

## **BUF08630EVM User Guide and Software Tutorial**

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This user's guide describes the characteristics, operation, and use of the BUF08630EVM 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 BUF08630EVM. This user's guide also includes information regarding operating procedures and input/output connections, an electrical schematic, and a parts list for the EVM.

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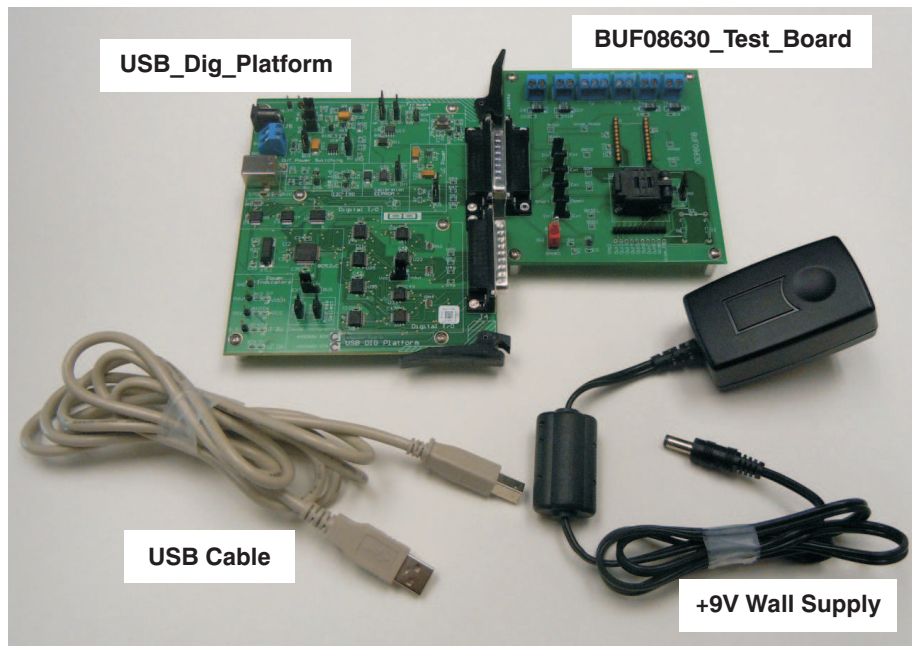
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## 1 Overview

The BUF08630 is a programmable gamma-voltage generator and  $V_{COM}$  calibrator. This device offers two banks of eight programmable gamma channels and one programmable  $V_{COM}$  channel, making it ideal for 10-bit source TFT-LCD reference drivers. The BUF08630EVM is a platform for evaluating the performance of the [BUF08630](#) under various signal, reference, and supply conditions. This document gives a general overview of the BUF08630EVM, and provides a general description of the features and functions to be considered while using this evaluation module.

### 1.1 BUF08630EVM Kit Contents

[Figure 1](#) illustrates the hardware included with the BUF08630EVM 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 BUF08630EVM Kit**

The complete kit includes the following items:

- BUF08630\_Test\_Board PCB
- USB\_DIG Platform PCB
- USB cable
- +6V power supply
- CD-ROM that contains this user's guide, product software, and related documentation

## 1.2 Related Documentation from Texas Instruments

The following documents provide information regarding Texas Instruments' integrated circuits used in the assembly of the BUF08630EVM. This user's guide is available from the TI web site under literature number **SBOU081**. 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
<a href="#">BUF08630 Product Data Sheet</a>	<a href="#">SBOS515</a>
<a href="#">USB_DIG Platform Users Guide</a>	<a href="#">SBOU058</a>

## 2 BUF08630EVM Hardware Setup

Figure 2 shows the system setup for the BUF08630EVM. 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 BUF08630\_Test\_Board. Connectors on the BUF08630\_Test\_Board allow the user to connect to the device under test (DUT), in order to monitor the power, current, and voltage of the BUF08630 DUT.

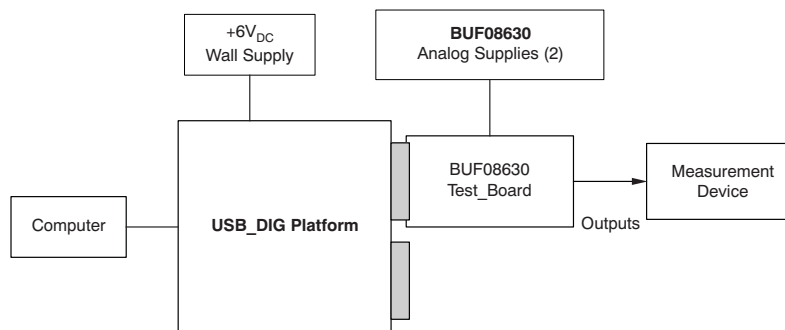


Figure 2. BUF08630EVM Hardware Setup

### 2.1 Theory of Operation for BUF08630\_Test\_Board Hardware

Figure 3 presents a block diagram of the BUF08630\_Test\_Board. The functionality of this PCB is relatively simple. It provides connections to the I<sup>2</sup>C™ 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 GND.

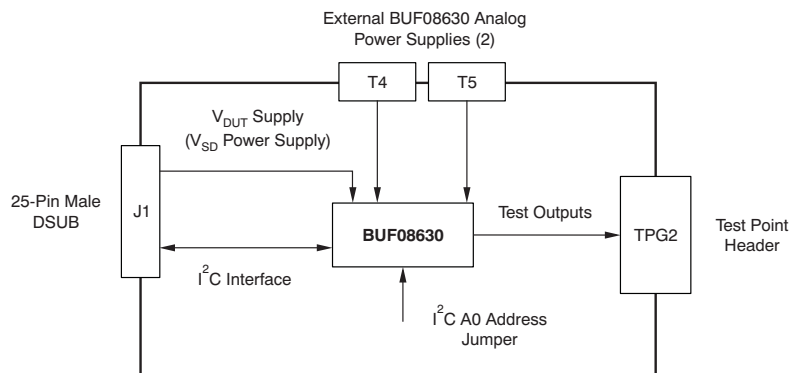


Figure 3. BUF08630\_Test\_Board Block Diagram

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

Table 1 lists the different signals connected to J1 on the BUF08630\_Test\_Board.

**Table 1. Signal Definition of J1 (25-Pin Male DSUB) on BUF08630\_Test\_Board**

PIN on J1	Signal	BUF08630 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 <sup>2</sup> C clock signal (SCL) channel 1; can be disconnected using a switch
13	I2C_SDA_ISO	I <sup>2</sup> C 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	V <sub>DUT</sub>	Switched 3V/5V power. Note that when power is switched off, digital I/O is also switched off.
18	V <sub>CC</sub>	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](#).

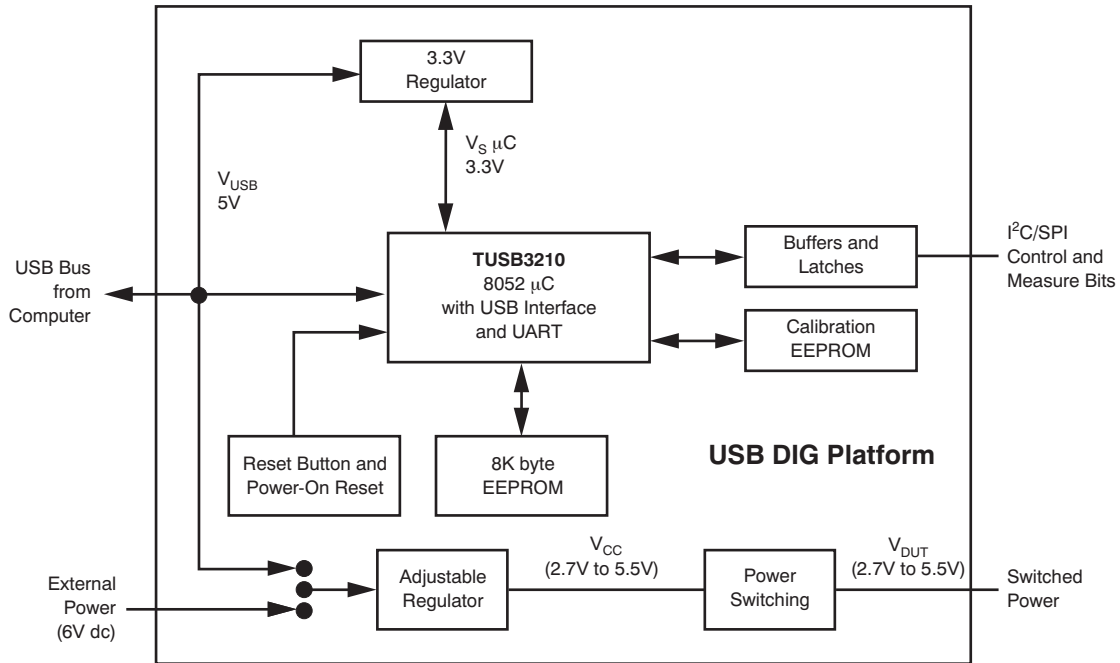


Figure 4. USB\_DIG\_Platform Block Diagram

### 3 BUF08630EVM Hardware Overview

The BUF08630EVM 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 BUF08630EVM 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 BUF08630EVM hardware, connect the two PCBs of the EVM together, and apply a power source to the BUF08630\_Test\_Board. The external connections may be the real-world system that the BUF08630 will be incorporated into. Figure 5 illustrates the typical hardware connections.

