Multi-DC/DC Color LED Kit

This document provides instructions to run a graphical user interface (GUI) that controls the Multi-DC/DC Color LED Kit board using the F28027 microcontroller.

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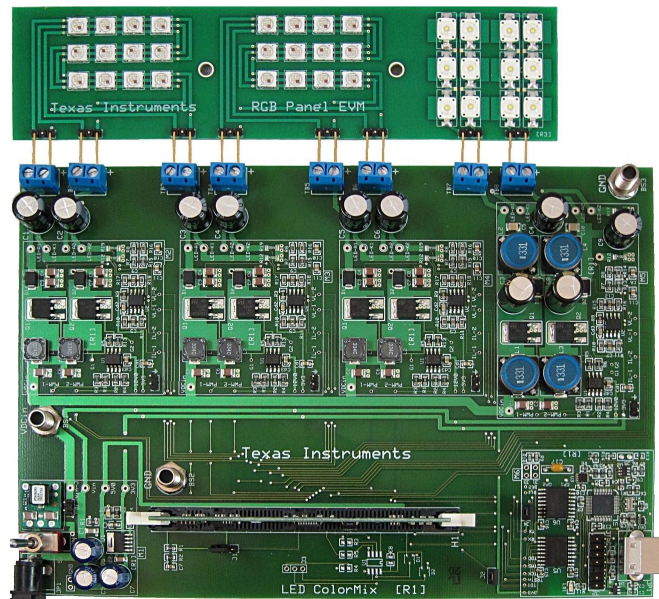
1   System Overview

Figure 1. Picture of the Multi-DC/DC Color LED Kit Board (TMDSRGBLEDKIT)

1.1   Kit Contents

Contents of the Multi-DC/DC Color LED kit:

- Multi-DC/DC Color LED Kit power board
- Piccolo™ F28027 controlCARD
- Color RGB LED panel with diffuser cover
- 12-V power adapter
- USB cable
- USB drive with GUI executable and Code Composer Studio™ (CCS) software

1.2   Kit Features

Features of the Multi-DC/DC Color LED Kit:

- Eight independent power stages (6×Boost, 2×SEPIC)
- Independent closed-loop average current control of eight LED strings
- Onboard isolated JTAG emulation
- Isolated universal asynchronous receiver/transmitter (UART) communication through the serial communications interface (SCI) peripheral and FTDI chip
- Hardware developer's package is available and includes schematics, bill of materials (BOM), Gerber files, and so on

