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MxL76508

18V 700kHz 8A Fast-PWM Synchronous Step-Down Converter

EVK User Manual

Revision History

Document No.	Release Date	Change Description
038UMR01	August 8, 2025	**Updated:** ■ "MxL76508 EVK Simplified Block Diagram" figure. ■ "EVK PCB Layers" section. ■ "Recommended Values of Components" table.
038UMR00	April 10, 2025	Initial release.

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Introduction

The MxL76508 evaluation kit (EVK) provides a platform to evaluate the features and performance of the MxL76508 synchronous step-down constant on-time (COT) buck converter. The MxL76508 provides a maximum load current rating of 8A with an input voltage range of 3V to 18V. It is packaged in a 3mm×3mm 16-lead QFN.

This document provides the EVK schematic (see "EVK Schematic" on page 7), PCB layout (see "EVK PCB Layers" on page 8), and bill of materials (see "EVK Bill of Materials" on page 11). They can help you with your design.

For more information, refer to the *MxL76508 Data Sheet* (286DS). It includes a complete list of the device features, pinout, pin descriptions, typical performance characteristics, and external component calculations. This user manual is intended to be used in conjunction with the data sheet.

Quick EVK Set-Up and Start-Up

Factory Settings

The EVK has been set up with the following factory default configurations for quick set-up and operation:

- V_{IN} = 3V to 18V, optimized for a 12V input rail.
- V_{OUT} = 1V. For a different V_{OUT} selection, see "V_{OUT} Selection" on page 3.
- Maximum I_{OUT} of 8A.
- Switching frequency of 700kHz.
- Forced continuous conduction mode (FCCM), pulse-frequency modulation (PFM) mode or ultra-sonic (UA) mode. See "Ordering Information" on page 2.
- Internal constant soft-start time of 1.8ms (minimum), or externally programmable soft-start time by the SS pin. See "System Set-Up" on page 3.

  Note: Do not exceed the device maximum load current rating.

Quick Start-Up

To quickly see the regulator in operation:

1. Use the factory settings and default configuration. If you wish to change any settings or components, do so before proceeding with the following steps. For more information, see "System Set-Up" on page 3.
2. Connect a turned-off power supply that is within the V_{IN} specification (from 3V to 18V, 12V typically) to the VIN pillar and to the GND pillar with short/thick leads. See the locations in "Test Set-Up and Result" on page 5.
3. Initially set to 0A, connect an electronic load not exceeding the maximum I_{OUT} (8A) to the VOUT pillar and to the GND pillar with short/thick leads. See the locations in "Test Set-Up and Result" on page 5.
4. Turn on the power supply and check V_{OUT}. The EVK should power up and regulate the output at 1V (factory setting).
5. Set or vary the load (do not exceed the maximum I_{OUT}) and check V_{OUT} and other desired performance levels, such as regulation and efficiency. For the result, see "Test Set-Up and Result" on page 5.

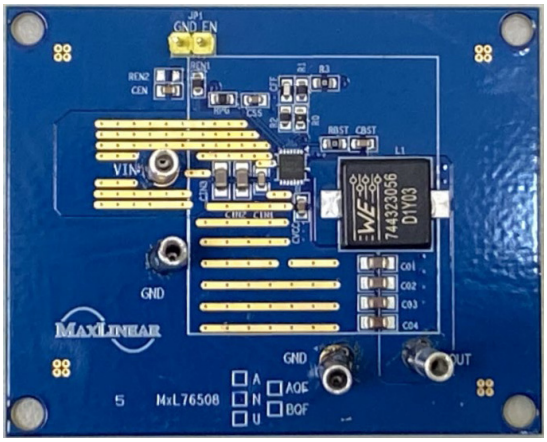

Figure 1: Top View of the MxL76508 EVK

Ordering Information

The following table lists the ordering part numbers for the evaluation kit.

Table 1: EVK Ordering Part Numbers

EVK Part Number	Maximum I_{OUT}	Default Output Voltage	Description
MXL76508A-EVK-1	8A	1V	EVK 8A step-down converter in FCCM mode
MXL76508N-EVK-1	8A	1V	EVK 8A step-down converter in PFM mode
MXL76508U-EVK-1	8A	1V	EVK 8A step-down converter in UA mode

Note: For the most up-to-date ordering information and additional information on environmental rating, go to www.maxlinear.com/MxL76508.

Evaluation Kit Overview

The following figure shows the EVK options for adjusting or testing.

