

EVM User's Guide: LP5867EVM

LP5867 Evaluation Module



Description

The LP5867 device is a small, high-performance design, integrating six constant current sinks with seven switching MOSFETs, driving up to 42 LED dots or 14 RGB LED pixels. Every LED dot is supported by 8-bit analog and 8-bit, or 16-bit, configurable PWM dimming methods, providing smooth audible-noise-free dimming control. The LP5867EVM helps users evaluate the features of Texas Instruments' LP5867 LED matrix driver. The LP5867 functions, RGB LED matrix performance, and simple animation effects are easily verified with this kit.

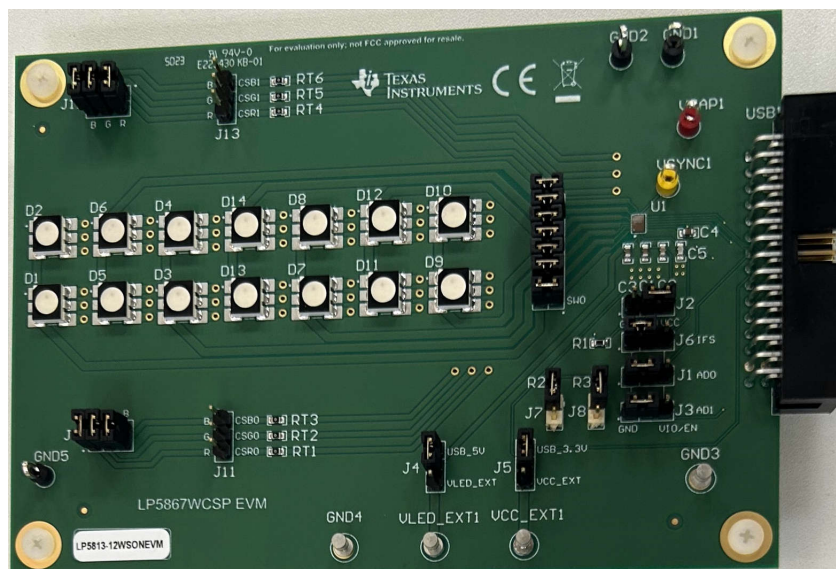
Features

- LED matrix topology
 - 6 constant current sinks with 7 scan switches for 42 LED dots
 - Configurable for 1 to 7 scan switches
- Operating voltage range
 - VCC/ILED range: 2.7V to 5.5V
 - Logic pins compatible with 1.8V, 3.3V, and 5V
- 6 constant current sinks with high precision
 - 0.1mA to 50mA per current sink when VCC ≥ 3.3V
 - Device-to-device error: ±3% when channel current = 50mA
 - Channel-to-channel error: ±3% when channel current = 50mA

- Phase-shift for balanced transient power
- Ultra-low power consumption
 - Shutdown mode: $ICC \leq 1\mu A$ when EN = Low
 - Standby mode: $ICC \leq 10\mu A$ when EN = High and CHIP_EN = 0 (data retained)
 - Active mode: $ICC = 4.3mA$ (typ.) when channel current = 5mA
- Flexible dimming options
 - Individual ON/OFF control for each LED dot
 - Analog dimming (7-step MC/7 bit CC/8 bit DC)
 - PWM dimming (8/16 bit) with audible-noise-free frequency
- Fully addressable SRAM to minimize data traffic
- Individual LED dot open/short detection
- De-ghosting and low brightness compensation
- Interface options
 - 1MHz (maximum) I2C interface when IFS = Low
 - 12MHz (maximum) SPI when IFS = High LED animation and indication for:
 - Portable electronics
 - Wearable electronics

Applications

- LED animation and indication for:
 - Portable electronics
 - Wearable electronics
 - Internet-of-Things (IOT)



1 Evaluation Module Overview

1.1 Introduction

Smart electronic devices require large quantities of LEDs for functions like animation and indication. High-performance LED matrix drivers continue to trend smaller in size to accommodate and improve user experience. This user guide describes the characteristics, setup, and usage of the LP5867 evaluation module (EVM). The LP5867EVM evaluates the characteristics, operation, and usage of the LP5867 LED matrix driver. This guide includes hardware setup instructions, graphical user interface (GUI) instructions, printed-circuit board (PCB) layout drawings, a schematic diagram, and a bill of materials.

