DACx760EMC-EVM

This user's guide describes the characteristics, operation, and use of the DAC7760 and DAC8760 (DACx760) evaluation boards (EMC-EVMs). This user's guide also discusses how to set up and configure the software and hardware, and reviews various aspects of the program operation. Throughout this document, the terms *DAC8760EMC-EVM, evaluation board, evaluation module*, and *EVM* are synonymous with the DACx760EMC-EVM. This user's guide also includes information regarding operating procedures and input/output connections, an electrical schematic, printed circuit board (PCB) layout drawings, and a parts list for the EVM.

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1 Overview

The DAC7760 (12-bit) and DAC8760 (16-bit) are precision digital-to-analog converters (DACs). The output can be configured to produce a current in output ranges of 0 mA to 20 mA, 4 mA to 20 mA, and 4 mA to 24 mA. Both devices can also be configured to have voltage output ranges of 0 V to 5 V, 0 V to 10 V, ±5 V, and ±10 V. The DAC7750 (12-bit) and DAC8750 (16-bit) feature current outputs only. All of these devices feature configurable slew rates, power-on reset functions, a highway addressable remote transducer (HART) signal interface, a watchdog timer, error checking, external and internal voltage references, and a common hardware fault output.

This EVM is designed to demonstrate capability of the DAC8760 family of products to survive harsh industrial environments when paired with the appropriate protection circuitry on the analog front-end.

1.1 EVM Kit Contents

Table 1 details the contents of the EVM kit. Contact the Texas Instruments Product Information Center nearest you if any component is missing. It is highly recommended that you check the TI web site at http://www.ti.com to verify that you have the latest versions of the related software.

Table 1. Contents of DACx760EMC-EVM and DACx750EMC-EVM Kit

Item	Quantity
DACx760EMC-EVM or DACx750EMC-EVM PCB	1
SM-USB-DIG platform PCB	1
USB extender cable	1
SM-USB-DIG connector ribbon cable	1

1.2 Related Documentation from Texas Instruments

The following documents provide information regarding Texas Instruments integrated circuits used in the assembly of the DACx760EMC-EVM and DACx750EMC-EVM. This user's guide is available from the TI web site under literature number SBAU205. 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 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 2. Related Documentation

Document	Literature Number
DAC7760 and DAC8760 product data sheet	SBAS528
DAC7750 and DAC8750 product data sheet	SBAS538
Single-Channel Industrial Voltage and Current Output Driver, Isolated, EMC/EMI Tested	TIPD153
SM-USB-DIG Platform User's Guide	SBOU98

2 EVM Hardware Setup

This section discusses the overall system setup for the EVM. A personal computer (PC) runs the software that communicates with the SM-USB-DIG Platform, which provides the power and digital signals used to communicate with the EVM board. Connectors on the EVM board allow the user to connect the required external power supply.

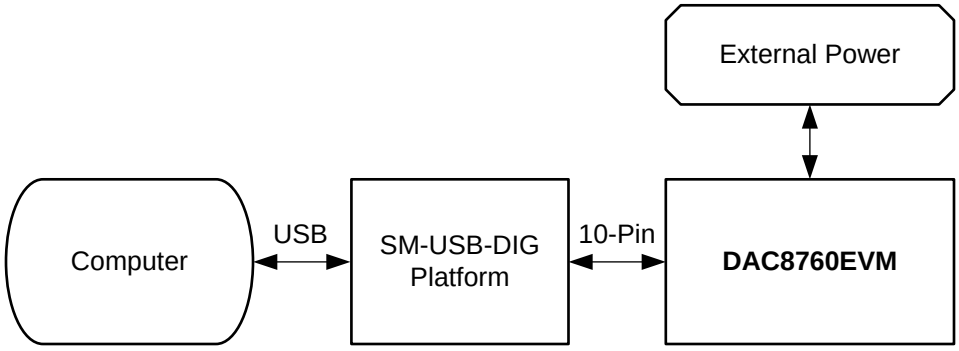


Figure 1. DAC8760EVM Hardware Setup

2.1 Theory of Operation for EVM Hardware

A block diagram of the EVM hardware setup is shown in Figure 2. This board provides test points for the SPI™ inputs, power, reference, ground connections, ALARM, CLR, BOOST, and the analog outputs of the DAC. Note that DACx750 only features current outputs (IOUT), but also includes a test point for R3-SENSE.

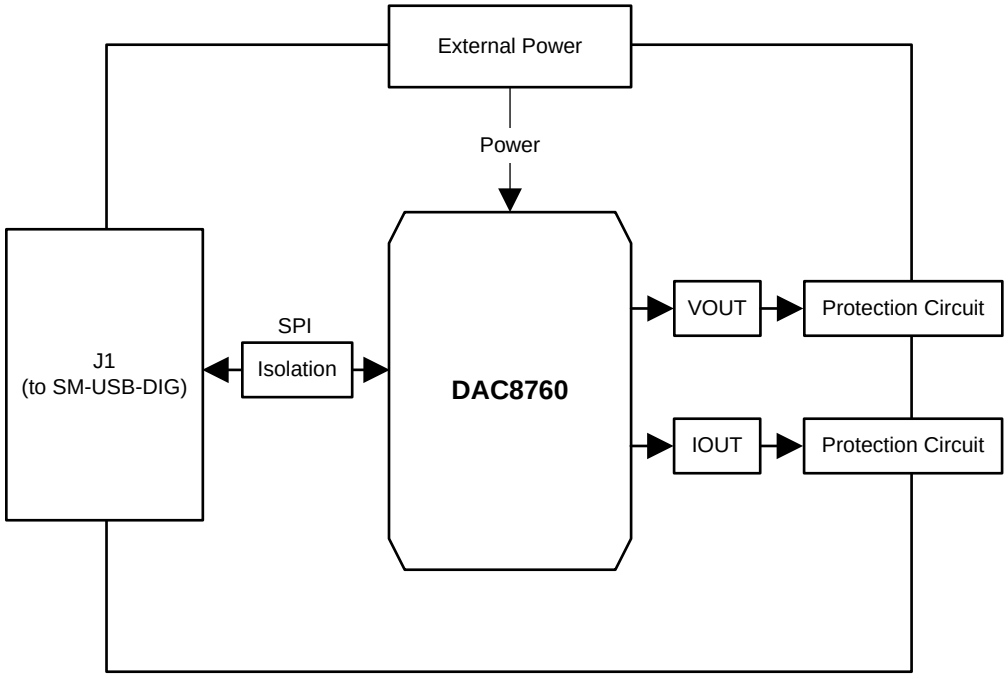


Figure 2. DAC8760EVM Block Diagram

2.2 Signal Definitions of J1 (10-Pin Male Connector Socket)

Table 3 shows the pinout for the 10-pin connector socket used to communicate between the EVM and the SM-USB-DIG. Note that the I^2C communications lines (I2C_SCL and I2C_SDA1) are not used.