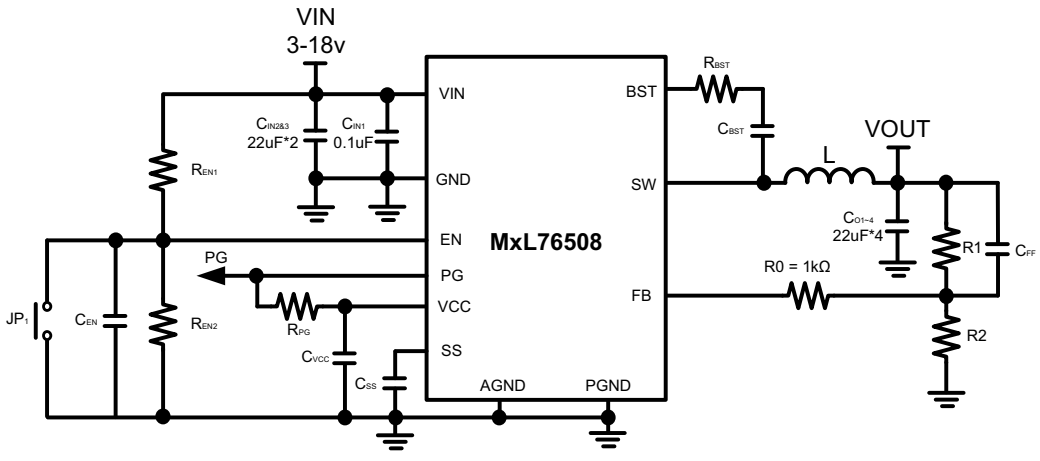

Figure 2: MxL76508 EVK Simplified Block Diagram

System Set-Up

EN Options

The following table lists the two options that the EN pin has reserved via JP1.

Table 2: Jumper JP1 Options for the EN Pin

Jumper Options	Description
Jumper 1-2	The enable (EN) pin is tied to GND, permanently disabling the channel.
No jumper (default)	The EN pin is connected to V_{IN} through a resistance and the channel is enabled at power-up.

To supply an external control signal on EN, you must ensure that the resistor R1 is removed and that the EN threshold specification is met.

Table 3: EN Threshold Specification

EN Pin Threshold		Condition	Minimum	Typical	Maximum
V_EN_VIH	Turn-on threshold	Rising	-	1.26V	-
V_EN_VIL	Turn-off threshold	Falling	-	1.00V	-

V_{OUT} Selection

The factory installed configuration of V_{OUT} is 1V. You can modify V_{OUT} by changing the low-side resistor (R2) of the feedback resistor divider according to:

$$R2 \equiv \left(\frac{R1 \times 0.6}{V_{OUT} - 0.6}\right)$$

Where R1 is the high-side resistor of the feedback resistor divider, which has a nominal value of 20kΩ.

Changing the output voltage also affects loop stability. For proper loop compensation, MaxLinear recommends also modifying the inductance (L) and feed-forward capacitance (Cff) values as listed in the following table, and using 1% resistors to maintain output voltage accuracy.

Table 4: Recommended Values of Components

V_{OUT}	L	R0	R1	R2	Cff
5.0V	1.2µH	1kΩ	20kΩ	2.7kΩ	56pF
3.3V	1µH	1kΩ	20kΩ	4.42kΩ	56pF
1.0V	0.56µH	1kΩ	20kΩ	30kΩ	56pF

Soft-Start Time Selection

You can set the soft-start time by adjusting the soft-start capacitor (C_{SS}). To achieve the minimum soft-start time of 1.8ms, you must leave the SS pin unconnected. The SS pin provides a constant current of 6μA to charge the C_{SS} and can be calculated as:

$$T_{SS} = max\left(\frac{C_{SS} \times 0.6}{6\mu A}, 1.8ms\right)$$

The following table lists several capacitances and the corresponding soft-start time.

Table 5: Soft-Start Time Selection

C_{SS}	T_{SS}	Comment
22nF	2.2ms	Default
33nF	3.3ms	-
47nF	4.7ms	-
68nF	6.8ms	-
82nF	8.2ms	-
100nF	10.0ms	-

Test Set-Up and Result

Input and Output Connections

MaxLinear recommends using a power supply and connect it to the VIN and GND pillars of the MxL76508 EVK via a pair of 17-AWG wires. Connect the output port at the VOUT and GND pillars to an electronic load or another load via a pair of 17-AWG wires, as shown in Figure 3. The connecting wire should be as short as possible to reduce losses.