This document covers the following topics:

- [How to set up the LP5867EVM hardware](#)
- [How to use LP5867 GUI to illuminate LEDs](#)
- [Design resources for the LP5867EVM](#)

1.2 Kit Contents

The LP5867EVM kit includes the following materials, as illustrated in [Figure 1-1](#):

- LP5867 evaluation module
- [USB2ANY interface adapter](#) with ribbon cables and USB cable

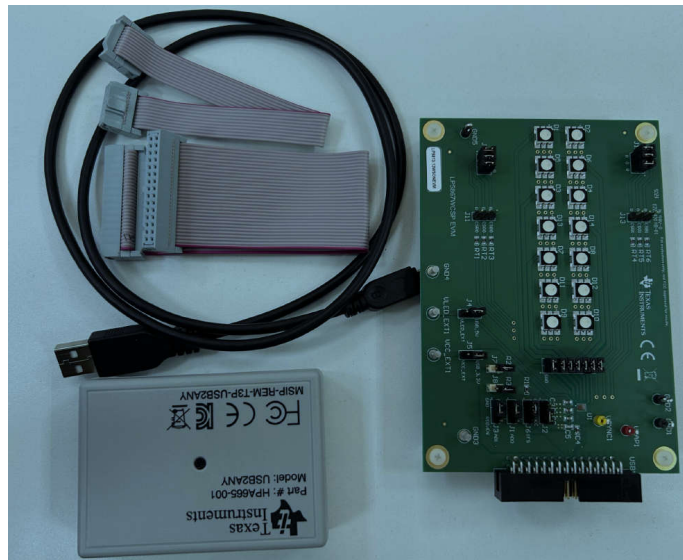


Figure 1-1. LP5867EVM Kit Contents

1.3 Specifications

The LP5867 is a high-performance LED matrix driver that integrates 6 constant current sinks with N (N = 7) switching MOSFETs supporting N × 6 LED dots, or N × 2 RGB LEDs. The LP5867 integrates 7 MOSFETs for up to 42 LED dots, or 14 RGB LEDs.

The LP5867 supports both analog dimming and PWM dimming methods. Each LED dot is adjustable with 256 steps for analog dimming. The integrated 8-bit, or 16-bit, configurable PWM generators allow smooth and audible-noise-free dimming control for PWM dimming. Each LED dot can be arbitrarily mapped into an 8-bit group PWM to achieve dimming control together.

The LP5867 device implements fully addressable SRAM to minimize data traffic. The ghost-cancellation circuitry is integrated to eliminate both upside and downside ghosting. The LP5867 supports both LED open and short detection functions. 1MHz (maximum) I2C interfaces and 12MHz (maximum) SPI are both available in LP5867.

1.4 Device Information

The LP5867 is a 7 × 6 LED matrix driver. The device integrates 7 switching FETs with 6 constant current sinks. One LP5867 device can drive up to 42 LED dots or 14 RGB pixels by using time-multiplexing matrix scheme.

For analog dimming, the current gain of each individual LED dot is adjustable with 256 steps through 8-bits dot correction. For PWM dimming, the integrated 8-bits, or 16-bits, PWM generators generate more than 20KHz PWM for each LED dot which enables smooth, vivid animation effects without audible noise. Each LED can be mapped into an 8-bits group PWM to achieve group control with minimum data traffic.

The LP5867 device implements fully addressable SRAM. The device supports an on demand entire SRAM data refresh and a partial SRAM data update to minimize data traffic. The LP5867 implements the ghost cancellation circuit to eliminate both upside and downside ghosting. The LP5867 uses low-brightness compensation technology to support high-density LED pixels.

2 Hardware

The following section describes how to set up the LP5867EVM. Evaluating the LP5867 requires the following itemized list:

- Computer
- LP5867EVM kit hardware
- LP5867 [GUI software](#)

2.1 Hardware Setup

The default jumper setting evaluates the board by USB power directly and does not need an external power supply. Setup connection is demonstrated in [Figure 2-1](#). The setup procedure is the following:

1. Connect the USB2ANY with the LP5867EVM using the 30-pin ribbon cable.
2. Plug the USB cable into the USB port on the computer.