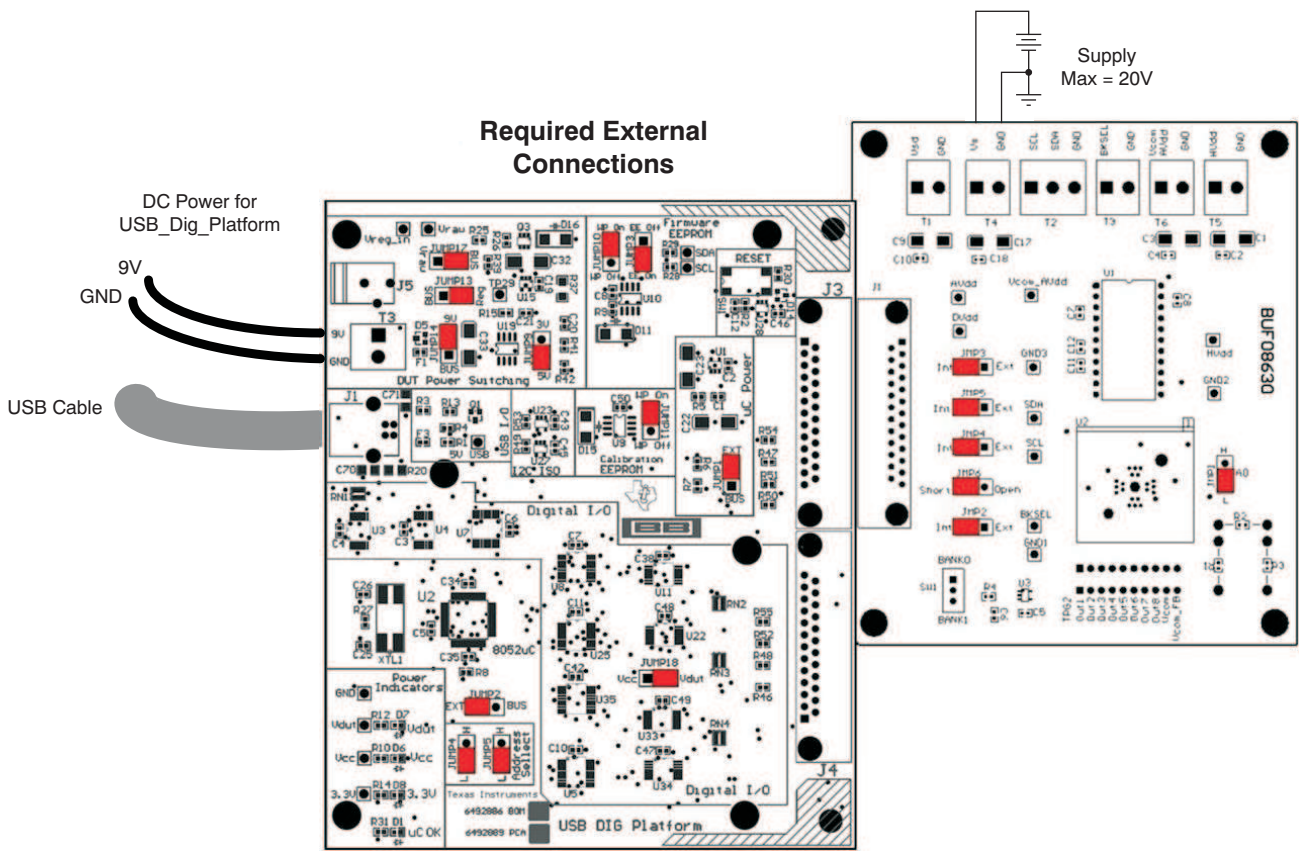


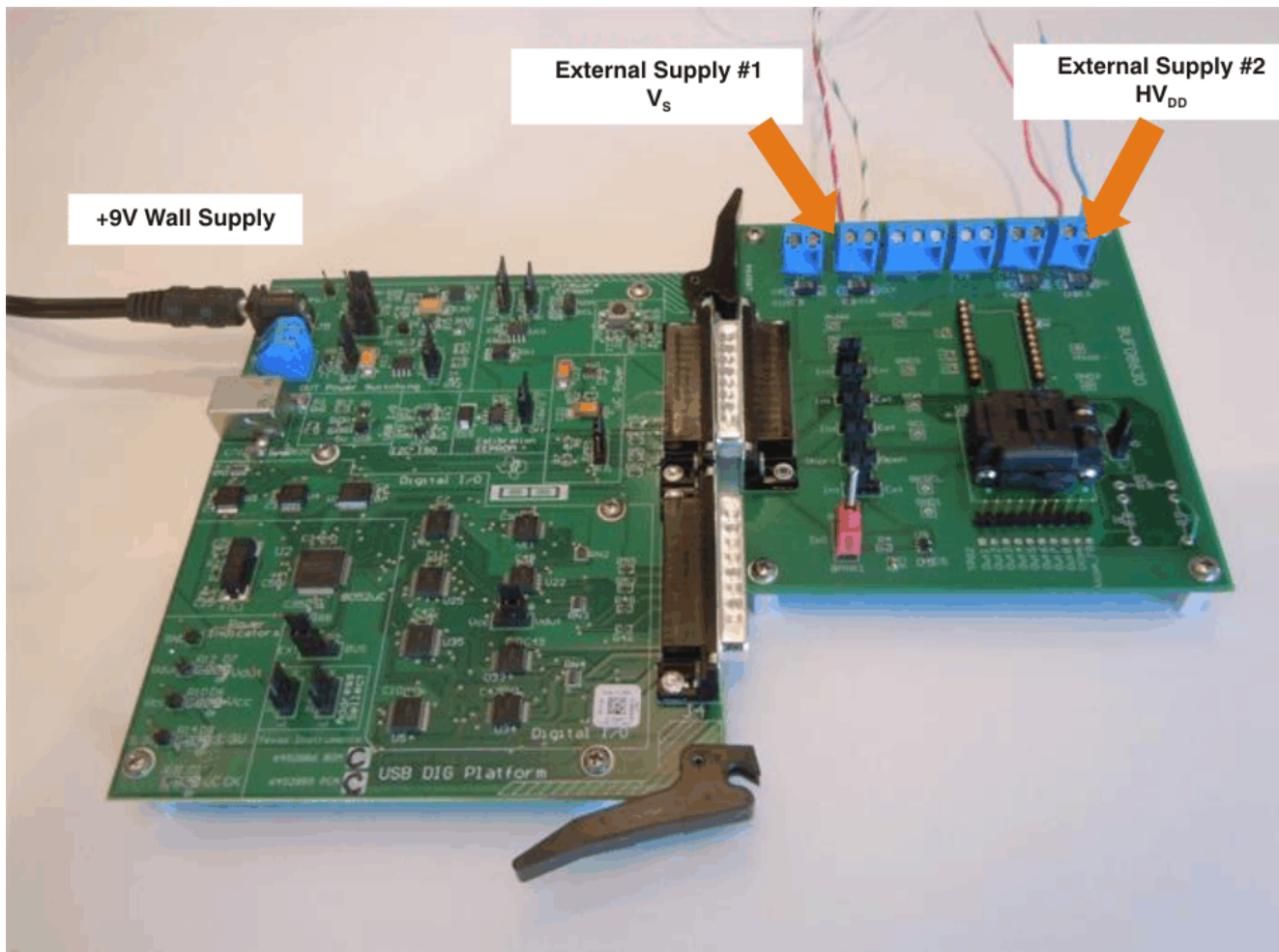
Figure 5. Typical Hardware Connections for BUF08630EVM

### 3.3 Connecting the Hardware

To connect the two PCBs of the BUF08630EVM together, gently push on both sides of the DSUB connectors (as shown in Figure 6). Note that the USB\_DIG Platform board has two DSUB connectors; either may be used. 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 BUF08630EVM are conjoined, connect a +9V wall supply to the USB\_DIG Platform board, as Figure 6 shows. 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 BUF08630\_Test\_Board also requires two external dc power sources. These sources are not included with the kit, and the respective voltage of each source may differ depending on your specific testing needs. One source will be used to provide dc supply voltage to the BUF08630\_Test board; the other will be used to deliver half that value to  $HV_{DD}$ , also on the BUF08630\_Test\_Board.

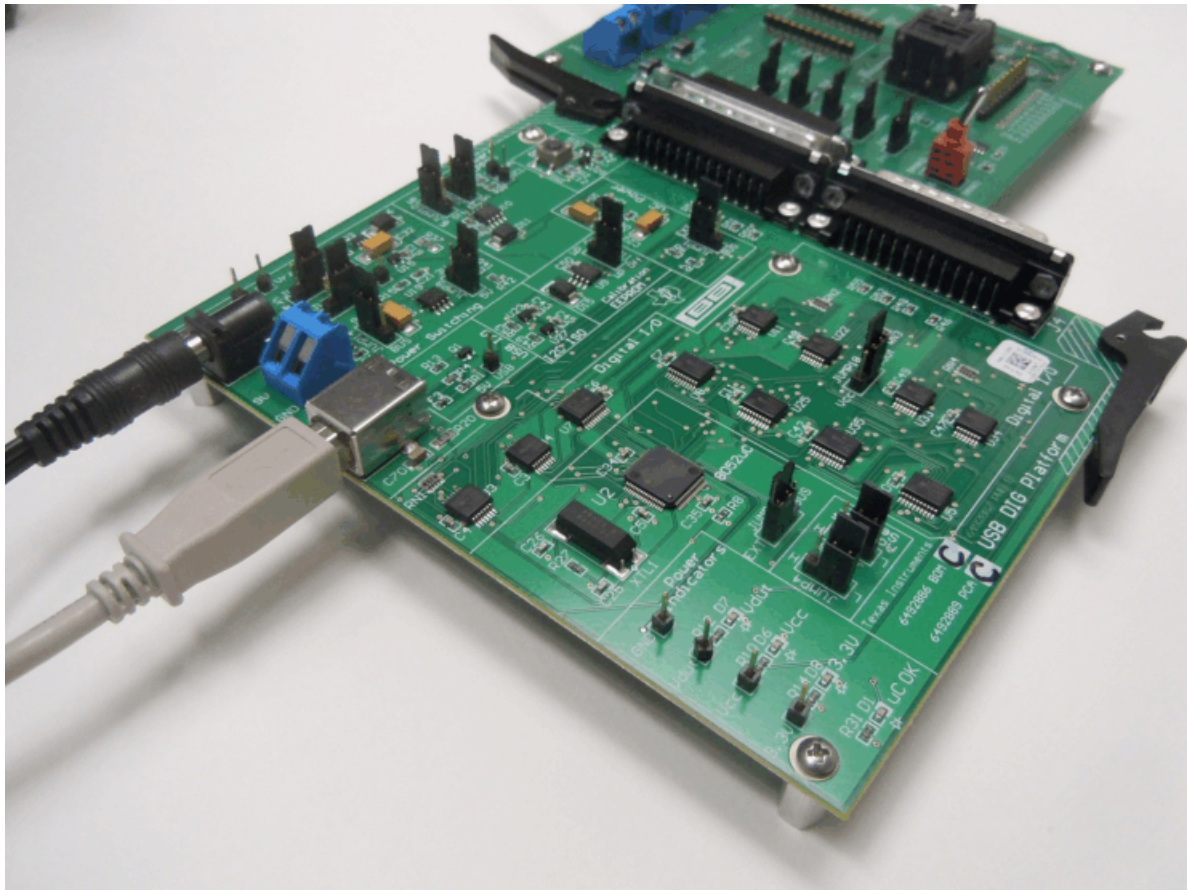
For example, if  $V_s$  (terminal T4) is connected to a +12V dc external supply,  $HV_{DD}$  (terminal T5) should be connected to a separate +6V dc external supply.



