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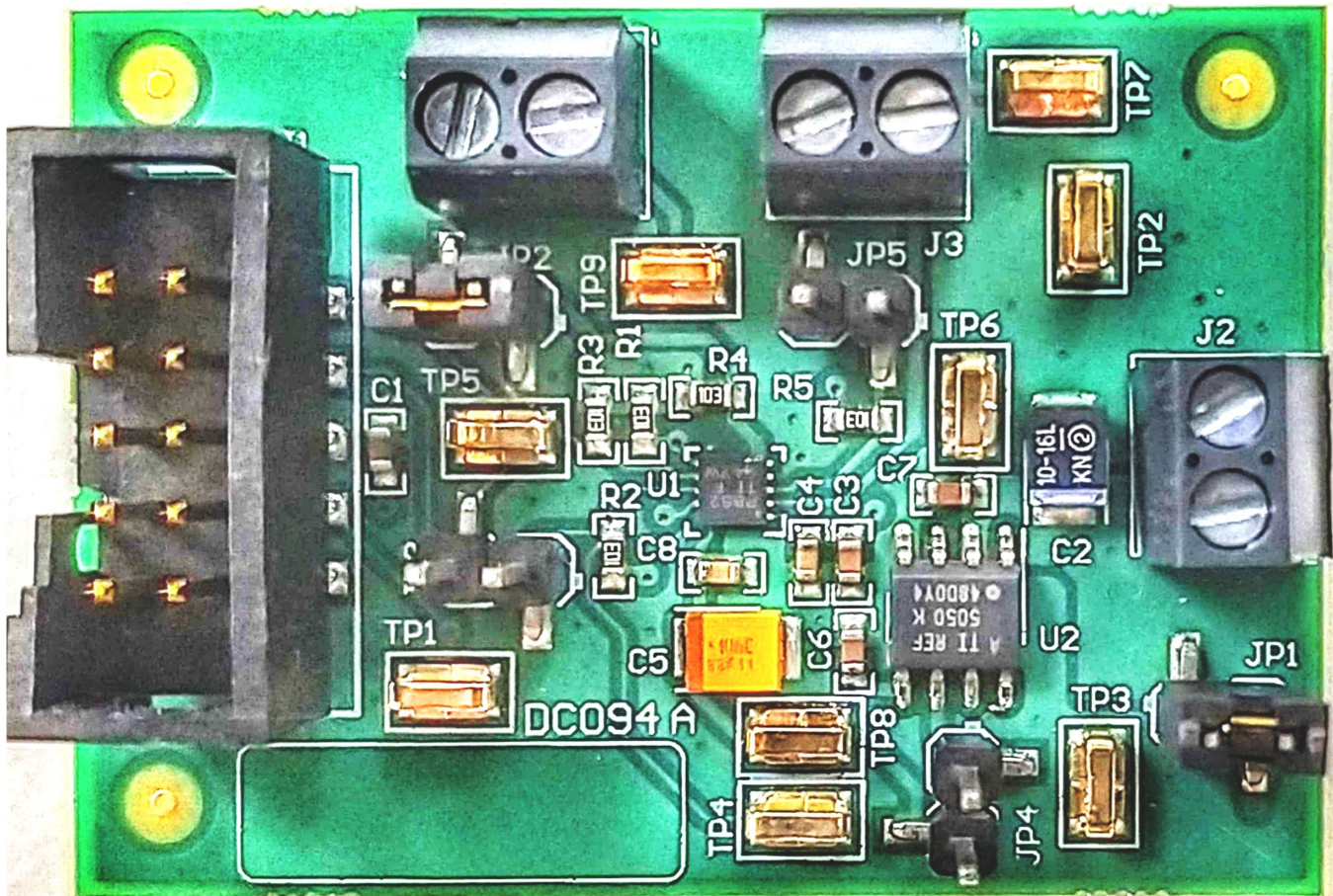
DAC80502 Evaluation Module

This user's guide describes the characteristics, operation, and use of the DAC80502EVM evaluation module (EVM). This EVM is designed to evaluate the performance of the DAC80502 buffered voltage output DAC in a variety of configurations. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the DAC80502EVM. This document includes a schematic, reference printed-circuit board (PCB) layouts, and a complete bill of materials.

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1 Overview

The DAC80502EVM is an easy-to-use platform to evaluate the functionality and performance of the DAC80502 device. The DAC80502 is a dual-channel, buffered, digital-to-analog converter (DAC) in 16-bit resolution with 2.5-V internal reference. This EVM provides output voltage from 0 V to 5 V. The EVM also provides the SPI programming interface using a PC-based graphical user interface (GUI).

1.1 Kit Contents

Table 1 details the contents of the EVM kit. Contact the TI Product Information Center at the phone number provided in Section 1.2 if any component is missing. TI highly recommends that the user verify latest versions of the related software at the TI website, www.ti.com.