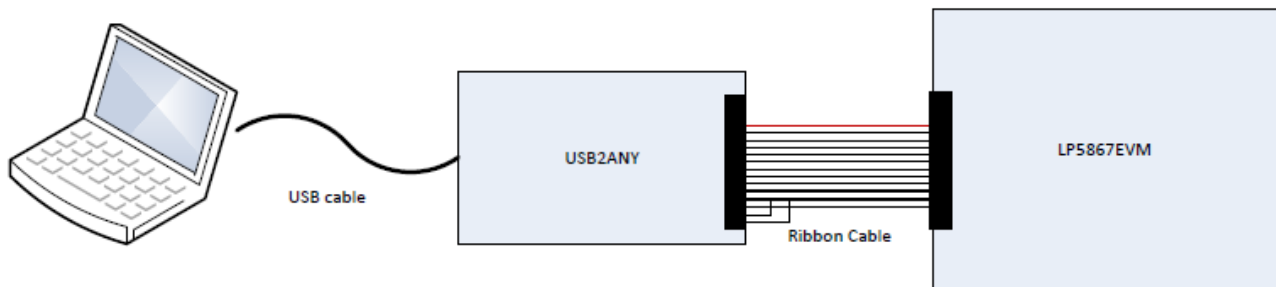


Figure 2-1. Hardware Connection

[Figure 2-2](#) shows the default jumper settings.

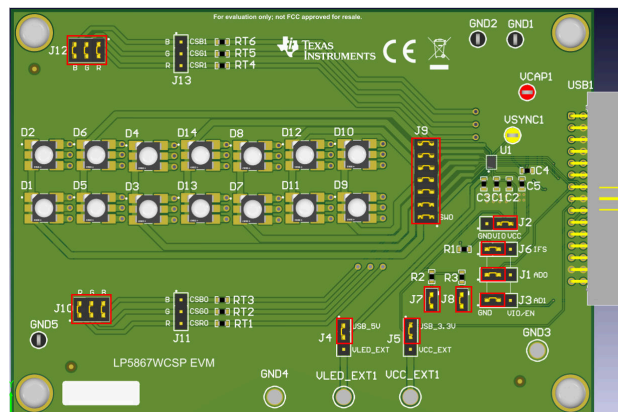


Figure 2-2. Default Jumper Setting

An external VLED supply is recommended during evaluation if maximum current is set above 60mA because the USB only provides 400mA of current. The setup procedure is the following:

1. Connect the USB2ANY to the LP5867EVM using the 30-pin ribbon cable.
2. Connect a 5V external power supply to the VLED_EXT1 terminal and connect the switching jumper (J4) to the downside.
3. Plug the USB cable into the USB port on the computer.

3 Software

The following section describes how to install and setup the GUI properly.

3.1 Software Setup

The software installation procedure is the following:

1. Download the LP5867 GUI installation package at this [installation package link](#).
2. Use access code: 5867
3. Follow the setup wizard to successfully install the LP5867 GUI.

Successful installation of the GUI installation package results in receiving an LP5867GUI.exe file (see [Figure 3-1](#) and [Figure 3-2](#)).







 bin	2023/11/8 15:58	File folder	
 license	2023/11/8 15:58	File folder	
 supportfiles	2023/11/8 15:58	File folder	
 nidist.id	2023/11/8 15:58	ID File	1 KB
 setup.exe	2020/11/5 16:31	Application	5,327 KB
 setup.ini	2023/11/8 15:58	Configuration sett...	19 KB

Figure 3-1. LP5867EVM GUI Setup File





 data	2023/11/8 16:03	File folder	
 LP5867GUI.aliases	2023/11/8 15:55	ALIASES File	1 KB
 LP5867GUI.exe	2023/11/8 15:55	Application	620 KB
 LP5867GUI.ini	2023/11/8 15:55	Configuration sett...	1 KB

Figure 3-2. LP5867EVM GUI exe File

3.2 Graphical User Interface Guidance

The LP5867 Graphical User Interface (GUI) is a convenient tool for controlling and evaluating all functions of LP5867. This section provides guidance on using the GUI.