### 3.5 Connecting the USB Cable to the BUF08630EVM

Once power is connected, the USB cable must be connected to the DIG Platform, as shown in [Figure 7](#). Note that the BUF08630\_Test\_Board and the USB\_DIG Platform board must each 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.

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.



**Figure 7. Connecting the USB Cable to the USB\_DIG Platform**

In some cases, the Windows Add Hardware Wizard will be shown. If this prompt occurs, allow the system device manager to install the human interface drivers by clicking **Yes** when requested to install drivers. Windows will confirm installation of the drivers with the message shown in [Figure 8](#).



**Figure 8. Confirmation of USB\_DIG Platform Driver Installation**

### 3.6 BUF08630EVM Default Jumper Settings

Figure 9 shows the default jumpers configuration for the BUF08630EVM. 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 BUF08630\_Test\_Board to match your specific configuration. For instance, you may wish to set a specific I<sup>2</sup>C address on the DUT.

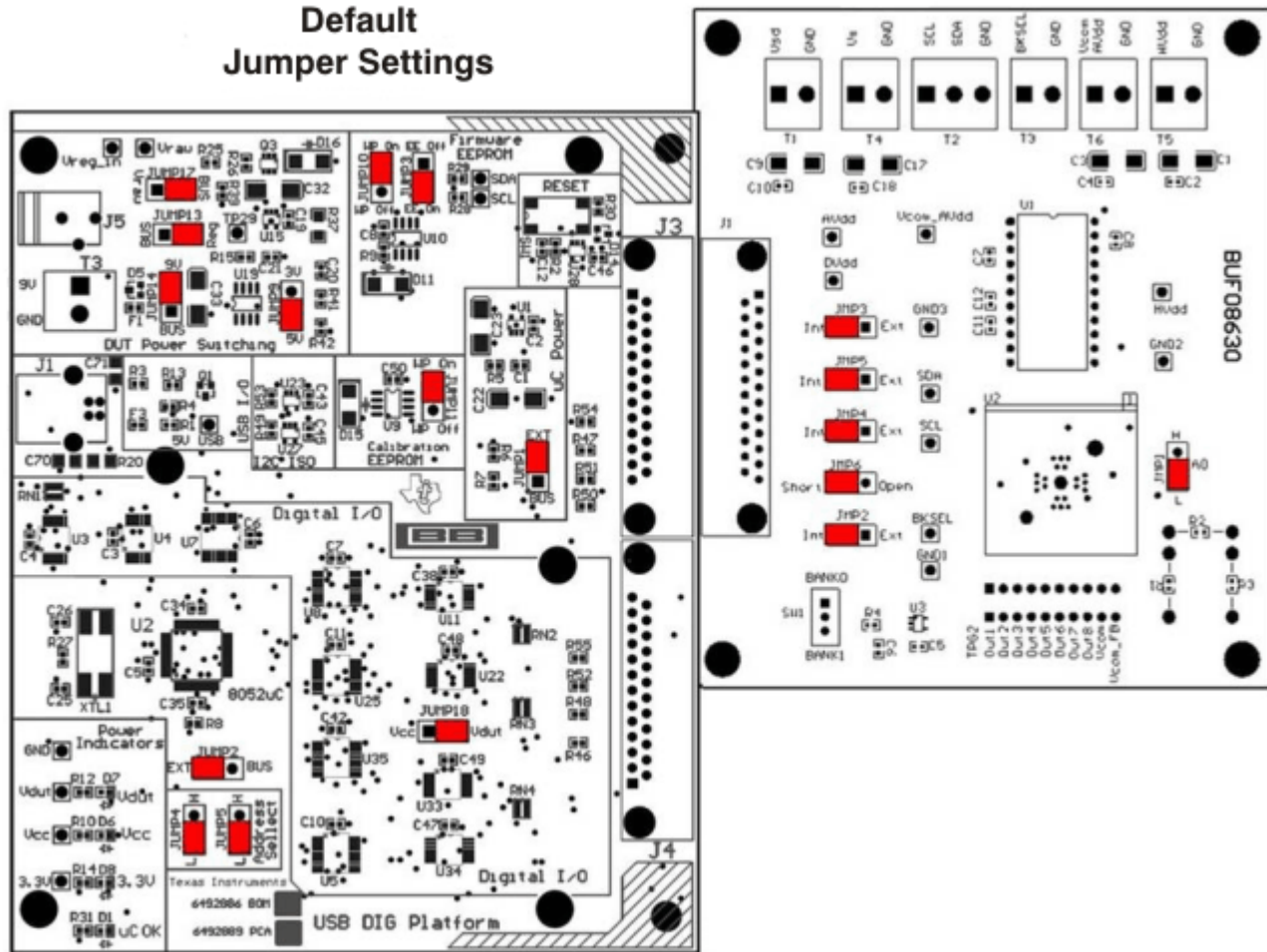


Figure 9. BUF08630EVM Default Jumper Settings

**Table 2** summarizes the function of the BUF08630\_Test\_Board jumpers. For most applications, Jumpers 2 through 5 are all set to the respective default position.

**Table 2. BUF08630\_Test\_Board Jumper Functions**

<b>Jumper</b>	<b>Default</b>	<b>Purpose</b>
JMP1	L	This jumper selects I <sup>2</sup> C A0 address selection. Two separate I <sup>2</sup> C addresses can be selected, depending on whether JMP1 is set to high or low.
JMP2	INT	This jumper selects whether the BKSEL pin on the BUF08630 is controlled by the manual switch located on the BUF08630_Test_Board or whether the BKSEL can be controlled by an external source connected to terminal T3. The default INT position allows the BKSEL pin to be controlled by the manual switch.
JMP3	INT	This jumper selects whether the VSD pin on the BUF08630 is connected to the VDUT signal generated from the USB_DIG_Platform or whether digital supply pin is connected to terminal T1, allowing for an external supply to power the digital circuitry. The default INT position connects the VSD pin to the VDUT control signal.
JMP4	INT	This jumper selects whether the SCL pin on the BUF08630 is connected to the I2C_SCK_ISO signal generated from the USB_DIG_Platform or whether the SCL pin is connected to terminal T2 allowing for an external source to control the I <sup>2</sup> C clock line. The default INT position connects the SCL pin to the I2C_SCK_ISO control signal.
JMP5	INT	This jumper selects whether the SDA pin on the BUF08630 is connected to the I2C_SDA_ISO signal generated from the USB_DIG_Platform or whether the SDA pin is connected to terminal T2 allowing for an external source to control the I <sup>2</sup> C data line. The default INT position connects the SDA pin to the I2C_SDA_ISO control signal.
JMP6	Short	This jumper shorts V <sub>COM</sub> and AV <sub>DD</sub> to each other. In the Open position, terminal T6 can be used to set the V <sub>COM</sub> using an external power source.

Table 3 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 3. 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 <i>EE Off</i> 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. While 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. <sup>(1)</sup>
JUMP18	$V_{DUT}$	Connects the pull-up on GPIO to the $V_{DUT}$ supply or the $V_{CC}$ supply.

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

### 3.7 BUF08630EVM Features

This section describes some of the hardware features present on the BUF08630EVM.

#### 3.7.1 JMP1: I<sup>2</sup>C Address Hardware Setting

Jumper JMP1 is used to set the hardware setting for the A0 I<sup>2</sup>C address pin on the BUF08630. Using JMP1, the A0 address can be set to either a logic '1' or a logic '0' to allow for two unique I<sup>2</sup>C addresses. See [Section 5.2.1](#) for more details about how to configure the BUF08630EVM software to match the JMP1 hardware setting.

#### 3.7.2 BKSEL: OTP Bank Selection

The BKSEL switch (illustrated in [Figure 10](#)) located on the BUF08630\_Test\_Board selects the memory bank to be used when operating the EVM. Bank 0 selects the gamma curve that is stored in Bank\_0 of the BUF08630. Bank 1 selects the gamma curve that is stored in Bank\_1 of the BUF08630.



**Figure 10. BKSEL Switch**

#### 3.7.3 JMP2: BKSEL Control Setting

Jumper JMP2 determines how the OTP memory bank selection is controlled. There are two settings for JMP2. Position INT specifies that control of the BKSEL pin is handled on the BUF08630\_Test\_Board. For this jumper setting, the BKSEL switch controls whether Bank 0 or Bank 1 OTP is selected.

The EXT position for JMP2 allows for an external control signal connected to terminal T3 to determine the selection of which OTP bank to be used.