Table 1. Contents of DAC80502EVM Kit

Item	Quantity
DAC80502EVM evaluation board PCB	1

Table 2. Required Components Not Included With Kit

Item	Quantity
USB2ANY interface adapter	1

The USB2ANY interface adapter can be purchased from the USB2ANY interface adapter product folder on www.ti.com.

1.2 Related Documentation from Texas Instruments

The following document provides information regarding Texas Instruments integrated circuits used in the assembly of the DAC80502EVM. This user's guide is available from the TI website under literature number SLAU818. 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 website at http://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 3. Related Documentation

Document	Literature Number
DAC80502 product data sheet	SBAS793

2   System Setup

2.1   *Software Setup*

This section provides the procedure for EVM software installation.

2.1.1   Operating Systems

The EVM software is compatible with the Windows™ 7 and 10 operating systems.

2.1.2   Software Installation

The software is available through the DAC80502EVM product folder. After the software is downloaded onto the PC, navigate to the *DAC80502EVM* folder, and run the *Setup_DAC80502_EVM.*exe file, as shown in Figure 1. When the software is launched, an installation dialog window opens and prompts the user to select an installation directory. If left unchanged, the software location defaults to *C:\Program Files (x86)\Texas Instruments\DAC80502 EVM*, as shown in Figure 2. The software installation automatically copies the required files and drivers to the local machine.

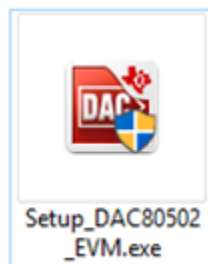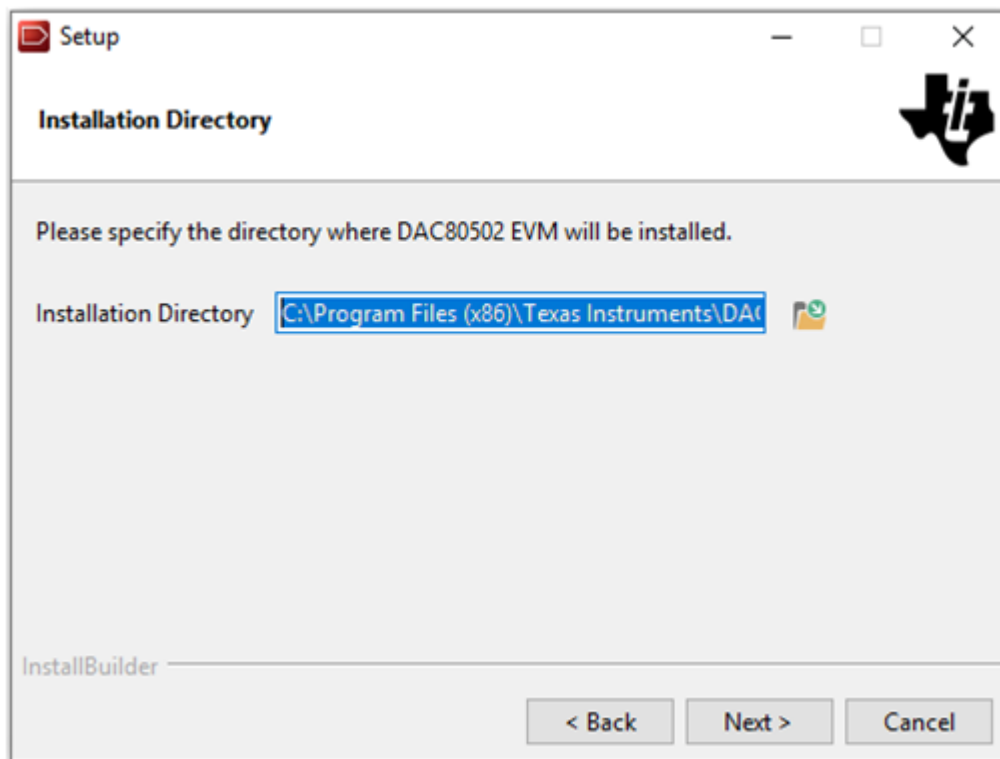**Figure 1. Software Setup**

Figure 2. Software Installation Path

2.2 Hardware Setup

This section provides the overall system setup for the EVM. A PC runs software that provides an interface to the USB2ANY platform. This platform generates the optional 3.3-V power and digital signals used to communicate with the EVM board. Connectors are included on the EVM board for external power supplies. Figure 3 displays the system setup for the DAC80502EVM.
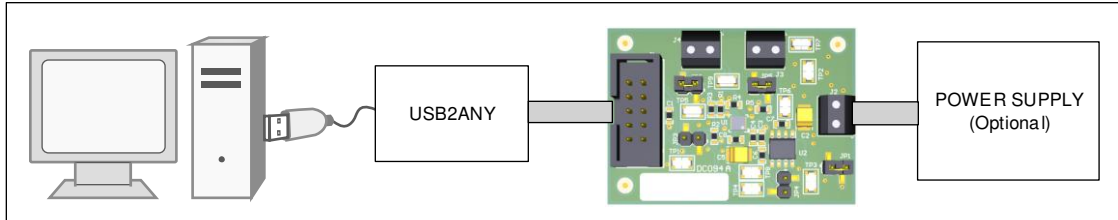

Figure 3. Hardware Setup

2.2.1 Power Configurations

The DAC80502EVM provides electrical connections to the device supply pins. The connectors and optional configurations are shown in the Table 4. The headroom between the reference and the power supply must be maintained. See the DAC80502 data sheet for details.

