XMC™ LED Current Control Explorer Board User Manual

XMC1000

About this document

Scope and purpose

This document describes the features and hardware details of the XMC™ LED Current Control Explorer card, designed to provide an evaluation platform for continuous conduction mode buck LED driving with Infineon's XMC1000 family of ARM® Cortex™-M microcontrollers.

Intended audience

This document is intended for engineers who are using the XMC™ LED Current Control Explorer Kit for evaluation or development.

Applicable products

- XMC1200 Boot Kit
- XMC1300 Boot Kit
- XMC1400 Boot Kit
- XMC LED Current Control Explorer Kit

References

- XMC1200 Boot Kit Board User Manual
- XMC1300 Boot Kit Board User Manual
- XMC1400 Boot Kit Board User Manual
- DALI PHY for XMC™ Boot Kits Board User Manual

Table of Contents

1 Overview

The XMC™ LED Current Control Explorer card is an integral component of the XMC™ LED Current Control Explorer Kit, which is an evaluation kit that introduces the user to continuous conduction mode (CCM) buck LED driving solution with Infineon's XMC1000 family of ARM® Cortex™-M microcontrollers.

The XMC™ LED Current Control Explorer Kit offers a single output channel for flicker-free control of LED light engines. The kit is pre-programmed with software that allows the adoption of different LED light engines and different input voltages to enable fast prototyping and inexpensive evaluation. The brightness of the LED light engine can be controlled via DALI communication protocol or the on-board potentiometer.

The analog and switching peripherals (ACMP, ERU, CCU4, CCU8 and BCCU) are closely interconnected in the on-board XMC1302 microcontroller. This allows flexibility enabling low-cost and compact design for a fast dimmable LED current control loop. The result is very high quality flicker-free LED lighting solution.

1.1 Key features

The XMC™ LED Current Control Explorer card features the following:

- 4x10-pin headers for connection to XMC1302 Boot Kit
- Single channel compact dimmable CCM buck circuit
- Configurable voltage divider circuit to adjust LED current
- LED input voltage up to $30V_{DC}$
- Peak LED current up to 1A

1.2 Block diagram

Figure 1 shows the functional block diagram of the XMC™ LED Current Control Explorer card.