Table 3. SM-USB-DIG Connector

Pin On U1	Signal	Description
1	I2C_SCL	I2C Clock Signal (SCL)
2	CTRL/MEAS4	GPIO – Control Output or Measure Input
3	I2C_SDA1	I2C Data Signal (SDA)
4	CTRL/MEAS5	GPIO – Control Output or Measure Input
5	SPI_DOUT1	SPI Data Output (MOSI)
6	VDUT	Switchable DUT Power Supply: +3.3V, +5V, Hi-Z (Disconnected). Note: When VDUT is Hi-Z all Digital I/O are Hi-Z as well.
7	SPI_CLK	SPI Clock Signal (SCLK)
8	GND	Power Return (GND)
9	SPI_CS1	SPI Chip Select Signal ($\overline{CS}$)
10	SPI_DIN1	SPI Data Input (MISO)

2.3 Theory of Operation for SM-USB-DIG Platform

Figure 3 shows the block diagram for the SM-USB-DIG 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 SBOU098, *SM-USB-DIG Platform User's Guide*. The block diagram shown in Figure 3 is given as a brief overview of the platform.

The primary component of the SM-USB-DIG Platform is the TUSB3210, an 8052 microcontroller that has a built-in USB interface. The microcontroller receives information from the host computer that is interpreted into power, I^2C, SPI, and other digital I/O patterns. During the digital I/O transaction, the microcontroller reads the response of any device connected to the I/O interface. The response from the device is then sent back to the computer where it is interpreted by the host computer.

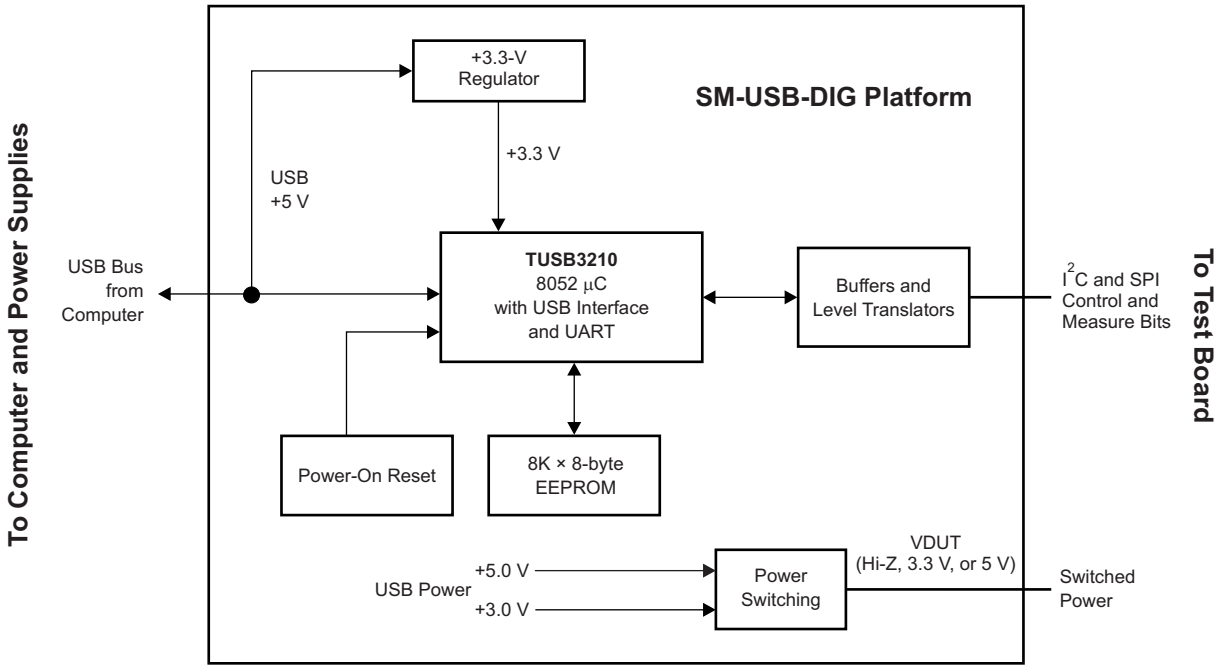


Figure 3. USB-DIG Platform Block Diagram

3 EVM Hardware Overview

To use the EVM hardware, set the jumpers, connect the SM-USB-DIG and the EVM together, apply external power, and connect the USB cable from the SM-USB-DIG to the computer. This section presents the details of these procedures.

3.1 Electrostatic Discharge Warning

While the input and circuitry is protected against electrostatic discharge, there are sensitive paths that can be damaged 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.

3.2 Jumper Summary

To facilitate strong EMC/EMI performance, there are no jumper options present with this EVM.

3.3 Connecting the Hardware

To connect the EVM board and the SM-USB-DIG Platform together, firmly slide the male and female ends of the 10-pin connectors together as shown in Figure 4. Make sure that the two connectors are completely pushed together; loose connections may cause intermittent operation.

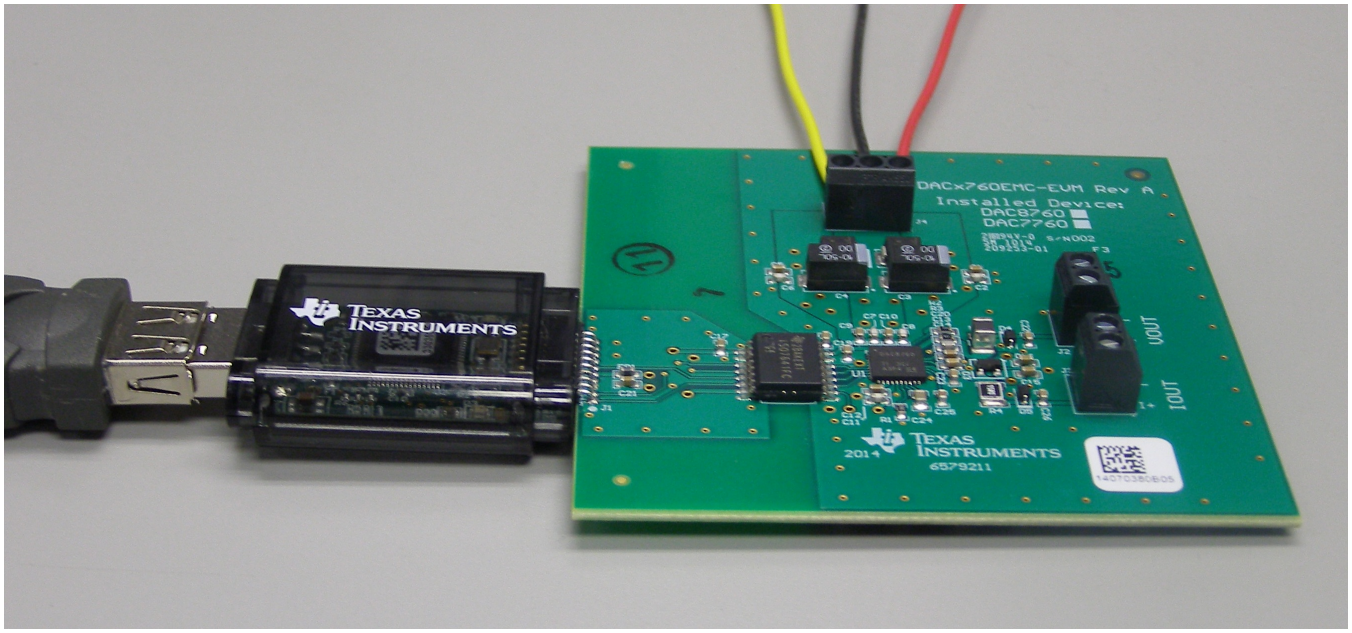


Figure 4. SM-USB-DIG Connection to the DAC8760EVM

3.4 Connecting the USB Cable to the SM-USB-DIG Platform

Figure 5 shows the typical response to connecting the SM-USB-DIG Platform 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 SM-USB-DIG Platform uses the human interface device drivers that are included in the Microsoft® 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 5. Confirmation of SM-USB-DIG Platform Driver Installation

3.5 Powering the EVM

This section describes the various power configurations that can be used by the EVM.