Table 4. Power Supply Inputs

DAC80502EVM Connector	Supply Name	Voltage Range
J2.1	VDD	2.7 V to 5.5 V
J2.2	GND	0 V
JP1.2 (Default)	USB_3p3	3.3 V from USB2ANY. **NOTE:** The REF-DIV bit must be 1 so that the internal 2.5-V reference is divided by 2 to meet the headroom requirements. The maximum output possible in this mode is 2.5 V. Use a 5-V external VDD on J2 for a higher voltage swing.

2.2.2 Connecting the Hardware

Connect the USB cable from the USB2ANY platform to the PC. To connect the USB2ANY to the EVM board, align and firmly connect the keyed ribbon connector to the J1 connector. Verify the connection is snug; loose connections may cause intermittent operation.

2.2.3 Electrostatic Discharge Warning

Many of the components on the DAC80502EVM 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   Detailed Description

3.1   Hardware Description

The following sections provide detailed information on the EVM hardware and jumper configuration settings.

3.1.1   Theory of Operation for the DAC80502EVM Hardware

The block diagram of the DAC80502EVM board is displayed in Figure 4. The EVM board connects to external power supply VDD either through USB2ANY (3.3 V) or through JP2. The headroom for the reference must be maintained as specified in the DAC80502 data sheet. The 10-pin wire-to-board connector, J1, provides an interface to the USB2ANY platform. The SPI signals are provided either by using the USB2ANY header or the test points. Use JP4 to select the onboard 5-V reference source. JP4 is open by default, making the DAC work with the internal reference.
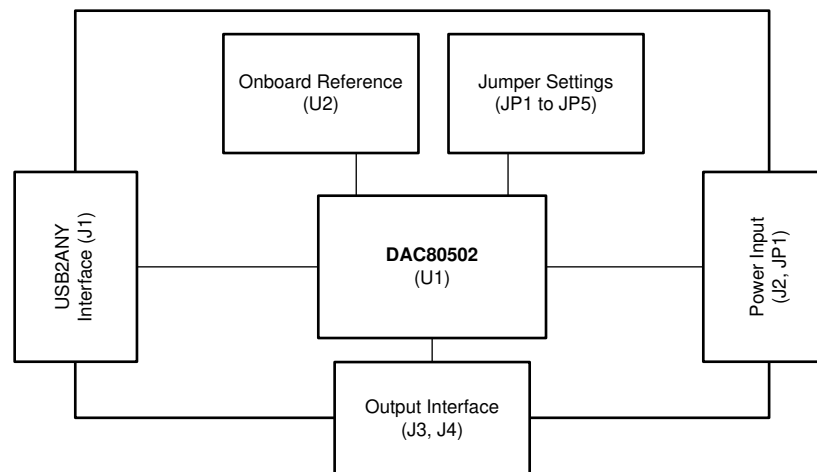
Figure 4. DAC80502EVM Hardware Block Diagram

3.1.2 Signal Definition of the DAC80502EVM

The DAC80502EVM provides a hardware connector (J1) that connects to the USB2ANY interface board The USBANY platform supplies VIO power and is responsible for providing the SPI commands sent from the PC GUI software. Optionally, the VDD supply can be provided through an external supply, and all digital communication lines can be accessed through their respective digital test points. Table 5 provides the pin definitions for this connector. Table 6 provides the corresponding test points for the SPI signals.

Table 5. J1 (USB2ANY) Pin Definitions

Pin#	Signal	Description
1	GPIO7	General-purpose I/O
2	$\overline{CS}$/GPIO6	$\overline{CS}$ | General-purpose I/O
3	RXD/MISO	SPI MISO
4	TXD/MOSI	SPI MOSI
5	3.3V	3.3-V supply
6	GND	Ground
7	GPIO3	General-purpose I/O
8	SCLK/GPIO2	SPI SCLK
9	GPIO1	General-purpose I/O
10	GPIO0	General-purpose I/O

Table 6. J1 SPI Signal Test Points

Test Points	SPI Signal
TP1	SCLK
TP2, TP3	GND
TP4	MOSI/SDI
TP5	$\overline{SYNC}$

3.1.3 DAC Signal Pins

The DAC80502EVM provides access to the DAC output through connection J3 and J4, as listed in Table 7.

Table 7. DAC Output Connector Pin Definitions

Connector-Pin	Signal Name
J3-1	VOUTA
J3-2	GND
J4-1	VOUTB
J4-2	GND

3.2 Software Description

This section describes the features of the DAC80502 EVM software, and discusses how to use these features. The software provides basic control of all the registers and functions to the DAC80502 device.

