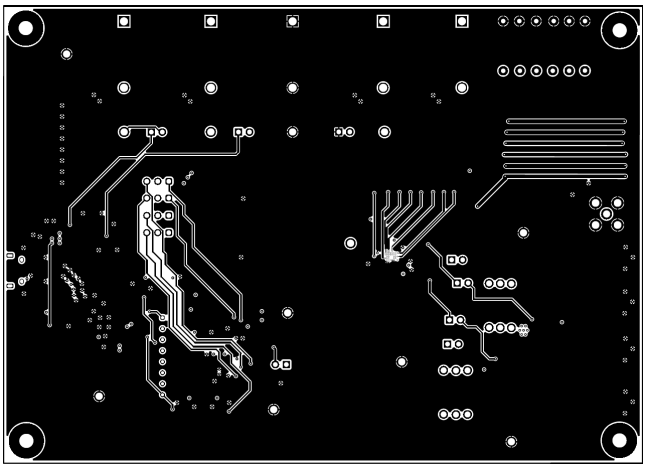


Figure 4-8. AMC8V208EVM PCB Mid Layer 2 Layout (Signal Layer)

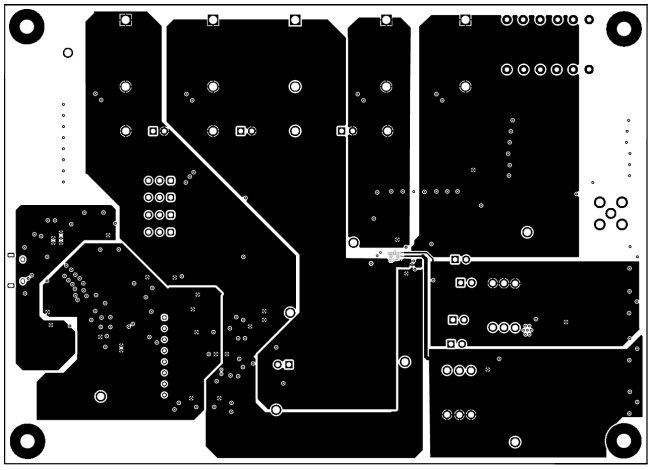


Figure 4-9. AMC8V208EVM PCB Mid Layer 3 Layout (Power Layer)

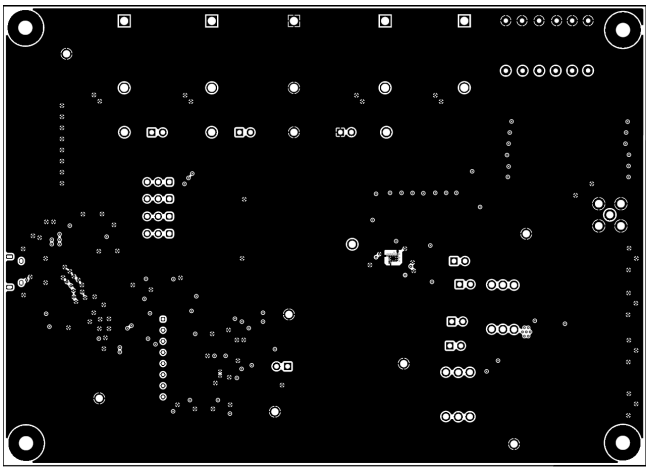


Figure 4-10. AMC8V208EVM PCB Mid Layer 4 Layout (Ground Plane)

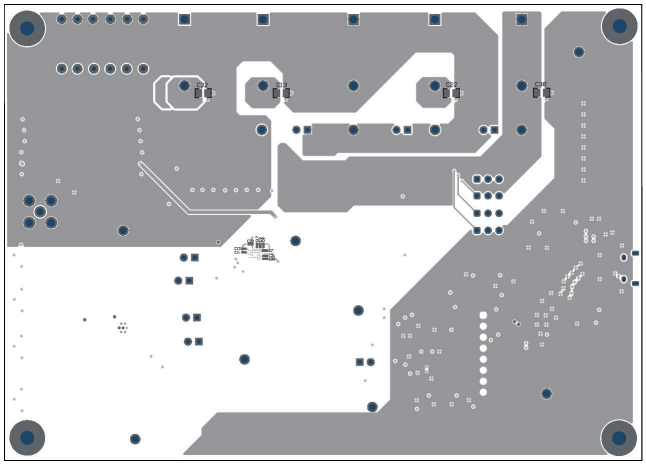


Figure 4-11. AMC8V208EVM PCB Bottom Layer Layout

4.3 Bill of Materials

The bill of materials for AMC8V208EVM is shown in Table 4-1.