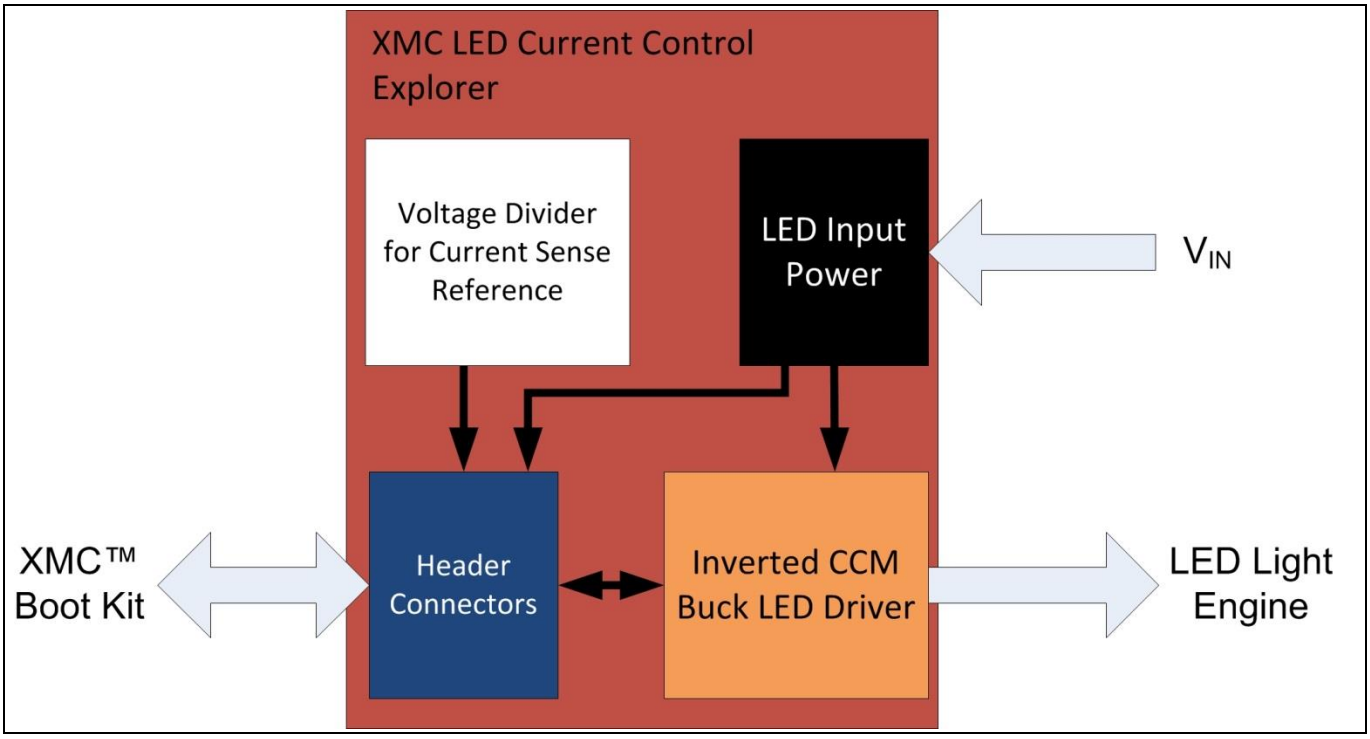

Figure 1 Block diagram of XMC™ LED Current Control Explorer card

2 Hardware Description

The following section provides a detailed description of the hardware. Figure 2 provides an overview of the hardware.