3.2.1 Starting the Software

To launch the software, locate the Texas Instruments folder in the *All Programs* menu, and select the *DAC80502 EVM* icon.
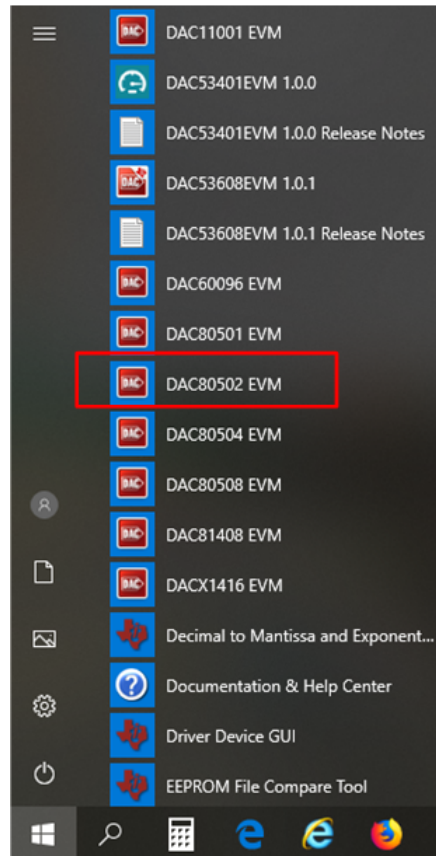

Figure 5. DAC80502EVM GUI Location

Figure 6 shows that If the USB2ANY is correctly connected, the status bar at the bottom of the screen displays *HARDWARE CONNECTED.* If the USB2ANY is not properly connected or not connected at all, the status bar displays *DEMO*. If the GUI is not displaying the *HARDWARE CONNECTED* status while the USB2ANY is connected, unplug and reconnect the USB2ANY and relaunch the GUI software.

Figure 6. GUI Connection Detection

3.2.2 Software Features

The DAC80502 EVM incorporates interactive functions that help configure the DAC80502 device. These functions are built into several GUI pages, as shown in Figure 7. The *Page Selection* menu allows the user to switch between the pages, with each page representing a feature of the software.
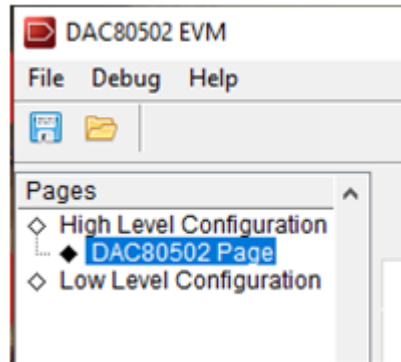

Figure 7. Page Selection

3.2.2.1 Low Level Configuration Page

The DAC80502 EVM *Register Map* page, shown in Figure 8, allows the user to access low level communication directly with the DAC80502 registers. Selecting a register on the *Register Map* list shows a description of the values in that register, as well as information on the register address, default value, size, and current value. Values can be read and written to the registers by writing to the *Value* or bit field of the GUI.
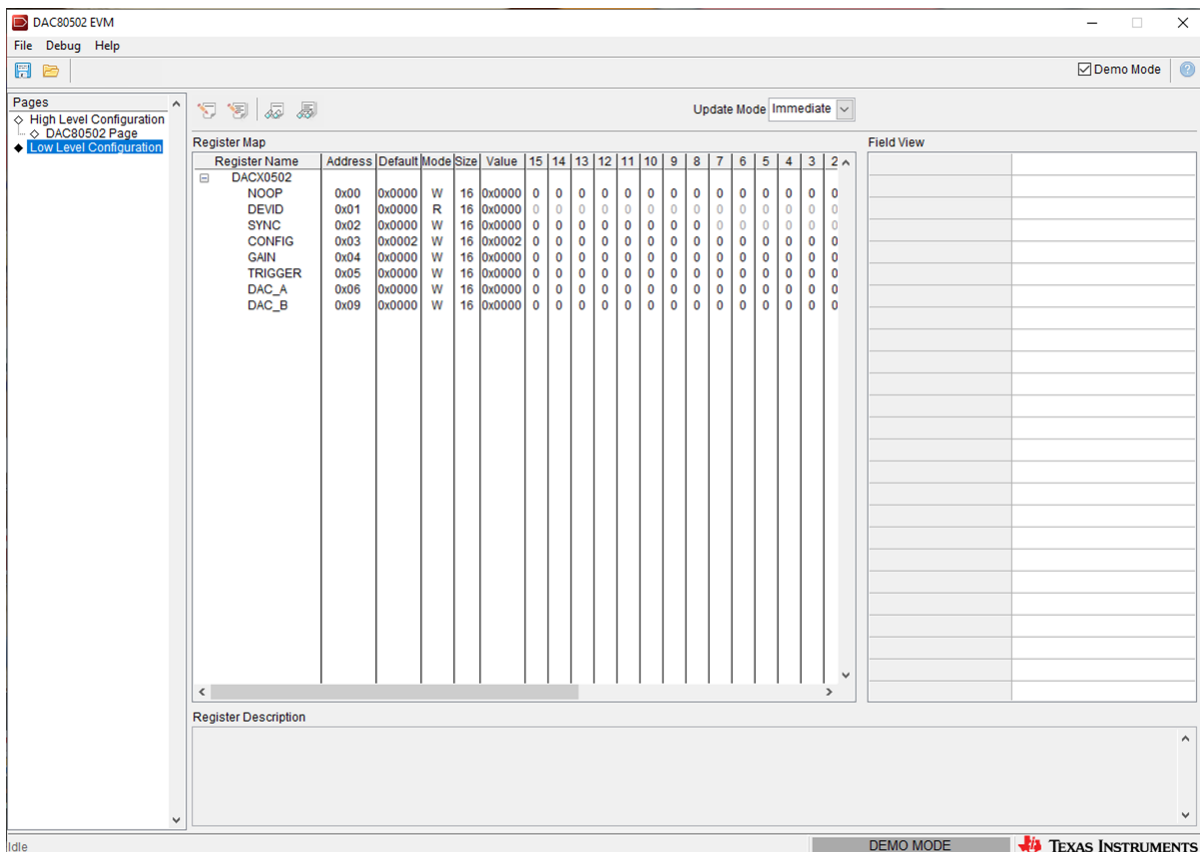