#### 3.7.4 JMP3: VSD Control Setting

Jumper JMP3 selects where the BUF08630 digital supply pin is connected. If JMP3 is set in the INT position, the V<sub>SD</sub> pin is connected to the switchable V<sub>DUT</sub> 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 JMP3 is set to the INT position, the V<sub>SD</sub> Power button on the BUF08630 software is able to control whether the V<sub>DUT</sub> supply voltage is turned on or off.

When JMP3 is set in the EXT position, an external supply connected to terminal T1 can be used to provide the digital supply voltage for the BUF08630.

### 3.7.5 JMP4: I<sup>2</sup>C SCK Control Setting

Jumper JMP4 selects where the BUF08630 I<sup>2</sup>C SCL pin is connected. If JMP4 is set in the INT position, the I<sup>2</sup>C clock signal is generated from the I2C\_SCK\_ISO signal from the USB\_DIG\_Platform.

When JMP4 is set in the EXT position, an external source connected to SCL pin of terminal T2 can be used to provide the I<sup>2</sup>C SCK signal for the BUF08630.

### 3.7.6 JMP5: I<sup>2</sup>C SDA Control Setting

Jumper JMP5 selects where the BUF08630 I<sup>2</sup>C SDA pin is connected. If JMP5 is set in the INT position, the I<sup>2</sup>C data signal is generated from the I2C\_SDA\_ISO signal from the USB\_DIG\_Platform.

When JMP5 is set in the EXT position, an external source connected to SDA pin of terminal T2 can be used to provide the I<sup>2</sup>C SDA signal for the BUF08630.

### 3.7.7 JMP6: V<sub>COM</sub> Supply Control Setting

Jumper JMP6 selects where the BUF08630 V<sub>COM</sub> supply pin is connected. If JMP6 is set to the *SHORT* position, the V<sub>COM</sub> supply pin is connected to the V<sub>S</sub> pin.

When JMP6 is set in the *OPEN* position, an external supply connected to terminal T6 can be used to provide the V<sub>COM</sub> supply voltage for the BUF08630.

### 3.7.8 BUF08630 Device Placement

The BUF08630\_Test\_Board allows the user two separate locations on the board where the BUF08630 test device can be installed. The U1 location on the BUF08630\_Test\_Board allows for a BUF08630 device that is soldered down on a DIP adaptor board to be installed on the BUF08630\_Test\_Board. The output capability of the BUF08630 that is soldered on this adaptor board can be fully evaluated. The PowerPAD of this soldered BUF08630 is connected correctly, and allows the device to dissipate the necessary power while being evaluated.

The U2 location on the BUF08630\_Test\_Board is a 20-pin QFN/MLF 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 of the BUF08630. Because of this drawback, while in this socket, the BUF08630 cannot operate at its full output capability as a result 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.

### 3.7.9 Terminal Strip TPG2

Terminal strip TPG2 provides the individual channel output signals on a single row of headers as well as a row of vias. This footprint provides the user with multiple options on how to interface the output signals of the BUF08630 with their display panel. The user can also develop a custom cable to connect directly to the headers to the desired panels or to solder directly to the individual vias.

## 4 BUF08630EVM Software Setup

This section discusses how to install the BUF08630 software.

### 4.1 Operating Systems for BUF08630EVM Software

The BUF08630EVM software has been tested on the Microsoft Windows XP, Windows Vista, and Windows7 operating systems (OSs) with United States and European regional settings.

### 4.2 BUF08630EVM Software Installation

The BUF08630EVM software is included on the CD that is shipped with the EVM kit. It is also available through the [BUF08630EVM product folder](#) on the TI web site. To download the software to your system, insert the disc into an available CD-ROM drive. Navigate to the drive contents and open the BUF08630EVM software folder. Locate the compressed file (*BUF08630EVM.zip*) and open it. Using WinZIP® or a similar file compression program, extract the BUF08630EVM files into a specific BUF08630 folder (for example, *C:\BUF08630*) on your hard drive.



**Figure 11. BUF08630EVM Software Install Window**

After the installation process initializes, the user must choose the directory where the program is to be installed, usually defaulting to *C:\Program Files\BUF08630\* and *C:\Program Files\National Instruments\*. Following this selection, two license agreements are presented that must be accepted; see [Figure 12](#). 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**.

The BUF08630EVM software installer file then opens to begin the installation process, as [Figure 13](#) shows.

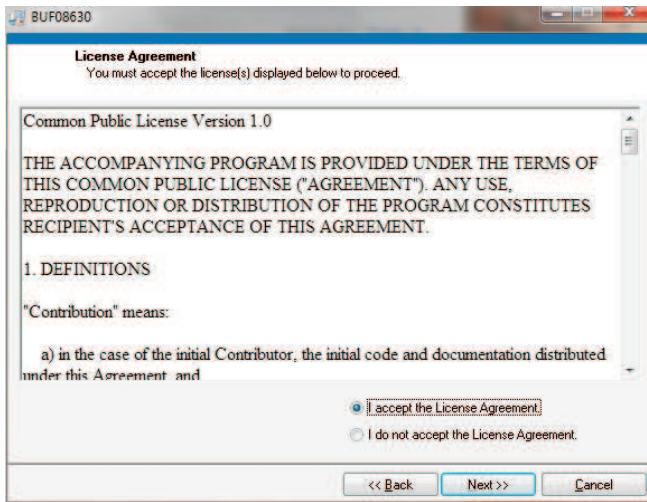


Figure 12. BUF08630EVM License Agreements

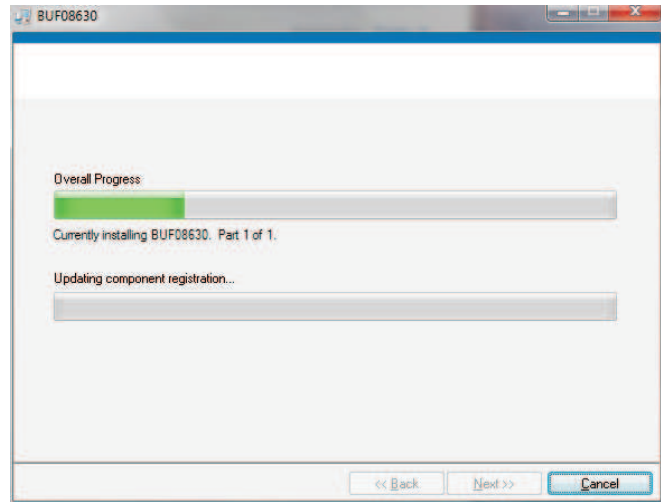


Figure 13. BUF08630EVM Software Installation Progress

### 4.3 Software Description and Set-Up

The BUF08630EVM software allows the user to read and write to all registers in the BUF08630 gamma correction buffer. Furthermore, it allows programming of the OTP register on the BUF08630. The software also permits the user to select either I<sup>2</sup>C address. Press the **About** button as shown in [Figure 14](#) to verify that you have the latest version of the software.

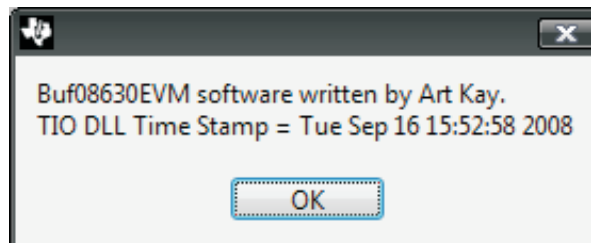


Figure 14. BUF08630EVM Software About Button

## 5 BUF08630EVM Software Overview

This section discusses how to use the BUF08630 software.

### 5.1 Starting the BUF08630EVM Software

The BUF08630 software can be operated through the Windows *Start* menu. From *Start*, select *All Programs*; then select the *BUF08630EVM* program.



Figure 15 shows how the software should appear if the EVM is functioning properly.

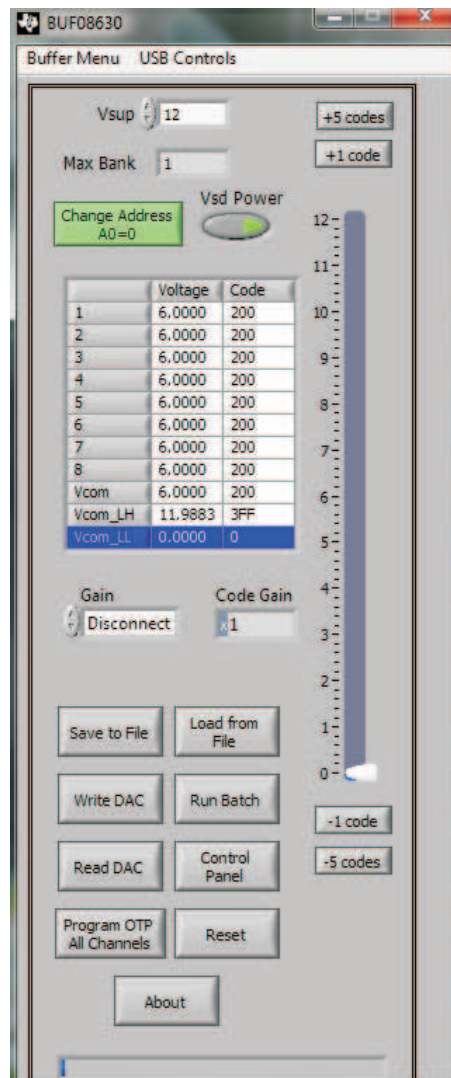


Figure 15. BUF08630EVM Software Functioning Properly

Figure 16 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 on both ends. This error can also occur if you connect the USB cable before the USB\_DIG\_Platform power source. Another possible source for this error is a problem with your PC USB Human Interface Device driver. Make sure that the device is recognized when the USB cable is plugged in; recognition is indicated by a Windows-generated confirmation sound.

