EVM3650-QW-00A

17V, 6A, Step-Down Converter Module Evaluation Board

DESCRIPTION

The EVM3650-QW-00A is an evaluation board designed to demonstrate the capabilities of the MPM3650, a fully integrated, high-frequency, synchronous, rectified, step-down power module with an internal inductor. It offers an ultra-compact solution that achieves up to 6A of continuous output current across a wide 2.75V to 17V input voltage range, with excellent load and line regulation. Synchronous mode provides high efficiency across the output current load range.

Constant-on-time (COT) control provides very fast transient response, easy loop design, and tight output regulation. Full protection features include short-circuit protection (SCP), over-current protection (OCP), under-voltage protection (UVP), and thermal shutdown.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	2.75 to 17	V
Output voltage	V_{OUT}	1	V
Output current	I_{OUT}	6	A

FEATURES

- Wide 2.75V to 17V Operating Input Range
- Continuous Output Current:
  - Up to 6A Output Current for Inputs Between 0.6V and 1.8V
  - Up to 5A Output Current for Inputs Above 1.8V
- Discontinuous Conduction Mode (DCM) for High Efficiency during Light Load Operation
- Adjustable Output from 0.6V
- Supports Pre-Biased Start-Up
- 1200kHz Fixed Switching Frequency (f_{SW})
- Configurable External Soft Start (SS)
- Enable (EN) and Power Good (PG) Pins for Power Sequencing
- Over-Current Protection (OCP) with Hiccup Mode
- Thermal Shutdown
- Available in a QFN-24 (4mmx6mmx1.6mm) Package

APPLICATIONS

- Field-Programmable Gate Array (FPGA) Power Systems
- Optical Modules
- Telecommunications
- Networking
- Industrial Equipment

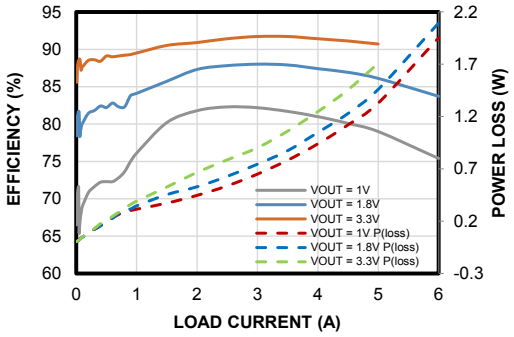
EVM3650-QW-00A EVALUATION BOARD

LxWxH (63.5mmx63.5mmx1.6mm)

Board Number	MPS IC Number
EVM3650-QW-00A	MPM3650GQW

Efficiency vs. Load Current vs. Power Loss

V_{IN} = 12V



QUICK START GUIDE

1. Preset the power supply between 2.75V and 17V.
2. Turn off the power supply.
3. Connect the power supply terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
4. Connect load terminals (≤6A) to:
   a. Positive (+): VOUT
   b. Negative (-): GND
5. After making the connections, turn on the power supply. The board should start up automatically.

