

LP5012EVM User's Guide

This user's guide describes the characteristics, setup, and use of the LP5012EVM evaluation module (EVM). The LP5012EVM helps the user evaluate the features of the Texas Instruments LP5012 device, which is an I²C bus-controlled, 12-channel, constant-current LED driver. This user's guide includes setup instructions, a schematic diagram, a bill of materials, printed-circuit board layout drawings, and software instructions.

The LP5012EVM can be converted for testing the LP5009 device by removing the factory-installed device (U1) and replacing it with the LP5009 counterpart. When testing the LP5009 device, select the corresponding LP5009 tag from the menu on the GUI home page ([Figure 5](#)) for the evaluation.

Contents

1	What You Get	2
2	What You Need In Addition	4
3	How to Get Started	4
4	Board Layout.....	15

List of Figures

1	LP5012EVM Kit	2
2	LP5012EVM Key Connectors	3
3	LP5012EVM Hardware Setup.....	4
4	LP5012EVM USB Cable Direction	5
5	LP50 Family GUI Home Page	6
6	Landing Page of LP5012EVM GUI.....	6
7	LED Control Panel.....	7
8	LP50 EVM GUI Connection Status.....	8
9	LP50xx Global Setting	9
10	LED Color and Brightness Setting	10
11	Bank Management Entry	11
12	Bank Setting	11
13	LED Lighting Pattern	12
14	Register Map.....	13
15	Tool Bar	14
16	Top Layer Routing	15
17	Bottom Layer Routing (Mirrored).....	16
18	LP5012EVM Schematic Diagram	17

List of Tables

1	LP5012EVM Parameters	3
2	Bill of Materials (BOM).....	18

Trademarks

All trademarks are the property of their respective owners.

1 What You Get

The LP5012EVM kit (Figure 1) contains:

- USB2ANY
 - Ribbon cable
 - USB cable
- LP5012EVM

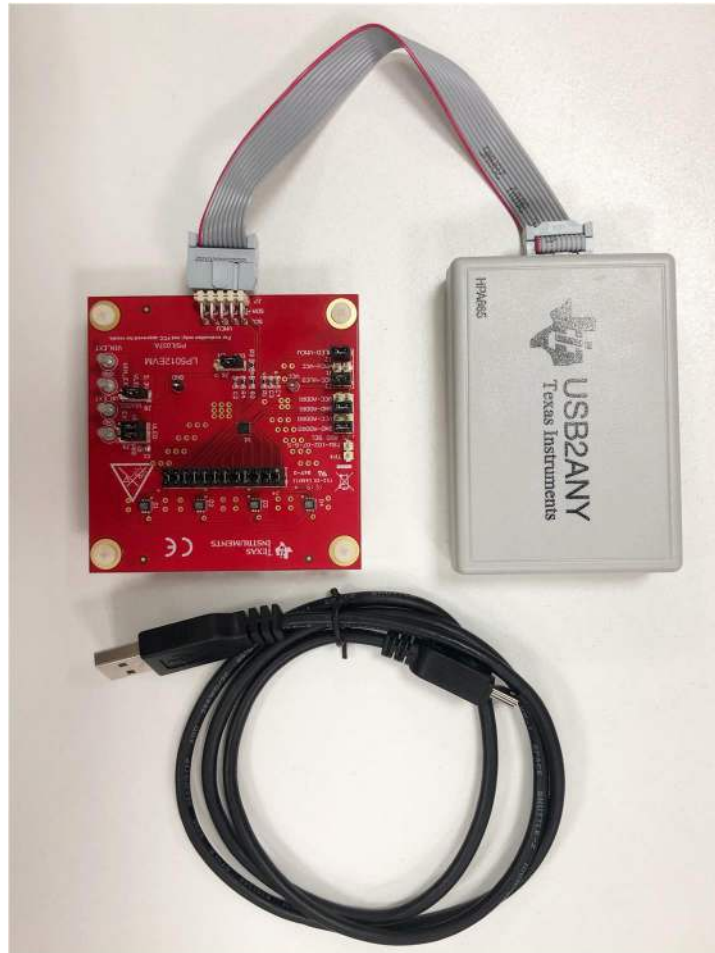


Figure 1. LP5012EVM Kit

Figure 2 shows the key connectors used to operate LP5012EVM.

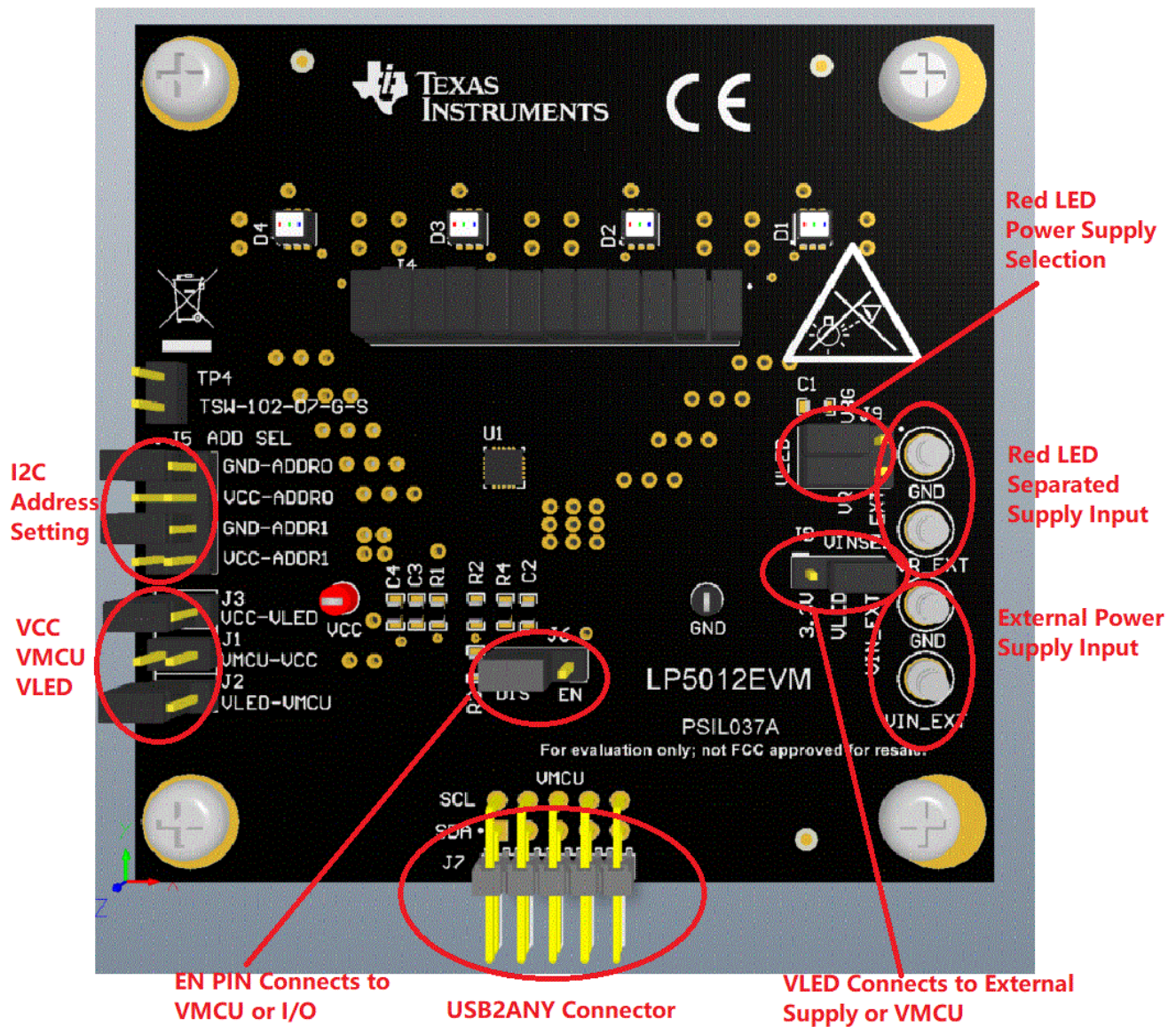


Figure 2. LP5012EVM Key Connectors

Table 1. LP5012EVM Parameters

PARAMETER	RANGE
VCC	3 V–5.5 V
VLED	3 V–5.5 V
VMCU	1.8 V, 3.3 V, 5 V
Channel current	35 mA (maximum)

Note: Channel current is set at 20 mA when the LED supply voltage is 5 V. Although the LP5012 device can withstand 6-V maximum LED supply voltage with 35 mA per channel, make sure that the PCB thermal performance can meet the power dissipation requirement, because increased LED supply voltage increases channel output current.

2 What You Need In Addition

A PC on which to install the LP50EVM GUI (click [here](#) to download software)
 DC supply

3 How to Get Started

3.1 Hardware Setup

Figure 3 shows the hardware setup of the LP5012EVM.