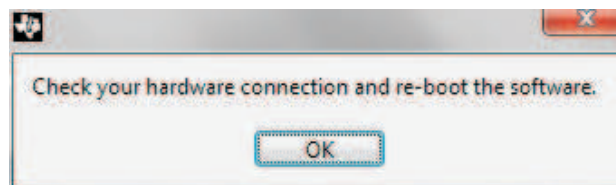
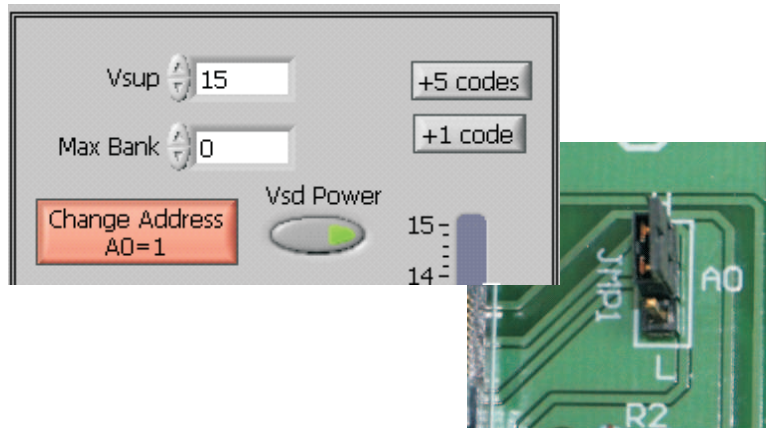


Figure 16. BUF08630EVM Software: Communication Error with the USB\_DIG\_Platform

## 5.2 Using the BUF08630 Software

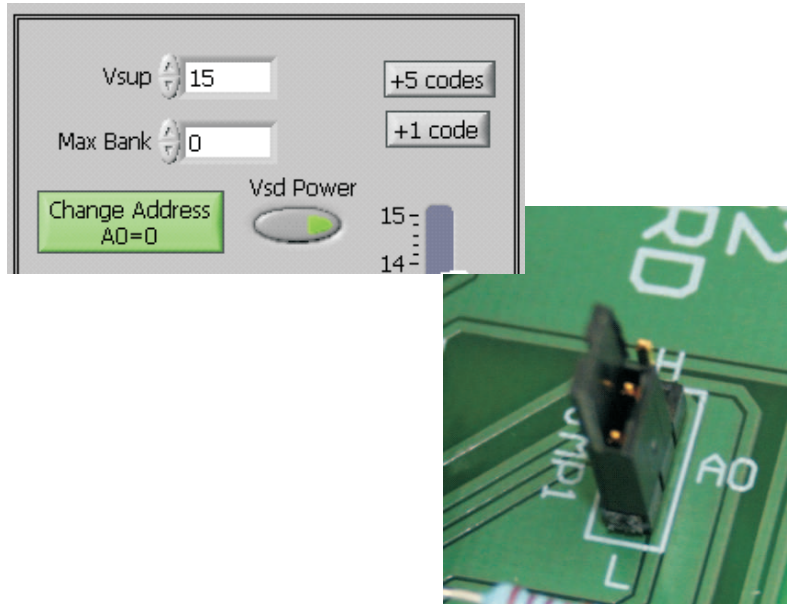
### 5.2.1 I<sup>2</sup>C Address Selection

As mentioned previously in the *BUF08630\_Test\_Board Features* section (see [Section 3.7](#)), jumper JMP1 is used to set the I<sup>2</sup>C address pin of the BUF08630. [Figure 17](#) shows how the hardware and software must both be set to allow for communication between the BUF08630EVM and the software. Without jumper JMP1 and the software address button configured correctly, the software will not be able to communicate with the BUF08630 device.



**Figure 17. BUF08630\_Test\_Board Jumper JMP1 Set For Logic '1'**

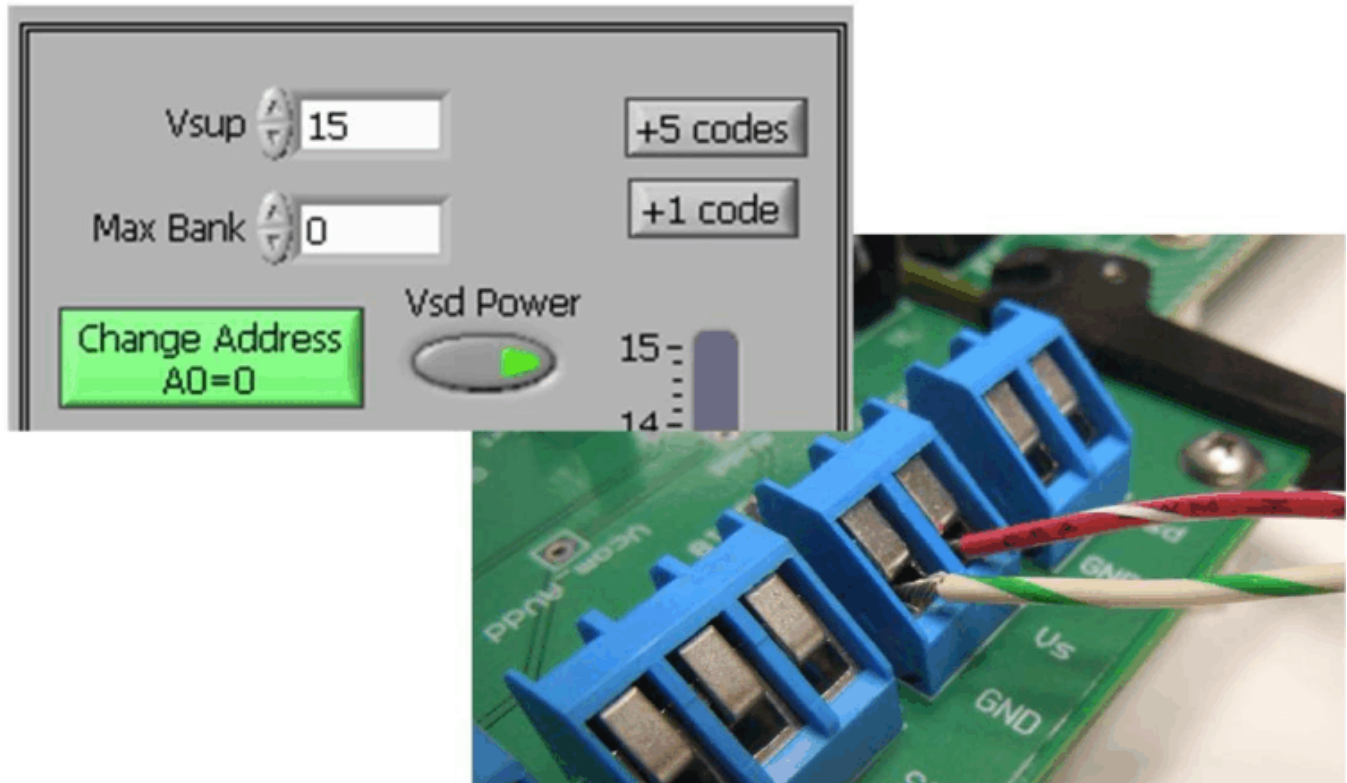
When JMP1 and the software are set as shown in [Figure 18](#), the second I<sup>2</sup>C address can be configured.



**Figure 18. BUF08630\_Test\_Board Jumper JMP1 Set 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 BUF08630\_Test\_Board and enter it in the  $V_{SUP}$  field located in the top section of the software interface, as shown in Figure 19.



**Figure 19. Measuring and Entering Power-Supply Voltage**

The voltage out of each DAC is calculated according to the  $V_s$  value entered. For example, changing the value in the channel 6 cell as shown below immediately changes the output of channel 6 to 0.996V. The calculation is performed according to Equation 1.

$$V_{DAC\_CHANNEL} = \frac{V_s \times \text{Code\_in\_Decimal}}{1024} \quad (1)$$

### Example 1.

Channel 6: Code 44 (hexadecimal) = 68 (decimal)

$$V_{DAC\_CHANNEL} = \frac{15V \times 68}{1024} = 0.996V$$

### 5.2.3 Read DAC Button

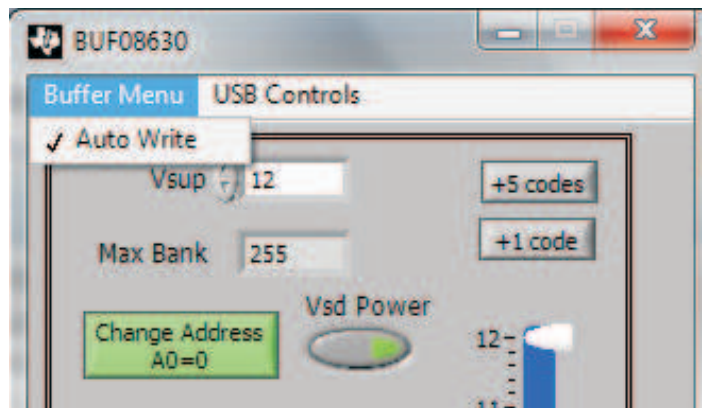
By pressing the **Read DAC** button in the BUF08630EVM software, all of the BUF08630 DAC/V<sub>COM</sub> registers are read to obtain the respective current register contents. Once the read procedure is complete, all of the corresponding text boxes are updated to show the current values present in the DAC/V<sub>COM</sub> registers.

### 5.2.4 Write DAC Button

The method used to write the values in the DAC/V<sub>COM</sub> registers is based on whether or not the Auto Write feature is enabled. The BUF08630 has two methods of writing information into the DAC/V<sub>COM</sub> registers. The first method allows for the output voltage to change immediately after the writing to the DAC register. In the BUF08630EVM 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/V<sub>COM</sub> 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/V<sub>COM</sub> register; thus, no change occurs.