3.5.1 AVDD and AVSS Power Configurations

Terminal block J2 allows for external voltage sources to be connected to the AVDD and AVSS supply rails of the DACx760. Note that the DACx750 devices feature only AVDD supplies. The DACx760EMC-EVM only requires an AVSS supply if the DACx760 is used in ±5 V or ±10 V mode. If bipolar output is not required, jumper JP1 can be shunted to connect AVSS to GND, or GND may be connected at J2. AVDD and AVSS are protected to the datasheet absolute maximum potentials by transient-voltage-suppression (TVS) diodes D2, D3, and D5.

3.5.2 DVDD Power Configurations

Terminal block J1 allows for an external voltage source to be connected to the DVDD pin of the DACx760 or DACx750. The EVM receives power from the SM-USB-DIG Platform when JP9 is installed. An external power source can be used when JP9 is removed and JP3 is installed. Note that if an external DVDD is used, it must be set to the same voltage as the SM-USB-DIG Platform for successful SPI communication alongside the SM-USB-DIG. The DVDD input is protected to the datasheet absolute maximum input by D1.

The DACx760 and DACx750 feature internal regulators that can be used to provide DVDD supplies. By removing JP3, the DACx760 or DACx750 provide the DVDD supply. In this configuration, JP9 must be removed and no external supply can be connected.

3.6 EVM Features

This evaluation platform has an output protection circuit designed to withstand the electrostatic discharge (ESD), electrically fast transient (EFT), conducted immunity (CI), and radiated immunity (RI) immunity tests as described by the IEC61000-4 test suite. For full details concerning the design of these circuits and the design considerations for the layout of this PCB, please refer to TIPD153.

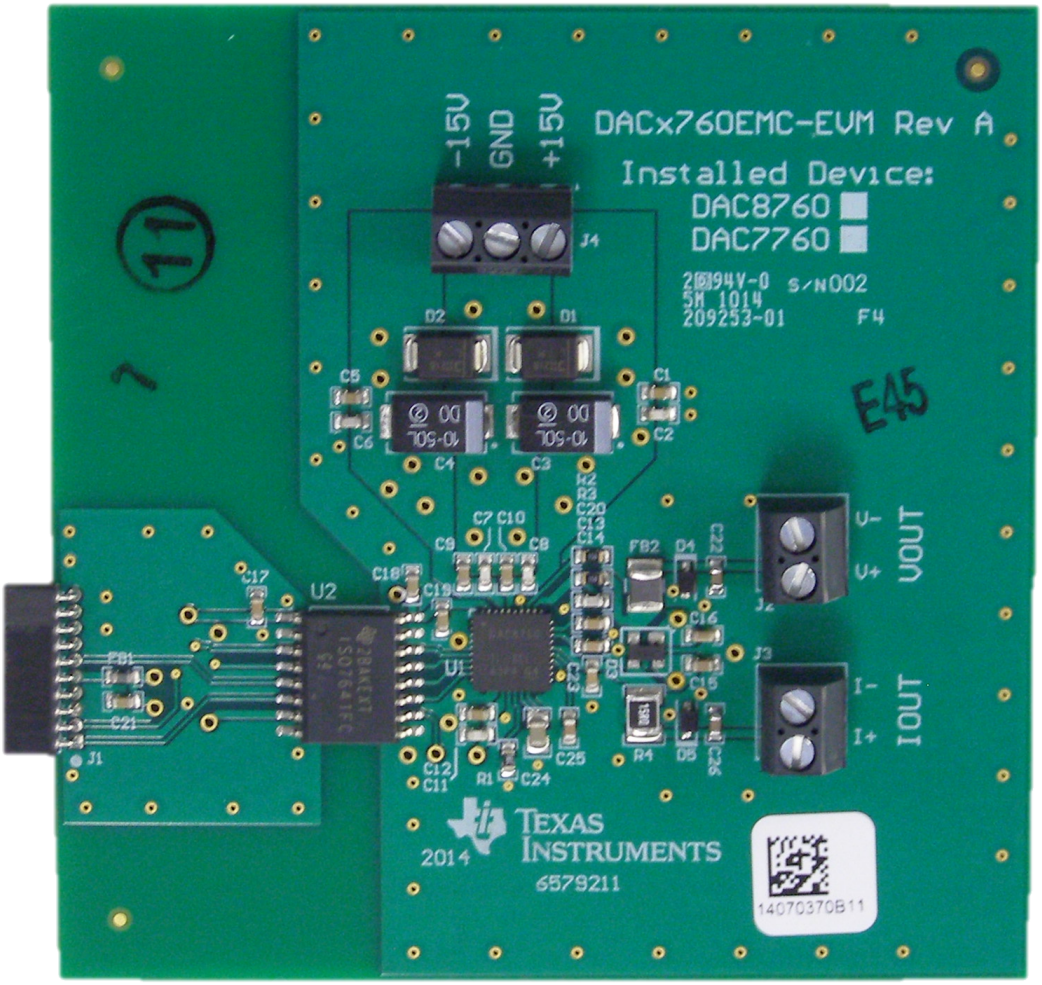


Figure 6. Hardware Features

4 EVM Software Setup

This section discusses how to install the EVM software.

4.1 Operating Systems for EVM Software

The EVM software has been tested on the Windows XP and Windows 7 operating systems with United States and European regional settings. The software should also function on other Windows operating systems.

4.2 EVM Software Installation

The EVM software is included on the CD that is shipped with the EVM kit. It is also available through the EVM product folder on the TI website. To install the software, insert the included CD into an available CD-ROM drive. Navigate to the drive contents and open the DAC8760EVM software folder. Locate the compressed file named *DACx760EMC-EVM.zip* or *DACx750EMC-EVM.zip* and open it. Extract the EVM files into a specific folder (for example, C:\DAC8760EVM) on your hard drive.

After the files are extracted, navigate to the folder you created on your hard drive. Locate and execute the *setup.exe* file to start the installation, as shown in Figure 7. The DAC8760 software installer file then opens to begin the installation process.