2   Hardware Overview

The Multi-DC/DC Color LED Kit board consists of eight independent power stages (6×Boost, 2×SEPIC), which can be used to drive the LED strings. Each power stage regulates the average output current using 2P2Z/PID closed-loop control. By adjusting the average output current, the brightness of each LED string can be regulated independently of each other. Figure 2 shows the circuit diagram for the Multi-DC/DC Color LED Kit.
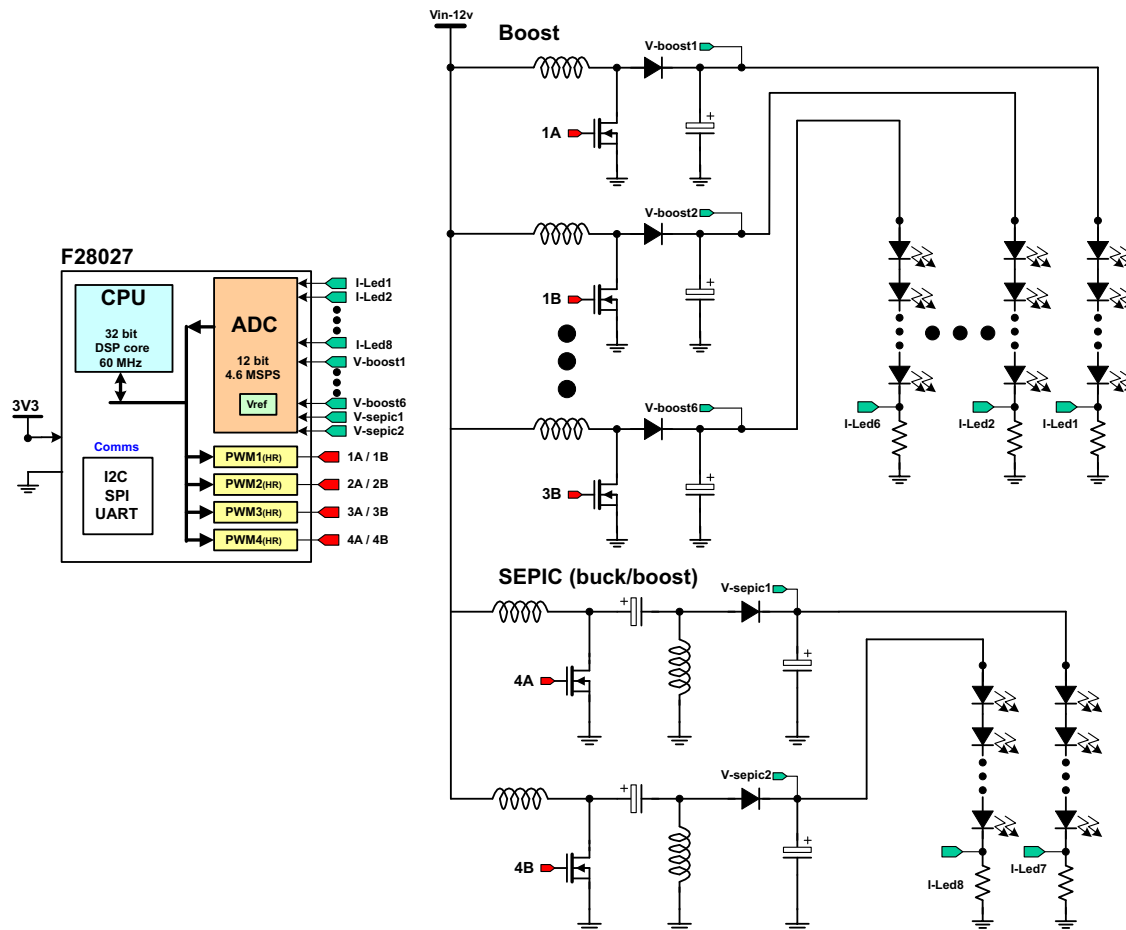

Figure 2. Multi-DC/DC Color LED Kit Circuit Diagram

The Multi-DC/DC Color LED Kit board is divided into functional groups referred to as macro blocks. The following is a list of the macro blocks present on the board and brief descriptions of each:

Main board [Main]—Contains the controlCARD socket, power connectors, jumpers, and the routing of signals between the controlCARD and the macro blocks. This section includes any area outside of other defined macro blocks.

DC-PwrEntry macro [M1]—Generates the 12-V, 5-V, and 3.3-V DC power rails from a 12-V DC supply included with the kit or an external DC power supply.

Isolated-USB-to-JTAG macro [M6]—Provides an onboard isolated JTAG connection through USB to the host as well as isolated SCI (UART) communication.

Dual boost macro [M2],[M3], and [M4]—Consists of two independent boost DC/DC conversion stages with voltage and output current feedback, per macro instance.