- Connect a 5-V power supply to TP1 (VIN_EXT) and TP6 (GND).
- Using the USB cable, connect the USB2ANY module to the PC.
- Using the ribbon cable, connect the USB2ANY module to the LP5012EVM.

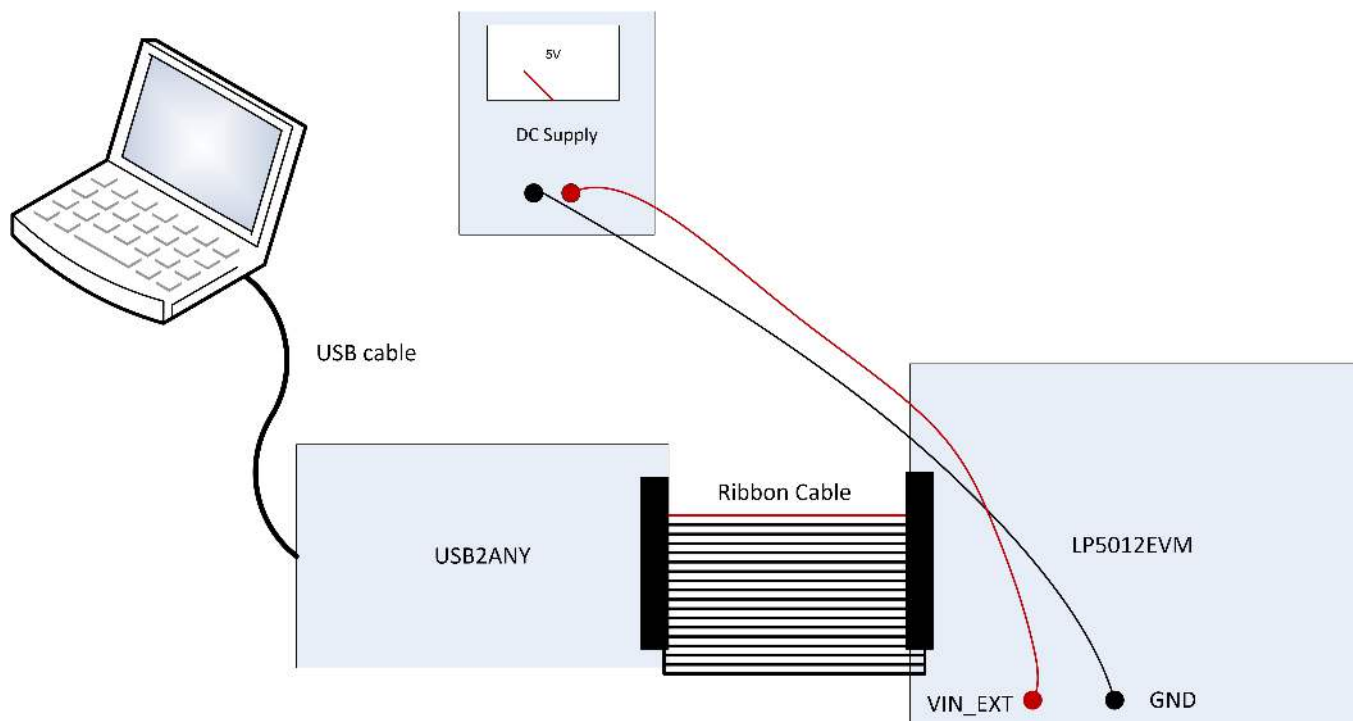


Figure 3. LP5012EVM Hardware Setup

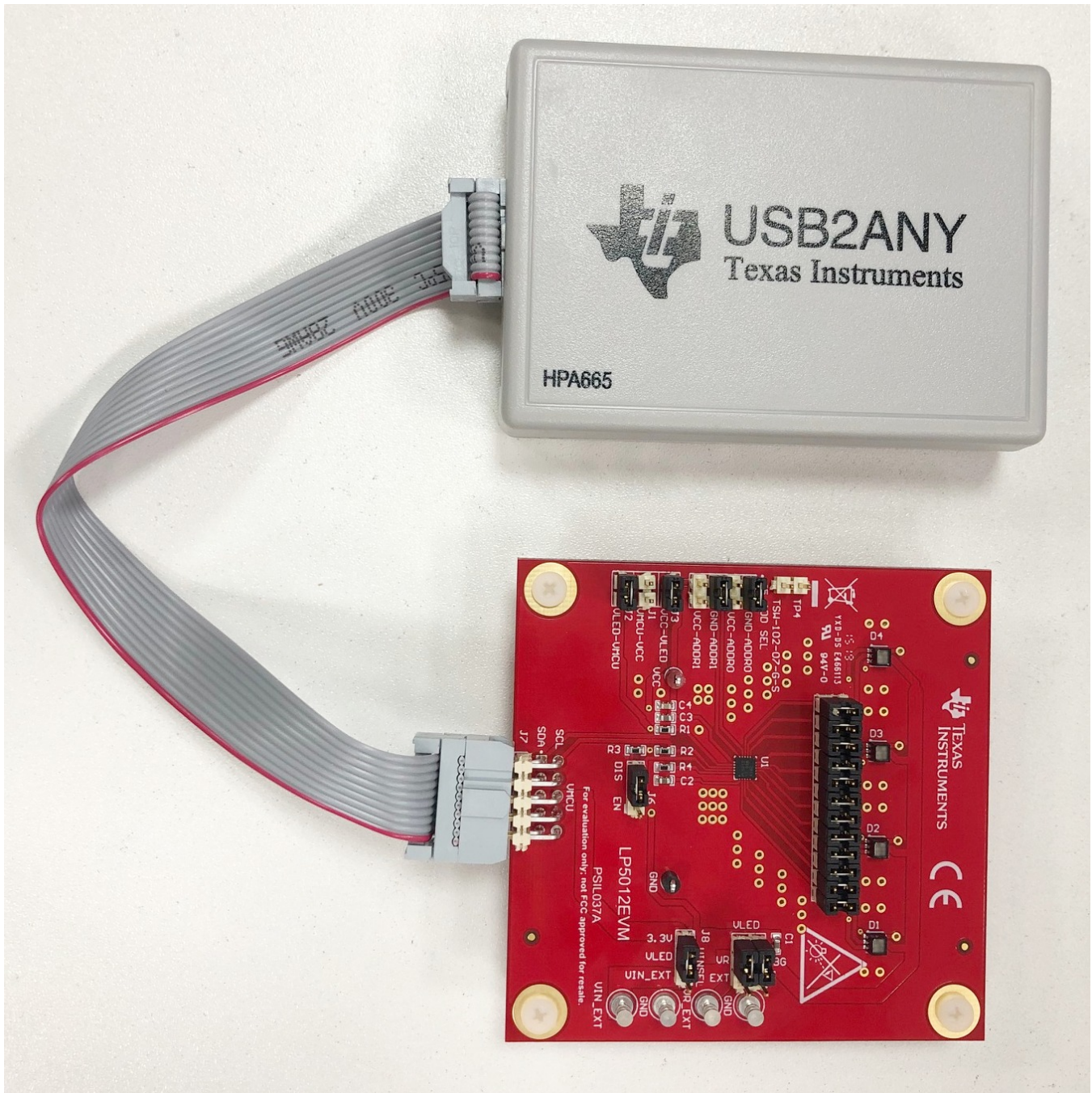


Figure 4. LP5012EVM USB Cable Direction

3.2 Software Installation

Download the GUI software from the [product folder](#). After downloading, install the LP50EVM GUI on the PC. A shortcut to the GUI will be found on the desktop. A shortcut can also be found in the startup menu under the Texas Instruments folder. [Figure 6](#) shows the landing page of the LP50EVM GUI. The landing page contains the LP50xx introduction information and LP5012EVM information. Clicking the menu icon (≡) shows more information.