Table 4-1. Bill of Materials for the AMC8V208EVM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C1	1	100pF	CAP, CERM, 100pF, 50V, +/- 10%, X7R, 0402	402	885012205055	Wurth Elektronik
C2	1	0.15µF	CAP, CERM, 0.15µF, 16V, ±10%, X7R, 0402	402	GRM155R71C154KA12D	MuRata
C5, C6, C13, C22, C32, C38	6	10µF	CAP, CERM, 10µF, 16V, +/- 20%, X7R, 0805	0805	EMK212BB7106MG-T	Taiyo Yuden
C7, C8, C9, C11, C12, C14, C18, C20, C21, C33	11	0.1µF	CAP, CERM, 0.1uF, 16V,+/- 10%, X7R, 0201	201	GRM033Z71C104KE14D	MuRata
C10	1	4.7µF	CAP, CERM, 4.7µF, 10V, ±20%, X7R, 0603	603	GRM188Z71A475ME15D	MuRata
C15, C51, C52	3	0.1µF	CAP, CERM, 0.1µF, 50V,± 5%, X7R, 0603	603	06035C104JAT2A	AVX
C16, C31	2	4.7µF	CAP, CERM, 4.7µF, 10V, ±20%, X7R, 0603	603	GRM188Z71A475ME15D	MuRata
C19, C36	2	0.1µF	CAP, CERM, 0.1µF, 100V, ±10%, X7R, 0603	603	GRM188R72A104KA35D	MuRata
C23, C24, C25, C26, C27, C28, C29, C30, C45, C46	10	0.1µF	CAP, CERM, 0.1µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	C0603C104K5RACAUTO	Kemet
C53, C54	2	20pF	CAP, CERM, 20pF, 50V, ±5%, C0G/NP0, 0805	805	CAP CER 20pF 50V X8R 0805	Kemet
D1, D2, D3	3	24V	PulseGuard ESD Suppressor, 24VDC, SMT	0603 TVS Diode	PGB1010603MR	Littelfuse
J1, J13, J16, J17	4		Header, 2.54mm, 3x1, Gold, TH	Header, 2.54mm, 3x1, TH	TSW-103-08-G-S	Samtec
J2, J33	2		Header, 2.54mm, 8x2, Gold, SMT	Header, 2.54mm, 8x2, SMT	TSM-108-01-L-DV	Samtec
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, J5, J24, J25	4		Standard Banana Jack, insulated, 10A, blue	571-0200	571-0200	DEM Manufacturing
J7	1		Header, 2.54mm, 3x2, Gold, SMT	Header, 2.54mm, 3x2, SMT	TSM-103-01-L-DV	Samtec
J8, J29	2		Header, 2.54mm, 6x2, Gold, SMT	Header, 2.54mm, 6x2, SMT	TSM-106-01-L-DV	Samtec
J11	1		Connector, SMA, TH	SMA	142-0701-201	Cinch Connectivity
J12, J14, J18, J27, J28	5		Header, 100mil, 2x1, Gold, TH	Header, 100mil, 2x1, TH	HTSW-102-07-G-S	Samtec
J15, J19, J20, J21, J22	5		Header, 2.54mm, 2x2, Gold, SMT	Header, 2.54mm, 2x2, Gold, TH	61030421121	Wurth Elektronik
J26	1		Standard Banana Jack, insulated, 10A, black	571-0100	571-0100	DEM Manufacturing
J30, J31, J32	3		Header, 2.54mm, 2x1, TH	Header, 100mil, 2x1, TH	HTSW-102-07-G-S	Samtec
L1	1	600Ω	Ferrite Bead, 600 ohm at 100MHz, 1A, 0603	603	782633601	Wurth Elektronik