Figure 8. Low Level Configuration Page

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The values of the register map can also be saved by pressing the *Save Configuration* button under the *File* menu option. Additionally, the configuration files can be accessed through the *Load Configuration* button. Other options selectable by the user are the *Update Mode*, *Write Selected*, *Read Selected*, *Write Modified*, and *Read All* buttons. All buttons are displayed in Figure 9.
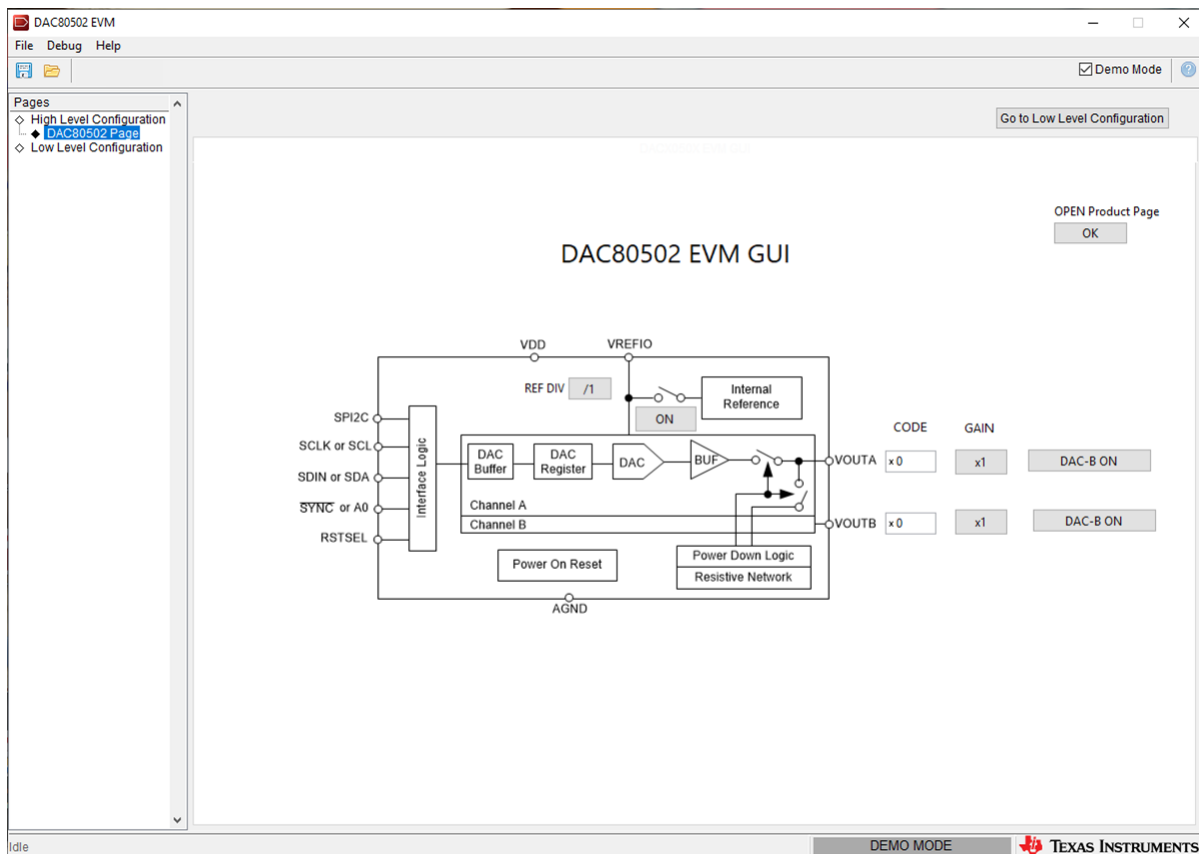

Figure 9. Low Level Configuration Page Options

If *Immediate* is selected under *Update Mode*, all changes to register values update immediately. The *Deferred* option allows the user to modify the value of a register without taking effect until the *Write Selected*, or *Write Modified* button is pressed. The *Read Selected* button allows individual register reads, whereas the *Read All* button reads the status of all registers located in the register map.

