BUF12840EVM User Guide and Software Tutorial

This user's guide describes the characteristics, operation, and use of the BUF12840EVM evaluation board. It discusses how to set up and configure the software and hardware, and reviews various aspects of the program operation. Throughout this document, the terms *evaluation board*, *evaluation module*, and *EVM* are synonymous with the BUF12840EVM. This user's guide also includes information regarding operating procedures and input/output connections, an electrical schematic, and a parts list for the EVM.

Contents

List of Figures

List of Tables

1 Overview

The BUF12840 is a programmable gamma-voltage generator with external EEPROM read capabilities. This device offers two banks of 12 programmable gamma channels, making it ideal for 10-bit source TFT-LCD reference drivers. The BUF12840EVM is a platform for evaluating the performance of the BUF12840 under various signal, reference, and supply conditions. This document gives a general overview of the BUF12840EVM, and provides a general description of the features and functions to be considered while using this evaluation module.

1.1 BUF12840EVM Kit Contents

Figure 1 illustrates the hardware included with the BUF12840EVM 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.

Figure 1. Hardware Included with the BUF12840EVM Kit

Table 1 lists the contents of the BUF12840EVM kit.

Table 1. BUF12840EVM Kit Contents

Item	Quantity
BUF12840 PCB Test Board	1
USB DIG Platform PCB	1
USB Cable	1
Barrel plug cable assembly	1
User's Guide CD-ROM	1

1.2 Related Documentation from Texas Instruments

The following documents provide information regarding Texas Instruments' integrated circuits used in the assembly of the BUF12840EVM. This user's guide is available from the TI web site under literature number SBOU97. 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, 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.

Related Documentation

Document	Literature Number
BUF12840 Product Data Sheet	SBOS536
USB DIG Platform Users Guide	SBOU058

2 BUF12840EVM Hardware Setup

Figure 2 shows the system setup for the BUF12840EVM. The PC runs software that communicates with the USB DIG Platform. The USB DIG Platform generates the analog and digital signals used to communicate with the BUF12840 board. Connectors on the BUF12840 board allow the user to connect to the system under test conditions where the power, current, and voltage are monitored.

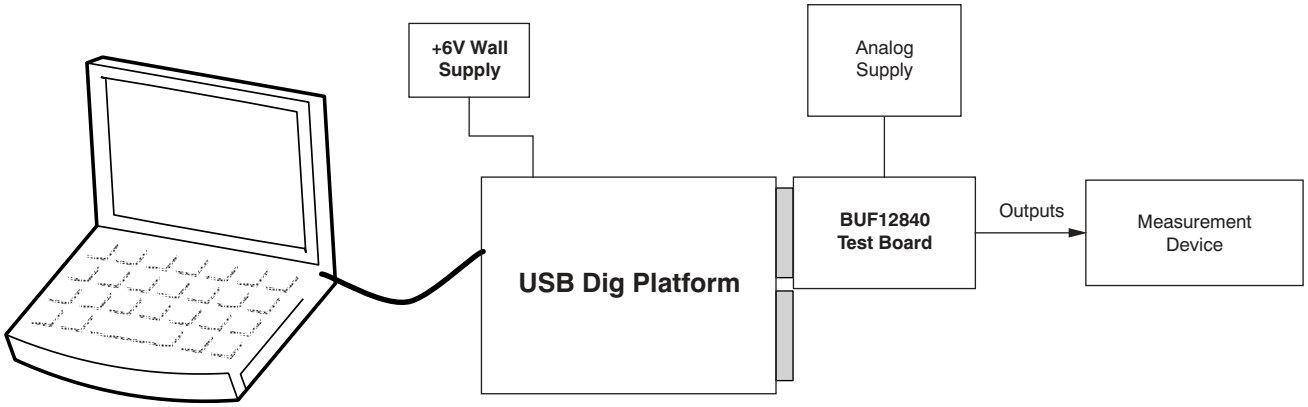

Figure 2. BUF12840EVM Hardware Setup

2.1 Theory of Operation for BUF12840 test board Hardware

Figure 3 presents a block diagram of the BUF12840 board. The functionality of this PCB is relatively simple. It provides connections to the I²C™ interface and general-purpose input/outputs (GPIO) on the USB DIG Platform board. It also provides connection points for external connections of the shunt voltage, bus voltage, and ground.

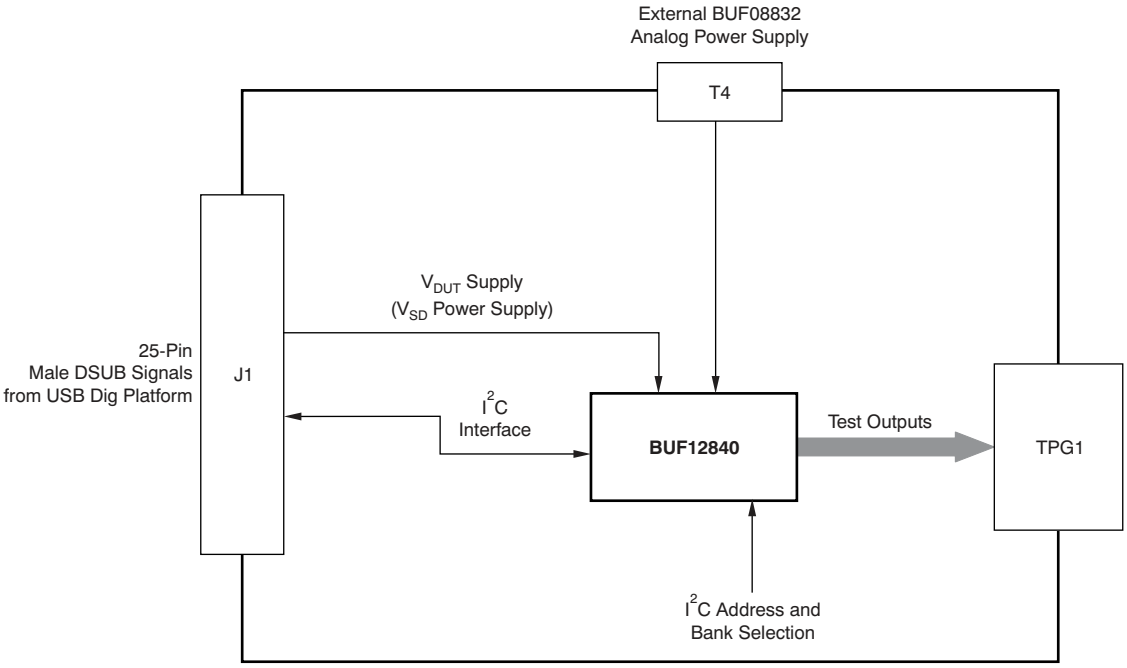

Figure 3. BUF12840 Test Board Block Diagram

2.2 Signal Definitions of J1 (25-Pin Male DSUB)

Table 2 lists the various signals connected to J1 on the BUF12840 test board. Table 2 also identifies signals connected to pins on J1 that are not used on the BUF12840 test board.

Table 2. Signal Definition of J1 (25-Pin Male DSUB) on BUF12840 Board

Pin	Signal	BUF12840 Pin
1	N/C	No connection
2	N/C	No connection
3	N/C	No connection
4	N/C	No connection
5	N/C	No connection
6	N/C	No connection
7	N/C	No connection
8	N/C	No connection
9	I2C_SCK	No connection
10	I2C_SDA2	No connection
11	N/C	No connection
12	I2C_SCK_ISO	I^2C clock signal (SCL) channel 1; can be disconnected using a switch
13	I2C_SDA_ISO	I^2C data signal (SDA) channel 1; can be disconnected using a switch
14	N/C	No connection
15	N/C	No connection
16	N/C	No connection
17	Vdut	Switched 3V/5V power. Note that when power is switched off, digital I/O is also switched off.
18	Vcc	No connection
19	N/C	No connection
20	N/C	No connection
21	GND	Common ground connection
22	SPI_SCK	No connection
23	SPI_CS1	No connection
24	SPI_DOUT1	No connection
25	SPI_DIN1	No connection

2.3 Theory of Operation for USB_DIG_Platform

Figure 4 shows the block diagram for the 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 its operation are included in a separate document, SBOU058 (available for download at www.ti.com). The block diagram shown in Figure 4 gives a brief overview of the platform. The primary control device on the USB DIG Platform is the TUSB3210. The barrel connector cable assembly included in the EVM kit can be used to connect an external power supply to the USB DIG through J5.