Table 4-1. Bill of Materials for the AMC8V208EVM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
Q3	1	–8 V	MOSFET, P-CH, -8 V, -3 A, YZC0006ABAB (DSBGA-6)	YZC0006ABAB	CSD23203W	Texas Instruments
R1, R2, R3, R4, R24, R25, R36, R37, R44, R45	10	4.99Ω	4.99 Ohms ±1% 2W Chip Resistor 2512 (6432 Metric) Moisture Resistant Thick Film	2512	RHC2512FT4R99	Stackpole electronics
R5, R6	2	10kΩ	RES, 10.0 k, 1%, 0.1 W, 0603	603	RCG060310K0FKEA	Vishay Draloric
R13	1	200kΩ	RES, 200 k, 0.1%, 0.1 W, 0603	603	ERA-3AEB204V	Panasonic Electronic Works
R14, R15, R16, R17	4	352Ω	RES, 352, 0.1%, 0.1 W, 0603	603	RT0603BRD07352RL	Yageo America
R26	1	12kΩ	12 kOhms ±1% 0.1W, 1/10W Chip Resistor 0402 (1005 Metric) Automotive AEC-Q200 Thick Film	402	ERJ-2RKF1202X	Panasonic ECG
R28, R29, R32, R33	4	23.7Ω	RES, 23.7, 1%, 0.05 W, 0201	201	RC0201FR-0723R7L	Yageo
R30, R46	2	10kΩ	RES, 10.0 k, 1%, 0.1 W, 0603	603	RC0603FR-0710KL	Yageo
R38, R39, R40	3	10kΩ	RES, 10 k, 5%, 0.1 W, 0603	603	RC0603JR-0710KL	Yageo
R48, R49	2	10Ω	RES, 10.0, 1%, 0.1 W, 0603	603	RC0603FR-0710RL	Yageo
R51	1	330Ω	RES, 330, 1%, 0.1 W, 0603	603	RC0603FR-07330RL	Yageo
R52	1	1.00MΩ	RES, 1.00M, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	603	CRCW06031M00DHEAP	Vishay-Dale
R55, R57, R58, R71	4	33Ω	27 Ohms ±1% 0.125W, 1/8W Chip Resistor 0603 (1608 Metric) Anti-Sulfur Thin Film	603	MCT06030C2709FP500	Vishay-Dale
TP1, TP2, TP3, TP4, TP9, TP10, TP11, TP12	8		Test Point, Compact, Black, TH	Black Compact Testpoint	5006	Keystone Electronics
TP5, TP6, TP8, TP18	4		Test Point, Compact, Orange, TH	Orange Compact Testpoint	5008	Keystone Electronics
U1	1		AMC8V208YBFR	DSBGA60	AMC8V208YBFR	Texas Instruments
U2	1		4-Bit Fixed Direction Voltage-Level Translator with Schmitt- Trigger Inputs, and Tri-State Outputs, WQFN14	WQFN14	TXU0304BQA	Texas Instruments
U3, U5	2		Voltage Level Translator Bidirectional 1 Circuit 1 Channel 500Mbps SC-70-6	SC70-6	SN74AXC1T45QDCKRQ1	Texas Instruments
U4	1		Dual Bidirectional I2C Bus and SMBus Voltage-Level Translator	PSOP8	TCA39306DCUR	Texas Instruments
U6	1		Low-Dropout Regulator, DBV0005A (SOT-23-5)	DBV0005A	TLV74118PDBVR	Texas Instruments
U10	1		USB2.0 to QuadSPI/I2C Bridge IC, VQFN-32	VQFN-32	FT4222HQ-D-R	FTDI
Y1	1		Crystal, 12MHz, 18pF, SMD	ABM3	ABM3-12.000MHZ-D2Y-T	Abracon Corporation
Q1	0	-60 V	MOSFET, P-CH, -60 V, -50 A, DPAK	DPAK	SUD50P06-15L-E3	Vishay-Semiconductor

Table 4-1. Bill of Materials for the AMC8V208EVM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
Q2	0	-20 V	MOSFET, P-CH, -20 V, -20 A, DQK0006C (WSON-6)	DQK0006C	CSD25310Q2	Texas Instruments
Q4	0	-20 V	MOSFET, P-CH, -20 V, -60 A, DQG0008A (VSON-CLIP-8)	DQG0008A	CSD25404Q3	Texas Instruments

5 Additional Information

5.1 Trademarks

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6 Related Documentation From Texas Instruments

The document in Table 6-1 provides information regarding Texas Instruments integrated circuits used in the assembly of the AMC8V208EVM. This user's guide is available from the TI web site under literature number SLAU932. 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 can be 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 Documentation

Document	Literature Number
AMC8V208EVM	SLASFI5

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