For the V_{IN} and V_{OUT} test points, MaxLinear recommends measuring both input and output capacitance.

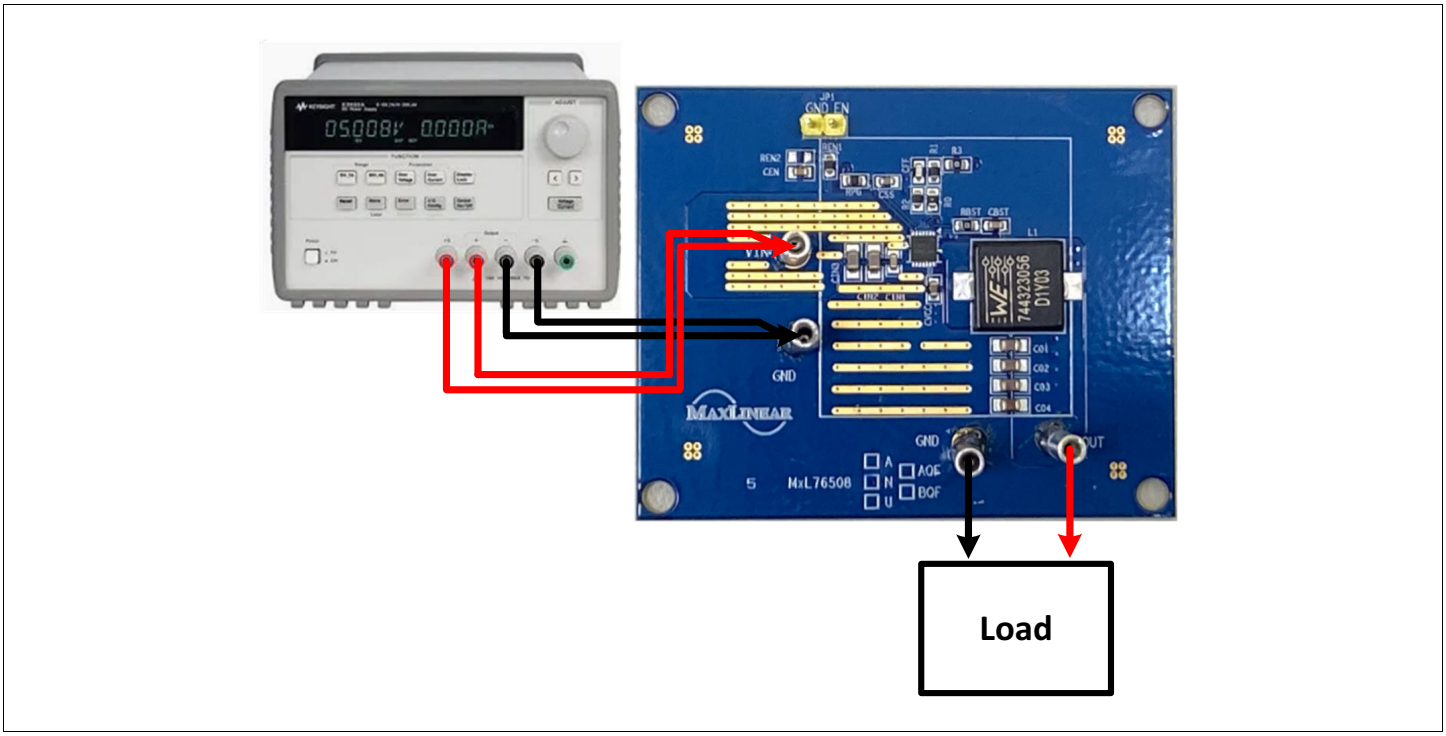

Figure 3: V_{IN} and V_{OUT} Connections of the MxL76508 EVK

Start-Up Procedure

1. Make sure that jumper JP1 is not populated. If JP1 is populated, remove it to start V_{OUT} ramp-up.
2. Apply the appropriate V_{IN} (typically 12V) to the EVK's VIN and GND pillars.
3. Verify that V_{OUT} is within the output regulation.

Start-Up

The start-up waveform of the MxL76508 is initiated by V_{IN}, as shown in the following figure.