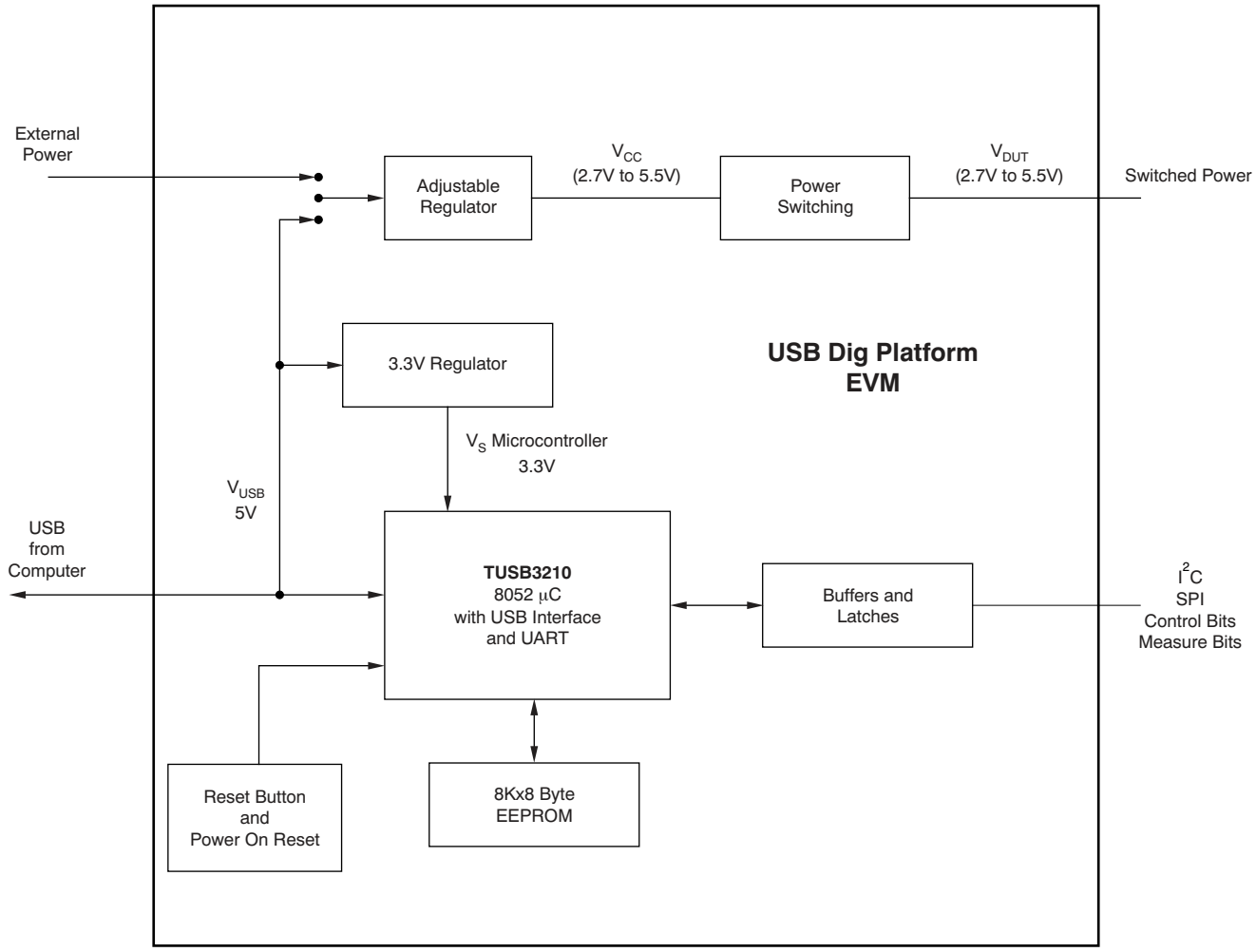

Figure 4. USB_DIG_Platform Theory of Operation

3 BUF12840EVM Hardware Overview

The BUF12840EVM hardware overview involves connecting the two PCBs of the EVM together, applying power, connecting the USB cable, and setting the jumpers. This section presents the details of this procedure.

3.1 Electrostatic Discharge Warning

CAUTION

Many of the components on the BUF12840EVM 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.

3.2 Typical Hardware Connections

To set up the BUF12840EVM hardware, connect the two PCBs of the EVM together, and apply a power source to the BUF12840 Test Board. The external connections may be the real-world system that the BUF12840 will be incorporated into. Figure 5 illustrates the typical hardware connections.

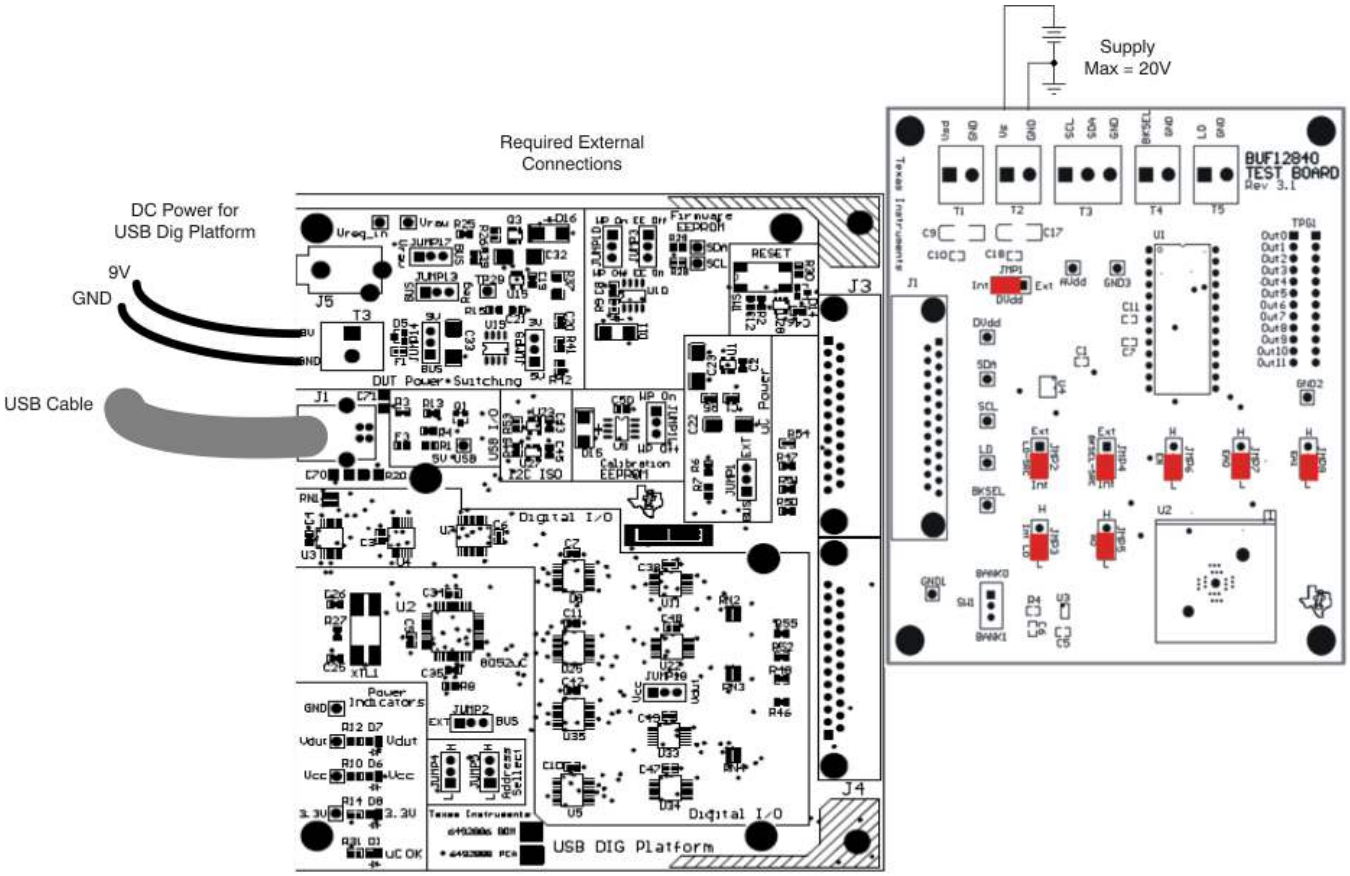

Figure 5. Typical Hardware Connections

3.3 Connecting the Hardware

To connect the two PCBs of the BUF12840EVM together, gently push on both sides of the DSUB connectors (as shown in Figure 6). Make sure that the two connectors are completely pushed together; loose connections may cause intermittent operation.

3.4 Connecting Power

After the two parts of the BUF12840EVM are connected, as Figure 6 shows, connect the power to the EVM. Always connect power before connecting the USB cable. If you connect the USB cable before connecting the power, the computer will attempt to communicate with an unpowered device that will not be able to respond.