3.2.2.2 High Level Configuration Page

The *High Level Configuration* page provides an easy interface to program the output code for the DAC80502 device. This page is displayed in Figure 10.

Figure 10. High Level Configuration Page

4 Schematic, PCB Layout, and Bill of Materials

This section contains the complete bill of materials, PCB layout, and schematic diagram for DAC80502EVM.
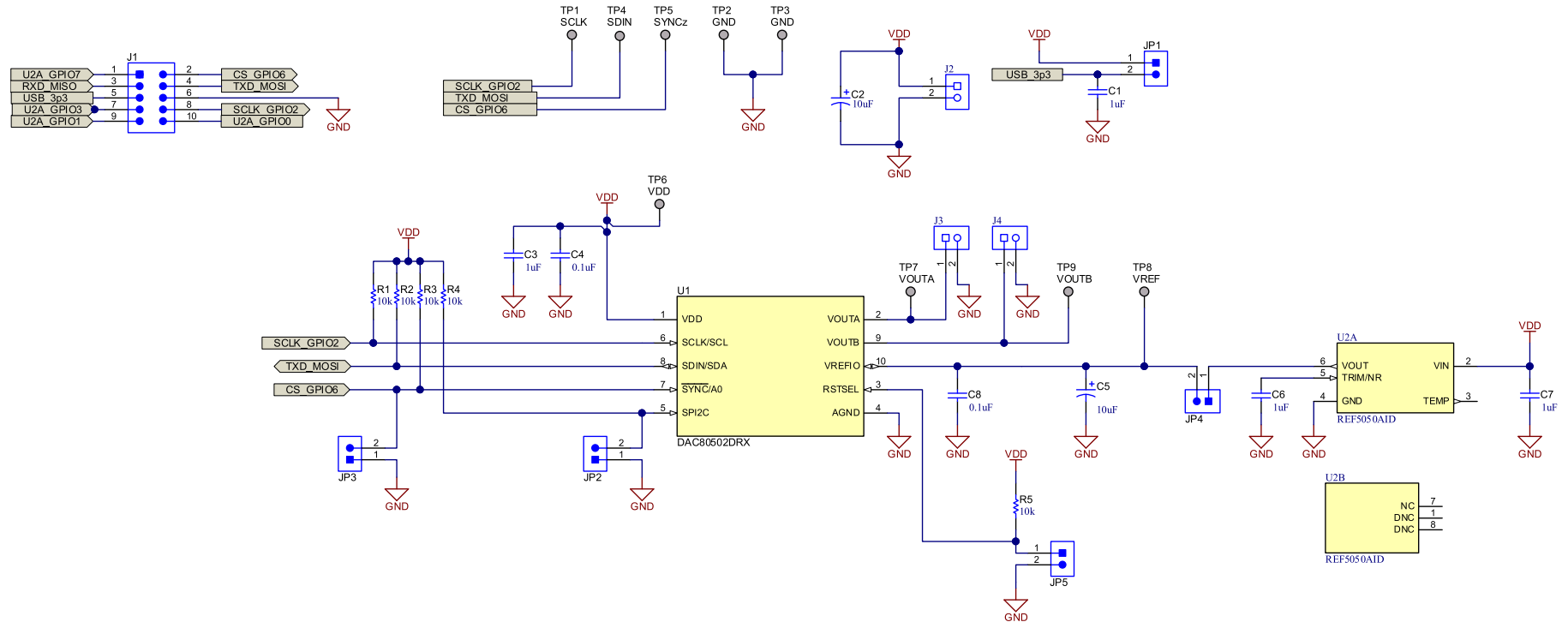
4.1 DAC80502EVM Schematic