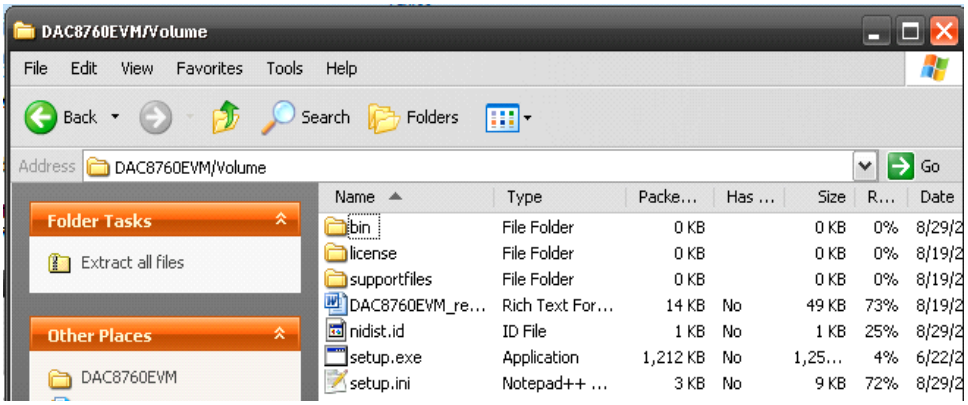


Figure 7. DAC8760EVM Installer

After the installation process initializes, the user is given a choice of selecting the installation directory, usually defaulting to *C:\Program Files\DAC8760EVM* and *C:\Program Files\National Instruments* as shown in Figure 8.

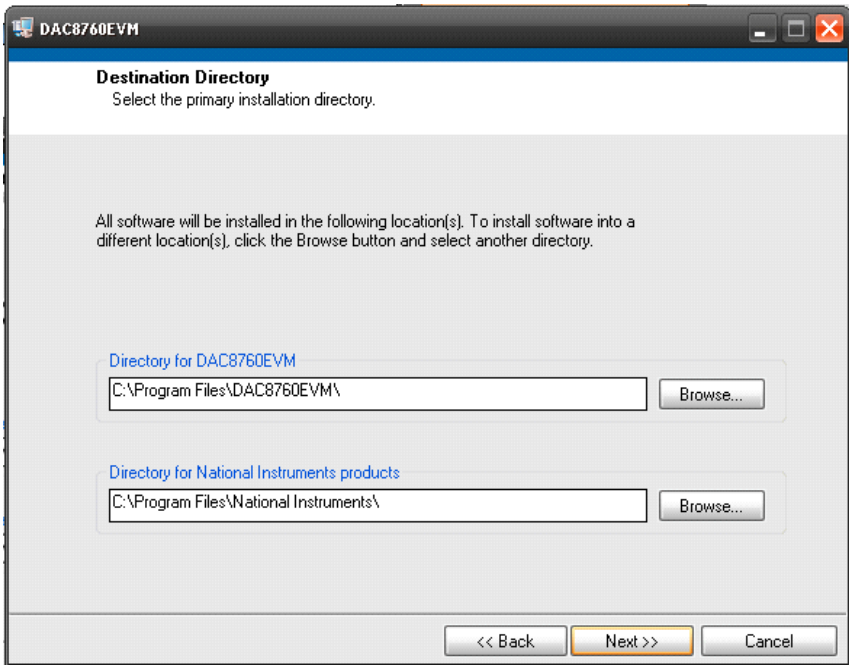


Figure 8. DAC8760EVM Install Path

After selecting the installation directory, two license agreements are presented that must be accepted, as shown in Figure 9.

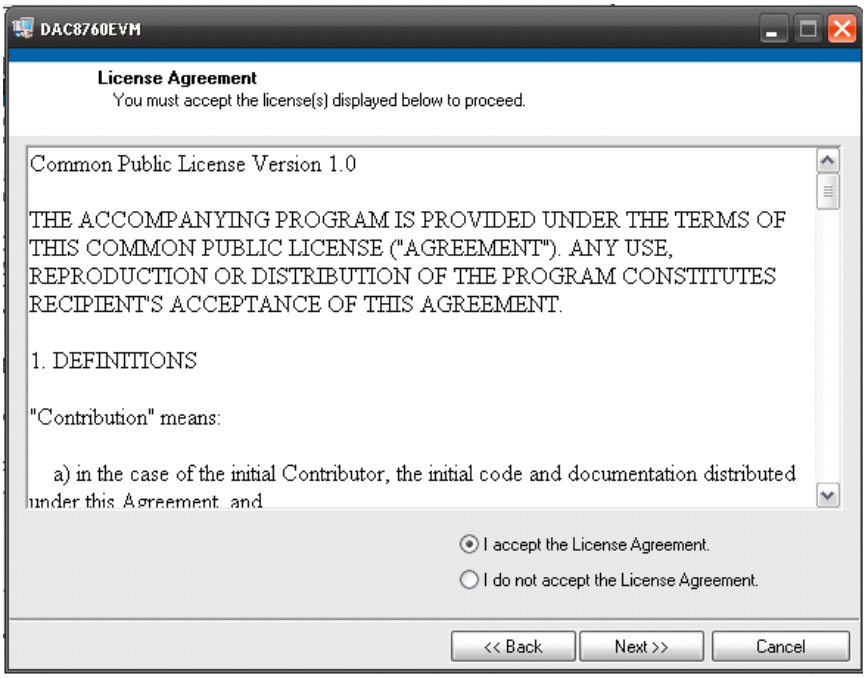


Figure 9. DAC8760EVM Software License Agreements

After accepting the Texas Instruments and National Instruments license agreements, the progress bar opens and shows the installation of the software. Once the installation process is completed, click *Finish*.

5 EVM Software Overview

This section describes the use of the EVM software.

5.1 Starting the EVM Software

The EVM software can be operated through the Windows start menu. From the start menu, select *All Programs*, and then select *DAC8760EVM*. Figure 10 illustrates how the software should appear at launch if the EVM is functioning properly.