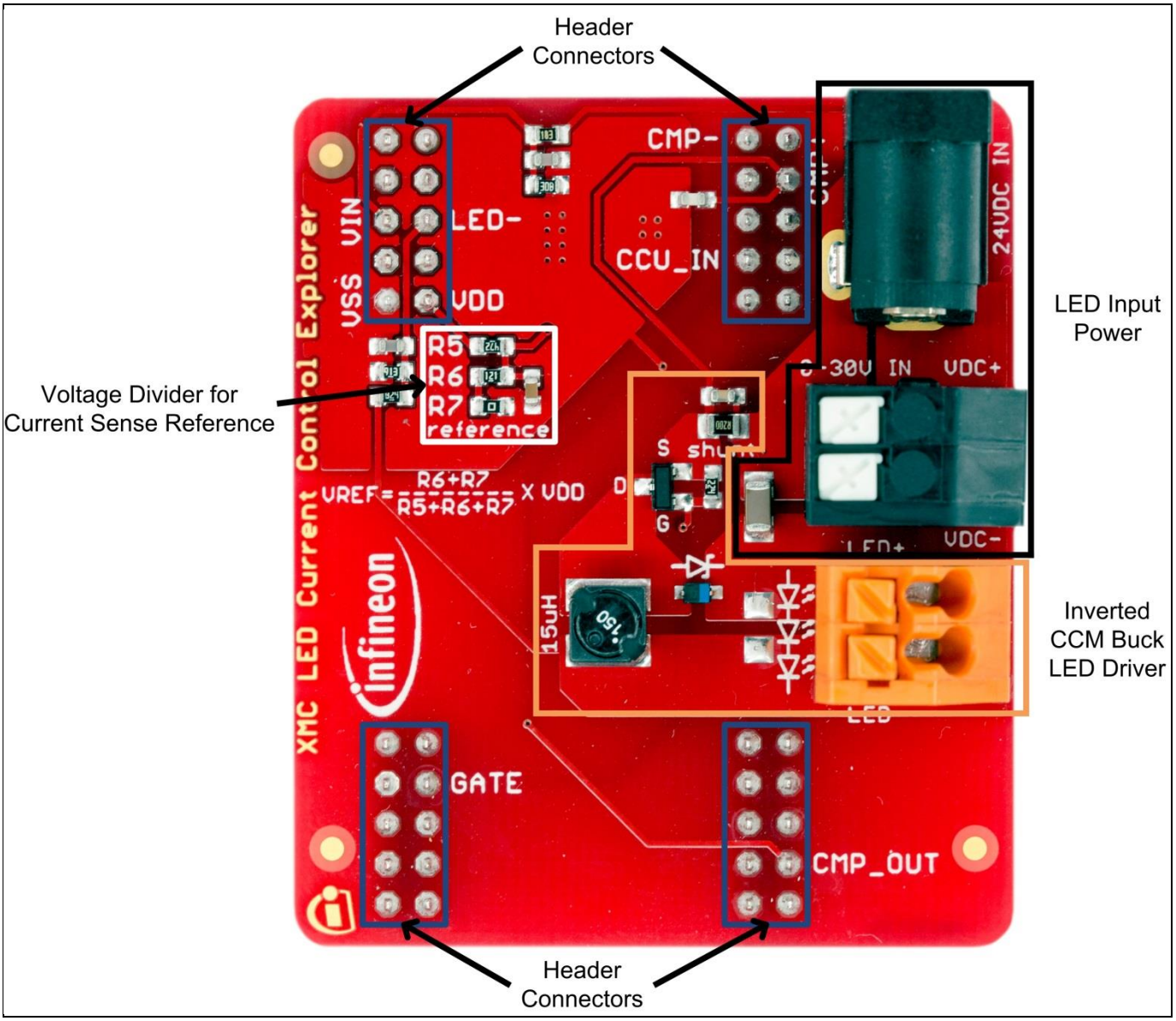

Figure 2 XMC™ LED Current Control Explorer card hardware overview

2.1 LED Input Power

The XMC™ LED Current Control Explorer card provides two options for the input power – a 24V DC input jack and a 0-30V DC WAGO connector (Figure 3). The input DC powers the inverted CCM buck LED driver circuit on the card.