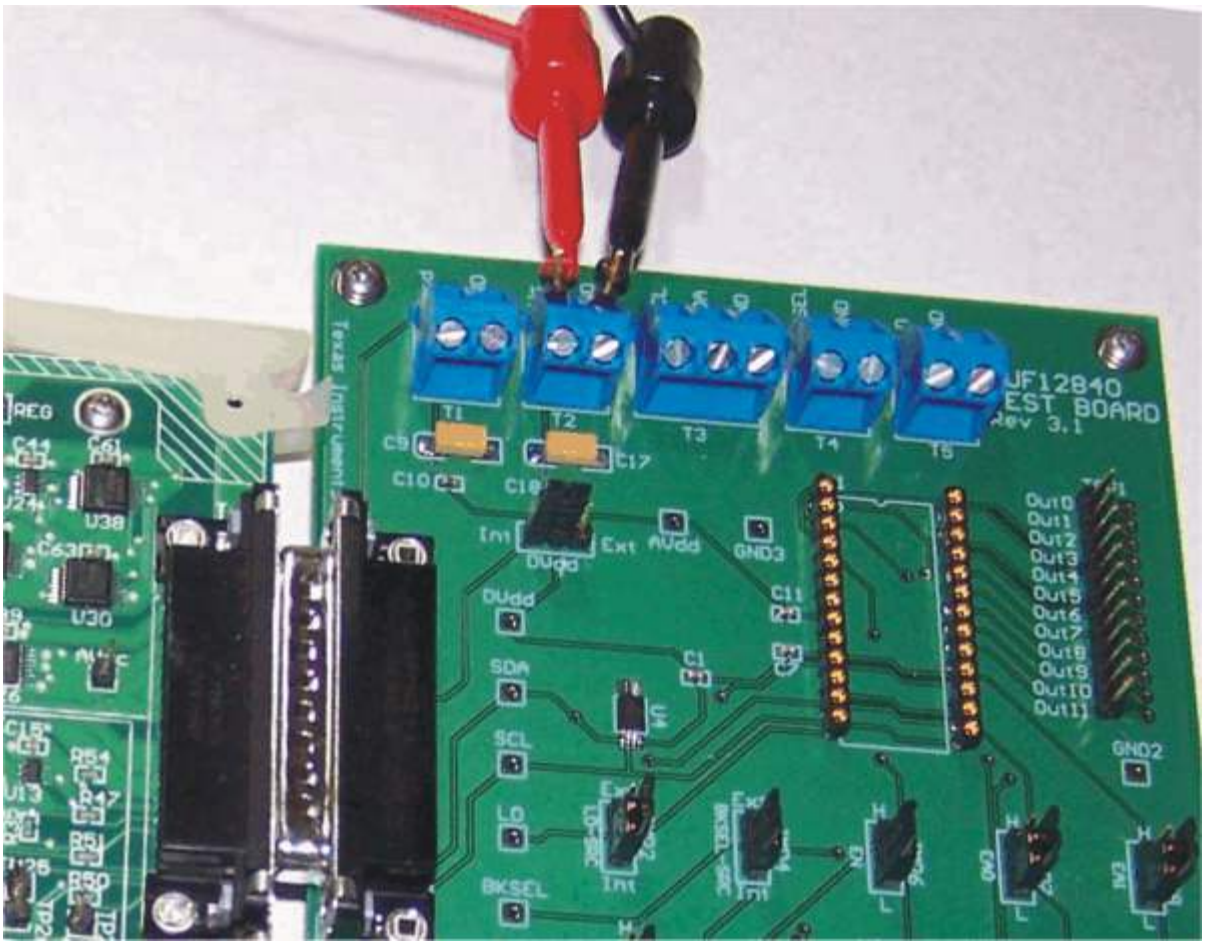

Figure 6. Connecting External Power to the EVM

In addition, the BUF12840EVM also requires an external power source. This source is not included with the kit, and its voltage may differ depending on your specific testing needs, and it will be connected to the terminal T2, as Figure 6 illustrates.

3.5 Connecting the USB Cable to the DIG Platform

Figure 7 shows the typical response to connecting the USB DIG Platform board to a PC USB port for the first time. Note that the EVM must be powered on before connecting the USB cable. Typically, the computer will respond with a *Found New Hardware, USB Device* pop-up dialog. The pop-up window typically changes to *Found New Hardware, USB Human Interface Device*. This pop-up indicates that the device is ready to be used. The USB DIG Platform uses the human interface device drivers that are part of the Microsoft® Windows® operating system.

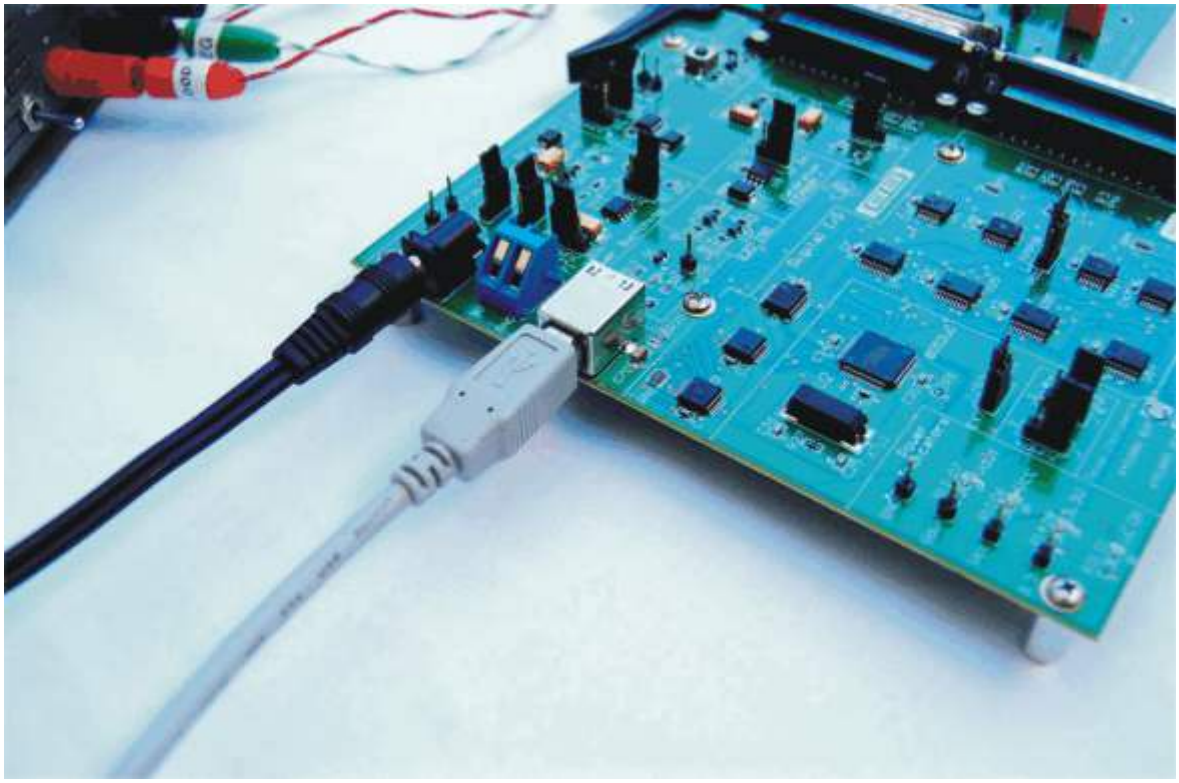

Figure 7. Connecting the USB Cable

In some cases, the Windows *Add Hardware Wizard* will pop up. If this prompt occurs, allow the system device manager to install the human interface drivers by clicking **Yes** when requested to install drivers. Windows then confirms the successful driver installation with the message shown in Figure 8.

Figure 8. USB DIG Platform Driver Installation Confirmation

3.6 BUF12840EVM Default Jumper Settings

Figure 9 shows the default jumpers configuration for the BUF12840EVM. In general, the jumper settings of the USB DIG Platform will not need to be changed. You may want to change some of the jumpers on the BUF12840 test board to match your specific configuration. For instance, you may wish to set a specific I^2C address.

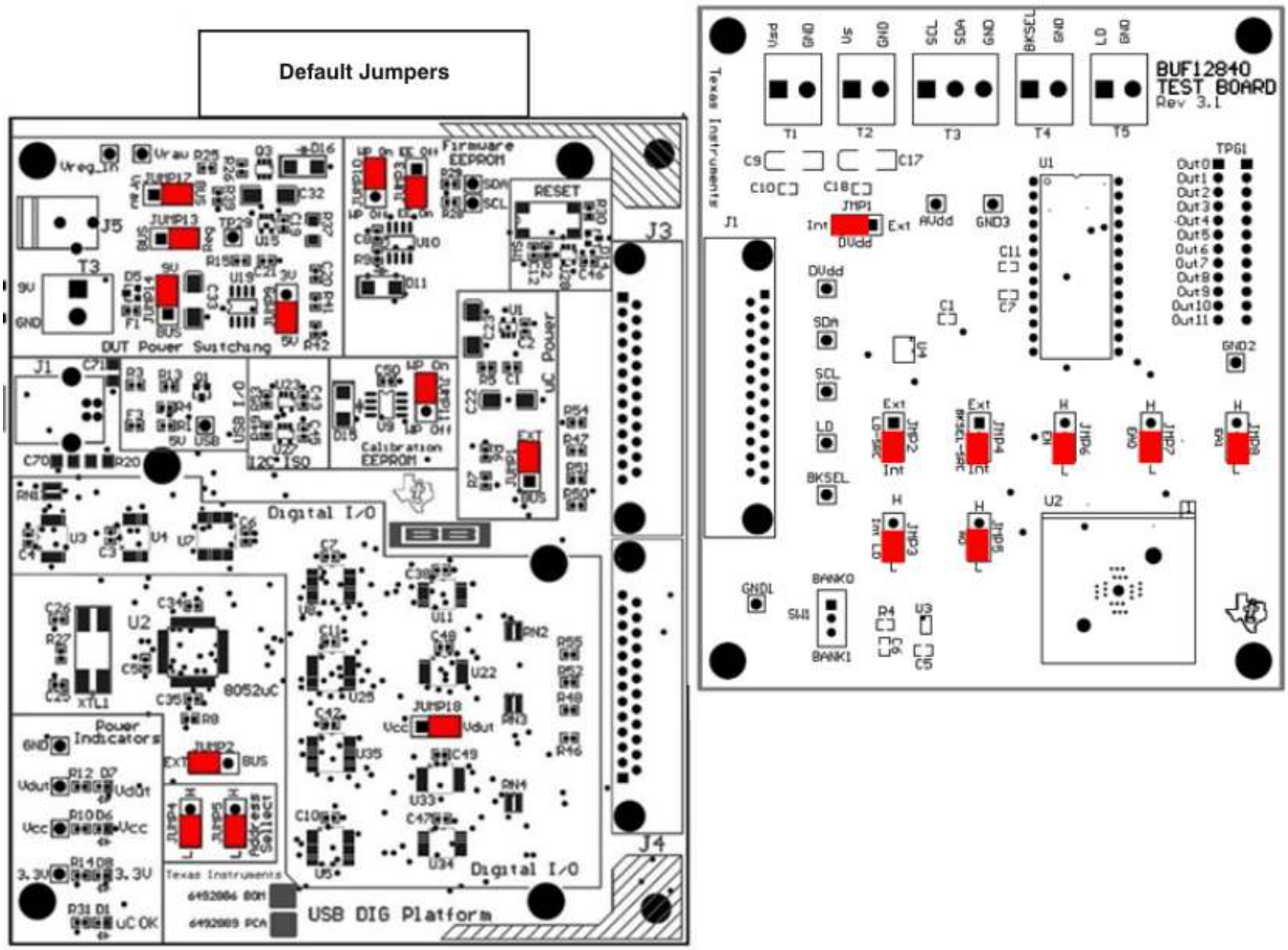

Figure 9. BUF12840EVM Default Jumper Settings

Jumpers 1 through 8 on the BUF12840EVM are all typically set to the same position. When set to the INT position, the signals from the digital supply, bank select, and the LD are generated and controlled from the USB DIG Platform, by the onboard bank select switch, and by the Int LD jumper, respectively. When these jumpers are set the EXT position, these signals connect to the terminal strips T1, T4, and T4. Jumper 5 controls the I^2C address pin for the BUF12840. This jumper can set the address for A0 to either high or low. Jumpers 6, 7, and 8 control the EN, EA0, and EA1 pins on the BUF12840; these pins are usually set to *L* for the simplest chip operation.