Dual SEPIC macro [M5]—Consists of two independent SEPIC DC/DC conversion stages with voltage and output current feedback.
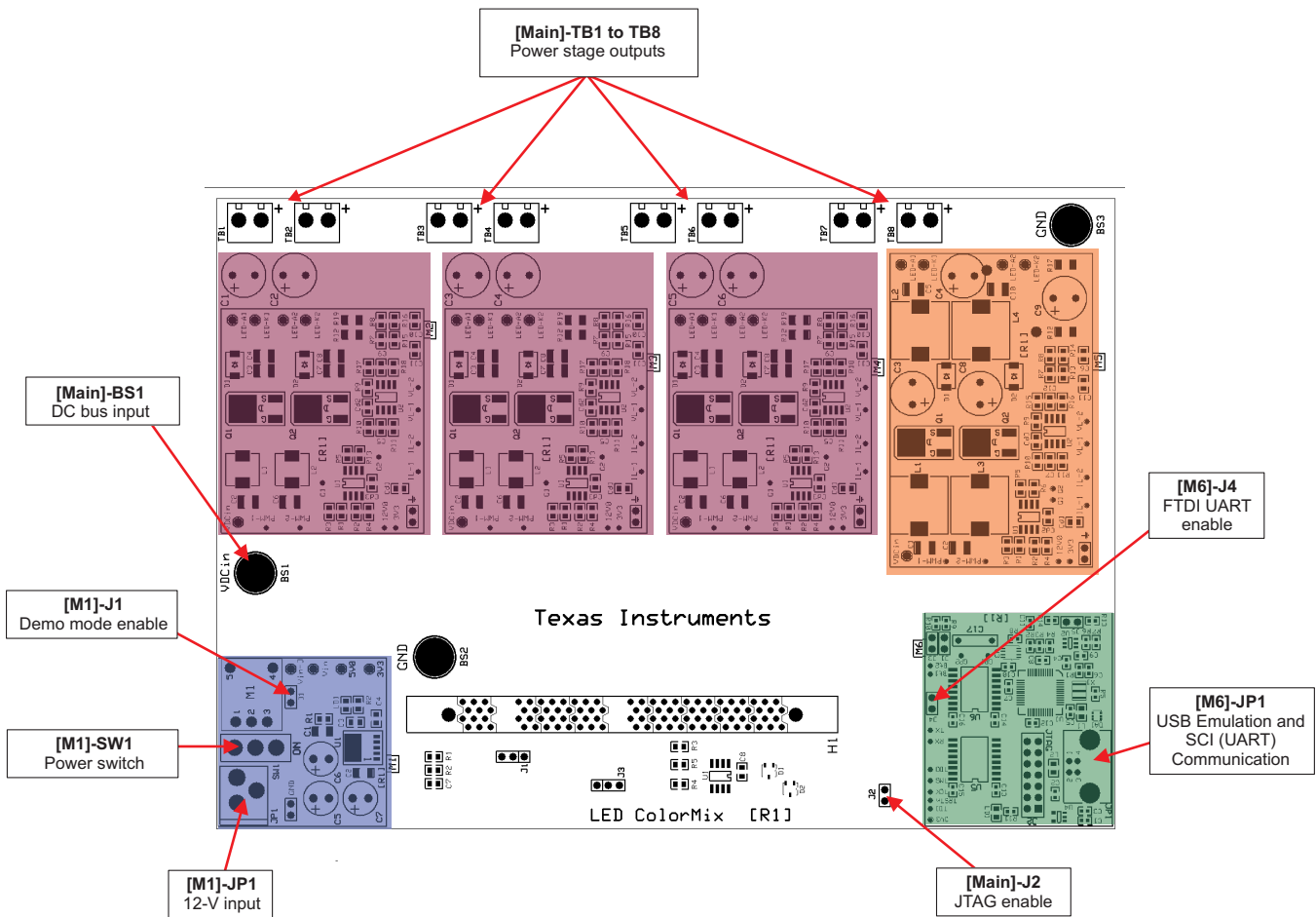
For the placement of each macro block, see Figure 3.

Figure 3. Multi-DC/DC Color LED Board Macro Block Locations

Table 1. Macro Block Locations Legend

[Main] – controlCARD socket, power connectors, and jumpers
[M1] – 12V, 5V, and 3.3V DC power rails
[M6] – Isolated JTAG and SCI (UART) communication via USB
[M2],[M3], and [M4] – Two independent Boost stages per macro instance
[M5] – Two independent Sepic stages

Each component in this document is named first with their macro number followed by the reference name. For example, [M2]-J1 would refer to the jumper J1 located in the macro M2, and [Main]-J1 would refer to the jumper J1 located on the board outside of the other defined macro blocks.

3 Hardware Setup

Perform or verify the following steps to prepare the Multi-DC/DC Color LED Kit for use with the included GUI.

1. Insert an F28027 control card into socket [Main]-H1.

2. Connect the LED panel to the board via [Main]-TB1 to TB8.

3. Connect your computer to the board using a USB cable. [M6]-LD1 near the USB connector [M6]-JP1 should turn on.

4. Verify the following jumper settings:

   (a) A jumper is placed on [M1]-J1.

   (b) A jumper is placed on [M6]-J4.

   (c) No jumper is placed on [Main]-J2.

5. Verify that the power switch [M1]-SW1 is in the *OFF* position.

6. Connect the 12-V DC power supply to [M1]-JP1.

NOTE: If CCS has never been installed, it may be necessary to install drivers to make the board work correctly. If a message comes up when the USB cable is connected from the board to the computer, use the install wizard to install drivers from the XDS100v1 directory of the zip file included with this kit.