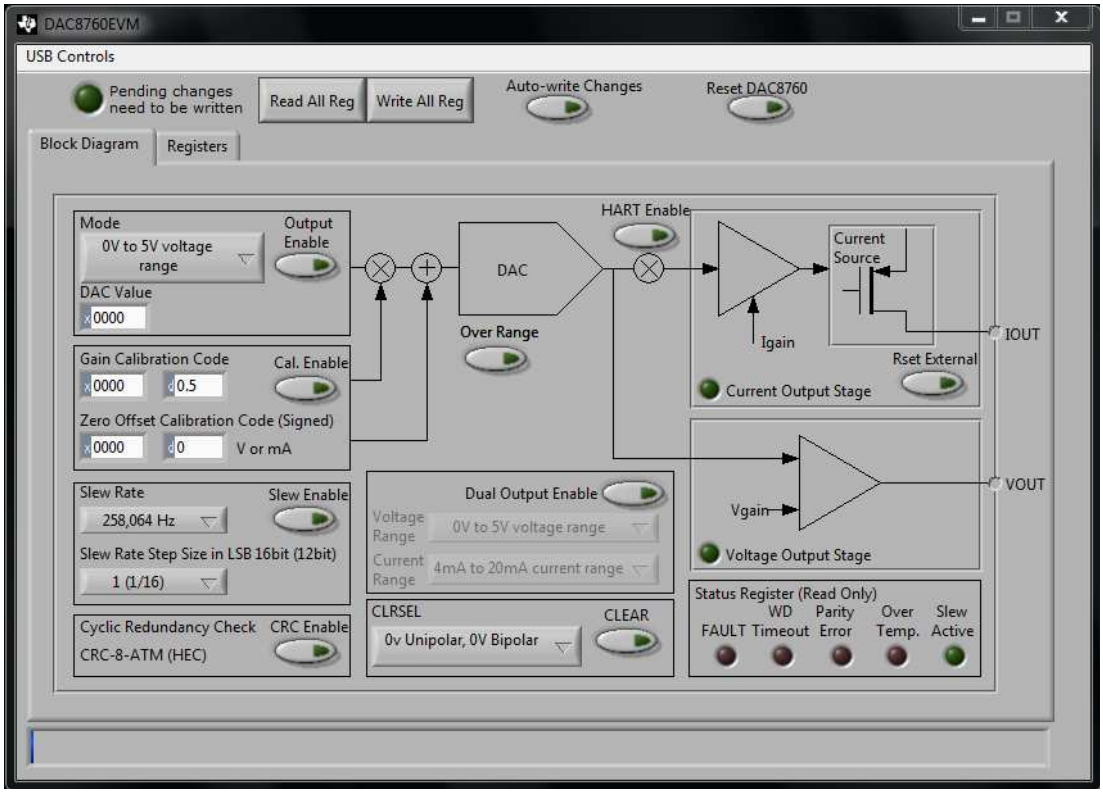


Figure 10. DAC8760EVM Software Interface

Figure 11 shows an error window that appears if the PC cannot communicate with the EVM. In the event you receive this error, first ensure that the USB cable is properly connected on both ends. This error can also occur if you connect the USB cable before the SM-USB-DIG Platform power source. Another possible source for this error is a problem with the USB human interface device driver on your PC. Make sure that the device is recognized when the USB cable is plugged in, indicated by a Windows-generated confirmation sound.

Figure 11. Communication Error with SM-USB-DIG Platform

5.2 EVM Software Features

5.2.1 Registers Tab

The EVM software features a tab devoted to reading and writing directly to the registers found on the DACx760 and DACx750, as shown in Figure 12. By selecting a register in the register table, the individual bits can be set in the *Register Value* section of the tab. The function of each bit can be found in the DACx760 and DACx750 data sheets, or by clicking the *Help w/ Reg* button. Note that read-only registers cannot have their values changed in this tab.

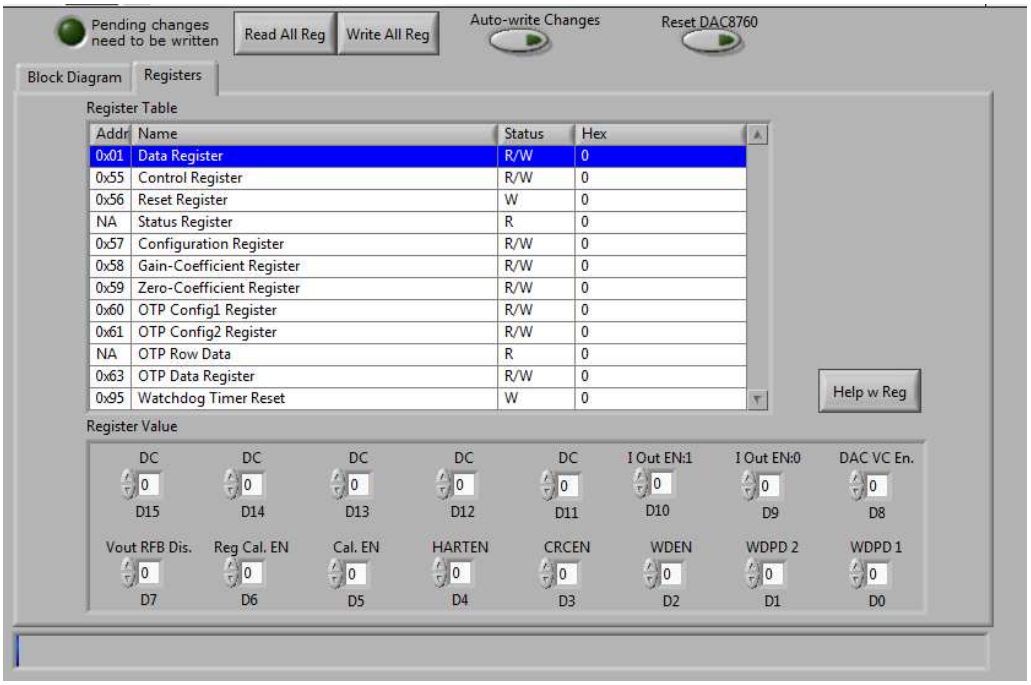


Figure 12. Registers Tab

5.2.2 Reading From and Writing to Registers

The EVM software only reads from and writes to the DACx760 and DACx750 registers at the user's command. These actions are accomplished with the *Read All Reg* and *Write All Reg* buttons. When any change is made to the configuration register in the *Registers* tab or the *Block Diagram* tab, the green light is on to show that changes are pending, as shown in Figure 13.

Figure 13. Read, Write, and Auto-Write Buttons

Pressing the *Write All Reg* button writes the pending changes to the DACx760 or DACx750. In addition, by enabling the *Auto-Write* button, changes are written to the configuration register automatically.

The registers in the DACx760 and DACx750 are read when the *Read All Reg* button is pressed. Perform a read after writing to the device configuration register to verify that the DACx760 or DACx750 successfully stored the data.

More information about the individual registers can be found by pressing the *Help w/ Reg* button.

5.2.3 Software Reset

Figure 14 shows the *Reset DAC8760* button. This button resets the DAC8760 back to the default power-on state after the change is written to the DAC.

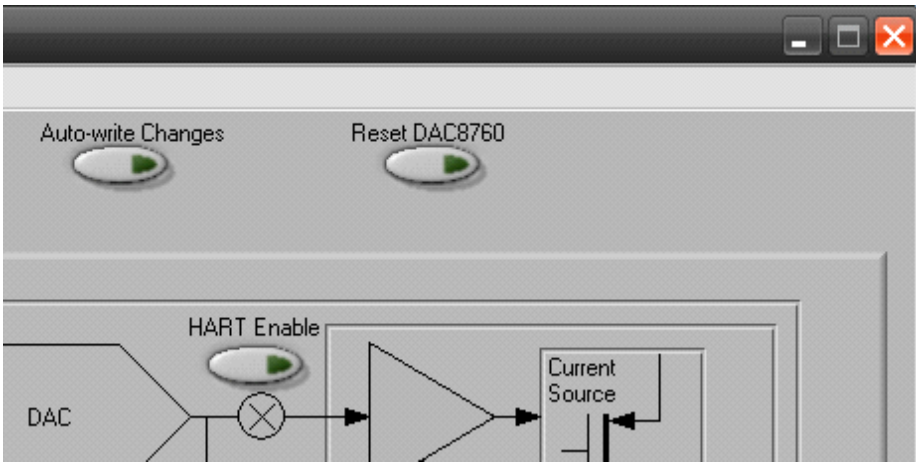


Figure 14. Resetting DAC8760

5.2.4 Setting the Output

The *Mode* section of the *Block Diagram* tab allows for the configuration of the output range, output enable, and output value to be set, as shown in Figure 15.

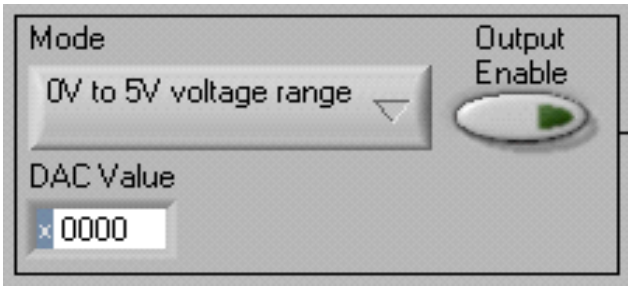


Figure 15. Mode Selection

The *DAC Value* field must be rewritten to the DACx760 or DACx750 when the range is changed because the DAC value is reset. The *Output Enable* toggle button sets the OUTEN bit in the control register to high, which enables either the I_{OUT} or V_{OUT} functions.