Table 3 summarizes the function of the BUF12840 test board jumpers. For most applications, Jumpers 1 through 5 are set to the respective default position.

Table 3. BUF12840 Test Board Jumper Functions

Jumper	Default	Purpose
JMP1	Int	This jumper selects whether the V_{SD} pin on the BUF12840 is connected to the V_{DUT} signal generated from the USB DIG Platform, or whether the digital supply pin is connected to terminal T1 to allow for an external supply to power the digital circuitry. The default INT position connects the V_{SD} pin to the V_{DUT} control signal.
JMP2	Int	This jumper selects whether the LD pin on the BUF12840 is controlled by jumper JMP3 or by terminal T5.
JMP3	L	This jumper sets the LD pin on the BUF12840 to high or low (with JMP2 set to Int).
JMP4,	Int	This jumper selects whether the BASEL pin on the BUF12840 is controlled by the manual switch located on the BUF12840 EVM or whether the BASEL can be controlled by an external source connected to terminal T4. The default INT position allows the BASEL pin to be controlled by the manual switch.
JMP5	L	This jumper selects I^2C A0 address selection. Two separate I^2C addresses can be selected, depending upon whether JMP5 is set to high or low.
JMP6	L	This jumper set the EN pin on the BUF12840 is set high or low.
JMP7, 8	L	These jumpers set the EA0 and EA1 pins on the BUF12840. Because this EVM has a 1k EEPROM, the jumpers should always be in the low position.

Table 4 summarizes the function of the USB DIG Platform jumpers. For most applications, the default jumper position should be used. A separate document (SBOU058) gives details regarding the operation and design of the USB DIG Platform.

Table 4. USB_DIG_Platform Jumper Functions

Jumper	Default	Purpose
JUMP1	EXT	This jumper selects external power or bus power. External power is applied on J5 or T3 (9V dc). Bus power is 5V from the USB bus. External power is typically used because the USB Bus power is noisy.
JUMP2	EXT	Same as JUMP1.
JUMP3	EE ON	This jumper determines where the TUSB3210 will load the USB DIG Platform firmware upon power-up or reset. The *EE Off* position is used for development for development or firmware update.
JUMP4, JUMP5	L, L	This jumper sets the address for the USB board. The only reason to change from the default setting is if multiple boards are being used.
JUMP9	5V	This jumper selects the voltage of the device under test supply (V_{DUT} = 5V or 3V). This jumper is typically the only jumper that is changed for most applications.
JUMP10	WP ON	This write protects the firmware EEPROM.
JUMP11	WP ON	This write protects the calibration EEPROM
JUMP13	REG	Uses the regulator output to generate the V_{DUT} supply. The USB bus can be used as the V_{DUT} supply.
JUMP14	9V	Uses the external power (9V as opposed to the bus)
JUMP17	BUS	While in the BUS position V_{DUT} operation is normal. In the V_{RAW} position, the V_{DUT} supply is connected to an external source. This configuration allows for any value of V_{DUT} between 3V and 5V.(1)
JUMP18	V_{DUT}	Connects the pull-up on GPIO to the V_{DUT} supply or the V_{CC} supply.

(1) **CAUTION:** Adjusting outside of this range will damage the EVM.

3.7 BUF12840EVM Features

This section describes some of the hardware features present on the BUF12840EVM.

SW1: Bank Selection Switch

The BASEL switch located on the BUF12840EVM PCB selects the memory bank to be used when operating the EVM. *Bank0* selects the gamma curve that is stored in Bank 0 of the BUF12840 device. *Bank1* selects the gamma curve that is stored in Bank 1 of the BUF12840. Note that this switch is not effective if JMP4 is set to EXT.

JMP1: V_{SD} Control Setting

Jumper JMP1 selects where the BUF12840 digital supply pin is connected. If JMP1 is set to the INT position, the V_{SD} pin is connected to the switchable V_{DUT} signal generated from the USB DIG Platform. This voltage can be set to either 3.3V or 5V, depending on how JUMP9 on the USB DIG Platform is set. While JMP1 is set to the INT position, the **V_{SD} Power** button on the BUF12840 software is able to control whether the V_{DUT} supply voltage is turned on or off.

When JMP1 is set to the EXT position, an external supply connected to terminal T1 can be used to provide the digital supply voltage for the BUF12840.

JMP2: LD Source Control Setting

This jumper controls the source for the LD pin on the BUF12840. In the *Int* position, LD is controlled by JMP3. When set in the *Ext* position the pin is controlled by terminal T5.

JMP3: Int LD

Jumper JMP3 controls the state of the LD pin on the BUF12840. In the *L* position, any changes made to the BUF12840 registers will update the output DACs immediately. In the *H* position, new values in the register do not update the DACs until LD is brought low again.

JMP4: BASEL Source Control Setting

Jumper JMP4 determines what controls the BASEL pin on BUF12840. There are two settings for JMP4 can be set to. The *INT* position specifies that control of the BASEL pin is handled by the BASEL switch on the BUF12840 test board. The *EXT* position for JMP4 allows for an external control signal connected to terminal T4 to determine the selection of which bank to be used.

JMP5: I^2C Address Hardware Setting

Jumper JMP5 configures the hardware setting for the A0 I^2C address pin on the BUF12840. Using JMP5, the A0 address can be set to either logic '1' or logic '0' to allow for two unique I^2C addresses. See Section 5.2.1 on how to configure the BUF12840EVM software to match the JMP5 hardware setting.

JMP6, 7, and 8: Auto-Read and EEPROM Control Settings

Jumper JMP6 allows the EN pin on the BUF12840 to be configured. In the high position, auto-read is enabled and the BUF12840 attempts to retrieve its register values from the EEPROM (U4). In the low position, the chip ignores the EEPROM and starts up in slave mode.

Jumpers JMP7 and JMP8 control the EA0 and EA1 pin on the BUF12840. The BUF12840 test board has a 1k EEPROM onboard; the jumpers must be in low position for the BUF12840 to properly read from this component. Different configurations of the jumpers are needed if a different EEPROM is used.

3.7.1 BUF12840 Device Placement

The BUF12840EVM allows the user two separate locations on the board where the BUF12840 test device can be installed. Location U1 on the BUF12840 test board allows a BUF12840 device soldered to a DIP adapter board to be installed on the BUF12840EVM. The output capability of the BUF12840 that is soldered to this adapter board can be fully evaluated. The PowerPAD™ thermal pad of this soldered BUF12840 is connected correctly, allowing the device to dissipate the necessary power while being evaluated.

Location U2 on the BUF12840EVM is a 24-pin test socket that allows the user to evaluate and program many devices very quickly. One drawback to this socket is that there is no connection to the PowerPAD thermal pad of the BUF12840. Because of this limitation, the BUF12840 cannot be operated to its full output capability while in this socket because of thermal dissipation limitations.

CAUTION

Only one location should be populated at a time. The use of both locations simultaneously will likely damage one or both of the devices being tested.

3.7.2 Terminal Strip TPG1

Terminal strip TPG1 provides the individual output signals on a single row of headers as well as a row of test points. This footprint provides the user with multiple options to interface the output signals of the BUF12840 with the individual display panel. The user can also design a custom cable to directly connect the headers to the panel, or to solder directly to the individual test points.

4 BUF12840EVM Software Setup

This section discusses how to install the BUF12840 software.

4.1 Operating Systems for BUF12840 Software

The BUF12840EVM software has been tested on the Microsoft Windows XP, Vista, and Windows 7 operating systems (OSs) with United States and European regional settings. The software should also function on other Windows operating systems.

BUF12840 Software Installation

The BUF12840EVM software is included on the CD that is shipped with the EVM kit. It is also available through the BUF12840EVM product folder on the TI website. To install the software on a computer, insert the disc into an available CD-ROM drive. Navigate to the drive contents and open the *BUF12840EVM* software folder. Locate the compressed file (*BUF12840EVM.zip*) and open it. Using WinZIP® or a similar file compression program; extract the BUF12840EVM files into a specific BUF12840EVM folder (for example, *C:\BUF12840EVM*) on the hard drive.

Once the files are extracted, navigate to the BUF12840EVM folder you created on the hard drive. Locate the *setup.exe* file and execute it to start the installation.