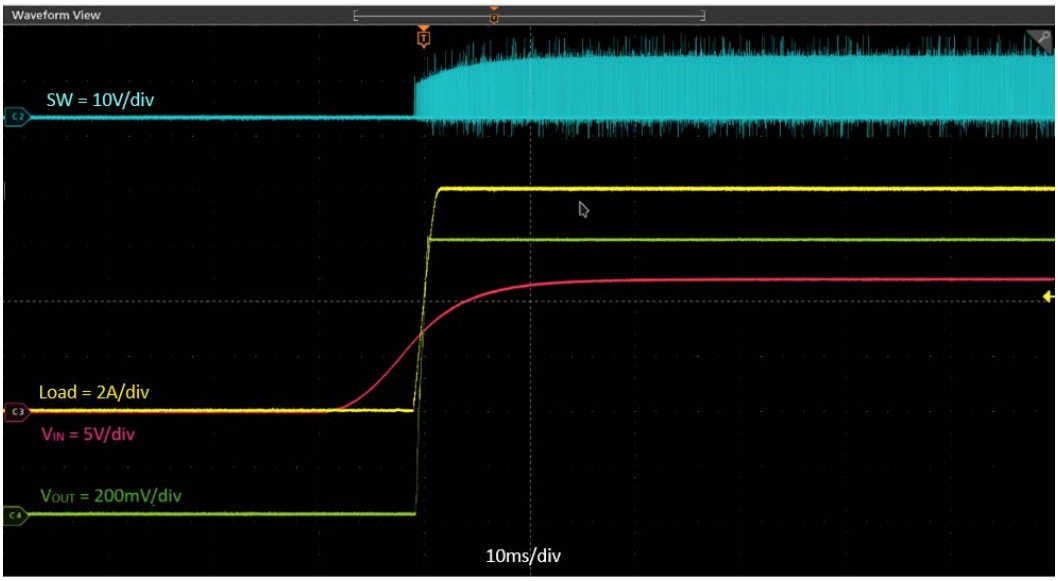

Figure 4: MxL76508 Start-Up with an 8A Load

Shutdown

The shutdown waveform of the MxL76508 is initiated by V_{IN}, as shown in the following figure.