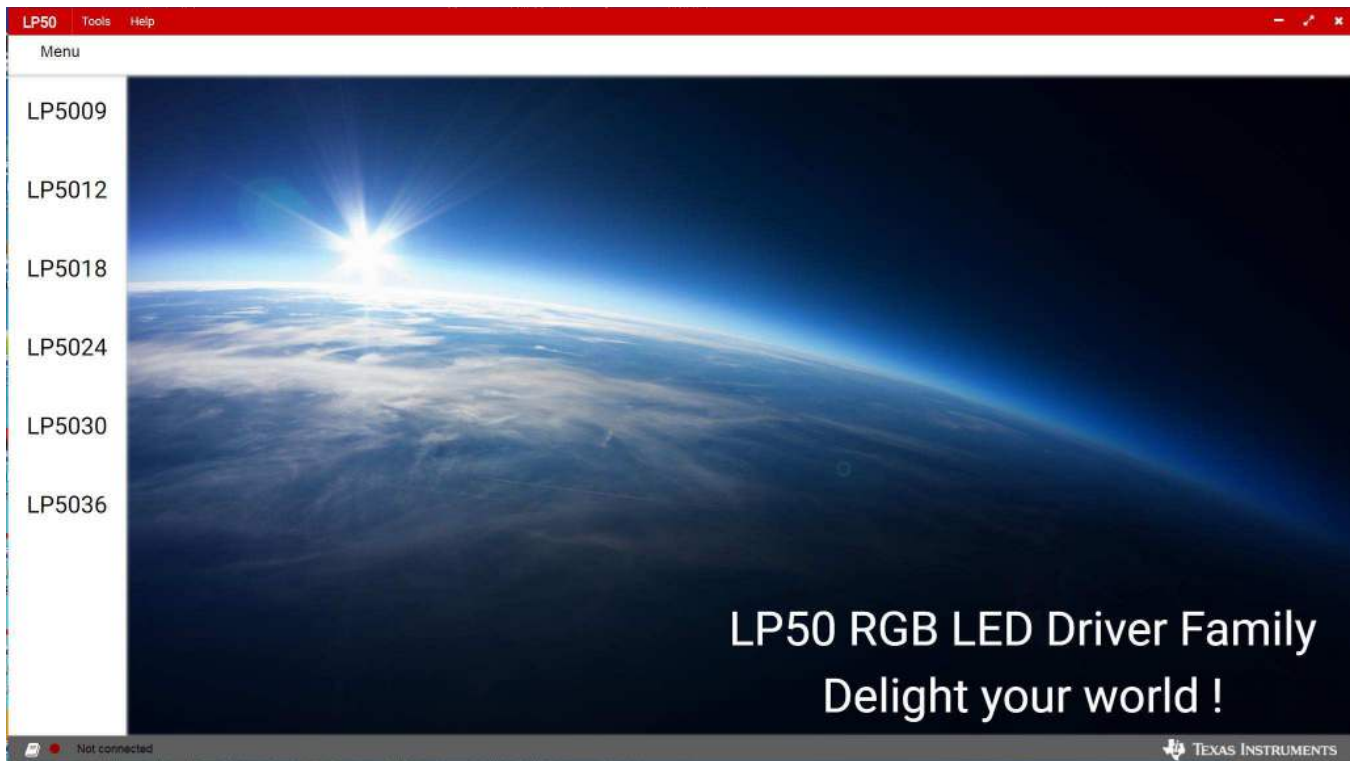


Figure 5. LP50 Family GUI Home Page

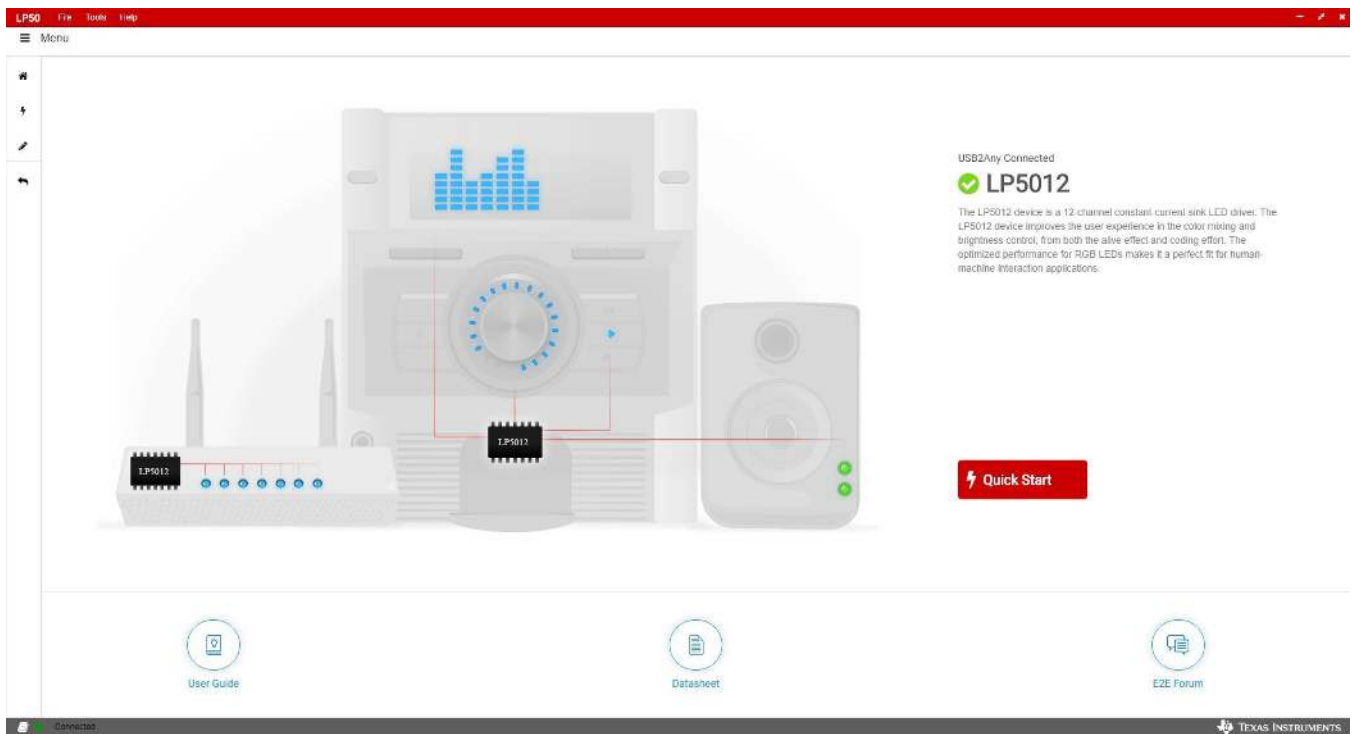


Figure 6. Landing Page of LP5012EVM GUI

3.3 GUI Function

Click the Quick Start button in the lower-right corner. The GUI displays a detailed LED control panel as shown in Figure 7.

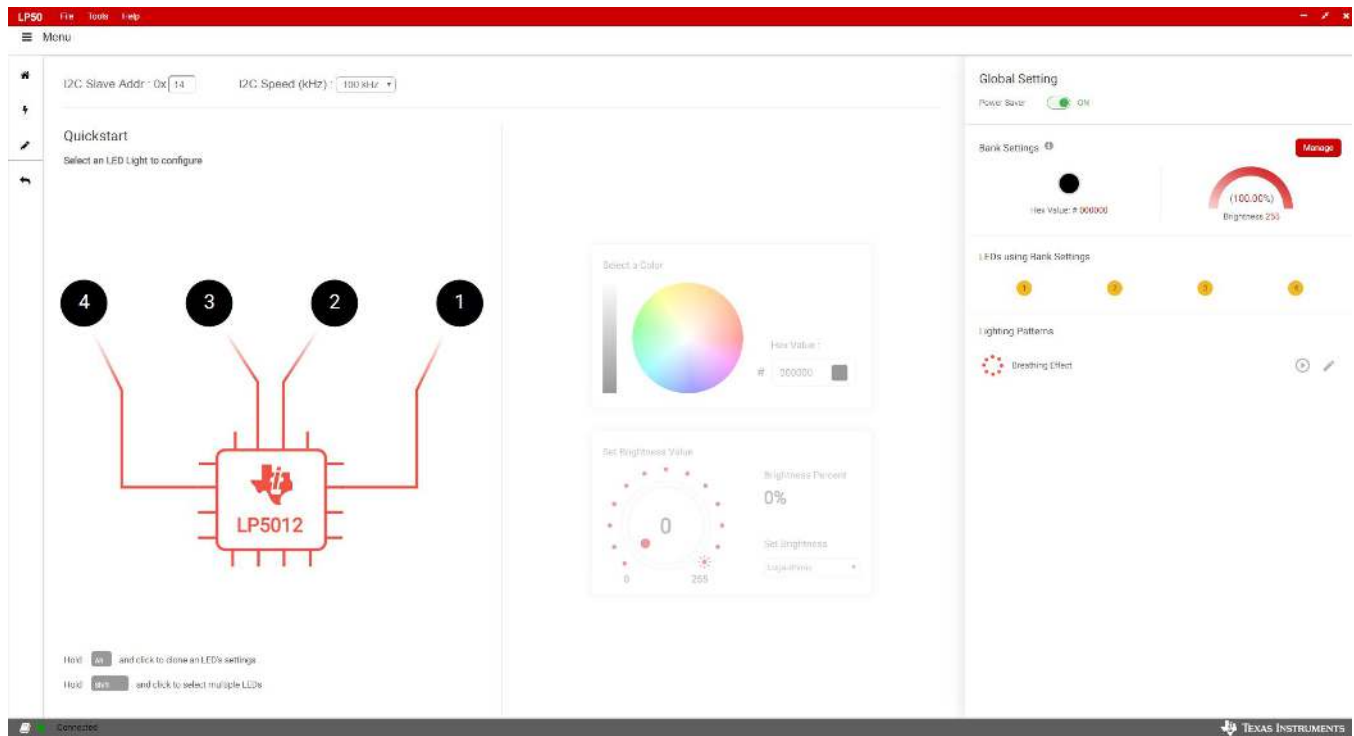


Figure 7. LED Control Panel

3.3.1 Connection Status

Before using the GUI, make sure the connection status indicator at the bottom left corner is *green*, which means the USB2ANY is connected to the computer successfully. If the status indicator is *red*, try to reconnect the USB2ANY cable and restart the LP50EVM GUI.