After the installation process begins, the user must select the directory location where the program will be installed, typically defaulting to *C:\Program Files\BUF12840* and *C:\Program Files\National Instruments* as shown in Figure 10. After this option is selected, two license agreements are also presented that must be accepted. Accept the Texas Instruments and National Instruments license agreements; the progress bar then opens and shows the installation progress of the software. Once the installation process is completed, click **Finish**.

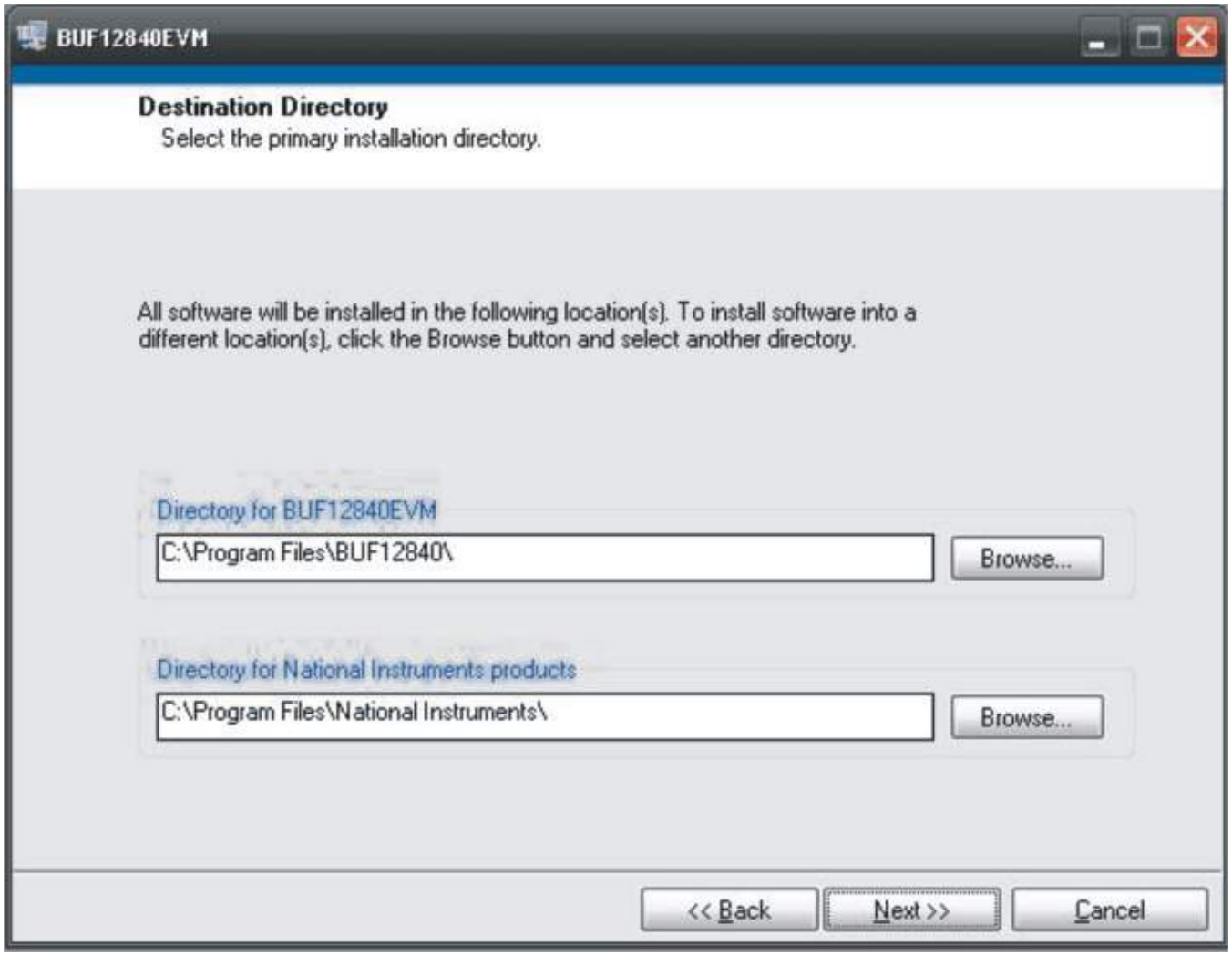

Figure 10. BUF12840EVM Software Install Window

Figure 11 shows....

Figure 11. BUF12840EVM Software Installation Progress

5 BUF12840EVM Software Overview

This section discusses several key features of the BUF12840 software.

Software Description and Set-Up

The BUF12840EVM software allows the user to read and write to all registers in the BUF12840 gamma correction buffer. Furthermore, it allows programming of the OTP register on the BUF12840. The software also permits the user to select either I^2C address. Press the **About** button (shown in Figure 12) to verify that you have the latest version of the software.

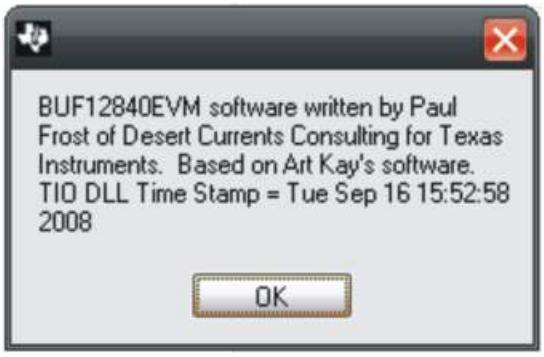

Figure 12. BUF12840EVM Software *About* Button

5.1 Starting the BUF12840EVM Software

The BUF12840 software can be operated through the Windows *Start* menu. From Start, select *All Programs*; then select the BUF12840EVM program.

Figure 13 shows an error that pops up if the computer cannot communicate with the EVM. If you receive this error, first check to see that the USB cable is properly connected. This error can also occur if you connect the USB cable before the USB DIG Platform power source. A second possible reason for this problem is that there may be a problem with your computer USB human interface device driver. Make sure that when you plug the in the USB cable, the computer recognizes the device. If the sound is on, you will hear the distinctive sound that you expect when a USB device is properly connected to the PC.

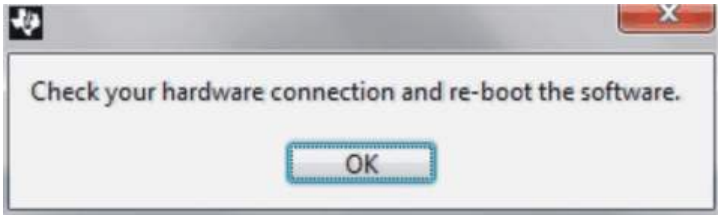

Figure 13. BUF12840EVM Software: No Communication with the USB_DIG_Platform

5.2 Using the BUF12840 Software

5.2.1 I²C Address Selection

As mentioned previously in the *BUF12840EVM Features* section (see Figure 12), jumper JMP5 is used to set the I²C address pin of the BUF12840. Figure 14 shows how the hardware and software must both be set to allow for communication between the BUF12840EVM and the software. Without jumper JMP5 and the software address button configured correctly, the software will not be able to communicate with the BUF12840 device.

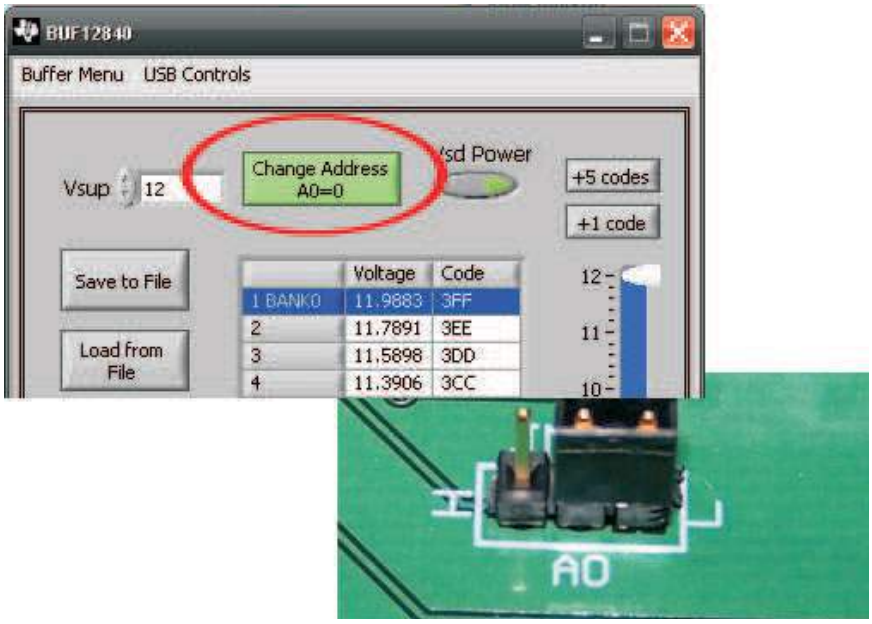

Figure 14. BUF12840 Test Board Jumper JMP5 Setting for Logic '0'

5.2.2 Measuring the Power Supply

You must measure the power supply (V_S) with respect to the GND on the BUF12840 test board and enter this value in the V_{SUP} field located in the top section of the software interface, as shown in Figure 15.