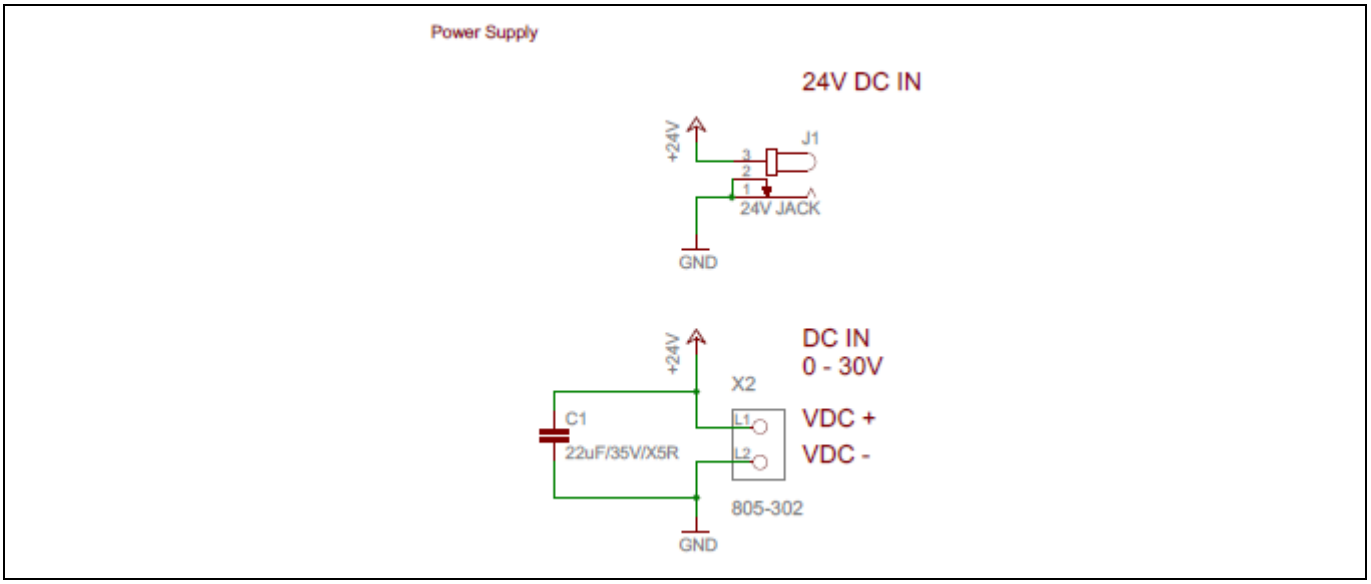

Figure 3 Power supply

2.2 Inverted CCM Buck LED Driver

The XMC™ LED Current Control Explorer card drives a single LED channel using an inverting CCM buck converter circuit (Figure 4). The compact circuit comprises of a small signal N-channel MOSFET (BSS306N), a schottky-diode (BAS3010A-03W) and an inductor. A shunt resistor (R1, 0.2Ω) is also on-board for LED current sensing. An orange WAGO connector is provided for convenient connection to the user's LED engine.