[Figure 20](#) shows 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 20. Auto Write Feature Enabled**

### 5.2.5 Reset Button

Pressing the **Reset** button in the BUF08630EVM software performs two functions. The first function is to call a General-Call Reset for the BUF08630. The status of the DAC/V<sub>COM</sub> registers after this General-Call Reset has been called depends upon whether the OTP has been programmed or not. If the OTP has been programmed, the channel registers will be loaded with the last values programmed into the OTP memory. If the OTP memory has not been programmed, the channel registers will default to 1000000000, or mid-supply. The second function performed after the **Reset** button is pressed is that a Read DAC call is made to update the corresponding channel text boxes to the current value for each channel.

### 5.2.6 Save to File Button

The register configurations of the BUF08630 DACs are displayed in both analog voltage and in hexadecimal (see [Figure 15](#)). 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 21](#). Pressing the folder icon creates a new folder on your PC. It is a good idea to create a directory exclusively for BUF08630 DAC code (that is, gamma voltage) files. Enter a unique file name in the *File name* field to store your BUF08630 register information. Press the **OK** button to save the file.

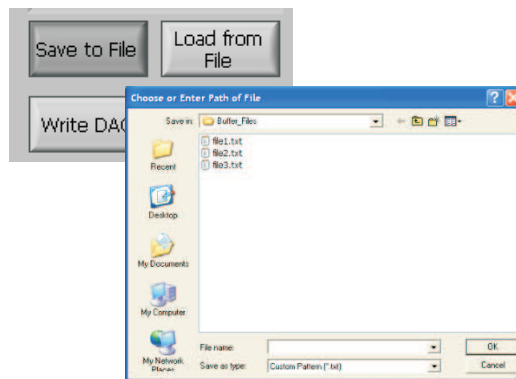


Figure 21. Save to File Dialog Box Button and Window

Saved BUF08630 DAC codes (gamma voltages) exist in a text file that can be opened in a text editor, as [Figure 22](#) illustrates.

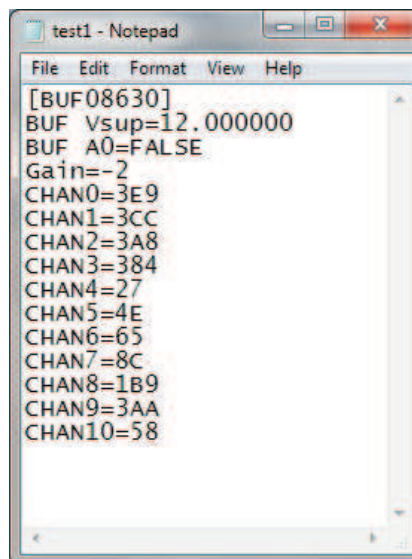
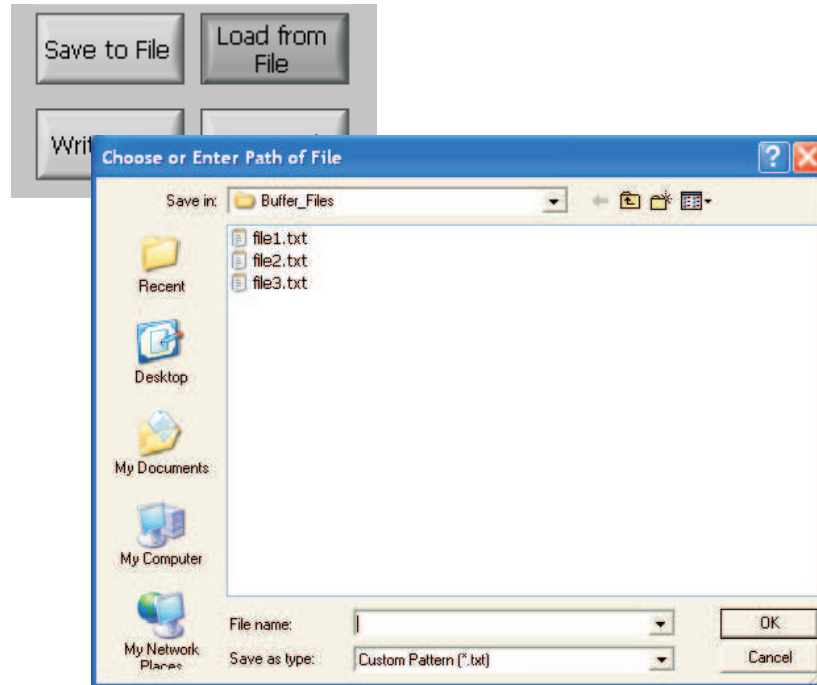


Figure 22. File Format of Saved Data

### 5.2.7 Load From File Button

The BUF08630EVM software is also able to load data saved from previous evaluations. A saved register configuration can be loaded into the BUF08630 using the **Load From File** button, as shown in [Figure 23](#). The program remembers where you saved the last register configuration. Simply select the desired configuration and press *Open*.



**Figure 23. Load From File Button and Window**

### 5.2.8 Changing the DAC/ $V_{COM}$ Analog Voltage

The voltage of any of the DAC or  $V_{COM}$  channels can be adjusted in several ways. First, you can 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, you must first click on the cell to be edited. Click a second time and the cell turns from blue to black, and allows the user to type the updated voltage 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 or  $V_{COM}$  channel is through the use of the slider on the main software window. There is only a single slider that is used for all channels. In order to use the slider to adjust the voltage of a particular channel, that channel must first be selected. To select a channel, click on either the channel number, voltage, or code of a particular channel. The entire channel row highlights in blue to show the user that the channel is selected. Adjusting the slider bar then only updates the highlighted channel.

The final method to change DAC/ $V_{COM}$  voltages is through the  **$\pm 1$  Code** and  **$\pm 5$  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 highlighted in [Figure 24](#)) enables the user to configure the BUF08630 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 24](#) shows. The delay time is the amount of time allowed between loading new configurations into the BUF08630 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.

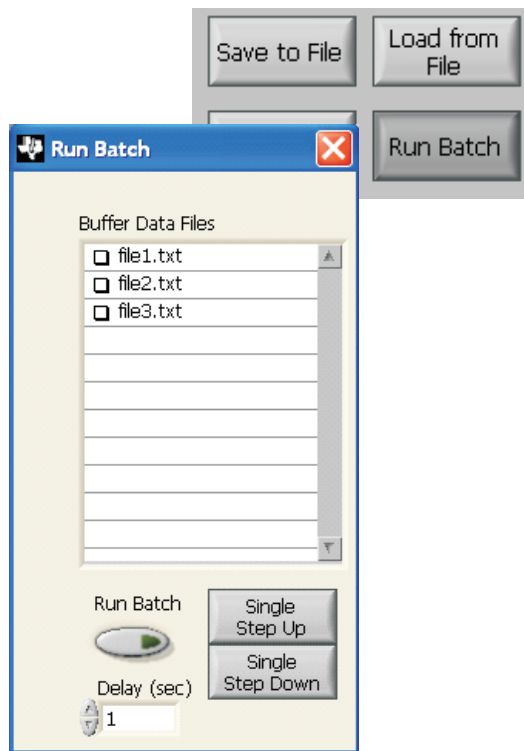
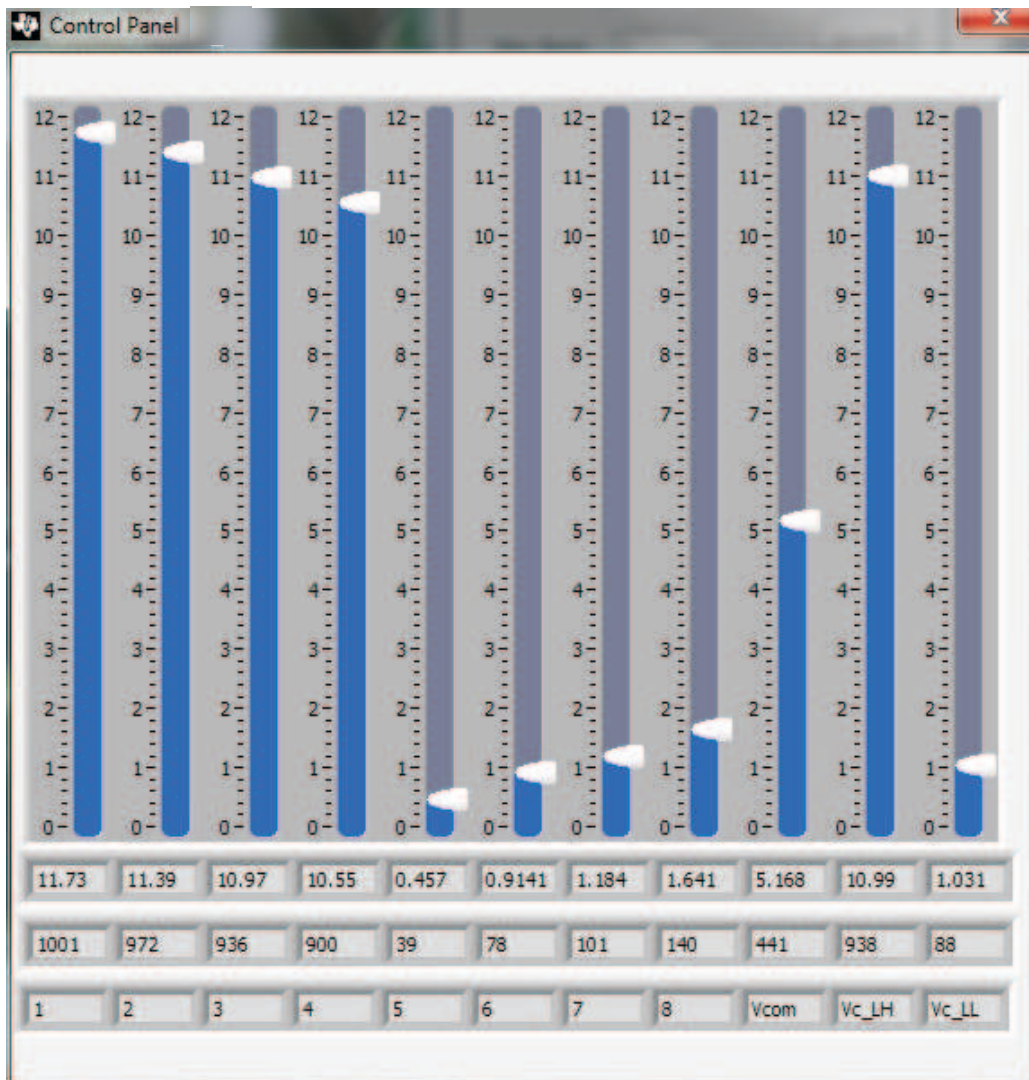


Figure 24. Run Batch Dialog Button and Window

### 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 25](#). 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 BUF08630EVM software window that changes based on the channel that highlighted (as discussed in the [above section](#)).