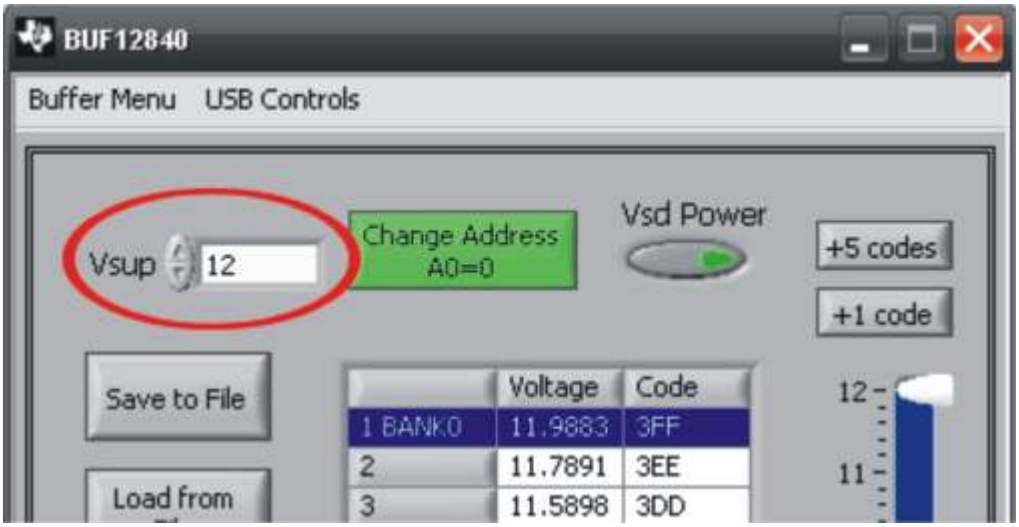

Figure 15. Measuring and Entering Power-Supply Voltage

The voltages calculated for each channel are based on the value entered as V_{SUP}, as Equation 1 shows. Note that *Code* is the value found in the channel registry converted to a decimal number.

$$V_{CHANNEL} = \frac{V_{SUP} \times Code}{1024} \quad (1)$$

5.2.3 Read DAC Button

By pressing the **Read DAC** button in the BUF12840EVM software, all of the BUF12840 DAC registers are read to obtain the respective current register contents. Once the read procedure is complete, all of the corresponding text boxes are updated to show the current values present in the DAC registers.

5.2.4 Write DAC Button

The method used to write the values in the DAC registers is based on whether or not the Auto Write feature is enabled. The BUF12840 has two methods of writing information into the DAC registers. The first method allows for the output voltage to change immediately after the writing to the DAC register. In the BUF12840EVM software, this mode is configured by enabling the Auto Write feature found in the Buffer Menu dropdown menu. In this mode, as an individual channel is written to, the output voltage changes as soon as the user moves to a different text box in the software. The second method of writing to the DAC registers allows for the user to write multiple channels and then have all of the output voltages change at the same time rather than each channel voltage changing as soon as it is written to.

Disabling the Auto Write feature in the software allows the user to enter all of the values desired for all of the channels and then press the **Write DAC** button to change all of the output voltage of all of the channels at one time. When the Auto Write feature is enabled, no change occurs to the output voltages when the **Write DAC** button is pressed. No change occurs because after the text box for a given channel has been updated, as soon as another item in the software is clicked, the Auto Write feature automatically performs a write command to the updated channel that then updates the output voltage. When in the Auto Write enabled mode, the **Write DAC** button cannot be pressed with different data in the corresponding channel text boxes than the values already stored in the DAC register; thus, no change occurs. Figure 16 illustrates the location in the Buffer Menu showing the Auto Write feature enabled. Clicking on the Auto Write feature again enables/disables the feature, depending on its current state.

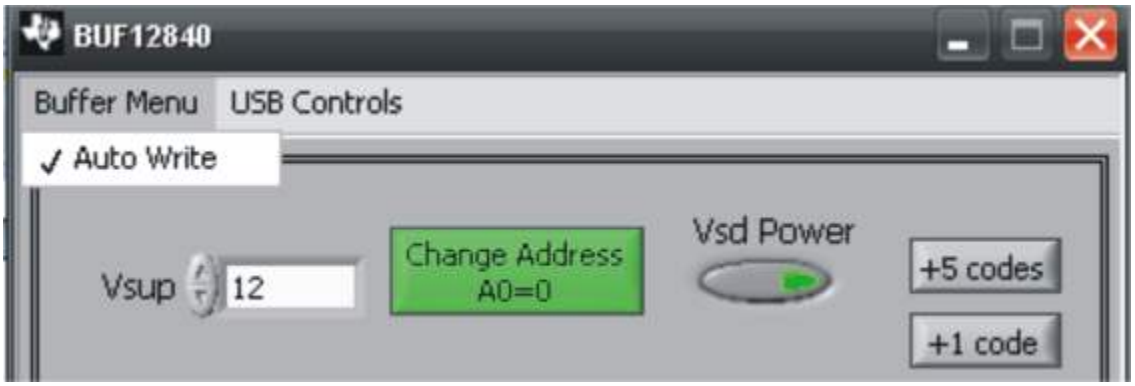

Figure 16. Auto Write Feature Enabled

5.2.5 Reset Button

Pressing the **Reset** button in the BUF12840EVM software performs two functions. The first function is to issue a General-Call Reset for the BUF12840. The status of the DAC registers after this General-Call Reset has been called depends on whether or not the auto-read function is enabled with jumper JMP6. If it is, then the values loaded into the register depend on the values found in the EEPROM. If it is not enabled, the default values will be *0x000*, or nearly 0V.

5.2.6 Save to File Button

The register configurations of the BUF12840 DACs are displayed in both analog voltage and in hexadecimal. The DAC codes (that is, gamma voltages) can be saved into a text file using the **Save to File** button.

Pressing the **Save to File** button opens a file-save dialog box similar to that shown in Figure 17. Pressing the folder icon creates a new folder on your PC. It is a good idea to create a directory exclusively for BUF12840 DAC code (that is, gamma voltage) files. Enter a unique file name in the *Filename* field to store your BUF12840 register information. Press **OK** to save the file.

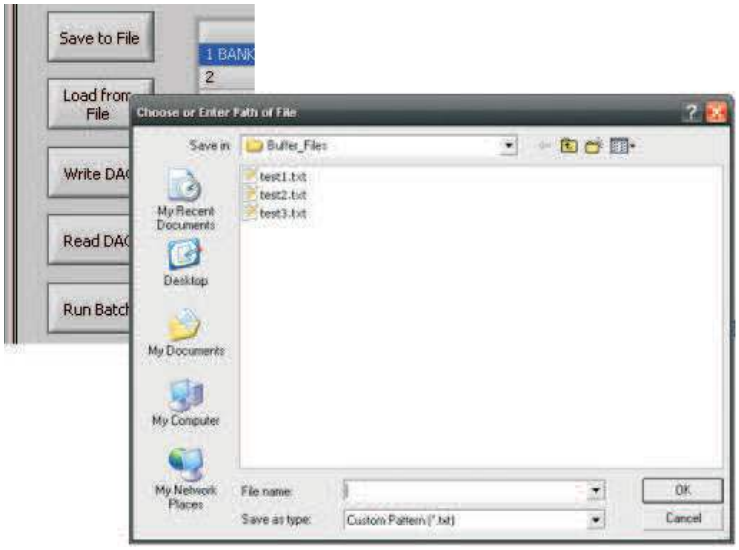

Figure 17. Save to File Dialog Box Button and Window

Saved BUF12840 DAC codes (gamma voltages) exist in a text file that can be opened in a text editor, as Figure 18 illustrates.

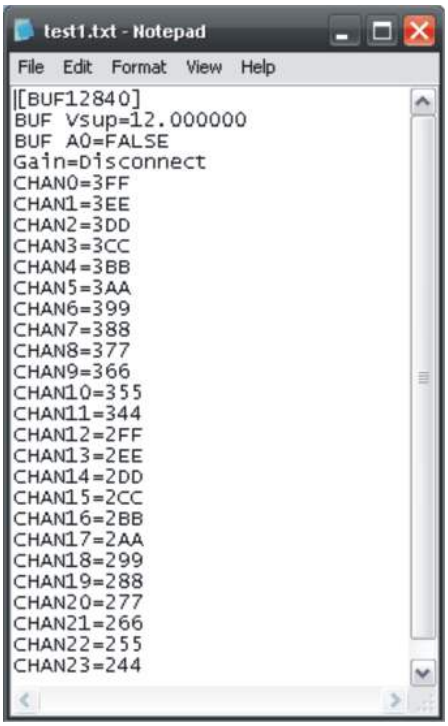

Figure 18. Saved Data Format

5.2.7 Load From File Button

The BUF12840EVM software is also able to load data saved from previous evaluations. A saved register configuration can be loaded into the BUF12840 using the **Load From File** button, as shown in Figure 19. The program remembers where you saved the last register configuration. Simply select the desired configuration and press *Open*.