1. Before opening the LP5867GUI.exe file, check that the hardware is connected by plugging the USB cable into the USB port of the computer.
2. Modify the *Num Bytes to Write/Read* field to 1 and select the *Read* button to successfully connect the EVM board to the USB2ANY (see [Figure 3-3](#)). The *Read Data* field returns data 0x00 if there are no errors.

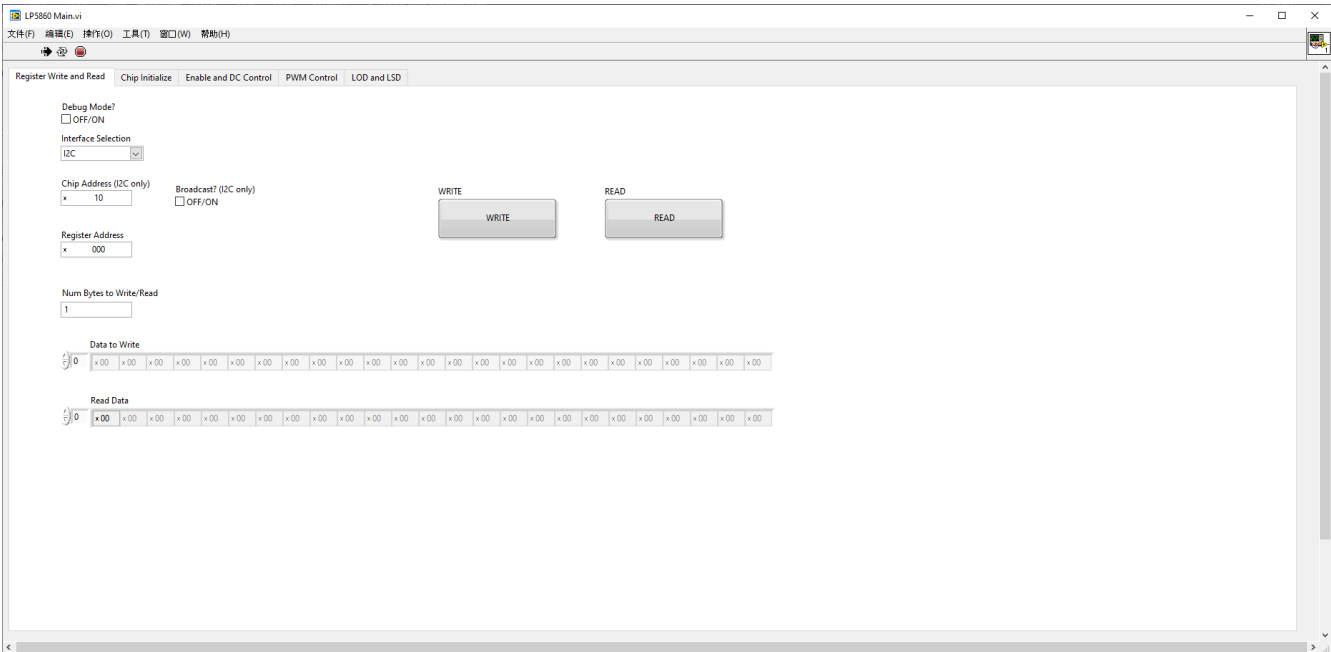


Figure 3-3. LP5867EVM GUI First Debug Step

The GUI can configure the LED to light up when the GUI successfully reads the default value 0x00 of register <0x00>. The following GUI instructions light up the LED.

1. Select the second page tab, entitled *Chip Initialize* (see [Figure 3-4](#)).
2. Select the *Chip Enable* button.
3. Configure the *Dev_initial* menu as follows:
 - a. Select the Mode 1 option in the *Data Refresh mode Selection* drop-down menu.
 - b. Select the 7 Scan lines option in the *Maximum Scan Line Number* drop-down menu.