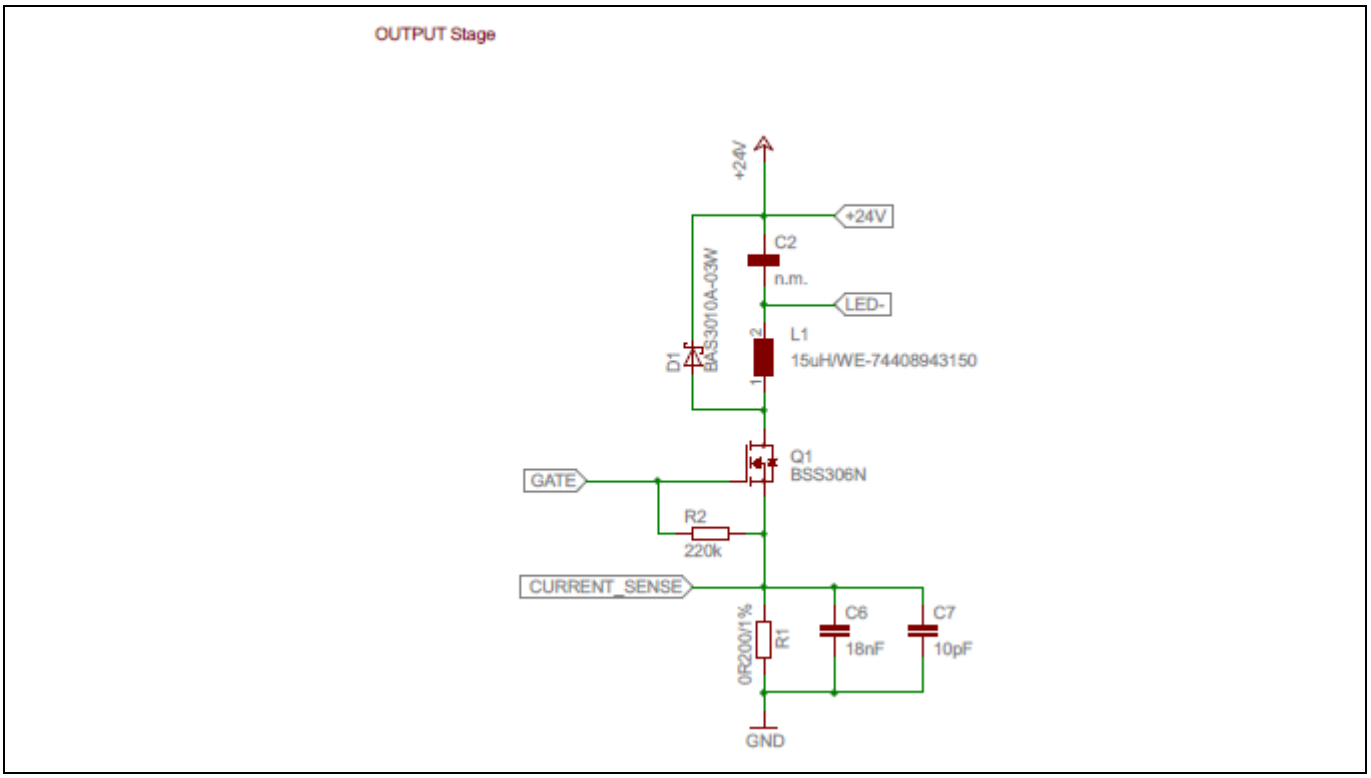

Figure 4 Output stage

2.3 Voltage Divider

A voltage divider circuit comprising of R5, R6 and R7 (Figure 5, Table 1) generates a voltage level used as the reference for current sensing. The reference level will determine the reference LED current, I_{REF}.

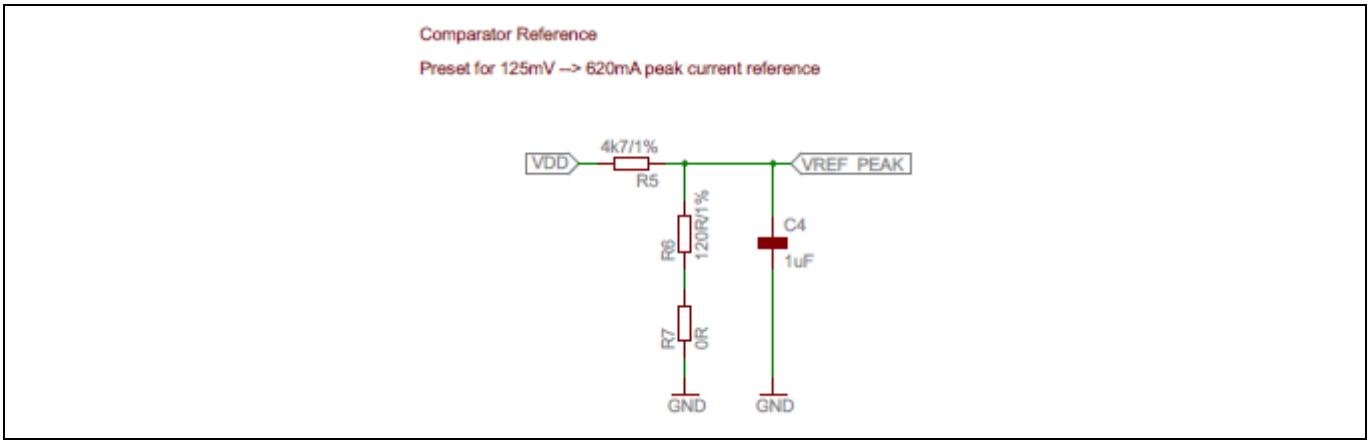

Figure 5 Reference generation circuit

Table 1 Default resistor values

Resistor	Value (Ohm)
R5	4700
R6	120
R7	0

With the default resistor values, I_{REF} is 620mA. The user may conveniently change the I_{REF} value by changing one or more of the 3 resistors. The equation for calculating the required resistor value is provided on the board to aid the user:

$$VREF = \frac{R6 + R7}{R5 + R6 + R7} \times VDD, where\ VDD = 5V$$

As an example, to get an I_{REF} value of 735mA,

$$\begin{aligned} VREF &= IREF \times R1 \\ &= 735 \times 0.200 \\ &= 0.147V \end{aligned}$$

$$\begin{aligned} R7 &= \frac{\frac{VREF}{VDD}(R5 + R6) - R6}{1 - \frac{VREF}{VDD}} \\ &= \frac{\frac{0.147}{5}(4700 + 120) - 120}{1 - \frac{0.147}{5}} \\ &\approx 22\Omega \end{aligned}$$

2.4 Header Connectors

Four 10-pin header connectors on the underside of the card make it easy for the card to be mounted on the XMC1302 Boot Kit (Figure 6). The connectors interface the XMC1302 microcontroller on the Boot Kit with the XMC™ LED Current Control Card for driving the MOSFET gate, current sensing and voltage sensing. Table 2 describes briefly the function of each pin that is used.