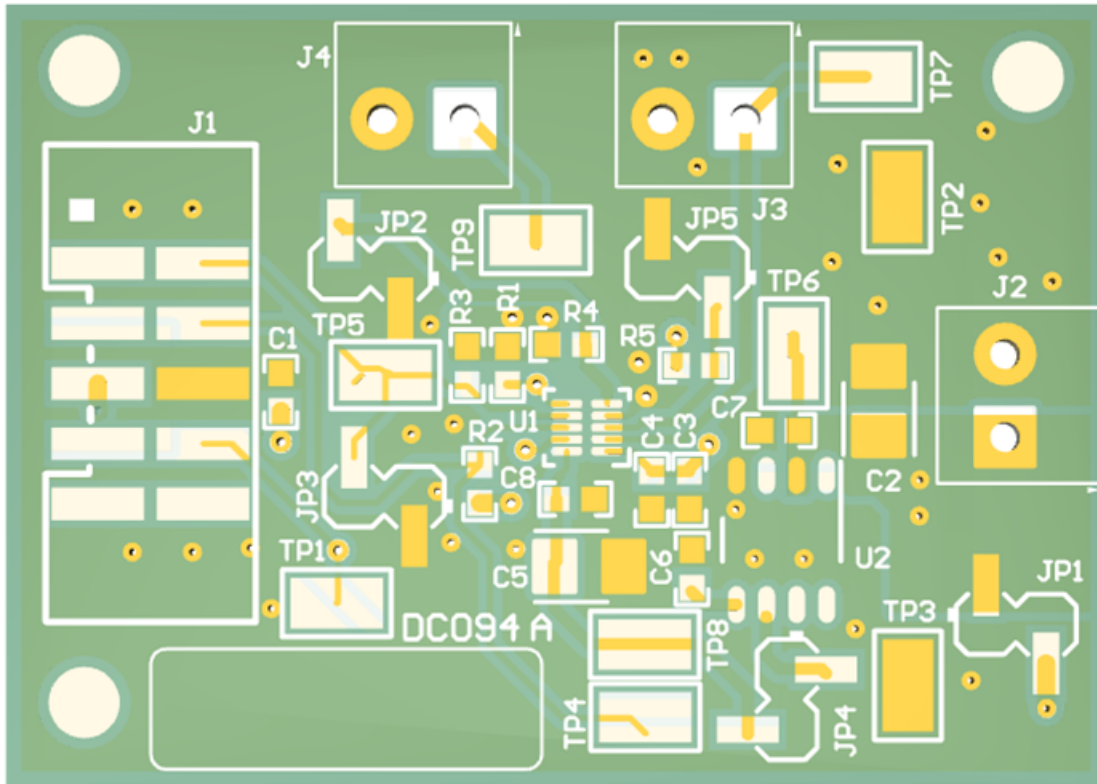**Figure 11. DAC80502EVM Schematic**

4.2   *PCB Components Layout*

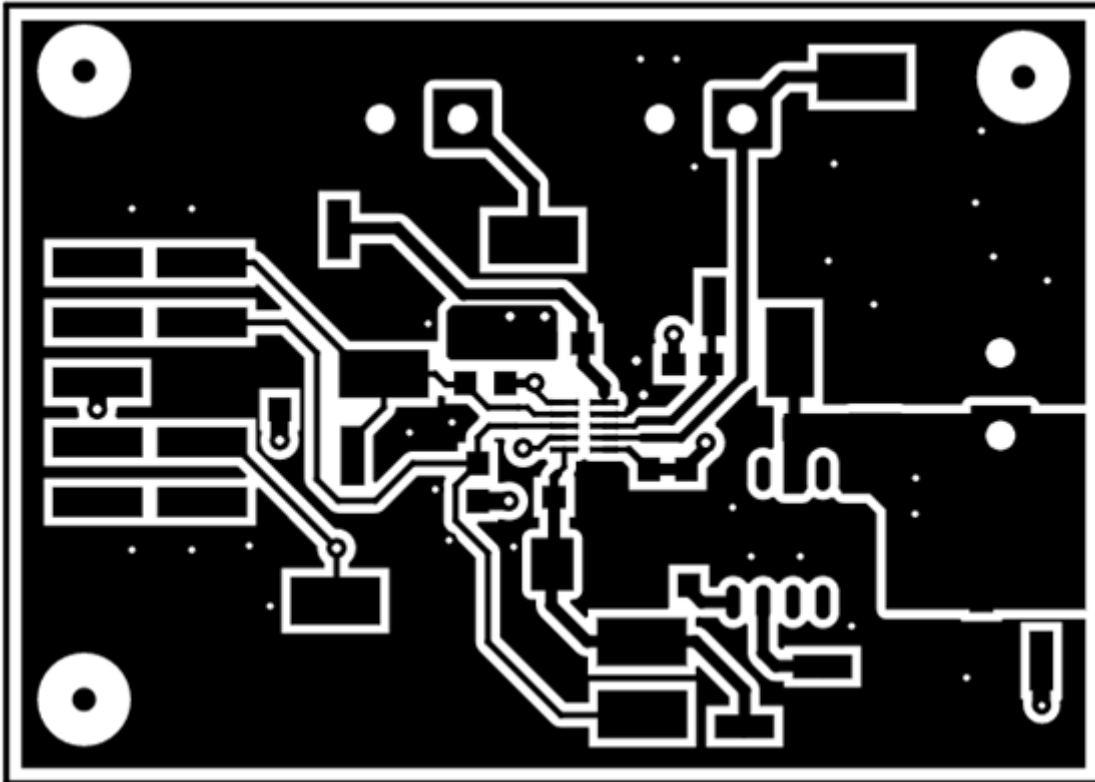**Figure 12. PCB Layout - Component Placement**