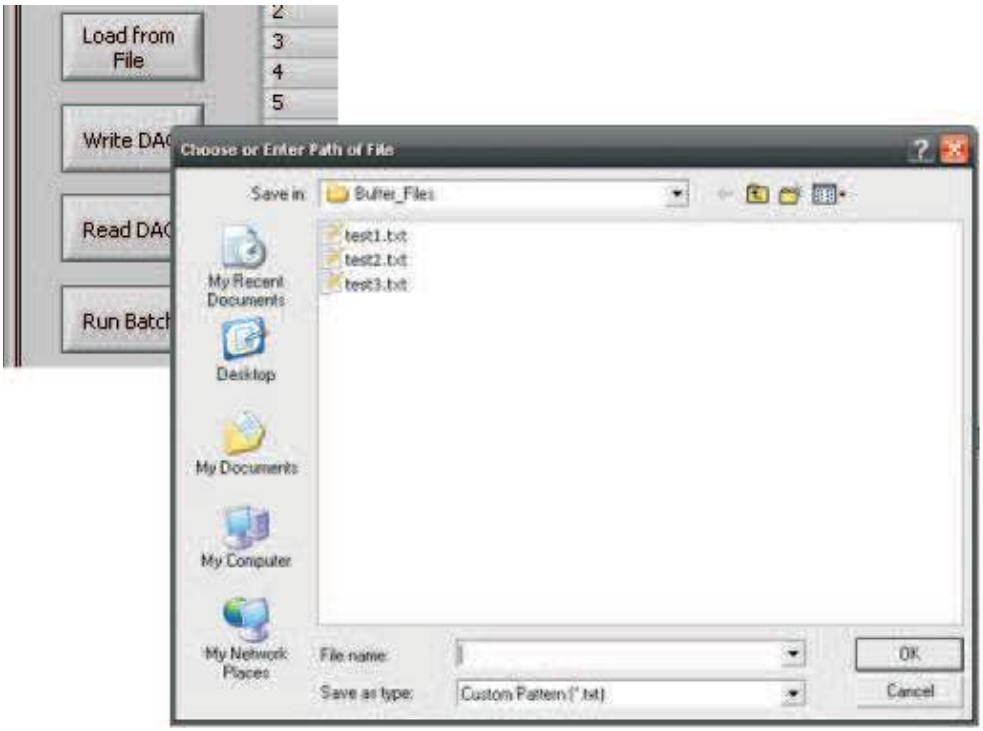

Figure 19. Load From File Button and Window

5.2.8 Changing the DAC/V_{COM} Analog Voltage

The voltage of any of the DAC channels can be adjusted in several ways. One way is to change the voltage by entering the desired voltage directly in the voltage text box. In order to be able to manually type the voltage into the text box, first click on the cell to be edited. Click a second time and the cell turns from blue to black, allowing the updated voltage to be entered in the cell. The hexadecimal DAC codes can be entered in the *Code* column in the same manner.

Another method of changing the voltage of a DAC channel is through the use of the slider on the main software window. A single slider is used for all channels. In order to use the slider to adjust the voltage of a particular channel, the channel must first be selected. Clicking on the channel number, voltage, or code of a particular channel highlights the entire channel row in blue to indicate the channel that is selected. Adjusting the slider bar will then update only the highlighted channel.

The final method to change DAC/V_{COM} voltages is through the **±1 Code** and **±5 Code** buttons on the main software window. These buttons allow for fine and coarse adjustments, respectively, to the highlighted channel, giving the user the ability to quickly step the channel output up or down as needed without having to manually enter the changes in the *Code* column.

5.2.9 Run Batch Button

The **Run Batch** button (as noted in Figure 20) enables the user to configure the BUF12840 to cycle through different register configurations in a continuous loop. When connected to the end application, this feature can be used to cycle through different gamma settings to determine what the optimal settings must be for a given application.

When the **Run Batch** button is pressed, a new dialog box displays as Figure 20 shows. The delay time is the amount of time allowed between loading new configurations into the BUF12840 DUT.

Use the **Single Step Up** and **Single Step Down** buttons to step through the selected files manually. The currently selected file name is displayed in the lower left corner area of the dialog box. Double-click on the file names to select them. Once a series of filenames have been selected, the check box turns dark. Double-click on a filename again to unselect it from the batch run.

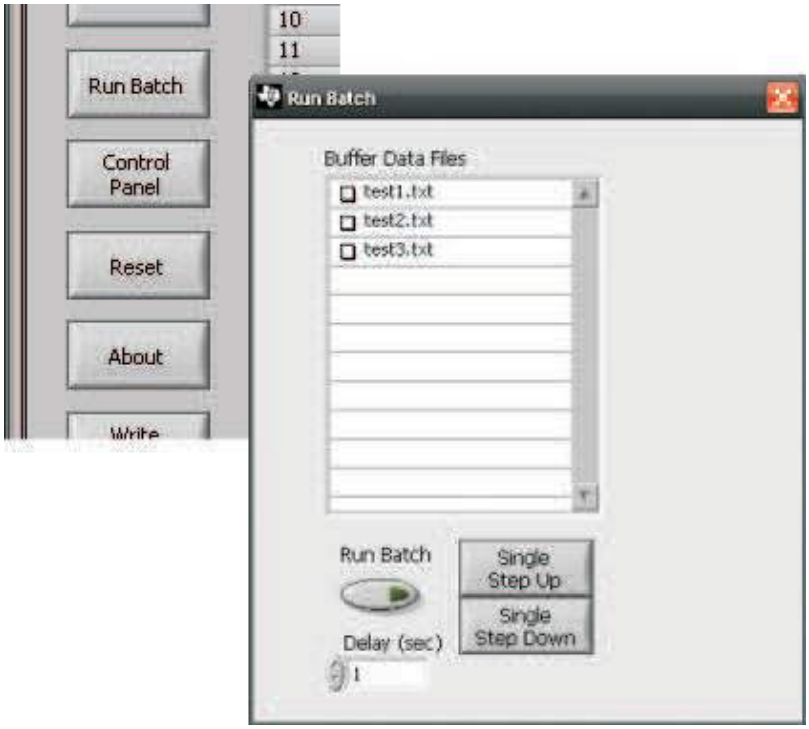

Figure 20. Run Batch Dialog Button and Window

5.2.10 Control Panel Button

Pressing the **Control Panel** button brings up a display panel that allows you to adjust each channel using a set of graphical sliders, as shown in Figure 21. Simply drag the slider to adjust the desired channel output. The DAC code and corresponding output value of each channel change automatically. This function is similar to the slider present on the primary BUF12840EVM software window that changes based on the channel that highlighted (as discussed in the above section).

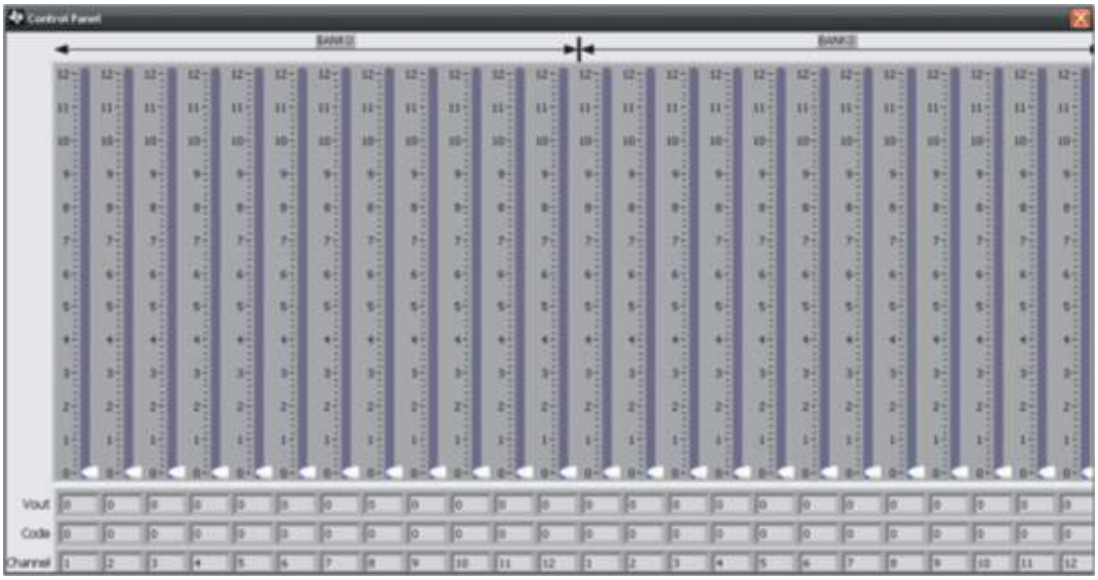

Figure 21. Control Panel Button and Window

5.2.11 Write EEPROM Button

Pressing the **Write EEPROM** button allows all the register values currently set in the BUF12840EVM software (regardless of whether these have been written to the BUF12840 DUT) to be written to the 1k EEPROM on the test board. The software has the capability to set EA0 and EA1 for other sizes of EEPROM, though the default is designed to interact with a 1k EEPROM, which comes installed on the BUF12840 test board. Both EA0 and EA1 must be set low to write all the values in the first 48 registers of the EEPROM. If EN is set high on the next reset, these values should be read automatically into the BUF12840. EA0 and EA1 can be set in the software from the main menu bar, as shown in Figure 22.

Figure 22. Configuring EA0 and EA1

6 BUF12840EVM Documentation

This section contains the complete bill of materials and schematic diagram for the BUF12840 Test Board. Documentation information for the USB_DIG_Platform can be found in the USB_DIG_Platform User's Guide, SBOU058, available at the TI web site at http://www.ti.com.

6.1 BUF12840 Test Board Schematic

Figure 23 shows the schematic for the BUF12840 Test Board.