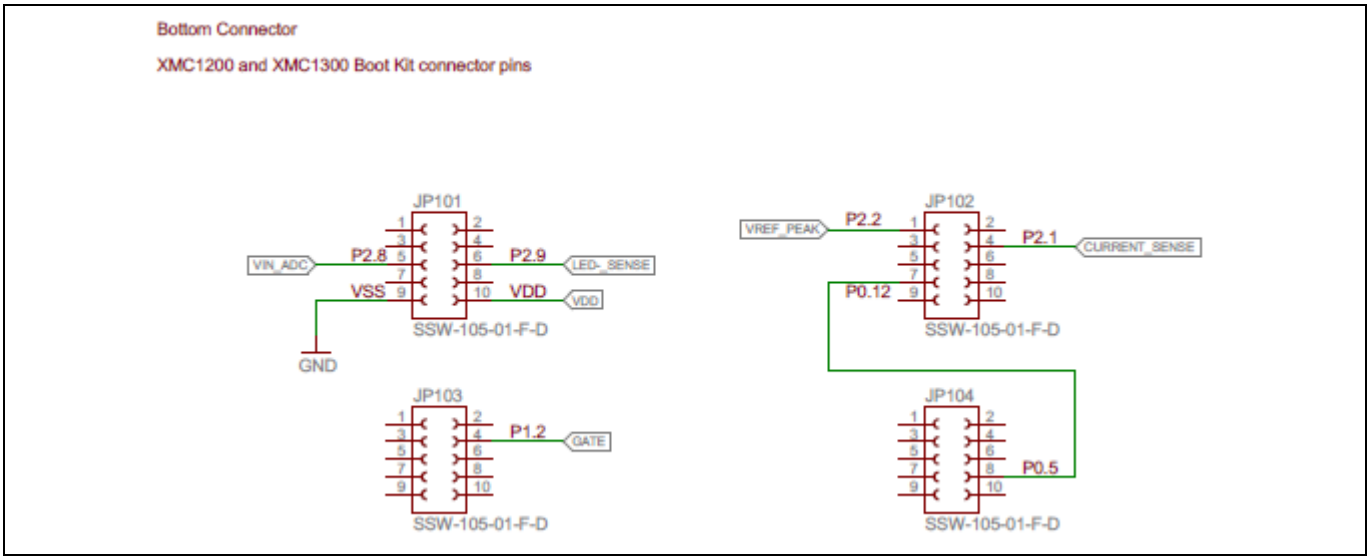

Figure 6 Bottom connectors

Table 2 Pin functions

Pin	Function
P1.2	MOSFET gate driver
P2.1	LED current sensing
P2.2	Reference voltage measurement
P2.8	Input power measurement
P2.9	LED forward voltage measurement
P0.5	Analog comparator output
P0.12	CCU4 slice input

3 Production Data

In this section, production data such as the schematics (Section 3.1), component placement (Section 3.2) and bill of materials (Section 3.3) are provided.

3.1 Schematics

The full PCB design data of this board can also be downloaded from www.infineon.com/xmc-dev.