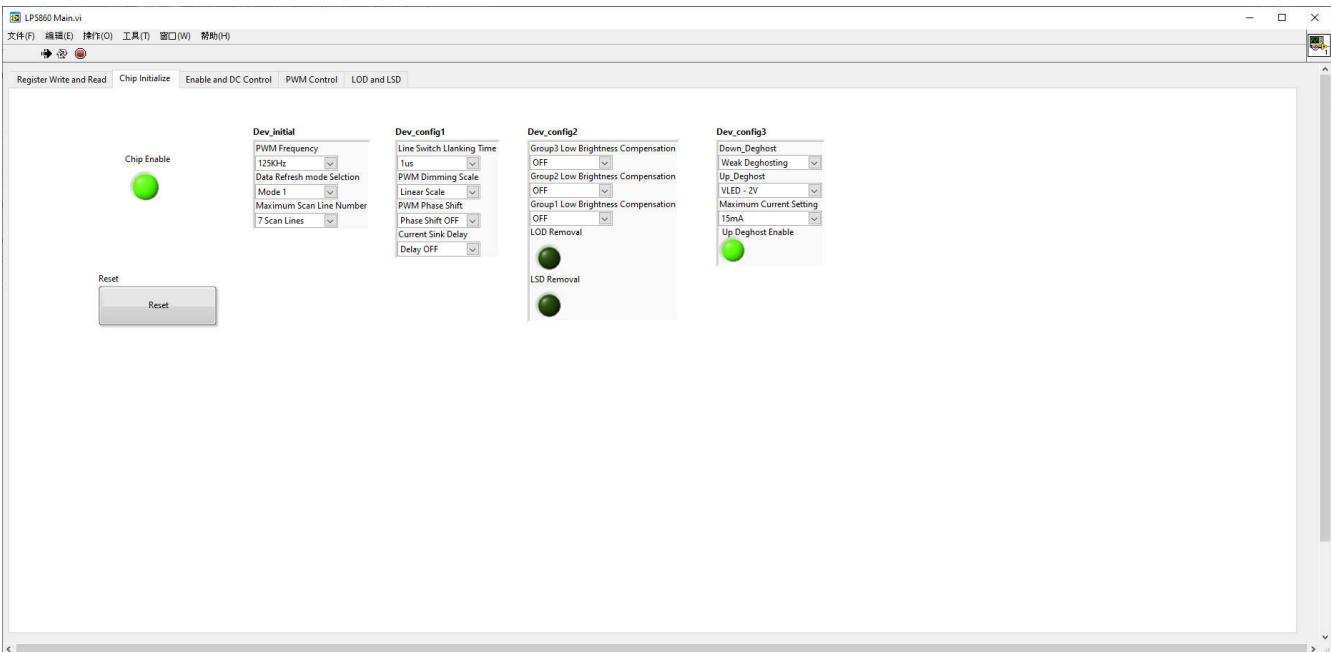


Figure 3-4. LP5867EVM GUI Chip Initialize

4. Select the forth page tab *PWM Control* (see [Figure 3-5](#)).
5. Select the ALL CS option in the *CS Index DotPWM* drop-down menu.
6. Select the ALL L option in the *L index DotPWM* drop-down menu.
7. Write 0x00FF in the *Dot PWM Set Value* field box.
8. Finally, select the *Update PWM Duty Cycle* button. The LED now lights up after completing these steps.