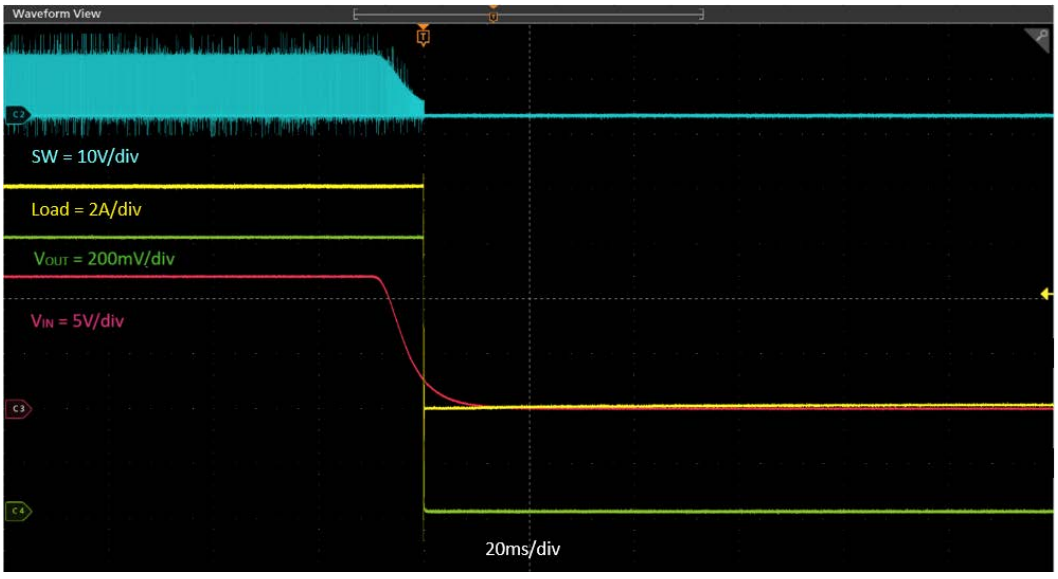

Figure 5: MxL76508 Shutdown with an 8A Load

EVK Schematic

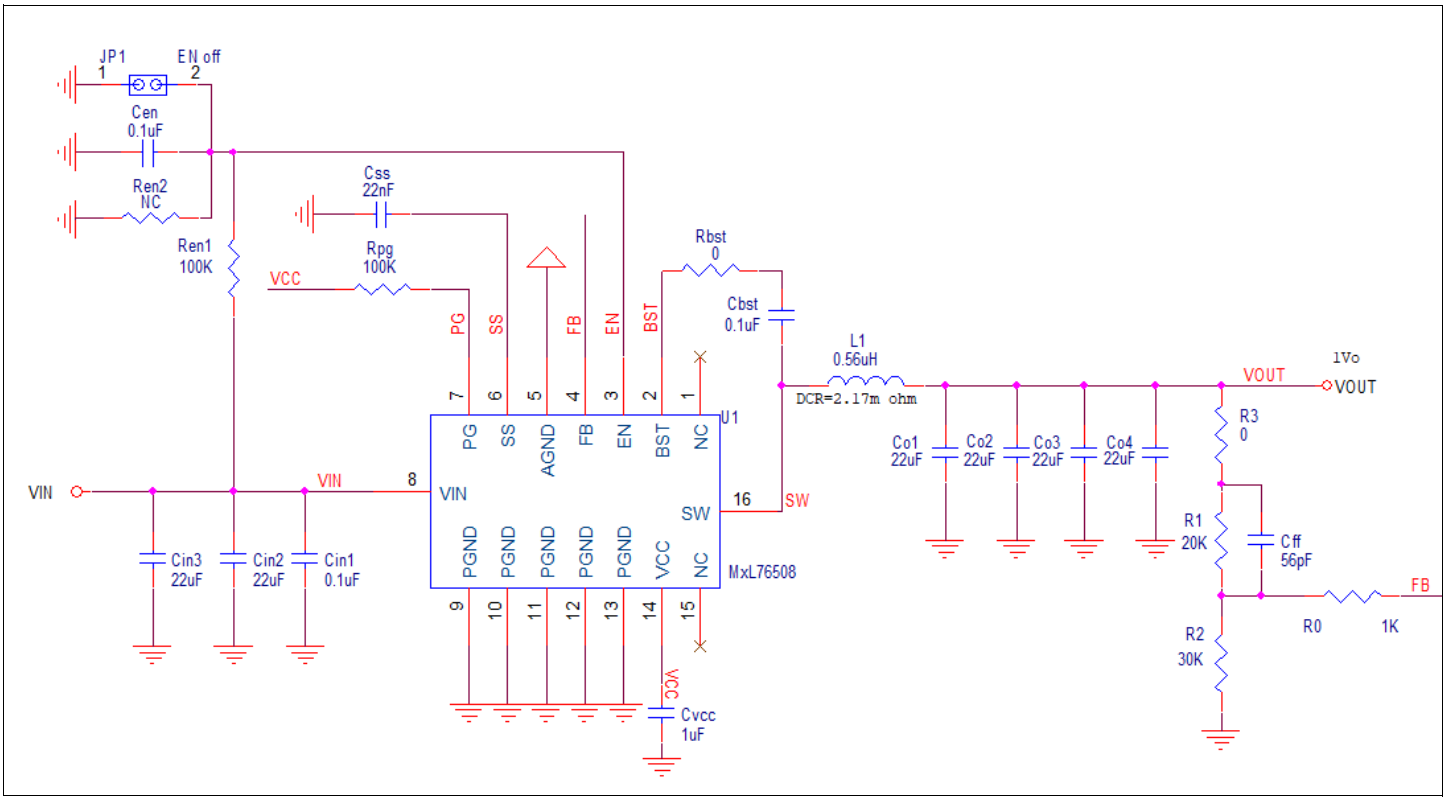

Figure 6: EVK Schematic

EVK PCB Layers

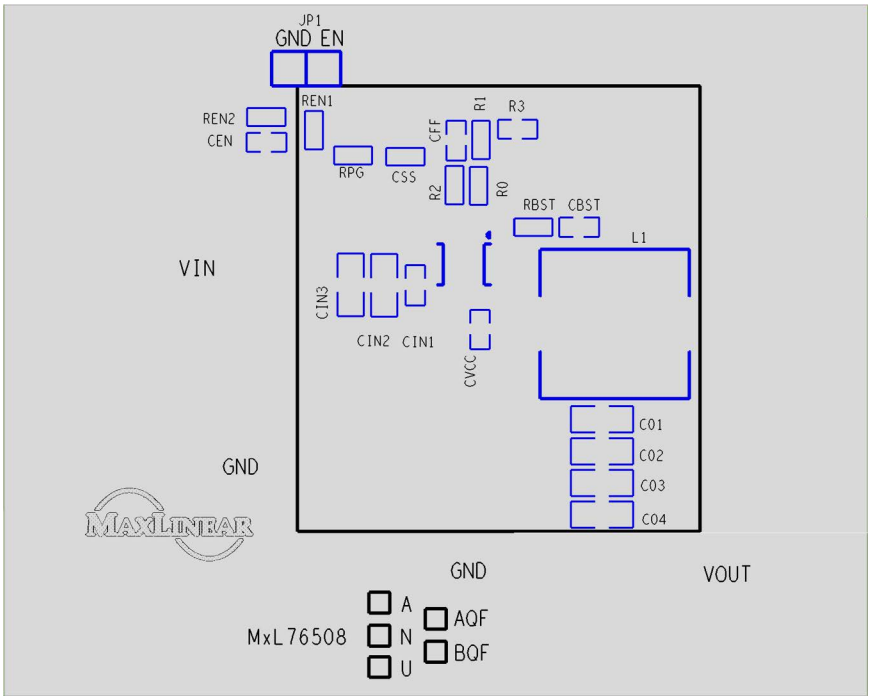

Figure 7: EVK PCB Silkscreen Top

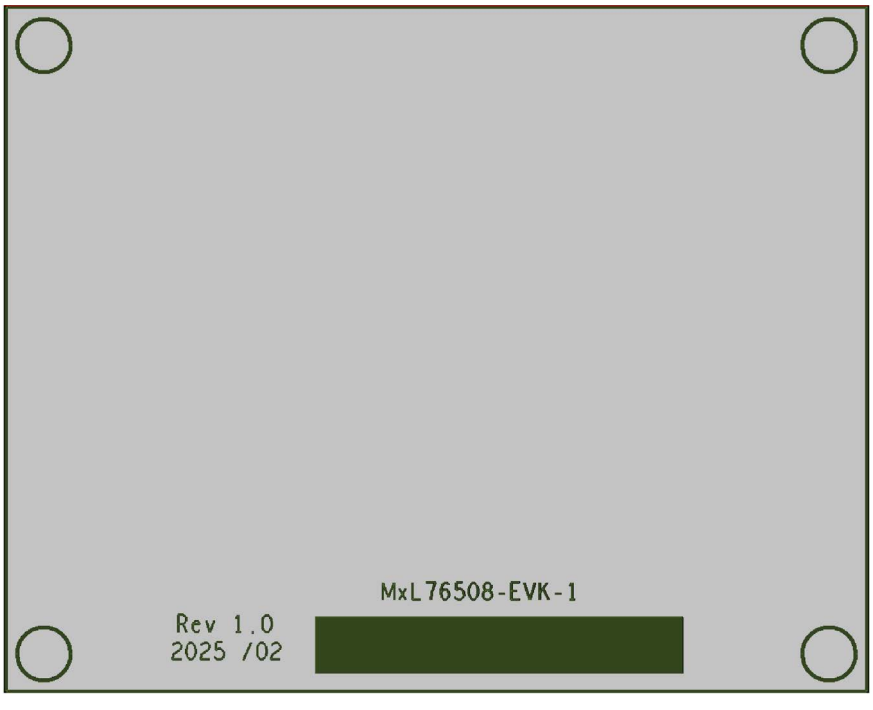

Figure 8: EVK PCB Silkscreen Bottom

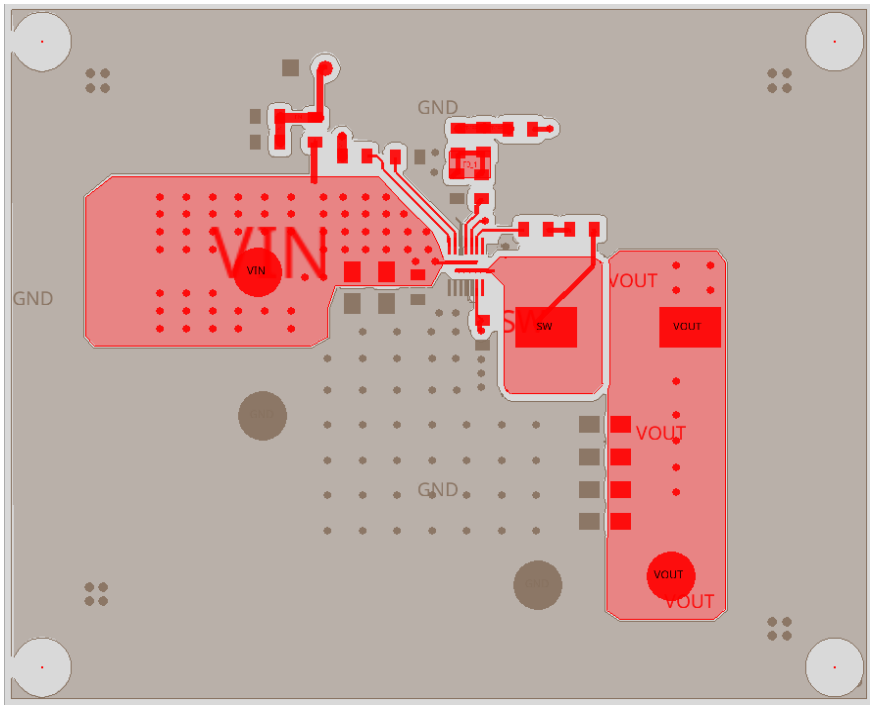