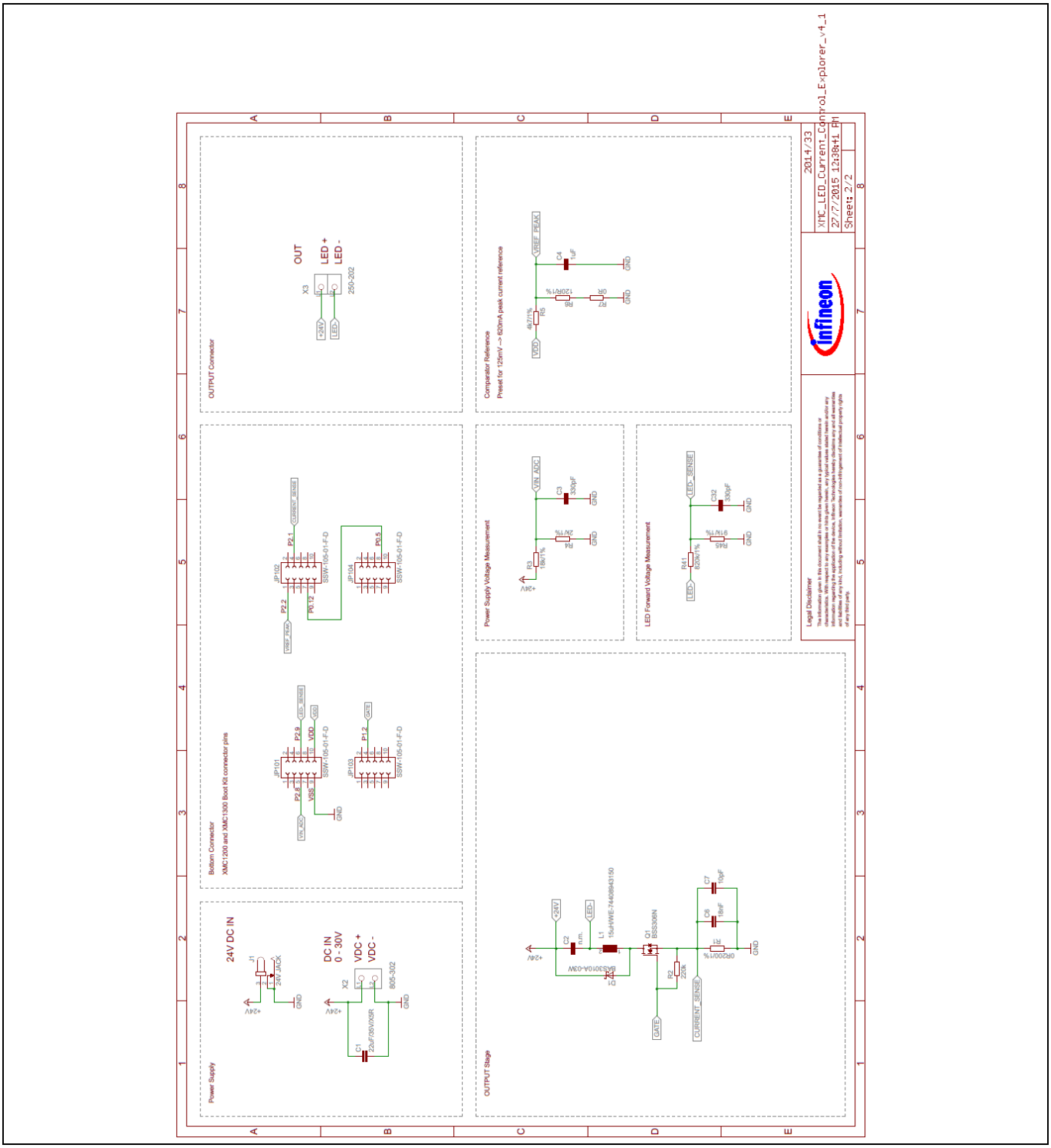

Figure 7 Schematic of XMC™ LED Current Control Explorer card

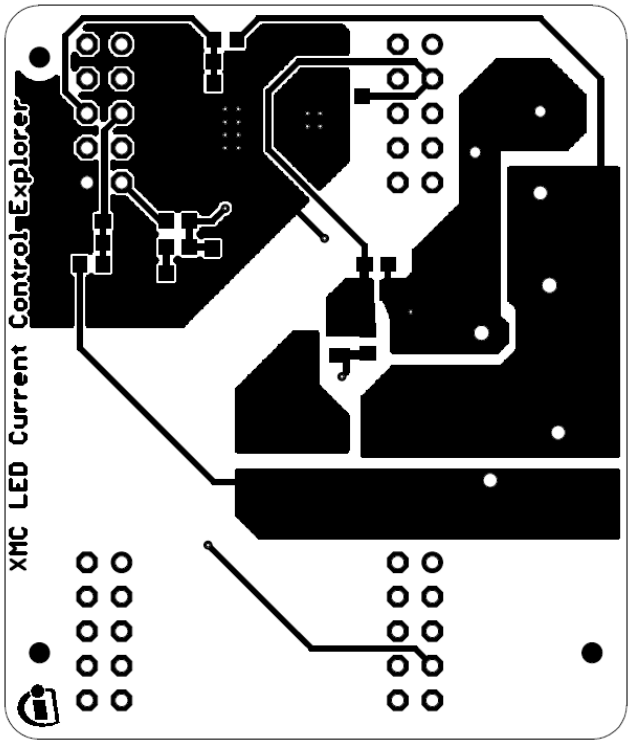

Figure 8 Layout top view of XMC™ LED Current Control Explorer card

3.2 Component Placement

In Figure 9, the placement of components is shown in a layout view of the top layer of XMC™ LED Current Control Explorer card.

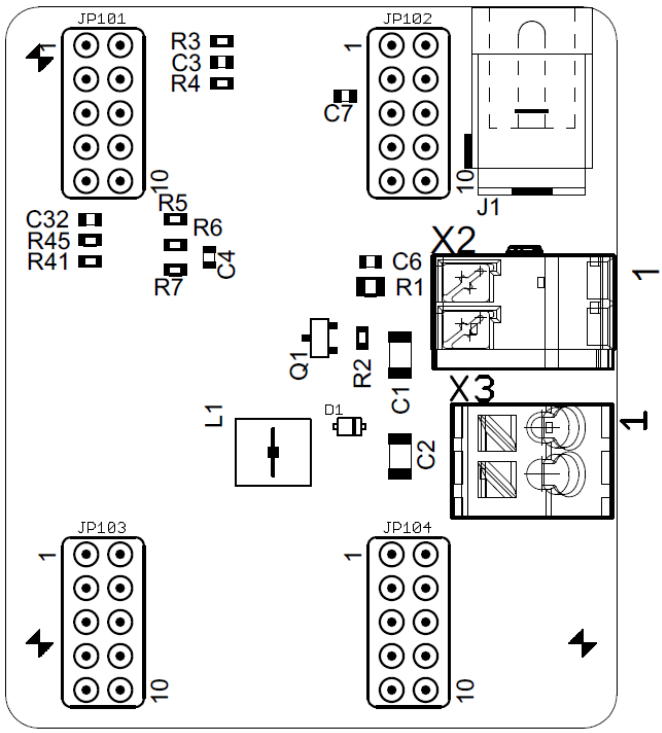

Figure 9 Component layout top level view of XMC™ LED Current Control Explorer card

3.3 Bill of Materials (BOM)

Table 3 provides a complete bill of material for the XMC™ LED Current Control Explorer card.

Table 3 Bill of Materials

No.	Device/Description	Quantity	Position
1	C-22uF-1206-35V	1	C1
2	n.m.	-	C2
2	C-330pF-0603	1	C3
3	C-1uF-0603	1	C4
4	C-18nF-0603	1	C6
5	C-10pF-0603	1	C7
6	C-330pF-0603	1	C32
7	BAS3010A-03W	1	D1
8	24V Jack	1	J1
9	Connectors SSW-105-01-F-D	4	JP101, JP102, JP103, JP104
10	L-15uH/WE-74408943150	1	L1
11	BSS306N	1	Q1
12	0R200-0805	1	R1
13	220k-0603	1	R2
14	18k-0603	1	R3
15	2k-0603	1	R4
16	4k7-0603	1	R5
17	120R-0603	1	R6
18	0R-0603	1	R7
19	820k-0603	1	R41
20	91k-0603	1	R45
21	805-302 WAGO Connector	1	X2
22	250-202 WAGO Connector	1	X3

Revision history

Major changes since the last revision

Page or Reference	Description of change

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