5.2.5 Dual Output Enable (DACx760 devices only)

The DACx760 devices that feature both current and voltage outputs also feature a dual output enable option. This feature is not included on the DACx750 current output only devices. To enable dual outputs toggle the *Dual Output Enable* button shown in Figure 16 and select a voltage and current output range. The *Output Enable* and *DAC Value* shown in Figure 15 are used in dual output mode to enable the pair of outputs and to set the output code.

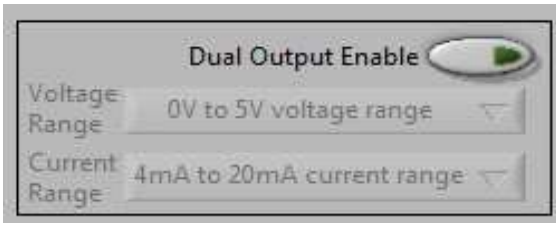


Figure 16. Dual Output Enable

5.2.6 Enabling Voltage Overrange (DACx760 devices only)

Figure 17 shows the *Over Range* toggle button. This button enables the DACx760 overrange function, which increases the voltage output range by 10% (not included in DACx750 devices).

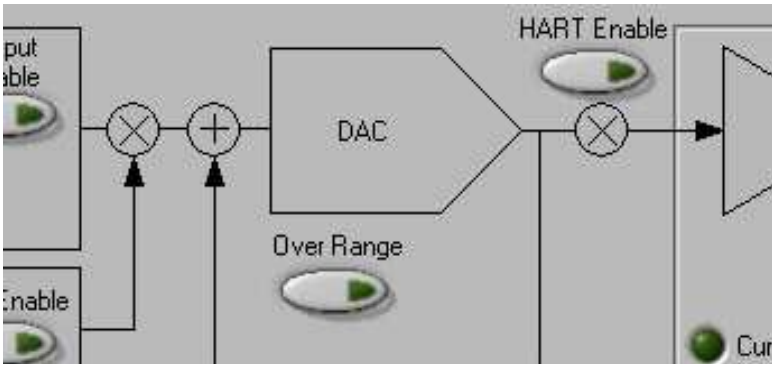


Figure 17. Enabling Over-Range Operation

5.2.7 Accessing Calibration Registers

The DACx760 and DACx750 feature programmable gain and offset functions. Set the gain and offset with the *Gain Calibration Code* and *Zero Offset Calibration Code* fields. As shown in Figure 18, the fields on the left allow a 16-bit hex value to be entered directly, and the fields on the right allow decimal values to be used. The *Cal. Enable* toggle button applies the gain and offset to the data register. After reading all registers, the *DAC Value* field shows the changes.

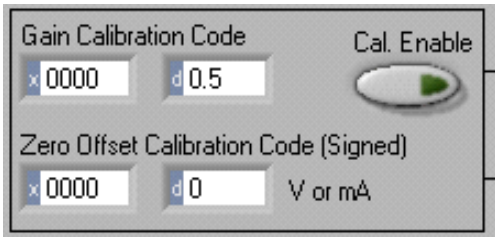


Figure 18. Calibration Registers

5.2.8 Slew Rate Configuration

Use the *Slew Rate* section of the *Block Diagram* tab, as shown in Figure 19, to set the various slew-rate controls. The *Slew Rate* drop-down menu sets the slewing frequency. The *Slew Rate Step Size* drop-down menu sets the step size, which is listed in LSB increments with the 12-bit step sizes in parentheses. The *Slew Enable* toggle button enables the programmed slew rates and step size on the DAC.

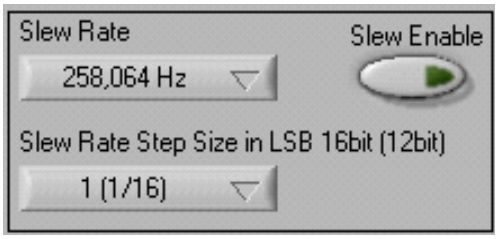


Figure 19. Setting Slew Rates

5.2.9 Cyclic Redundancy Check

The *CRC Enable* toggle button enables the DACx760 or DACx750 cyclic redundancy check function. When the button is pressed, the EVM software informs the user that the configuration register will be written to immediately, as shown in Figure 20. It is written immediately to make sure that any other pending changes are written to the DACx760 or DACx750 with the correct CRC value.

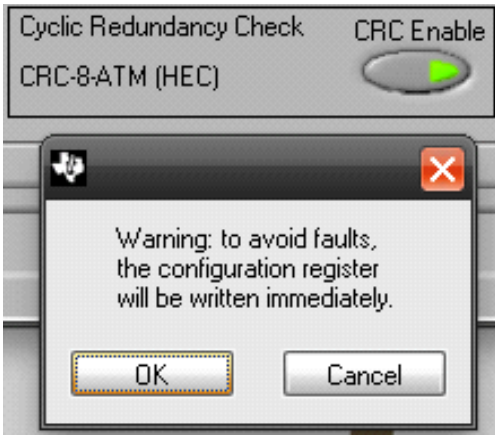


Figure 20. CRC Enable and Dialog

5.2.10 Clear Functionality

The *CLRSEL* drop-down menu, as shown in Figure 21, sets the value of VOUT after a power-on and reset occur. The *CLEAR* button sets the CLR pin high, resulting in a *clear* state. Note that the DACx760 and DACx750 set the voltage out to midscale (negative full-scale when in bipolar mode for DACx760 devices) if either the CLR-SEL pin is high or the register is set to midrange.

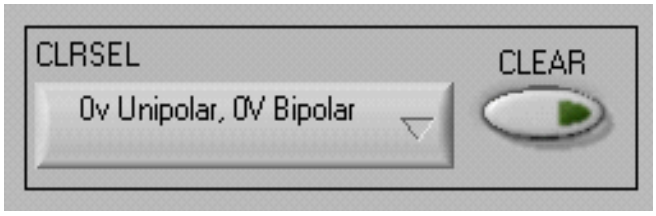


Figure 21. CLRSEL Drop-Down Menu and Clear Button

6 PCB Assembly Drawings, Bill of Materials, and Schematics

This section contains the schematics, PCB layouts, and bills of materials for the DACx760EMC-EVM and DACx750EMC-EVM. Documentation information for the SM-USB-DIG Platform can be found in SBOU098, *SM-USB-DIG Platform User's Guide*, available at the TI web site at http://www.ti.com.

6.1 DACx760EMC-EVM Assembly Drawing

Figure 22 shows the assembly drawing of the components for the DACx760EMC-EVM board.