**Figure 25. Control Panel Button and Window**



### 5.2.11 Program OTP All Channels Button

As Figure 26 shows, pressing the **Program OTP All Channels** button allows you to program a gamma curve into the nonvolatile memory in the BUF08630. All eight channels (including the  $V_{COM}$  channels) are then programmed simultaneously. The values are stored in the memory bank that is selected via the BKSEL switch (see Section 3.7.2).

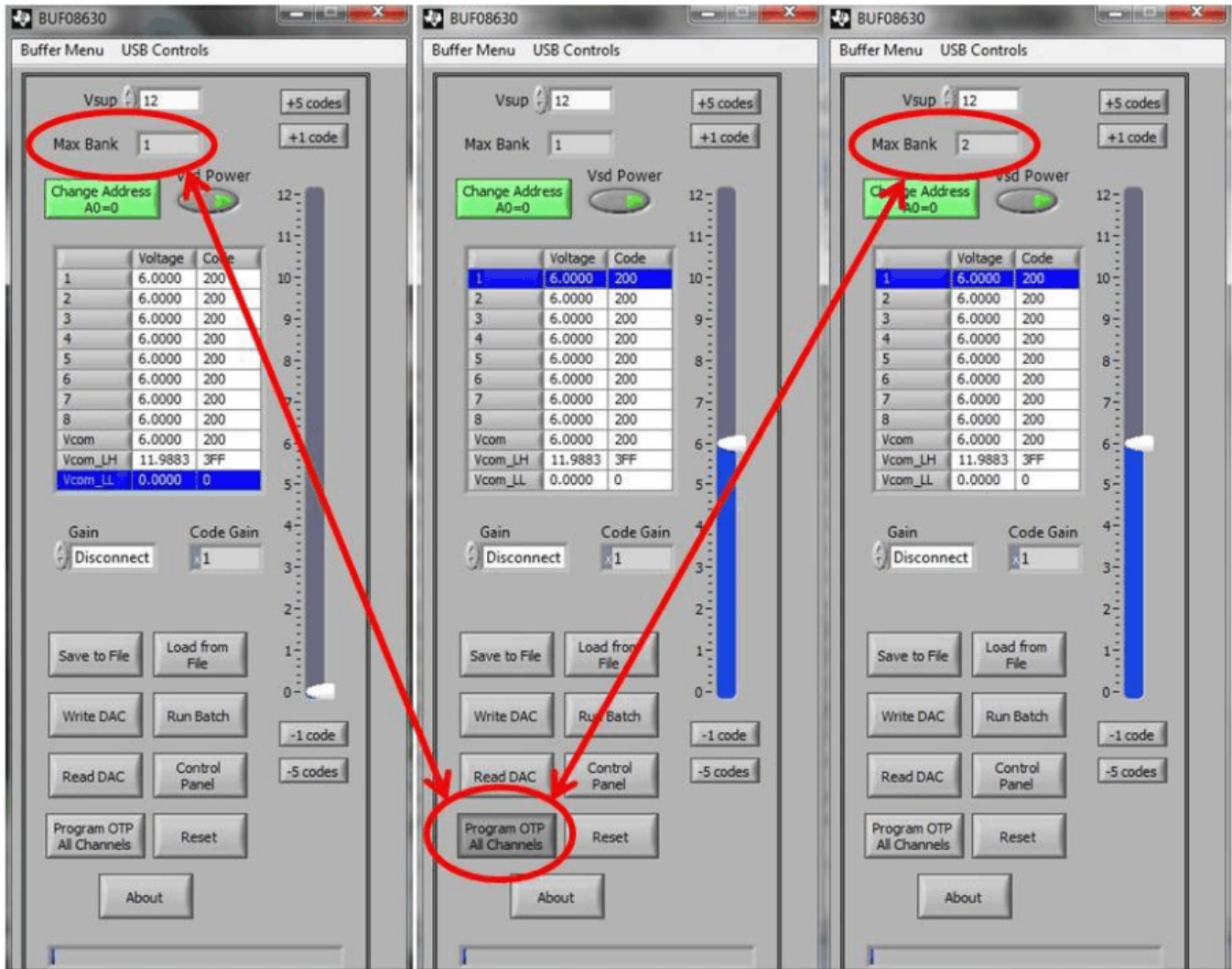


Figure 26. Program OTP All Channels Button

### 5.2.12 Gain

Figure 27 shows the different programmable gain settings for the  $V_{COM}$  output. The gain can be set using the included buffer gains of 1 through 6, or can be configured externally by the user.

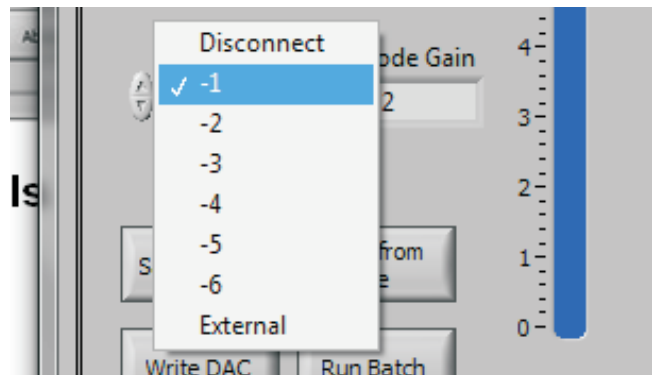


Figure 27. Gain Settings

The external function allows you to customize your gain levels using external resistors  $R_1$ ,  $R_2$ , and  $R_3$ . Figure 28 shows where these resistors may be added on the BUF08630\_Test\_Board. You may use either surface-mount or through-hole resistors.

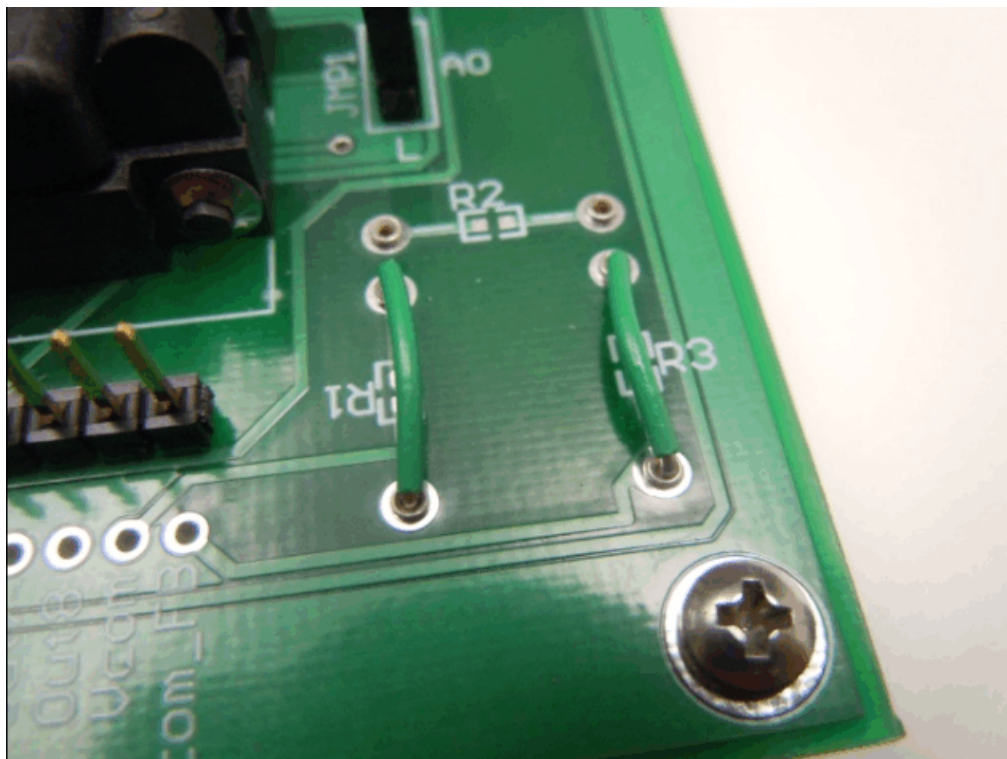


Figure 28. Adding External Gain Resistors

## 6 BUF08630EVM Documentation

This section contains the complete bill of materials and schematic diagram for the BUF08630\_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 BUF08630\_Test\_Board Schematic

Figure 29 shows the schematic for the BUF08630\_Test\_Board.