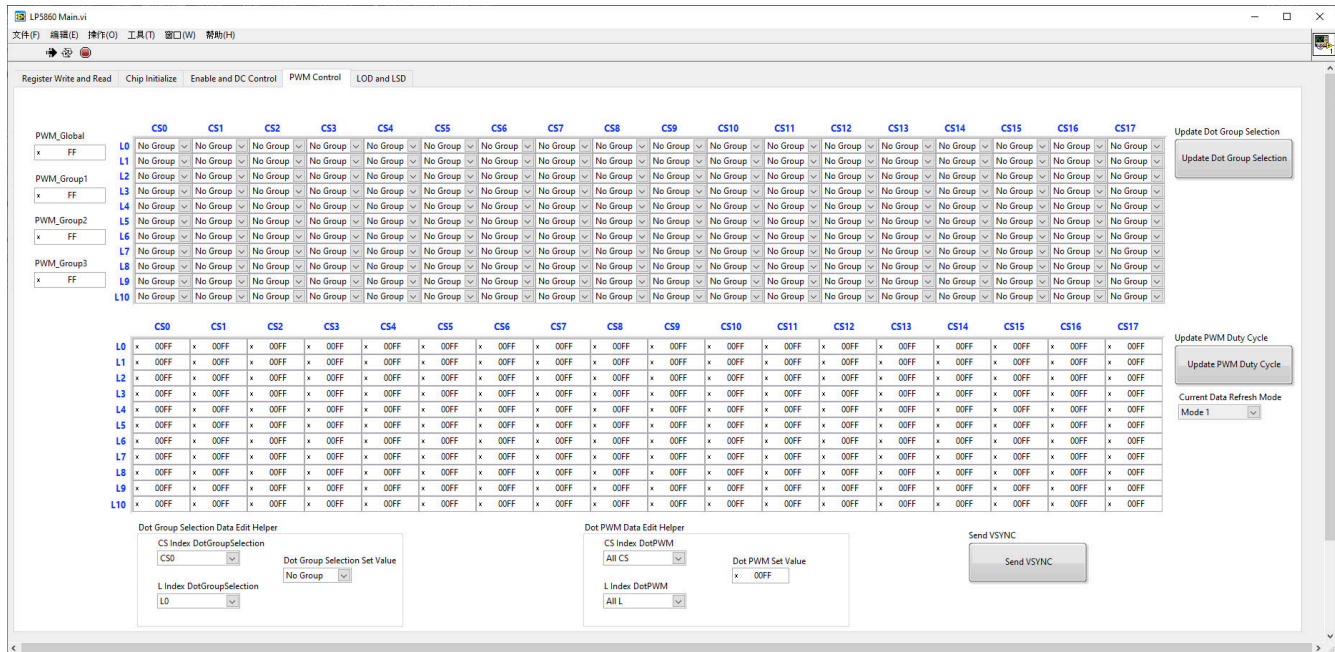


Figure 3-5. LP5867EVM GUI PWM Control

4 Hardware Design Files

The [schematic](#), [layout](#), and [bill of materials \(BOM\)](#) of the LP5862 EVM board design are included in this section.

4.1 LP5867EVM Schematic

Figure 4-1 shows the LP5867EVM schematic.