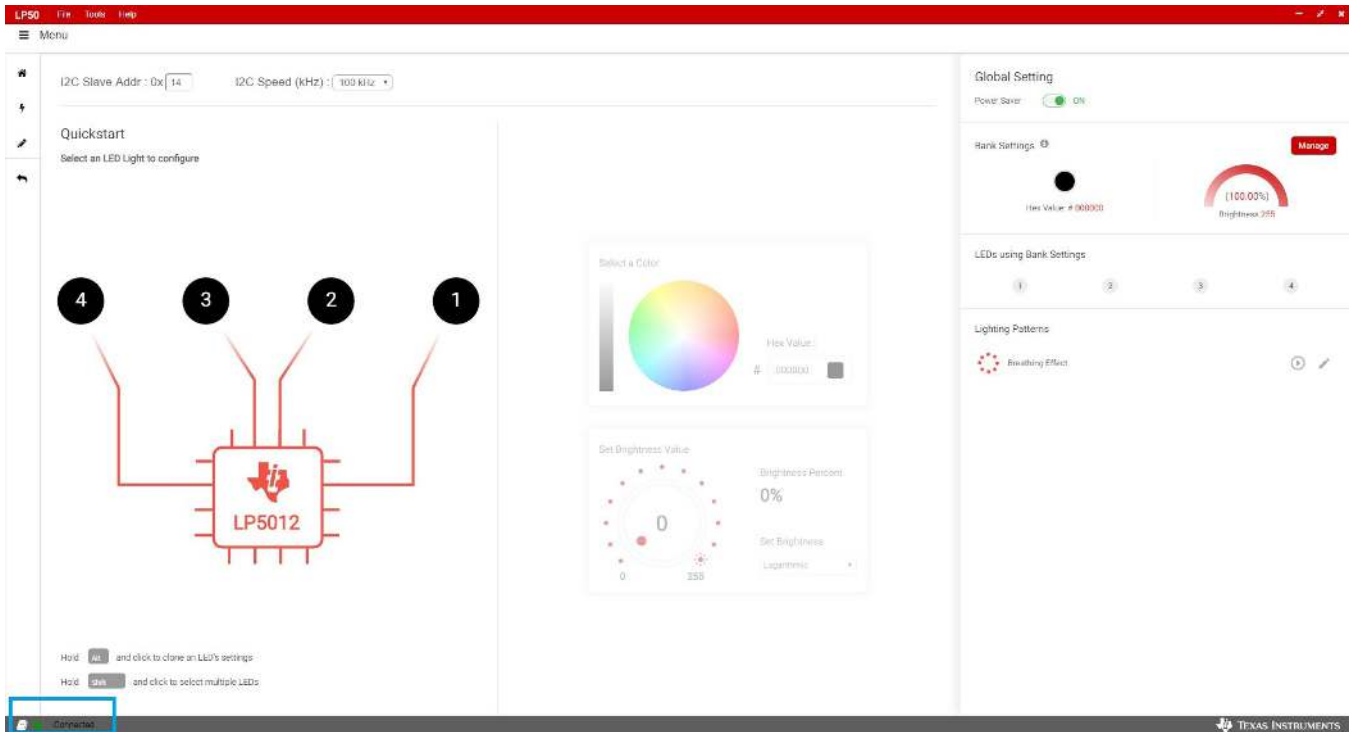


Figure 8. LP50 EVM GUI Connection Status

3.3.2 GUI Functions

3.3.2.1 Global Setting

When all the LED outputs are inactive, the LP50xx device is able to enter power-save mode automatically, thus lowering idle-current consumption down to 10 μ A (typical). The automatic power-save mode is enabled when register bit Power_Save_EN = 1 (default) and all the LEDs are off for a duration of > 30 ms. Almost all analog blocks are powered down in power-save mode. If any I²C command to the device occurs, the LP50xx device returns to the NORMAL mode. Set the Power Saver switch to activate the function (see Figure 8).

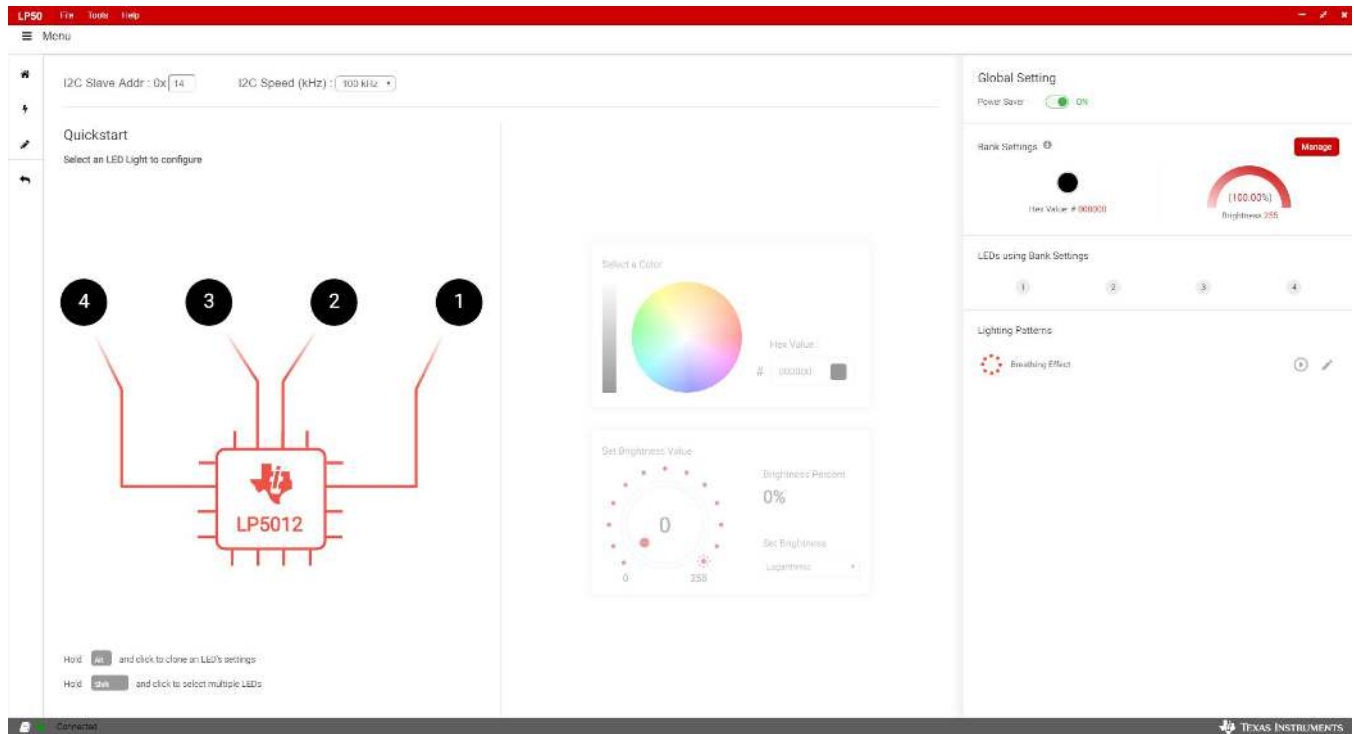


Figure 9. LP50xx Global Setting

3.3.2.2 RGB LED Color and Intensity Control

Each output channel has its own individual 8-bit color-setting register (OUTx_COLOR). The device allows every RGB LED module to achieve > 16 million (256 × 256 × 256) color-mixing. When color is fixed, the independent *intensity control*, formerly called brightness control, is used to achieve accurate and flexible dimming control for every RGB LED module. Every three consecutive output channels are assigned to their respective intensity-control register (LEDx_BRIGHTNESS). The LP50xx device allows 256-step intensity control for each RGB LED module, which helps achieve a smooth dimming effect. For human-eye-friendly visual performance, a logarithmic-scale dimming curve is usually implemented in LED drivers. The LP50xx device, with independent color-mixing and intensity-control registers, implements the logarithmic scale dimming control inside the intensity control function, which solves the color distortion issue effectively. Also, the LP50xx device allows users to configure the dimming scale either logarithmically or linearly through the global Log_Scale_EN register. Click the Manage button, shown in Figure 10, to set the color and brightness.