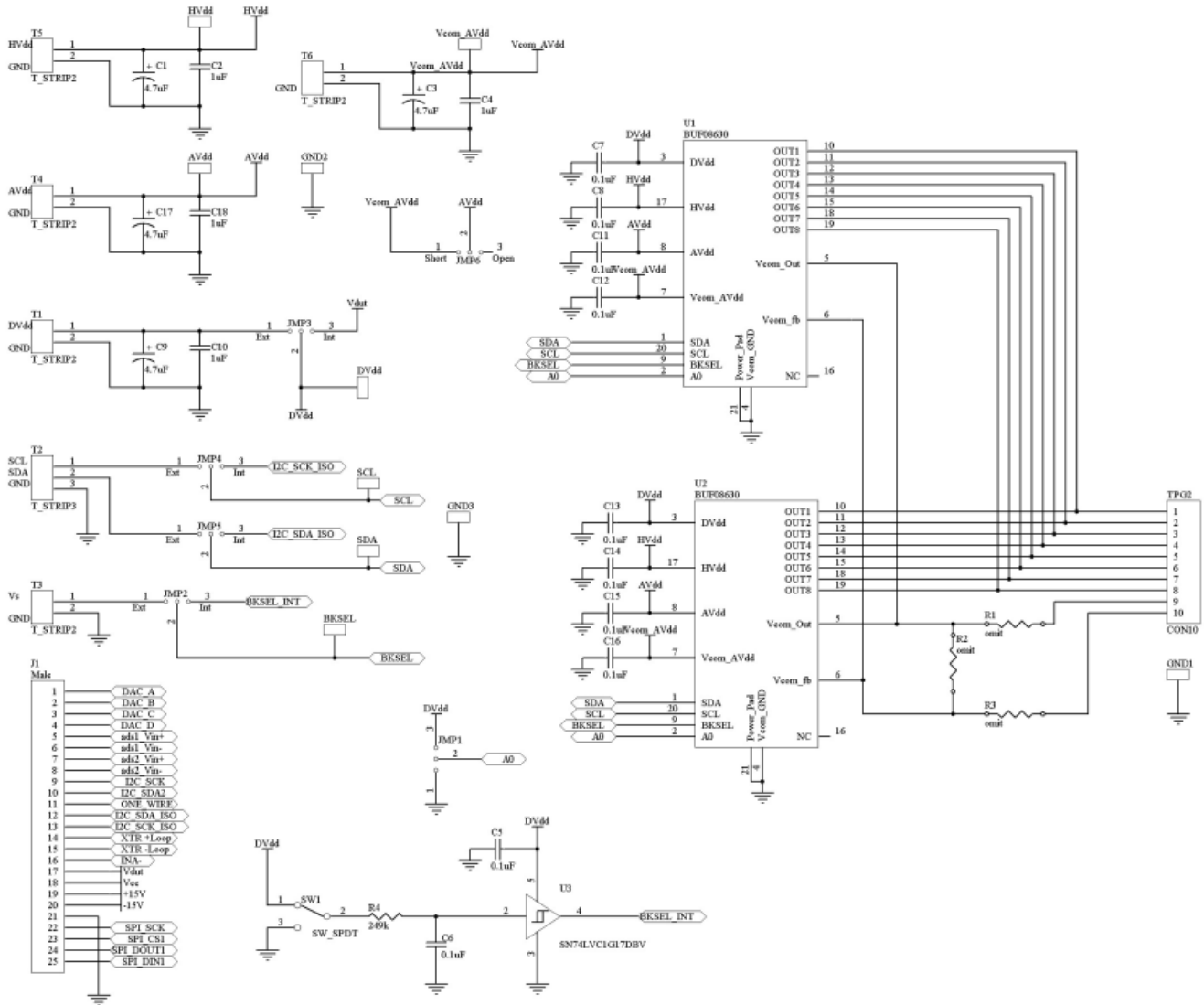
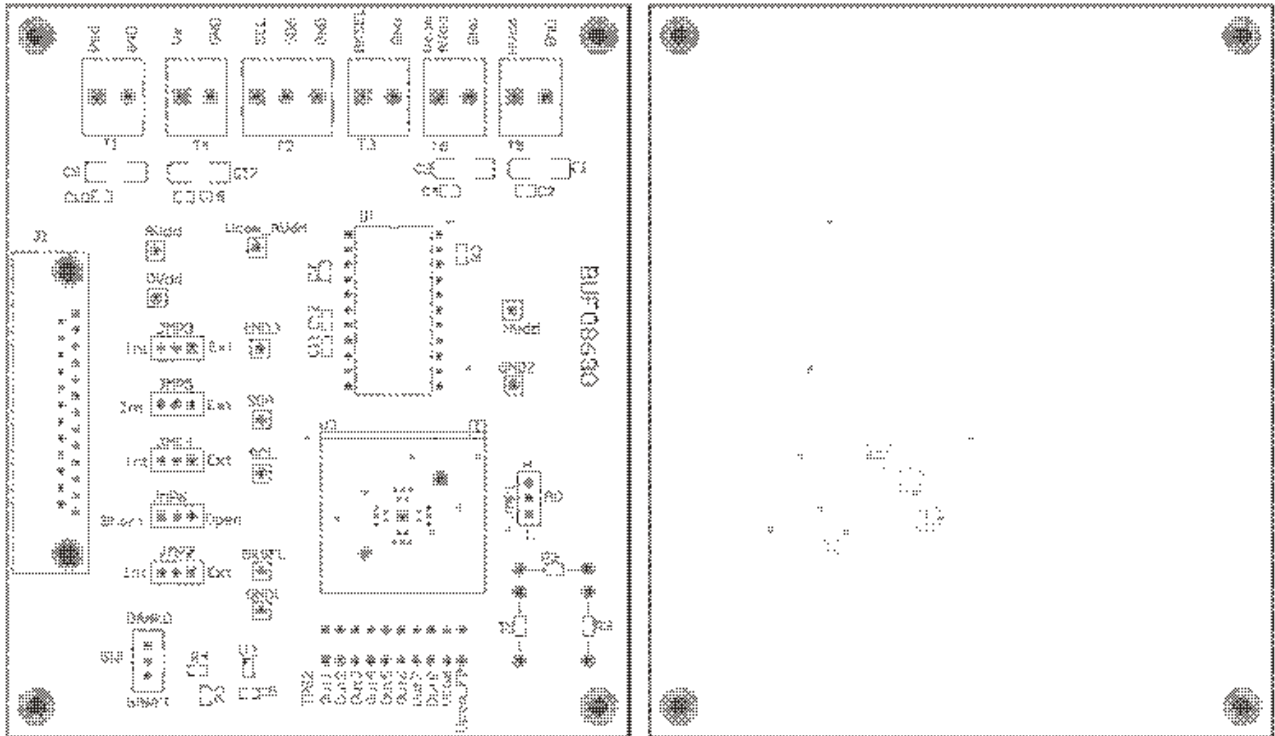


Figure 29. BUF08630\_Test\_Board Schematic

## 6.2 BUF08630\_Test\_Board PCB Layout

The PCB layout of the components for the BUF08630EVM is shown in [Figure 30](#).



**Figure 30. BUF08630EVM PCB Components Layout**

### 6.3 BUF08630\_Test\_Board Bill of Materials

Table 4 lists the bill of materials for this EVM.

**Table 4. BUF08630\_Test\_Board Bill of Materials**

No.	Qty	Value	Ref Des	Description	Vendor	Part number
1	1	34Ω	R1	Resistor, 34.0Ω 1% 50PPM 1/4W, See assembly drawing in <a href="#">Figure 29</a>	Vishay/Dale	CMF5034R000FHEB
2	1	1.2kΩ	R2	Resistor, 1.21KΩ 1% 50PPM 1/4W, See assembly drawing in <a href="#">Figure 29</a>	Vishay/Dale	CMF501K2100FHEB
3	1	150Ω	R3	Resistor, 150Ω 1% 50PPM 1/4W, See assembly drawing in <a href="#">Figure 29</a>	Vishay/Dale	CMF50150R00FHEB
4	1	249kΩ	R4	Resistor, 249kΩ 1/16W .5% 0603 SMD	Susumu Co Ltd	RR0816P-2493-D-39D
51	4	4.7μF	C1, C3, C9, C17	Capacitor, Tantalum 4.7μF 35V 10% SMD	Vishay/Sprague	293D475X9035C2TE3
6	4	1μF	C2, C4, C10, C18	Capacitor, Ceramic 1 μF 25V Y5V 0603	Murata Electronics North America	GRM188F51E105ZA12D
7	10	0.1μF	C5-C8, C11-C16	Capacitor, .10μF 25V Ceramic Y5V 0603	Kemet	C0603C104Z3VACTU
8	1		U1	Test Socket for 20-Pin QFN/MLF	Emulation Technology, Inc.	S-MLF-00-020-A
9	2		U2	Conn RCPT .100" 11POS GOLD T/H; See assembly drawing in <a href="#">Figure 29</a>	Samtec Inc	SS-111-G-2
10	1		U3	IC Buffer Schmitt Trig SOT235	Texas Instruments	SN74LVC1G17DBVR
11	1		T2	Term Block 3-Pos 5.08mm SCREWLESS	Tyco Electronics	1437671-4
12	6		Pin Socket (R1-R3)	Pin Socket Rcpt .014-.026 30AU	AMP	5050863-5
13	8	TP Cut to Size	Test Points, All	Conn Header 1POS .100" SGL Gold	Samtec	TSW-132-07-G-S
14	4	Standoff	None	Standoffs, Hex , 4-40 Threaded, 0.500" length, 0.250" OD, Aluminum Iridite Finish	Keystone	2203
15	4	Screw	none	Screw Machine Phil 4-40X1/4 SS	Building Fasteners	PMSSS 440 0025 PH
16	5	Cut to Size	JMP1-JMP6	Conn Header 3POS .100" SGL Gold	Samtec	TSW-132-07-G-S
17	5		N/A	Shunt LP W/Handle 2-Pos 30AU	AMP/Tyco Electronics	881545-2
18	1	BUF08630	U1	20-Pin QFN	Texas Instruments	BUF08630

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## EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 5.7V to 9V; the BUF06830 Test Board within the supply voltage range of 9V to 20V; and the output voltage range of BUF08630 Test Board must remain below 20V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the 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 +25°C. The EVM is designed to operate properly with certain components above +25°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>	Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Energy	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>	Space, Avionics & Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>	Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless-apps">www.ti.com/wireless-apps</a>

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