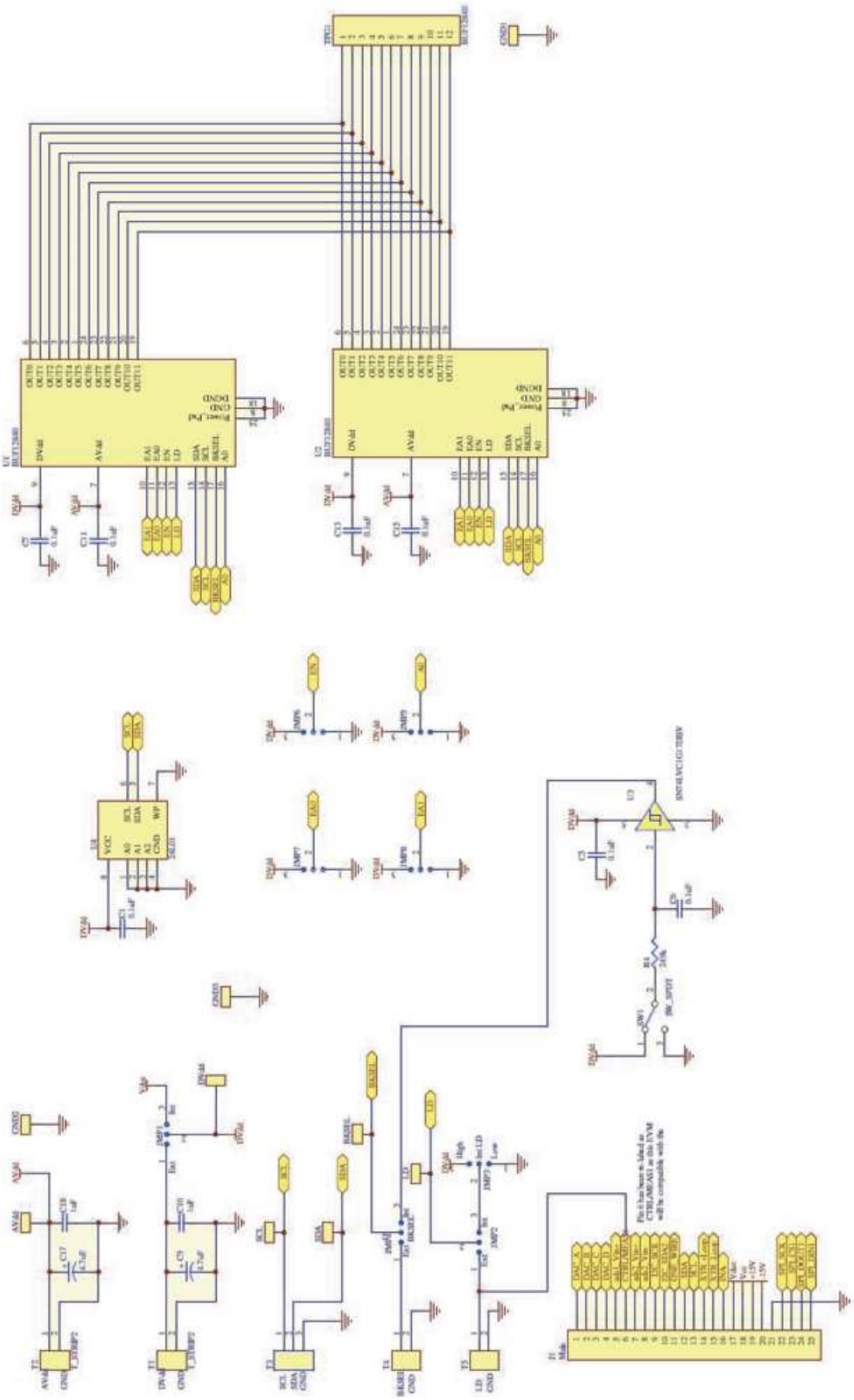

Figure 23. BUF12840 Test Board Schematic

BUF12840EVM PCB Components Layout

Figure 24 shows the layout of the components for the BUF12840EVM board.

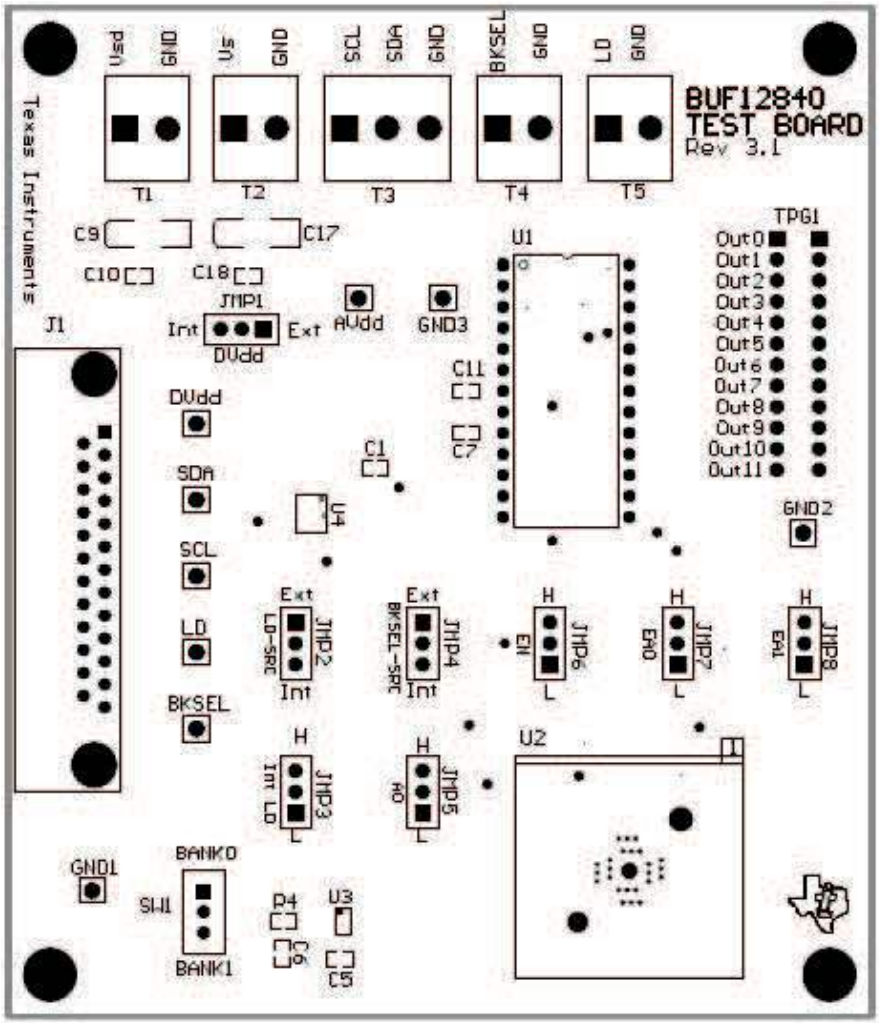

Figure 24. BUF12840EVM PCB Components Layout

6.2 BUF12840 Test Board Bill of Materials

Table 5 lists the bill of materials for the BUF12840EVM.

Table 5. BUF12840EVM Parts List

No.	Qty	Value	Ref Des	Description	Vendor	Part Number
1	1	249kΩ	R4	Resistor, 294kΩ 1/16W .5% 0603 SMD	Susumu Co Ltd	RR0816P-2493-D-39D
2	2	4.7µF	C9, C17	Capacitor, tantalum 4.7µF 35V 10% SMD	Vishay/Sprague	293D475X9035C2TE3
3	2	1µF	C10, C18	Capacitor, ceramic 1 µF 25V Y5V 0603	Murata Electronics North America	GRM188F51E105ZA12D
4	8	0.1µF	C1, C5, C6, C7, C11, C15, C13	Capacitor, 0.10µF 25V ceramic Y5V 0603	Kemet	C0603C104Z3VACTU
5	2		U1	Conn Rcpt .100" 13 Pos Gold T/H	Samtec	SS-113-G-2
6	1		U2	Socket, QFN24	Emulation Technology	S-MLF-00-024-B
7	1		U3	IC Buffer Schmitt Trig SOT235	Texas Instruments	SN74LVC1G17DBVR
8	1	1kB	U4	1k EEPROM	Rohm Semiconductor	BR24L01AFV-WE2
9	1	DSUB25M	J1	Conn D-Sub Plug R/A 25 Pos 30GOLD (With Threaded Inserts and Board locks)	AMP/Tyco Electronics	5747842-4
10	1		SW1	Switch Toggle SPDT .4VA PC mnt	E-Switch	200AWMSP1T1A1M2RE
11	4		T1, T2, T4, T5	Terminal Block 5mm 2 Pos	On-Shore Technology Inc	ED300/2
12	1		T3	Terminal Block 5mm 3 Pos	On-Shore Technology Inc	ED300/3
13	1		TPG1	Conn Header 12 Pos .100" Sgl Gold	Samtec	TSW-109-07-G-S
14	9		Test Points, All	Conn Header 1 Pos .100" Sgl Gold	Samtec	TSW-101-07-G-S
15	4		—	Standoffs, Hex , 4-40 Threaded, 0.500" length, 0.250" OD, Aluminum Iridite Finish	Keystone	2203
16	4	Standoff	—	Screw Machine Phil 4-40X1/4 SS	B&F Fastener Supply	PMSSS 440 0025 PH
17	8	Screw	JMP1 to JMP8	Conn Header 3 Pos .100" SGL Gold	Samtec	TSW-103-07-G-S
18	8	Jumper	JMP1 to JMP8	Shunt LP W/Handle 2 Pos 30AU	AMP/Tyco Electronics	881545-2

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (January 2011) to A Revision **Page**

- Changed 'Hardware Included' image. 3
- Added new part to the *BUF12840EVM Kit Contents* table..... 3
- Added new language to the first paragraph of the *Theory of Operation for USB_DIG_Platform* section..... 7

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

   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 and conditions 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 and conditions 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 any defects that are 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. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, 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.

3 *Regulatory Notices:*

   3.1 *United States*

      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      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*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-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.

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/lsds/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。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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 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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・インスツルメンツ株式会社

東京都新宿区西新宿６丁目２４番１号

西新宿三井ビル

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

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 WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (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 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.

   6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS AND CONDITIONS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT MADE, CONCEIVED OR ACQUIRED PRIOR TO OR AFTER DELIVERY OF THE EVM.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS 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 OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS AND CONDITIONS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS ANDCONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

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.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

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