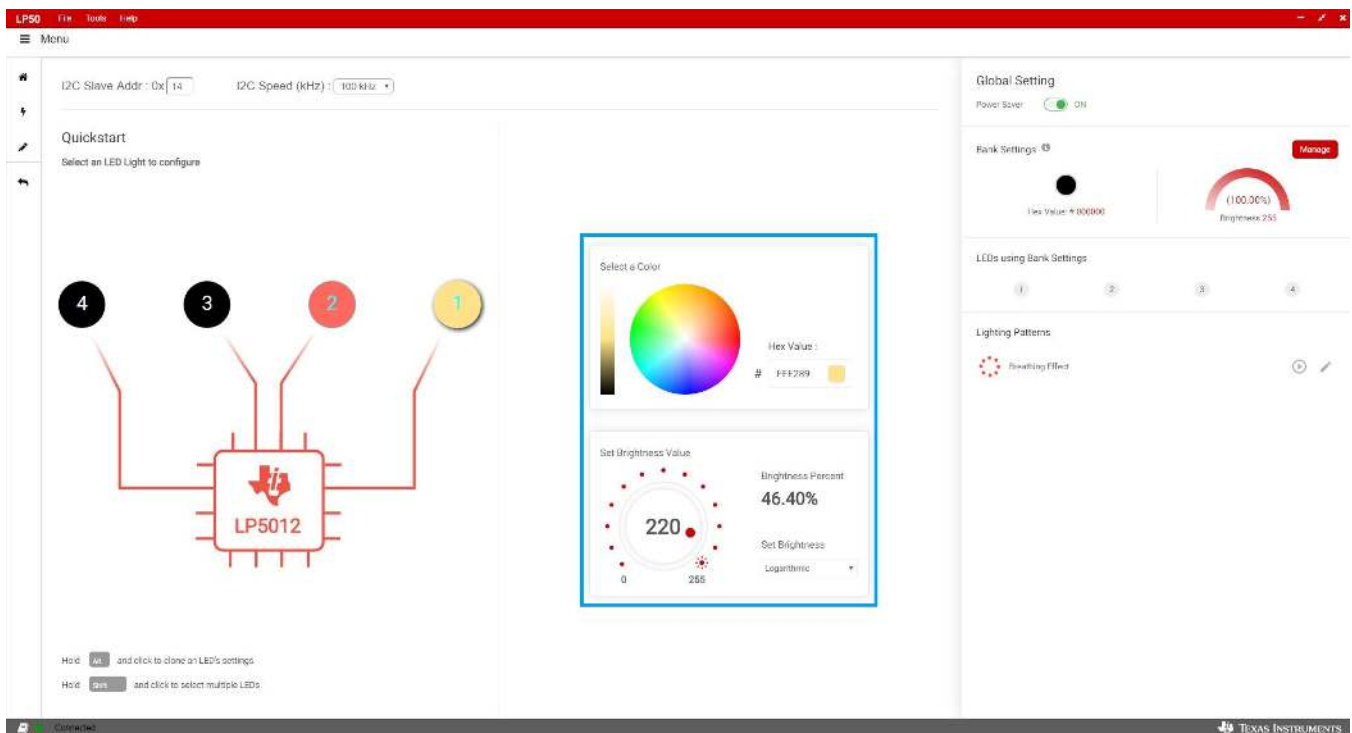


Figure 10. LED Color and Brightness Setting

3.3.2.3 Bank Management

For most LED-animation effects, like blinking and breathing, all the RGB LEDs have the same lighting pattern. Instead of controlling the individual LED separately, which occupies the microcontroller resources heavily, the LP50xx device provides an easy coding approach, the LED bank control. Each channel can be configured as either independent control or bank control through the LEDx_Bank_EN register. When LEDx_Bank_EN = 0 (default), the LED is controlled independently by the related color-mixing and intensity-control registers. When LEDx_Bank_EN = 1, the LP50xx device drives the LED in LED bank-control mode. The LED bank has its own independent PWM control scheme, which is the same structure as the PWM scheme of each channel. See the register map Figure 14 for more details. When a channel is configured in LED bank-control mode, the related color mixing and intensity control is governed by the bank control registers (BANK_A_COLOR, BANK_B_COLOR, BANK_C_COLOR, and BANK_BRIGHTNESS) regardless of the inputs on its own color-mixing and intensity-control registers.

