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.

Contents
1 System Overview ................................................................. 2
2 Hardware Overview .............................................................. 3
3 Hardware Setup ................................................................. 5
4 Quick Start GUI ................................................................. 6
5 References ........................................................................ 8

List of Figures
1 Picture of the Multi-DC/DC Color LED Kit Board (TMDSRGBLEDKIT) .................................................. 2
2 Multi-DC/DC Color LED Kit Circuit Diagram ................................................................. 3
3 Multi-DC/DC Color LED Board Macro Block Locations .................................................. 4
4 Windows Update Options .................................................................................. 5
5 Wizard Options .................................................................................. 5
6 Driver Options .................................................................................. 5
7 The Multi-DC/DC Color LED Kit GUI ........................................................................ 7
8 The GUI Setup Connection Window ........................................................................ 7

List of Tables
1 Macro Block Locations Legend .................................................................................. 4
1 System Overview

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.

![Multi-DC/DC Color LED Kit Circuit Diagram](image)

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.
Hardware Overview

For the placement of each macro block, see Figure 3.

![Diagram showing Multi-DC/DC Color LED Board Macro Block Locations]

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

Table 1. Macro Block Locations Legend

<table>
<thead>
<tr>
<th>Macro Block Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Main] – controlCARD socket, power connectors, and jumpers</td>
</tr>
<tr>
<td>[M1] – 12V, 5V, and 3.3V DC power rails</td>
</tr>
<tr>
<td>[M6] – Isolated JTAG and SCI (UART) communication via USB</td>
</tr>
<tr>
<td>[M2], [M3], and [M4] – Two independent Boost stages per macro instance</td>
</tr>
<tr>
<td>[M5] – Two independent Sepic stages</td>
</tr>
</tbody>
</table>

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.

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

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

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).

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

   **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](image)

   **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]"
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.

<table>
<thead>
<tr>
<th>Products</th>
<th>Applications</th>
<th>TI E2E Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td>Automotive and Transportation</td>
<td><a href="http://www.ti.com/automotive">www.ti.com/automotive</a></td>
</tr>
<tr>
<td>Amplifiers</td>
<td>Communications and Telecom</td>
<td><a href="http://www.ti.com/communications">www.ti.com/communications</a></td>
</tr>
<tr>
<td>Data Converters</td>
<td>Computers and Peripherals</td>
<td><a href="http://www.ti.com/computers">www.ti.com/computers</a></td>
</tr>
<tr>
<td>DLP® Products</td>
<td>Consumer Electronics</td>
<td><a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a></td>
</tr>
<tr>
<td>DSP</td>
<td>Energy and Lighting</td>
<td><a href="http://www.ti.com/energy">www.ti.com/energy</a></td>
</tr>
<tr>
<td>Clocks and Timers</td>
<td>Industrial</td>
<td><a href="http://www.ti.com/industrial">www.ti.com/industrial</a></td>
</tr>
<tr>
<td>Interface</td>
<td>Medical</td>
<td><a href="http://www.ti.com/medical">www.ti.com/medical</a></td>
</tr>
<tr>
<td>Logic</td>
<td>Security</td>
<td><a href="http://www.ti.com/security">www.ti.com/security</a></td>
</tr>
<tr>
<td>Power Mgmt</td>
<td>Space, Avionics and Defense</td>
<td><a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a></td>
</tr>
<tr>
<td>Microcontrollers</td>
<td>Video and Imaging</td>
<td><a href="http://www.ti.com/video">www.ti.com/video</a></td>
</tr>
<tr>
<td>RFID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMAP Applications Processors</td>
<td><a href="http://www.ti.com/omap">www.ti.com/omap</a></td>
<td></td>
</tr>
<tr>
<td>Wireless Connectivity</td>
<td></td>
<td><a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a></td>
</tr>
</tbody>
</table>

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2014, Texas Instruments Incorporated