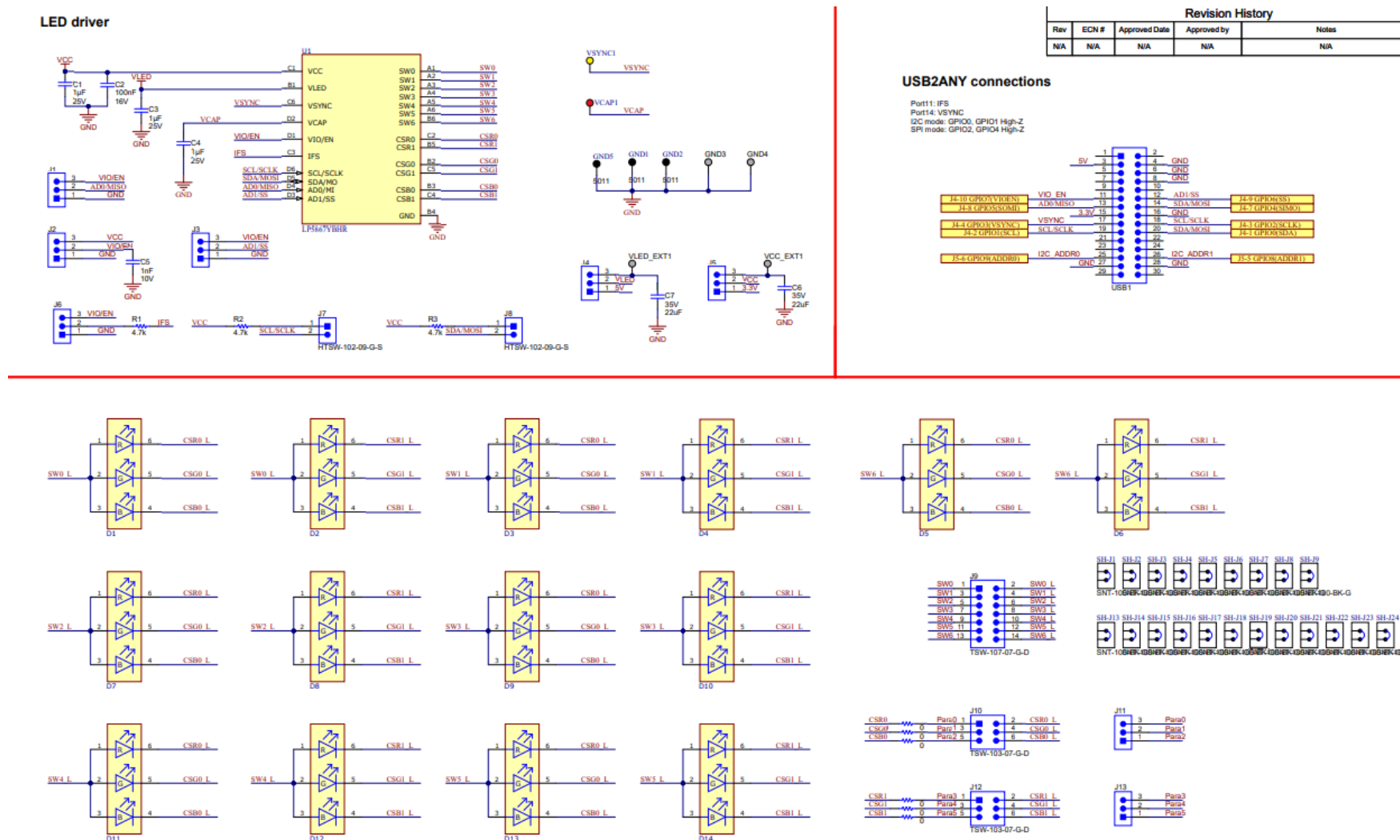


Figure 4-1. Schematic

4.2 PCB Layouts

Figure 4-2 and Figure 4-3 demonstrate the LP5867EVM layout images.