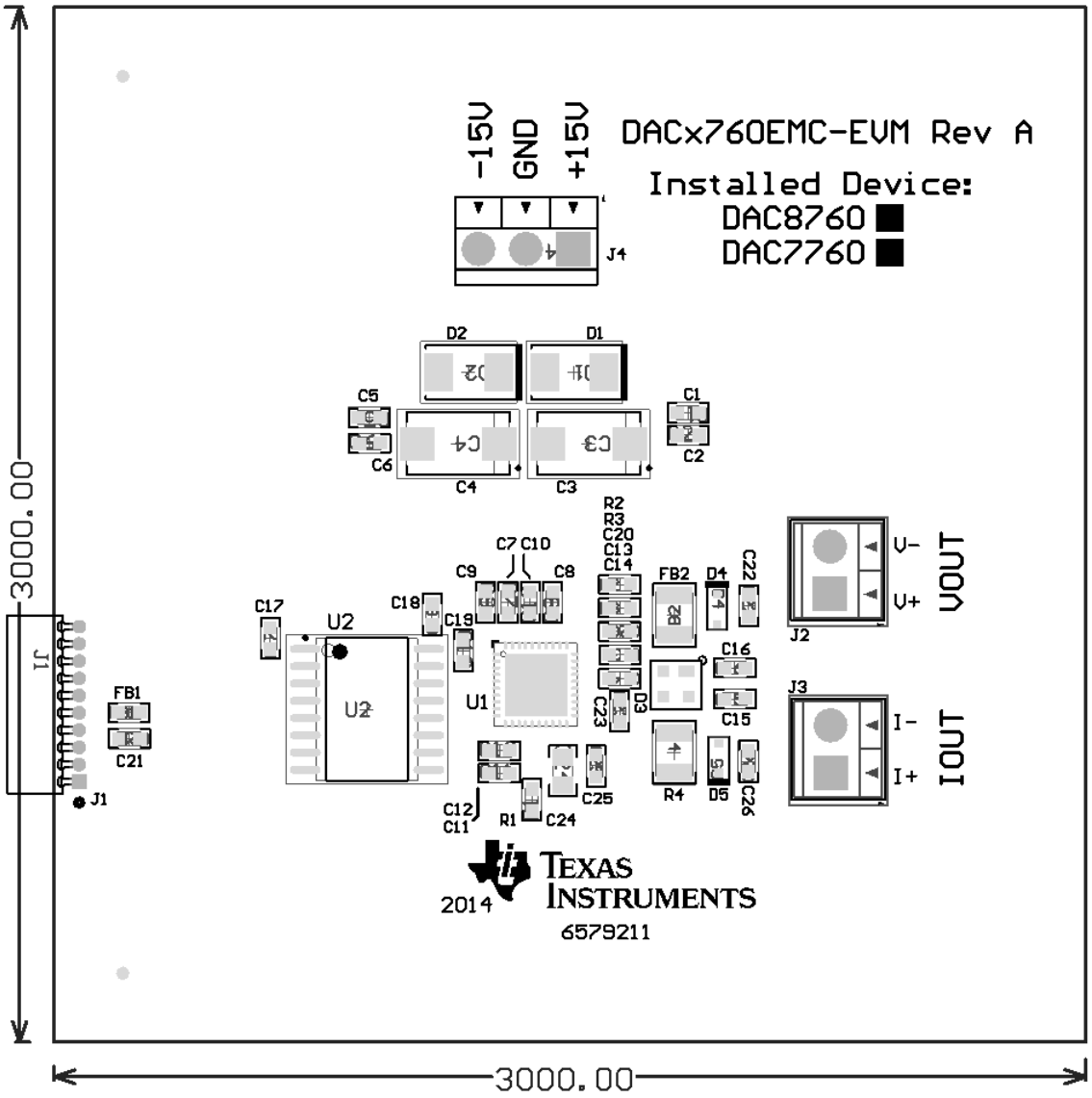


Figure 22. DACx760EMC-EVM Assembly Drawing

6.2 DACx760EMC-EVM Bill of Materials

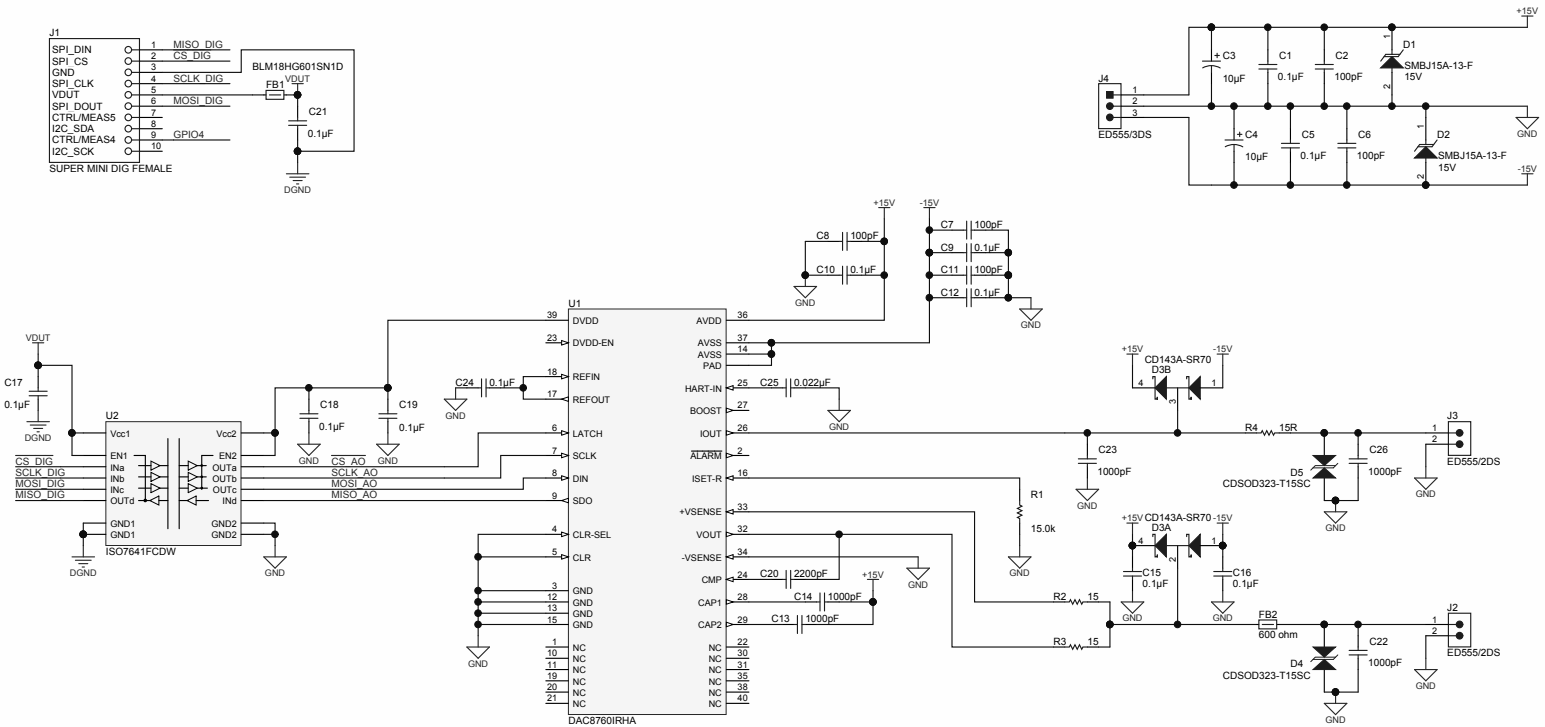
DACx760EMC-EVM Bill of Materials lists the bill of materials for the DACx760EMC-EVM.