Figure 9: EVK PCB Top Layer

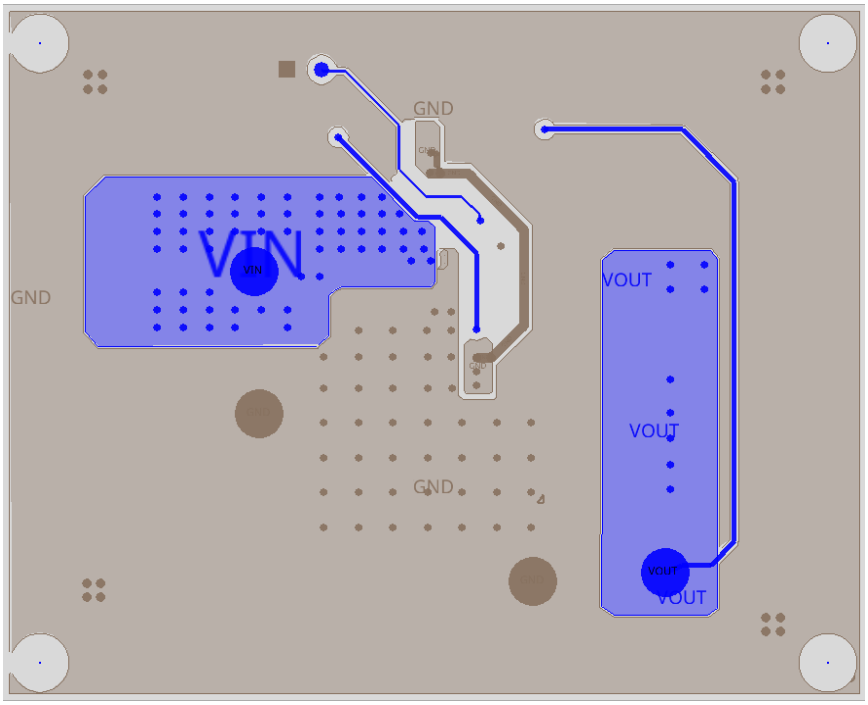

Figure 10: EVK PCB Bottom Layer

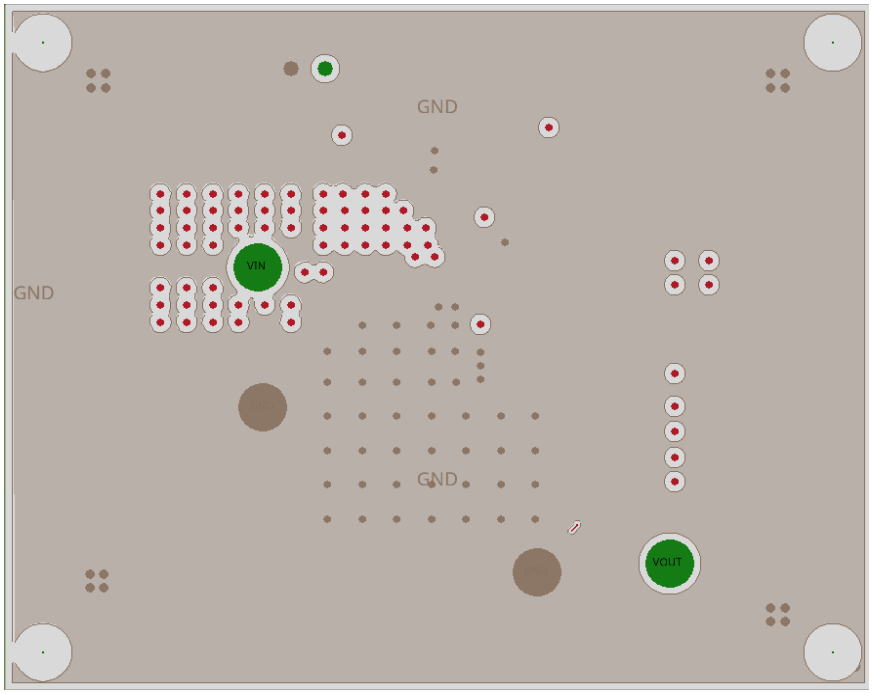

Figure 11: EVK PCB Layer 2

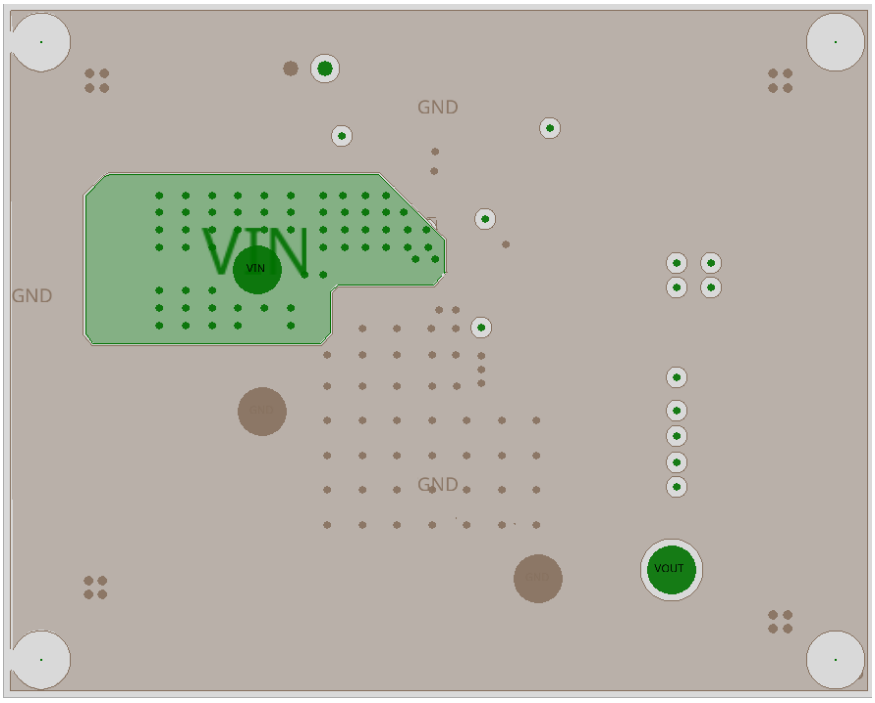

Figure 12: EVK PCB Layer 3

EVK Bill of Materials

Table 6: EVK Bill of Materials

Item	Qty	Reference Designator	Value	Description	Package
1	6	CIN2, CIN3, CO1, CO2, CO3, CO4	22µF	Ceramic capacitor, 25V, X5R	0805
2	3	CEN, CBST, CIN1	0.1µF	Ceramic capacitor, 50V, X5R	0603
3	1	CVCC	1µF	Ceramic capacitor, 10V, X5R	0603
4	1	CSS	22nF	Ceramic capacitor, 10V, X5R	0603
5	1	CFF	56pF	Ceramic capacitor, 10V, X5R	0603
6	1	L	0.56µH	Wurth Electronics 744323056, DCR = 2.17mΩ	0603
7	1	R1	20kΩ	Resistor, ±1%	0603
8	1	R2	30kΩ	Resistor, ±1%	0603
9	1	R0	1kΩ	Resistor, ±1%	0603
10	2	RBST, R3	0Ω	Resistor	0603
11	2	RPG, REN1	100kΩ	Resistor, ±1%	0603
12	4	VIN, GND, VOUT	-	Pin header	Pin header
13	0	REN2	NC	-	-
14	1	JP1	2.54mm pin header *2	Pin header	2.54mm *2
15	1	Power IC	MXL76508N-AQF-R	Step-down DC/DC converter	FC-QFN3x3-16L

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