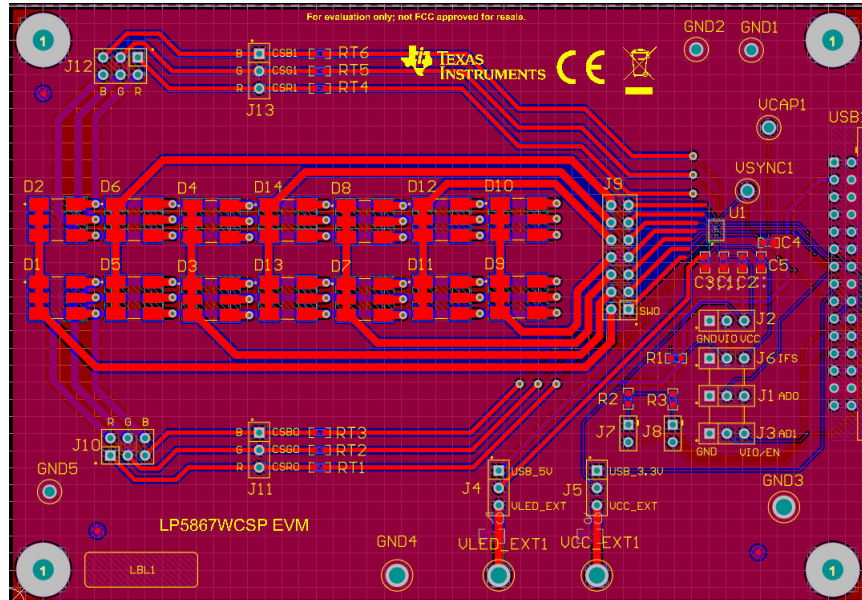


Figure 4-2. LP5867EVM Top Layer

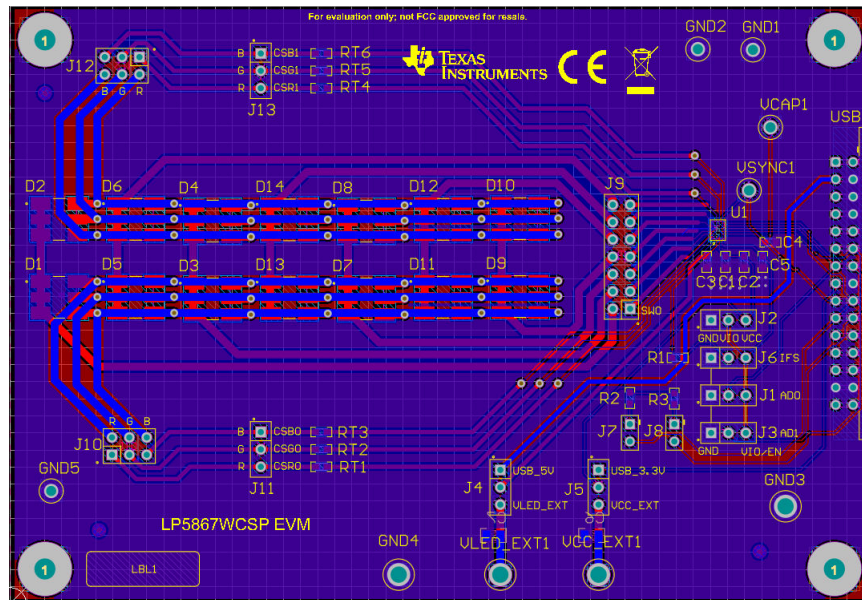


Figure 4-3. LP5867EVM Bottom Layer

4.3 Bill of Materials

Table 4-1 displays the bill of materials (BOM). To download the BOM, see the design files at the LP5867EVM tools page.

Table 4-1. Bill of Materials (BOM)

DESIGNATOR	DESCRIPTION	MANUFACTURER	PART NUMBER	QUANTITY
C1, C2,C3	CAP, CERM, 1uF, 25V, $\pm 10\%$, X7R, 0603	AVX	06033C105KAT2A	3
C2	CAP, CERM, 0.1uF, 16V, $\pm 5\%$, X7R, 0603	AVX	0603YC104JAT2A	1
C5, C7	CAP, CERM, 22uF, 35V, $\pm 20\%$, X5R, 0805	TDK	C2012X5R1V226M125AC	2
C6	CAP, CERM, 1000pF, 10V, $\pm 10\%$, X7R, 0603	AVX	0603ZC102KAT2A	1
D1 to D14	LED, RGB, SMD	Cree	CLY6D-FKC-CK1N1D1BB7D3D3	14
GND1, GND2, GND3	Test Point, Multipurpose, Black, TH	Keystone	5011	3
GND, GND4, VCC_EXT1, VIO_EXT1, VLED_EXT1	Terminal, Turret, TH, Double	Keystone	1502-2	5
H1, H2, H3, H4	Machine Screw, Round, 4-40 x 1/4, Nylon, Philips panhead	B&F Fastener Supply	NY PMS 440 0025 PH	4
H5, H6, H7, H8	Standoff, Hex, 0.5"L 4-40 Nylon	Keystone	1902C	4
J1, J2, J3, J4, J5, J6, J7, J10, J12	Header, 100mil, 3x1, Gold, TH	Samtec	TSW-103-07-G-S	9
J8	Header, 100mil, 7x2, Gold, TH	Samtec	TSW-107-07-G-D	1
J9, J11	Header, 100mil, 3x2, Gold, TH	Samtec	TSW-103-07-G-D	2
R1	RES, 4.7k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW06034K70JNEA	1
RT1, RT2, RT3, RT4, RT5, RT6	RES, 0, 5%, 0.1W, 0603	Yageo	RC0603JR-070RL	6
USB1	Header(shrouded), 2.54mm, 15x2, Gold with Tin tail, R/A, TH	Samtec	TST-115-04-L-D-RA	1
VCAP1	Test Point, Multipurpose, Red, TH	Keystone	5010	1
VSYN1	Test Point, Multipurpose, Yellow, TH	Keystone	5014	1
SH-J1 to SH-J20	Shunt, 100mil, Gold plated, Black	Samtec	SNT-100-BK-G	20
U1	LP5867YBHR	Texas Instruments	LP5867YBHR	1

5 Additional Information

Trademarks

All trademarks are the property of their respective owners.

6 Related Documentation

- Texas Instruments, [USB2ANY Interface Adapter](#), user guide.
- Graphical User Interface, [GUI installation package](#), website.

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