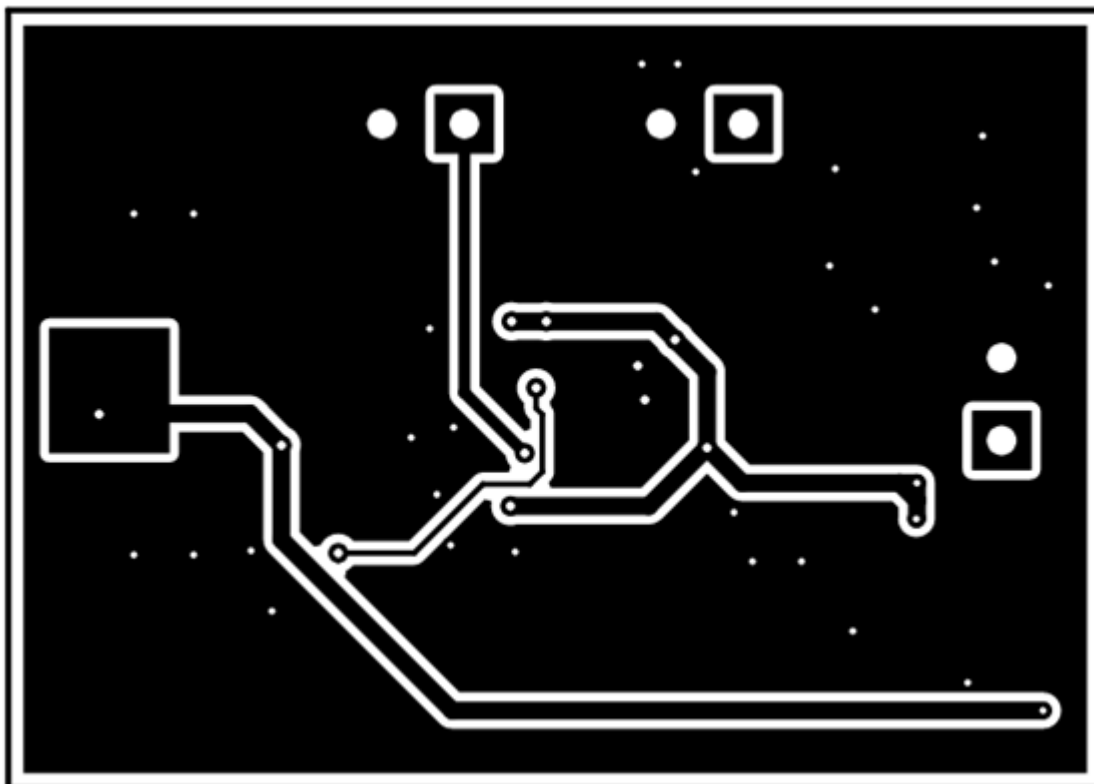**Figure 13. PCB Layout - Top Layer**

Figure 14. PCB Layout - Bottom Layer

4.3 DAC80502EVM Bill of Materials

Table 8. DAC80502EVM Bill of Materials

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
!PCB	1		Printed Circuit Board		DC094-001	Any
C1, C3, C6, C7	4	1uF	CAP, CERM, 1 uF, 25 V, +/- 10%, X7R, 0603	0603	C1608X7R1E105K080AB	TDK
C2	1	10uF	CAP, TA, 10 uF, 16 V, +/- 20%, 2 ohm, SMD	3528-21	293D106X0016B2TE3	Vishay-Sprague
C4, C8	2	0.1uF	CAP, CERM, 0.1 uF, 25 V, +/- 10%, X7R, 0603	0603	06033C104KAT2A	AVX
C5	1	10uF	CAP, TA, 10 uF, 16 V, +/- 10%, 0.8 ohm, SMD	3528-21	TPSB106K016R0800	AVX
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1	1		Header (shrouded), 100mil, 5x2, Gold, SMT	SMT Header	52601-S10-8LF	FCI
J2, J3, J4	3		Terminal Block, 3.5mm Pitch, 2x1, TH	7.0x8.2x6.5mm	ED555/2DS	On-Shore Technology
JP1, JP2, JP3, JP4, JP5	5		Header, 2.54mm, 2x1, Tin, SMT	Header, 2.54mm, 2x1, SMT	M20-8770246	Harwin
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, R2, R3, R4, R5	5	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0JNEA	Vishay-Dale
SH-JP1, SH-JP2, SH-JP5	3	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9	9		Test Point, Miniature, SMT	Test Point, Miniature, SMT	5019	Keystone
U1	1		DAC80502DRX, DRX0010A (WSON-10)	DRX0010A	DAC80502DRX	Texas Instruments
U2	1		Low Noise, Very Low Drift, Precision Voltage Reference, -40 to 125 degC, 8-pin SOIC (D), Green (RoHS & no Sb/Br)	D0008A	REF5050AID	Texas Instruments

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