DACx760EMC-EVM Bill of Materials

	Qty					
Item	**DAC8760**	**DAC7760**	**Designator**	**Description**	**Manufacturer**	**Part Number**
1	1	1		Printed Circuit Board	Any	6579211
2	11	11	C1, C5, C9, C10, C12, C15, C16, C17, C18, C19, C21	CAP, CERM, 0.1uF, 50V, +/-10%, X7R, 0603	MuRata	GRM188R71H104KA93D
3	5	5	C2, C6, C7, C8, C11	CAP, CERM, 100pF, 50V, +/-5%, C0G/NP0, 0603	AVX	06035A101JAT2A
4	2	2	C3, C4	CAP, TANT, 10uF, 50V, +/-10%, 0.8 ohm, 7343-43 SMD	Vishay-Sprague	293D106X9050E2TE3
5	3	3	C13, C14, C23	CAP, CERM, 1000pF, 100V, +/-10%, X7R, 0603	MuRata	GRM188R72A102KA01D
6	1	1	C20	CAP, CERM, 2200pF, 50V, +/-5%, C0G/NP0, 0603	MuRata	GRM1885C1H222JA01D
7	2	2	C22, C26	CAP CER 0.1UF 100V 10% X7R 0603	MuRata	GRM188R72A104KA35J
8	1	1	C24	CAP, CERM, 0.1uF, 50V, +/-5%, X7R, 0805	AVX	08055C104JAT2A
9	1	1	C25	CAP, CERM, 0.022uF, 50V, +/-10%, X7R, 0603	TDK	C1608X7R1H223K
10	2	2	D1, D2	Diode, TVS, Uni, 15V, 600W, SMB	Diodes Inc.	SMBJ15A-13-F
11	1	1	D3	IC TVS ARRAY 2-LINE 70V SOT-143	Bourns	CD143A-SR70
12	2	2	D4, D5	DIODE TVS ARRAY 15V SOD323	Bourns	CDSOD323-T15SC
13	1	1	FB1	FERRITE CHIP 600 OHM 200MA 0603	MuRata	BLM18HG601SN1D
14	1	1	FB2	3A Ferrite Bead, 600 ohm @ 100MHz, SMD	Taiyo Yuden	FBMH3225HM601NT
15	1	1	J1	Receptacle, 50mil 10x1, R/A, TH	Mill-Max	851-43-010-20-001000
16	2	2	J2, J3	Terminal Block, 6A, 3.5mm Pitch, 2-Pos, TH	On-Shore Technology	ED555/2DS
17	1	1	J4	Terminal Block, 6A, 3.5mm Pitch, 3-Pos, TH	On-Shore Technology	ED555/3DS
18	1	1	R1	RES, 15.0k ohm, 0.1%, 0.1W, 0603	Yageo America	RT0603BRD0715KL
19	2	2	R2, R3	RES, 15 ohm, 5%, 0.1W, 0603	Vishay-Dale	CRCW060315R0JNEA
20	1	1	R4	RES 15 OHM 1/2W 1% 1210 SMD	Panasonic	ERJ-14NF15R0U
21	1	0	U1	Single-Channel, 16-Bit Programmable Current Output and Voltage Output DIGITAL-TO-ANALOG CONVERTER for 4-mA to 20-mA Current Loop Applications, RHA0040C	Texas Instruments	DAC8760IRHA
	0	1		Single-Channel, 12-Bit Programmable Current Output and Voltage Output DIGITAL-TO-ANALOG CONVERTER for 4-mA to 20-mA Current Loop Applications, RHA0040C	Texas Instruments	DAC7760IRHA
22	1	1	U2	ISOLATOR DGTL 25MBPS 4CH 16SOIC	Texas Instruments	ISO7641FCDW

6.3 DACx760EMC-EVM Board Schematic

The EVM schematic is appended to the end of this user's guide.



Designed for: Public Release		Mod. Date: 3/12/2014	
Project Title: Change in menu Project|Project Options|Parameter			
Number: 6579211	Rev: A	Sheet Title:	
SVN Rev: Not in version control		Assembly Variant: Variant name not interpreted	Sheet: 1 of 1
Drawn By:		File: DAC8760EMC-EVM_A.SchDoc	Size: B
Engineer: Enter name of project lead		Contact: http://www.ti.com/support	http://www.ti.com

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10. User has sole responsibility to ensure the safety of any activities to be conducted by it and its employees, affiliates, contractors or designees, with respect to handling and using EVMs. Further, user is responsible to ensure that any interfaces (electronic and/or mechanical) between EVMs 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.
11. User shall employ reasonable safeguards to ensure that user's use of EVMs will not result in any property damage, injury or death, even if EVMs should fail to perform as described or expected.
12. User shall be solely responsible for proper disposal and recycling of EVMs consistent with all applicable federal, state, and local requirements.

Certain Instructions. User shall operate EVMs within TI's recommended specifications and environmental considerations per the user's guide, accompanying documentation, and any other applicable requirements. Exceeding the specified ratings (including but not limited to input and output voltage, current, power, and environmental ranges) for EVMs may cause property damage, personal injury or death. If there are questions concerning these ratings, 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the applicable EVM user's 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, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using EVMs' schematics located in the applicable EVM user's guide. When placing measurement probes near EVMs during normal operation, please be aware that EVMs may become very warm. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use EVMs.

Agreement to Defend, Indemnify and Hold Harmless. User agrees to defend, indemnify, and hold TI, its directors, officers, employees, agents, representatives, affiliates, licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of, or in connection with, any handling and/or use of EVMs. User's indemnity shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if EVMs fail to perform as described or expected.

Safety-Critical or Life-Critical Applications. If user intends to use EVMs in evaluations of safety critical applications (such as life support), and a failure of a TI product considered for purchase by user for use in user's product would reasonably be expected to cause severe personal injury or death such as devices which are classified as FDA Class III or similar classification, then user must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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General Statement for EVMs Not Including a Radio

For EVMs not including a radio and not subject to the U.S. Federal Communications Commission (FCC) or Industry Canada (IC) regulations, TI intends EVMs to be used only for engineering development, demonstration, or evaluation purposes. EVMs are not finished products typically fit for general consumer use. EVMs may nonetheless generate, use, or radiate radio frequency energy, but have not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or the ICES-003 rules. Operation of such EVMs may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: For EVMs including a radio, the radio included in such EVMs is intended for development and/or professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability in such EVMs and their development application(s) must comply with local laws governing radio spectrum allocation and power limits for such EVMs. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by TI unless user has obtained appropriate experimental and/or development licenses from local regulatory authorities, which is the sole responsibility of the user, including its acceptable authorization.

U.S. Federal Communications Commission Compliance

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 could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

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 its own expense.

FCC Interference Statement for Class B EVM devices

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.

Industry Canada Compliance (English)

For EVMs Annotated as IC – INDUSTRY CANADA Compliant:

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs Including Radio Transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

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.

Canada Industry Canada Compliance (French)

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

Important Notice for Users of EVMs Considered "Radio Frequency Products" in Japan

EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If user uses EVMs in Japan, user is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

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.

http://www.tij.co.jp

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