See Step 2 of the *Software Setup.*

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7. When Windows asks to search through the Windows Update, select *No, not this time* and click *Next* (see Figure 4).
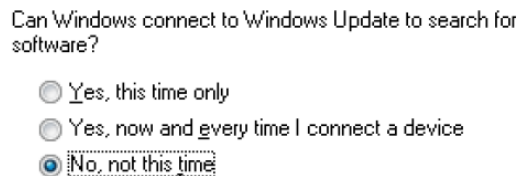

Figure 4. Windows Update Options

8. Select *Install from a list or specific location* and click *Next* (see Figure 5).
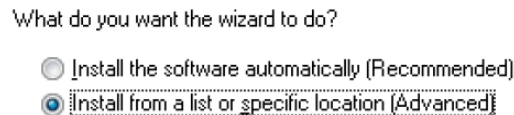

Figure 5. Wizard Options

9. Select *Search for the best driver in these locations*, uncheck *Search removable media*, and check *Include this location in the search* and browse to *[USB Drive]:\XDS100 Drivers* (see Figure 6).
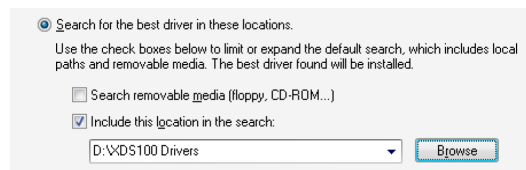

Figure 6. Driver Options

10. Click *Next* to install the drivers. The driver install screen will appear three times. Repeat this procedure each time.

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4   Quick Start GUI

This kit comes with a GUI that provides a convenient way to evaluate the functionality of this kit and the F28027 device without having to learn and configure the underlying project software or install CCS. The interactive interface using sliders, buttons, and text boxes allows LED lighting with the C2000™ device to be demonstrated quickly and easily.

The GUI for evaluating this kit is named *LED-ColorMix-GUI[R1].exe* and can be found on the USB drive included in the kit box. This GUI is all the software necessary to do a quick evaluation of this kit. To explore deeper, the underlying reference software can be found within controlSUITE™.

To obtain the most recent version of the CCS project for this kit, reference material, and other software for the C2000 MCU, download the controlSUITE installer from http://www.ti.com/controlSUITE.

Once controlSUITE is installed, the Multi-DC/DC Color LED Kit project files can be found in the following directory:

• controlSUITE\development_kits\TMDSRGBLEDKIT_v1.0\

The GUI mentioned in this guide can be found at:

• \TMDSRGBLEDKIT_v1.0\~GUI\LED-ColorMix-GUI[R1].exe

The kit ships with an F27027 controlCARD that has been pre-flashed with the code that enables it to run with the kit's GUI. If, for any reason, the controlCARD needs to be re-flashed so that it works with the GUI again, the flash image can be found at:

• \TMDSRGBLEDKIT_v1.0\~GUI\LED-ColorMix-FLASH[R1].out

The CCS v4 project and source code can be found at:

• \TMDSRGBLEDKIT_v1.0\LED-ColorMix\

The documentation can be found at:

• \TMDSRGBLEDKIT_v1.0\~Docs\

The hardware development package can be found at:

• \TMDSRGBLEDKIT_v1.0\~LED-ColorMix-HWdevPkg[R1]\

NOTE: The GUI requires Microsoft® .NET® framework 3.0 to run. Ensure that this software is installed prior to running this program.

NOTE: If this demo is being used on a computer that uses a decimal comma, the regional settings of the computer may need to be changed to English for this demo to run correctly.

Follow these instructions to run the GUI included with the Multi-DC/DC Color LED Kit:

1. Browse to *LED-ColorMix-GUI[R1].exe* and run the GUI. The program shown in Figure 7 should appear.
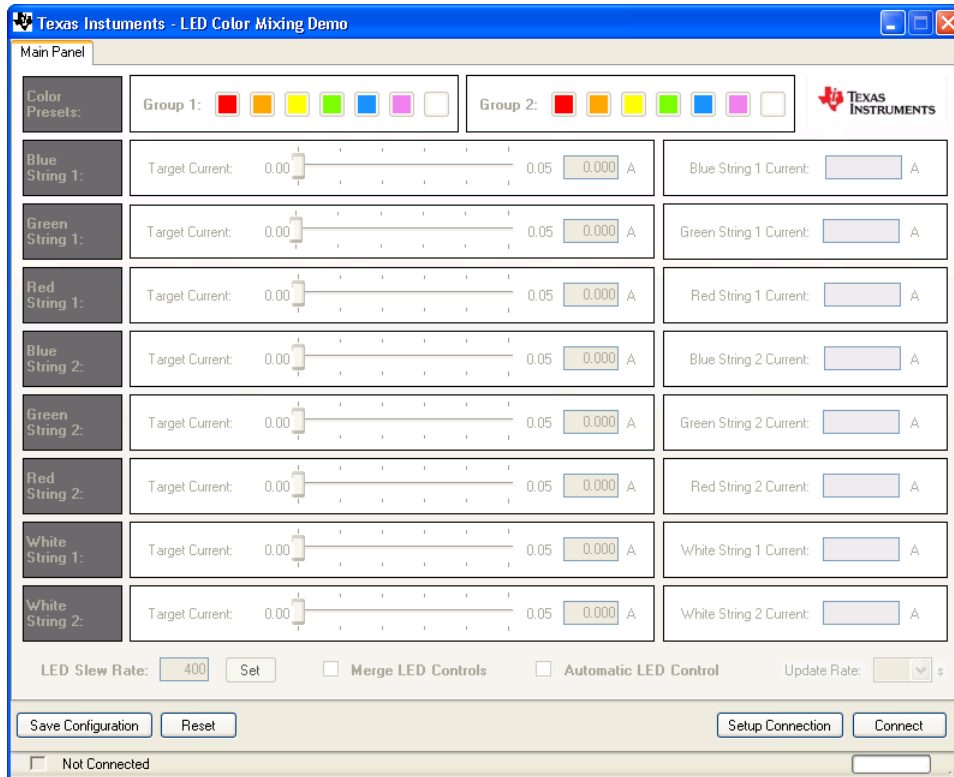

Figure 7. The Multi-DC/DC Color LED Kit GUI

2. Click *Setup Connection* and make sure the *Baud Rate* is set to 57600 and that the *Boot on Connect* box is unchecked, as shown in Figure 8.
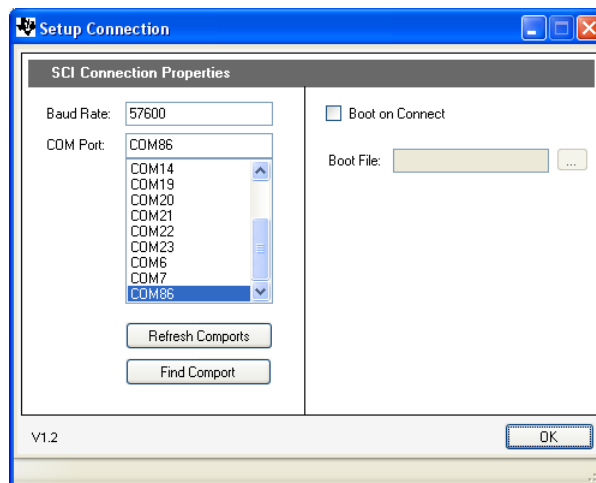

Figure 8. The GUI *Setup Connection* **Window**

3. Select a serial COM port. This can be found by going to:

   (a) *Control Panel → System → Hardware Tab → Device Manager → Ports (Com and LPT)*

   Look for the COM port that is named *USB Serial Port* or similar and note the number. Select this COM port in the *Setup Connection* window and click *OK* to close the window. Hint: Try selecting the largest number or refreshing the list while connecting or disconnecting the USB cable to or from the board to see which one changes.

4. Turn on the board by setting the power switch [M1]-SW1 to the *ON* position. A red LED should begin blinking on the controlCARD.

5. Click *Connect* in the GUI main window. The status bar at the bottom left corner of the GUI should turn green and say *Connected* once the GUI is connected.

6. Use the *Color Presets* provided or manually adjust the current level for each LED string to vary the color generated by each LED array.

7. When finished, set each LED string's *Target Current* to 0.00 A and press *Disconnect* to terminate the connection.

8. Turn off the board by setting the power switch [M1]-SW1 to the *OFF* position.

5   References

- LED-ColorMix-Application Report: provides detailed information on the CCS v4 project.
  - \TMDSRGBLEDKIT_v1.0\~Docs\LED-ColorMix-AppNote[R1].pdf
- LED-ColorMix-Hardware Guide: provides detailed information on the hardware on the board.
  - \TMDSRGBLEDKIT_v1.0\~Docs\LED-ColorMix-HWGuide[R1].pdf
- LED-ColorMix-Hardware Development Package: a folder containing files related to the hardware on the board (schematics, bill of materials, Gerber files, PCB layout, and so on).
  - \TMDSRGBLEDKIT_v1.0\~LED-ColorMix-HWdevPkg[R1]\

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