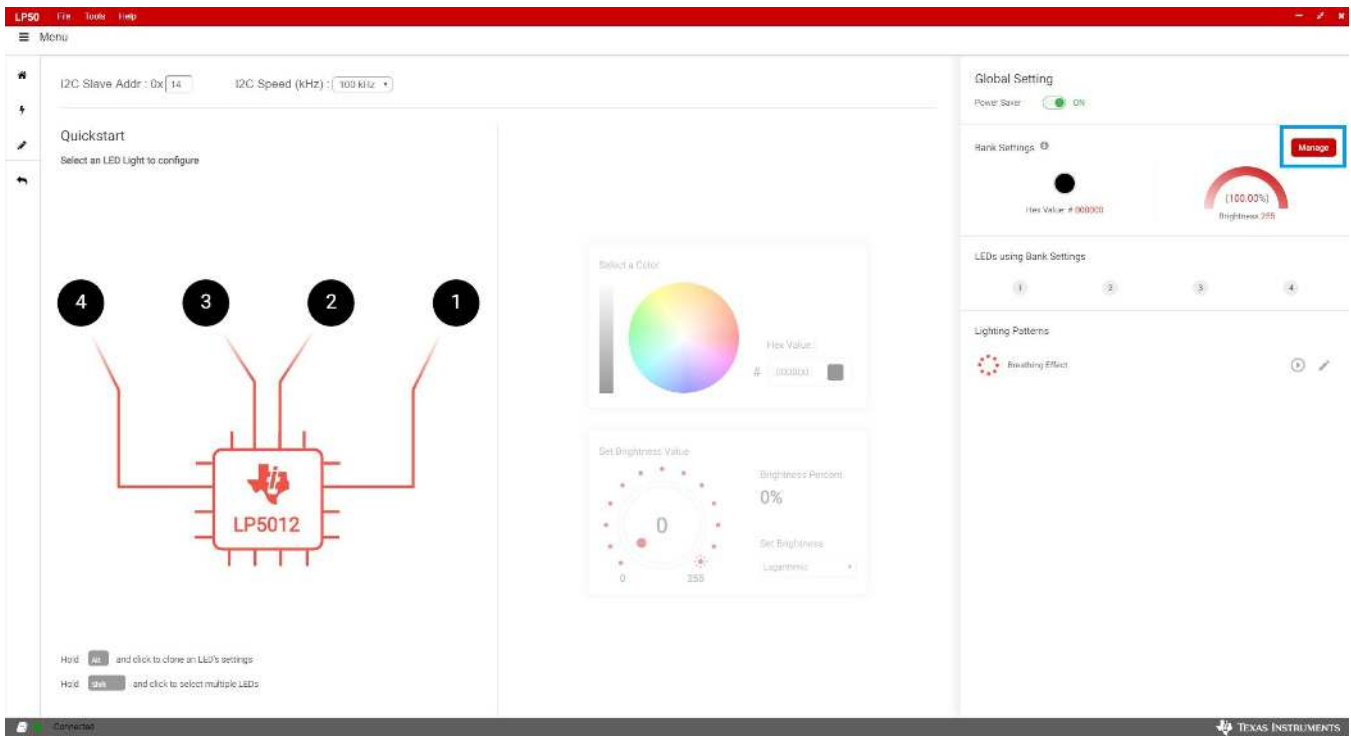


Figure 11. Bank Management Entry

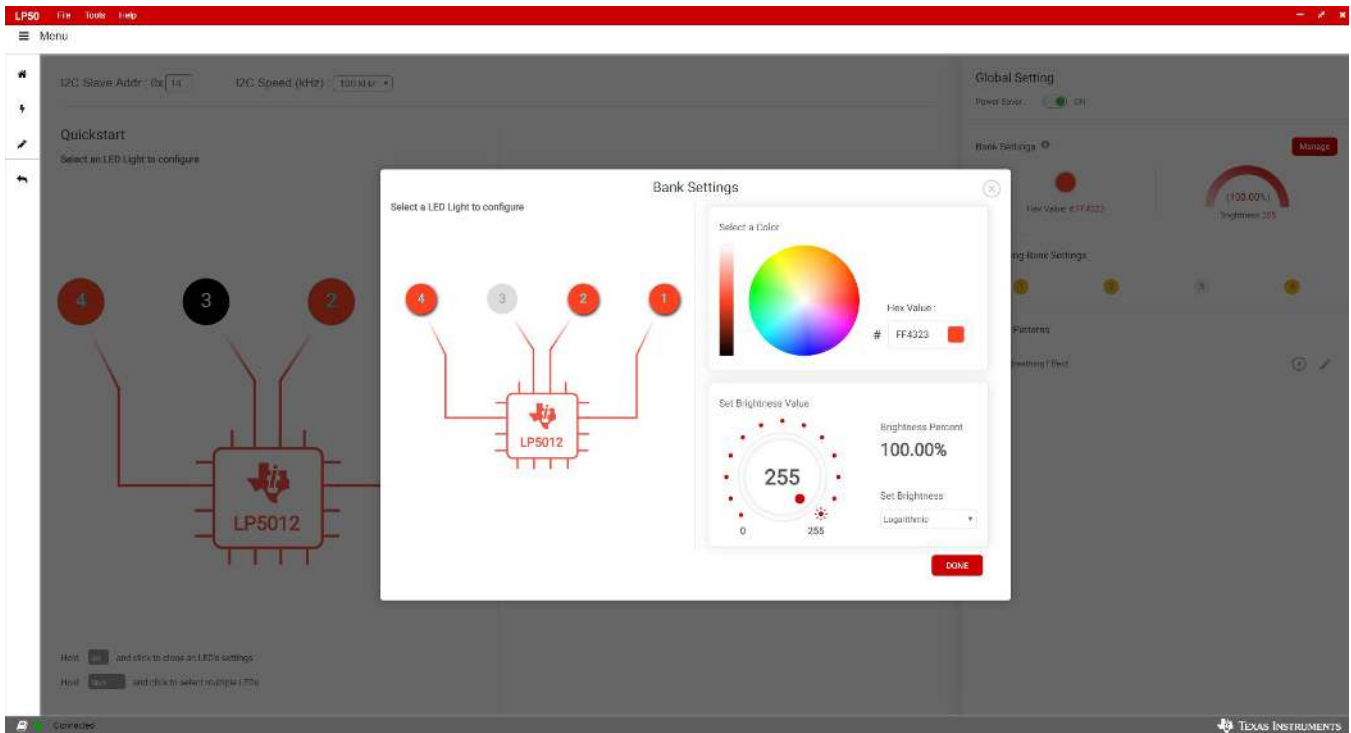


Figure 12. Bank Setting

3.3.3 Lighting Patterns

The GUI also can run the preset lighting patterns and customize the lighting patterns by modifying some parameters.

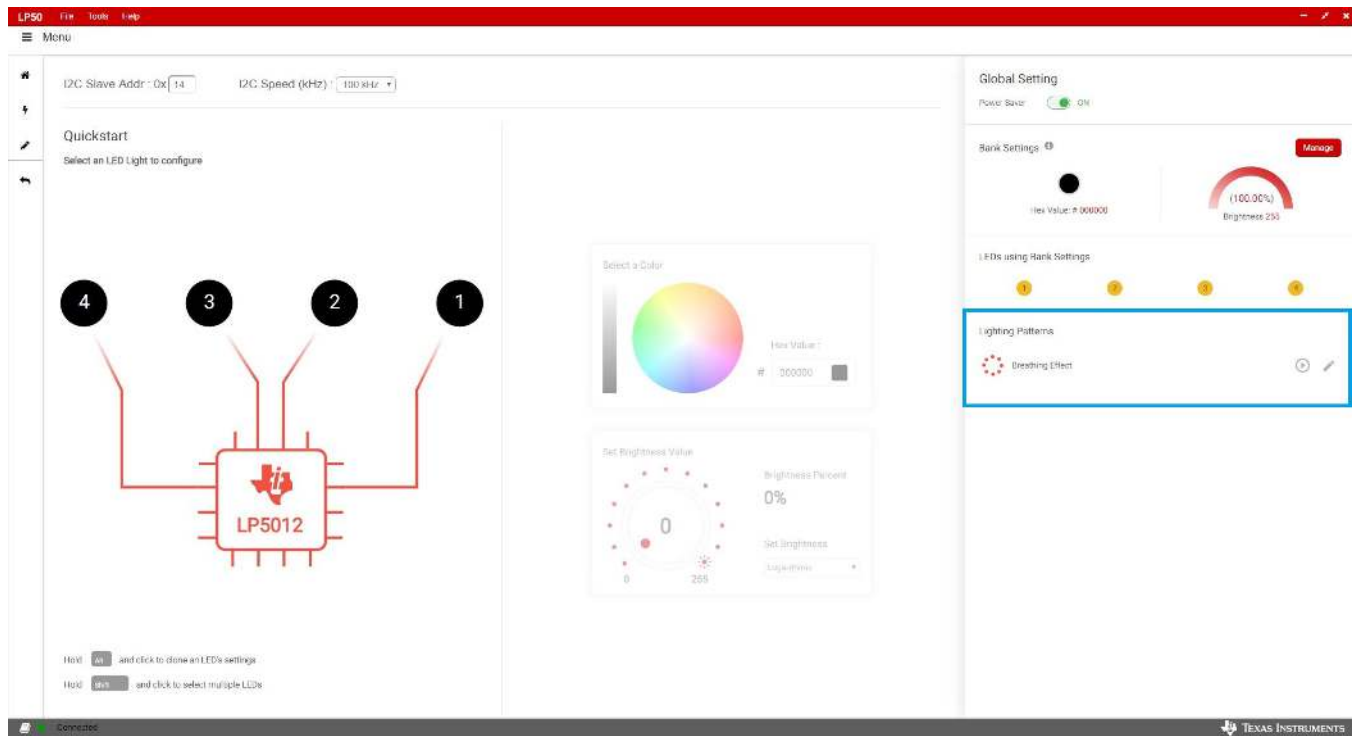


Figure 13. LED Lighting Pattern

3.3.4 Register Map

The register view appears when the Register icon in Figure 14 is clicked. The register view provides the register values, field values, and descriptions. The registers can be operated directly through the input check box.

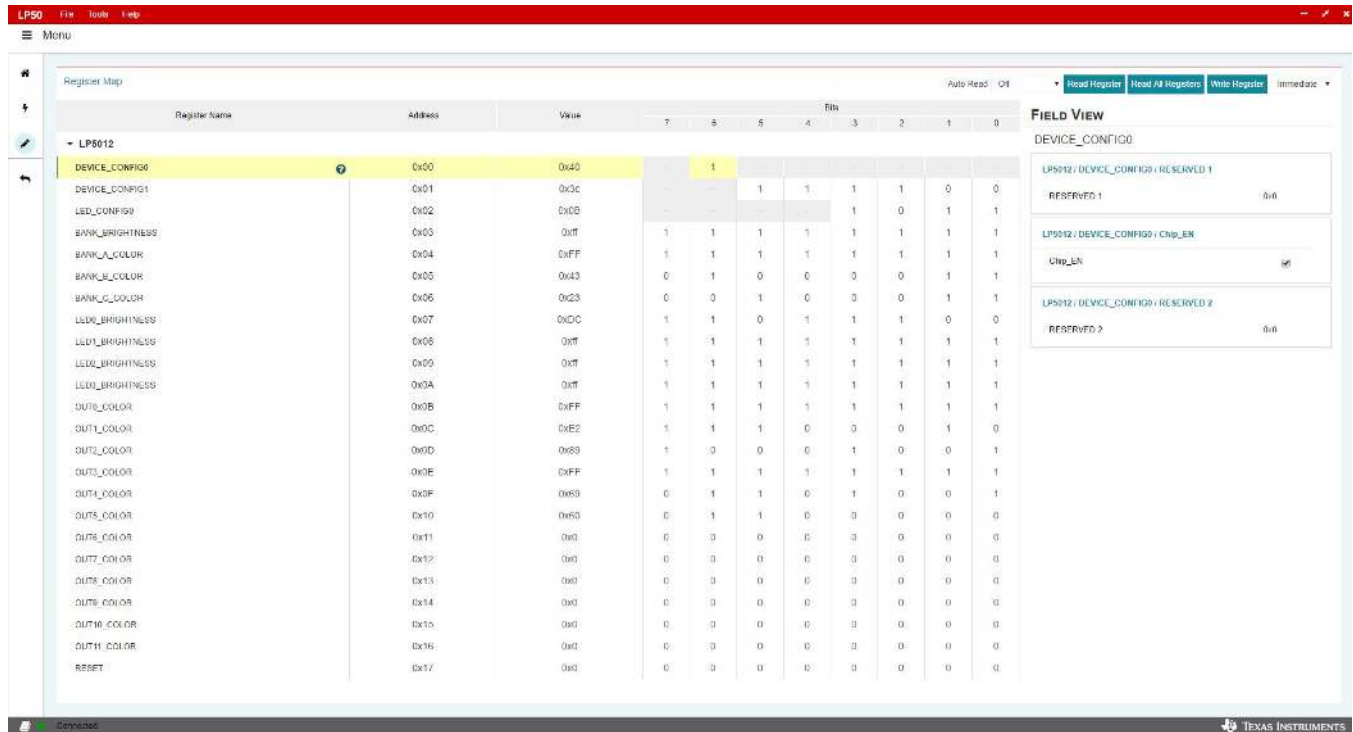


Figure 14. Register Map

Enter the desired hex value in the registers (Value column), perform a bit-wise configuration of any register fields by double-clicking on the corresponding register bit, or configure a register field by entering the desired value as hex in the Value column, binary in the Bits columns, or by using the input boxes for each field under FIELD VIEW to set values for the corresponding variables. Field View displays the description of all fields of the selected register. Each register can be read individually or all registers can be read at once by using the Read Register or Read All Registers button, respectively. The data is written to the registers in one of two ways, depending on the update mode (Immediate↓ or Deferred↓) button. Clicking the button toggles between the two modes. In Immediate mode, the register data is written immediately following a Current Value, an individual bit, or a Value change. In Deferred mode, the displayed data is written to all registers on depression of the Write Register button. Press the Read All Registers button to read back all the registers and update the values in this table. If any register value must be changed, simply double-click on the individual bit values to change the value in this table in immediate updated mode or press the Write Register button to write all the registers at a time if Deferred is selected instead of Immediate from the drop-down box. Register settings can be saved in text-file format by selecting Save Registers from the file menu. A register settings file in text-file format can be loaded and programmed automatically by selecting Load Register from the file menu.

3.3.5 Tool Bar

Registers can be loaded and saved through the tool bar under the File menu.

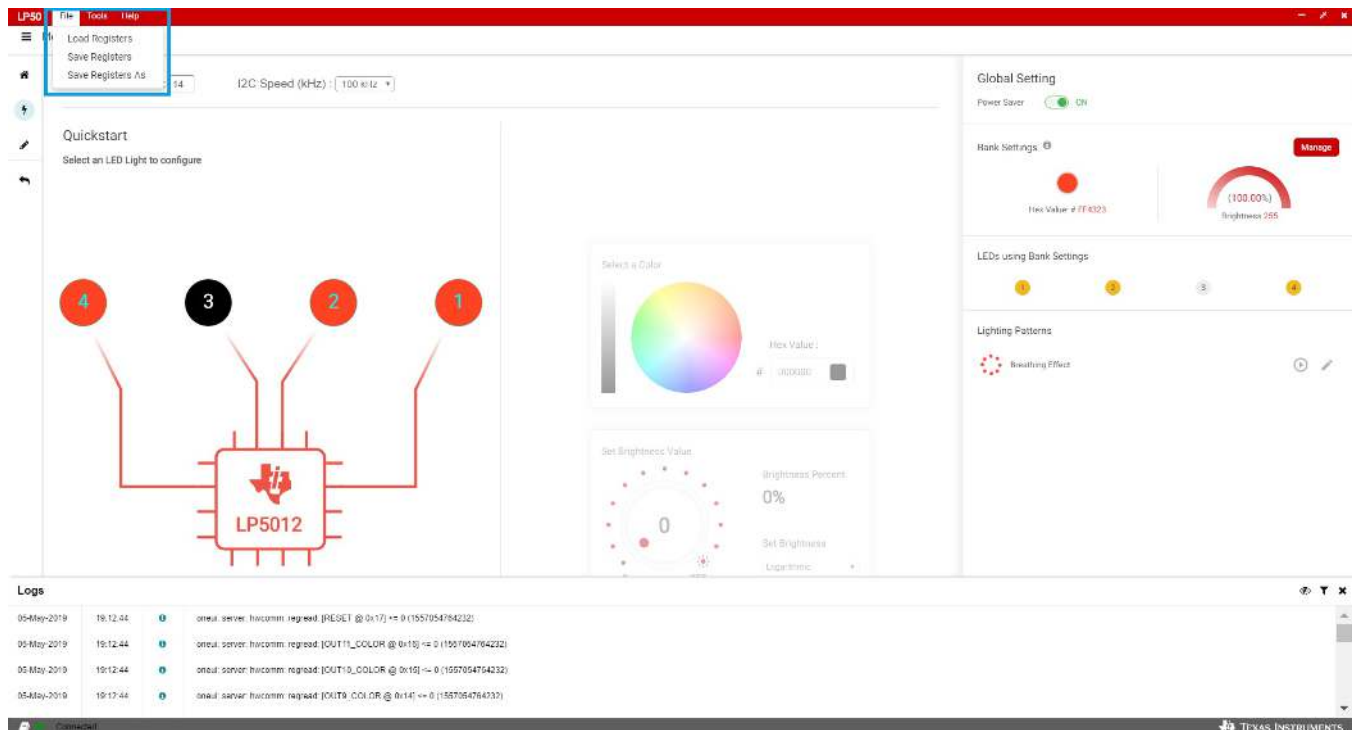


Figure 15. Tool Bar

4 Board Layout

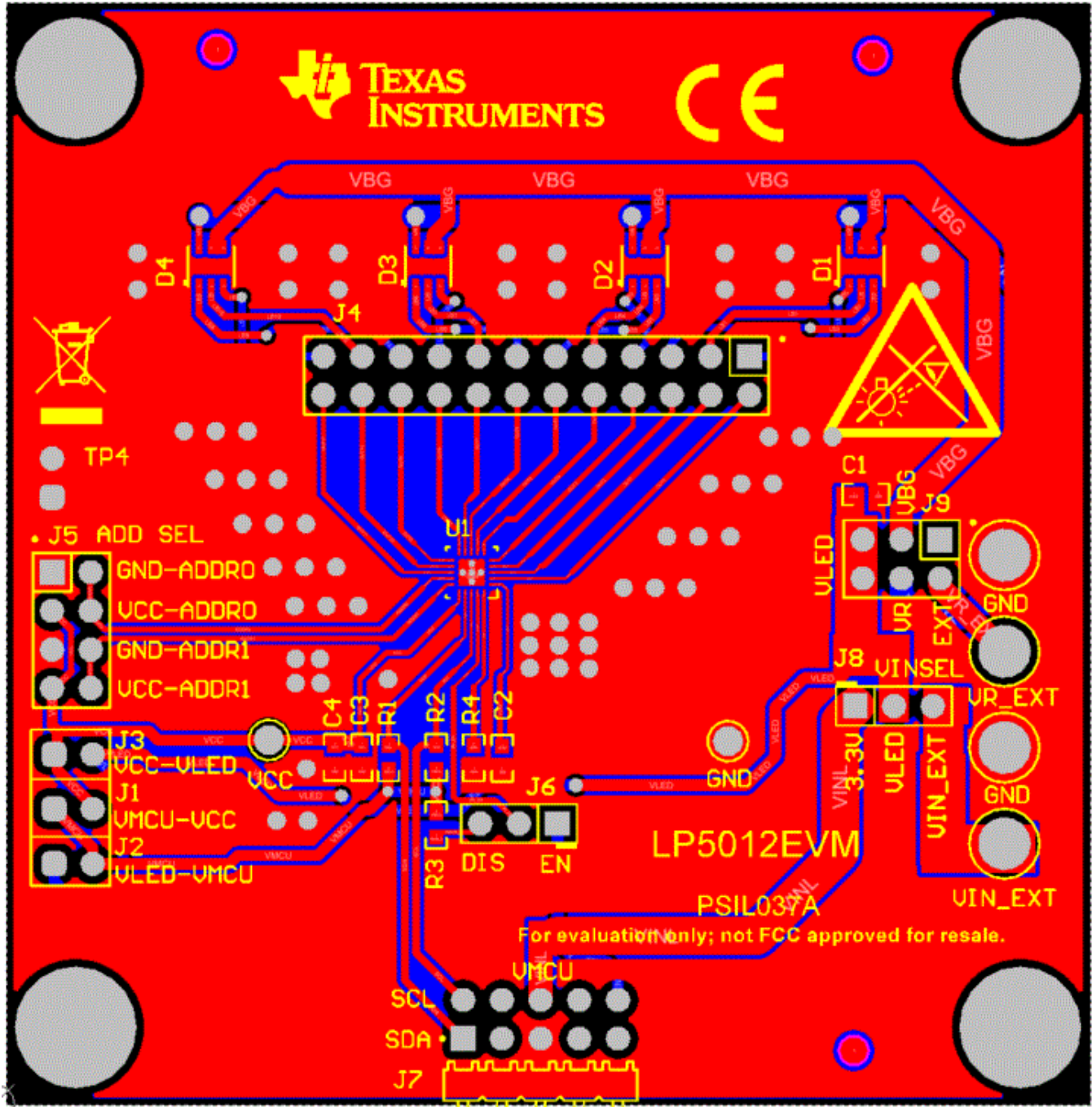


Figure 16. Top Layer Routing

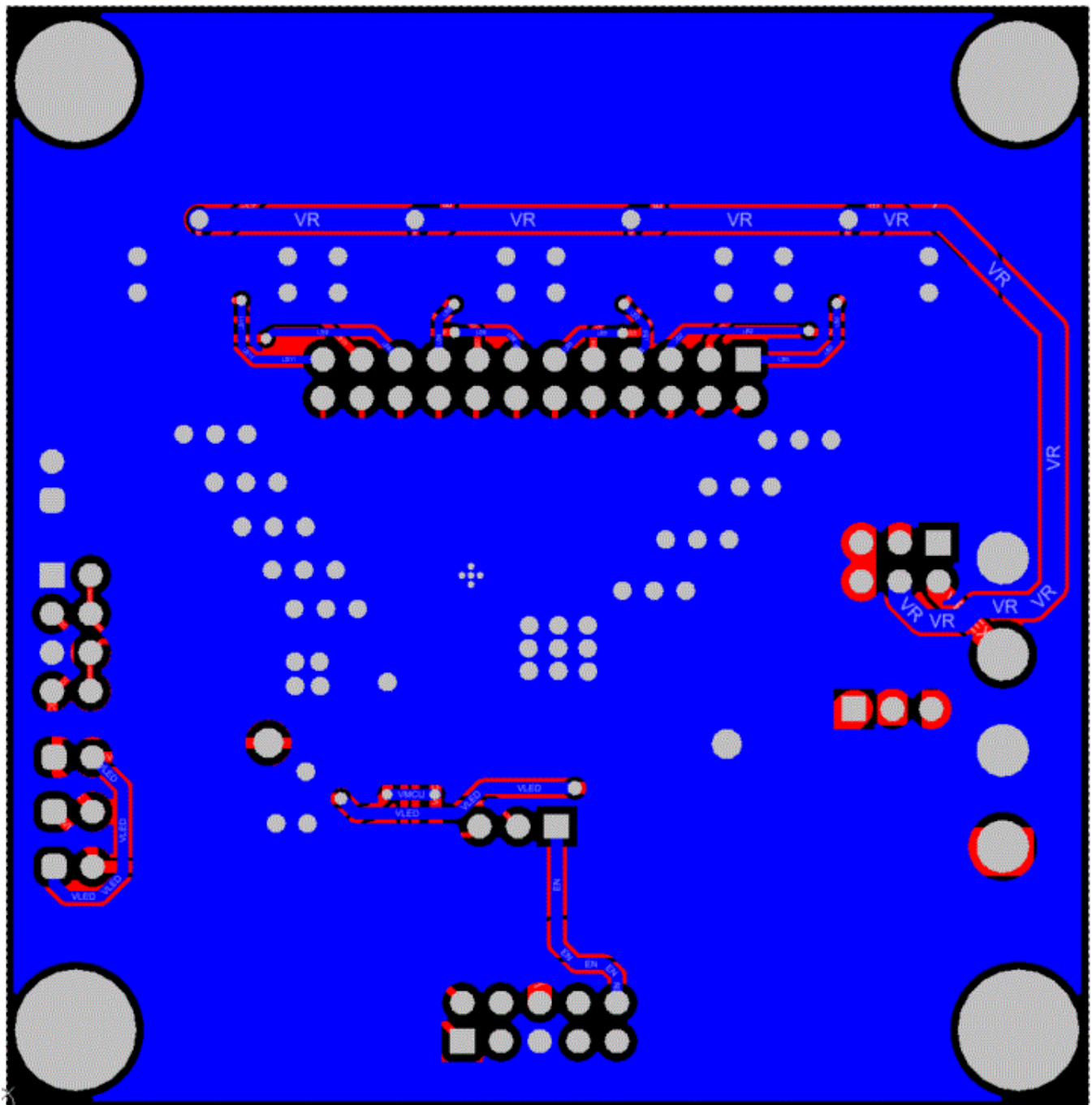


Figure 17. Bottom Layer Routing (Mirrored)

4.1 Schematic

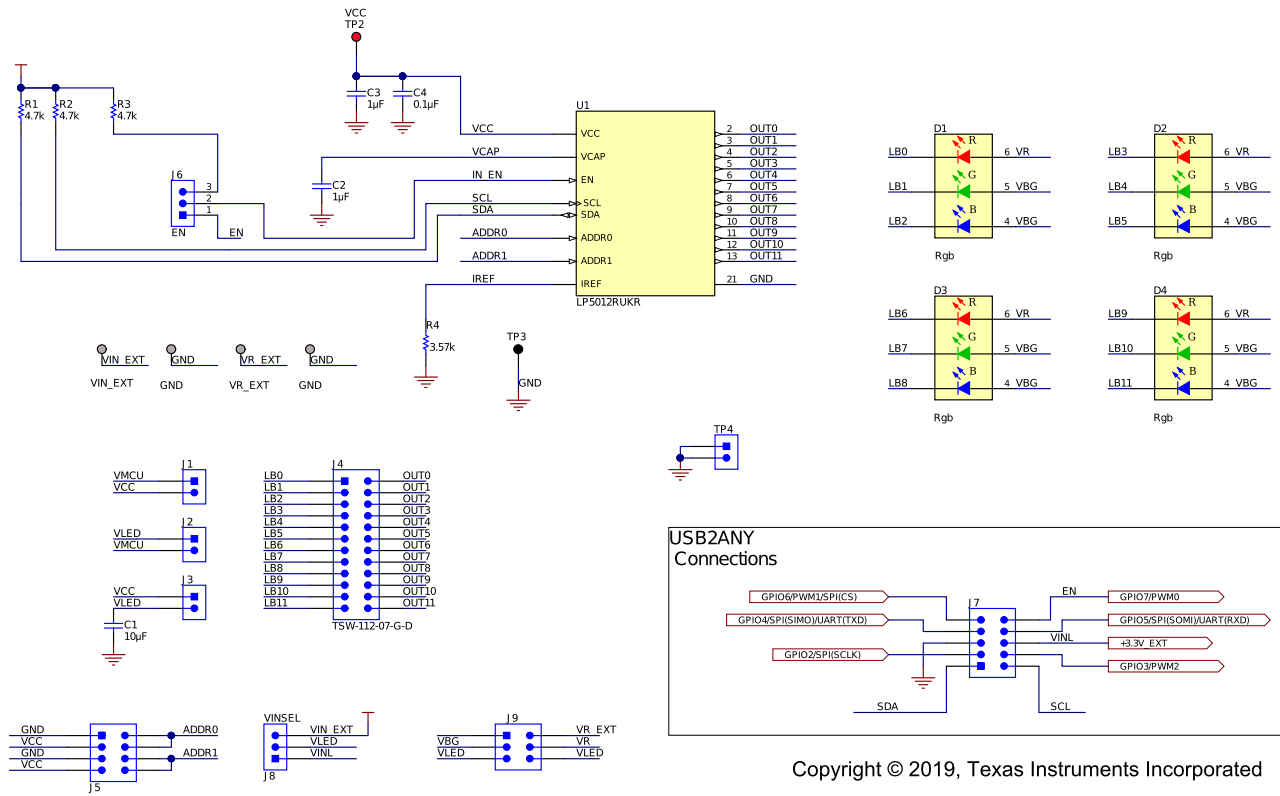


Figure 18. LP5012EVM Schematic Diagram

4.2 Bill of Materials

Table 2. Bill of Materials (BOM)

DESIGNATOR	QTY	VALUE	DESCRIPTION	PART NUMBER	MANUFACTURER
C1	1	10 μ F	CAP, CERM, 10 μ F, 6.3 V, +/- 10%, JB, 0603	C1608JB0J106K080AB	TDK
C2, C3	2	1 μ F	CAP, CERM, 1 μ F, 25 V, +/- 10%, X7R, 0603	06033C105KAT2A	AVX
C4	1	0.1 μ F	CAP, CERM, 0.1 μ F, 16 V, +/- 5%, X7R, 0603	0603YC104JAT2A	AVX
D1, D2, D3, D4	4	Rgb	LED, RGB, SMD	KRTB HFLP71.32	OSRAM
H1, H3, H5, H7	4		Standoff, Hex, 0.5"L #4-40 Nylon	1902C	Keystone
H2, H4, H6, H8	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Phillips panhead	NY PMS 440 0025 PH	B&F Fastener Supply
J1, J2, J3, TP4	4		Header, 100mil, 2x1, Gold, TH	TSW-102-07-G-S	Samtec
J4	1		Header, 100mil, 12x2, Gold, TH	TSW-112-07-G-D	Samtec
J5	1		Header, 100mil, 4x2, Gold, TH	TSW-104-07-G-D	Samtec
J6, J8	2		Header, 100mil, 3x1, Gold, TH	TSW-103-07-G-S	Samtec
J7	1		Header, 100mil, 5x2, Gold, R/A, TH	TSW-105-08-G-D-RA	Samtec
J9	1		Header, 100mil, 3x2, Gold, TH	TSW-103-07-G-D	Vishay-Dale
R1, R2, R3	3	4.7k	RES, 4.7 k, 5%, 0.1 W, 0603	CRCW06034K70JNEA	Yageo America
R4	1	3.57k	RES, 3.57 k, 1%, 0.1 W, 0603	RC0603FR-073K57L	Sullins Connector Solutions
SH1, SH2, SH3, SH4, SH5, SH6, SH7, SH8, SH9, SH10, SH11, SH12, SH13, SH14, SH15, SH16, SH17, SH18, SH19, SH20	20	1 x 2	Shunt, 100mil, Flash Gold, Black	SPC02SYAN	Sullins Connector Solutions
TP1, TP6, TP7, TP8	4		Terminal, Turret, TH, Double	1502-2	Keystone
TP2	1		Test Point, Miniature, Red, TH	5000	Keystone
TP3	1		Test Point, Miniature, Black, TH	5001	Keystone
U1	1		12-Channel I2C Constant Current RGB LED Driver, RUK0020B (WQFN-20)	LP5012RUKR	Texas Instruments

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2022, Texas Instruments Incorporated