EVALUATION BOARD SCHEMATIC

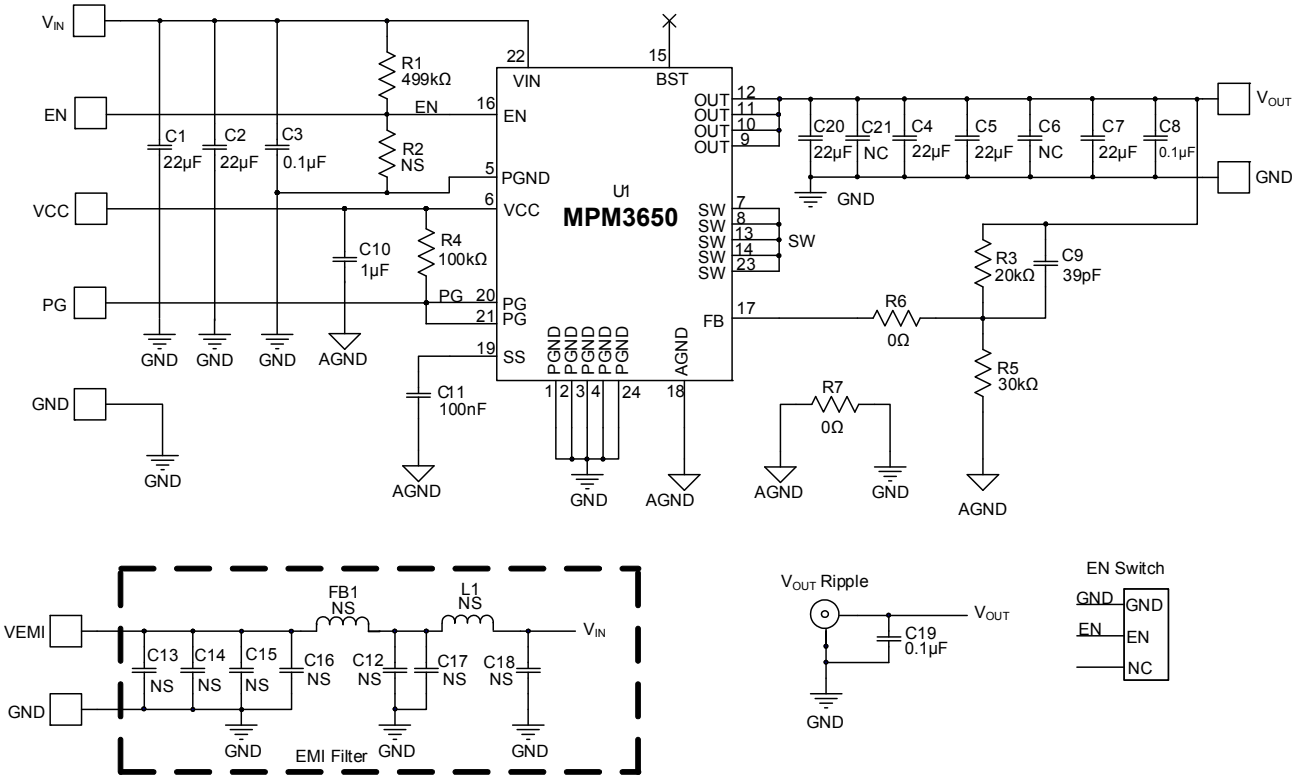


Figure 1: Evaluation Board Schematic

EVM3650-QW-00A BILL OF MATERIALS

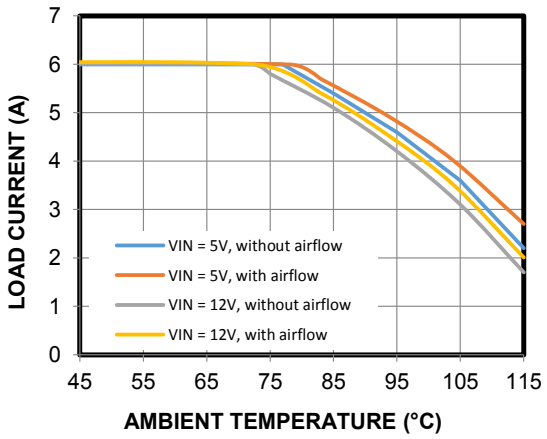
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
6	C1, C2, C4, C5, C20, C7	22µF	Ceramic capacitor, 25V, X5R	0805	Murata	GRM21BR61E226ME44L
4	C3, C8, C11, C19	0.1µF	Ceramic capacitor, 25V, X5R	0402	Wurth	885012105018
1	C10	1µF	Ceramic capacitor, 25V, X5R	0402	Murata	GRM155R61E105KA12D
1	C9	39pF	Ceramic capacitor, 50V, C0G	0402	Murata	GRM1555C1H390JA01D
1	R1	499kΩ	Film resistor, 1%	0402	Yageo	RC0402FR-07499KL
1	R4	100kΩ	Film resistor, 1%	0402	Yageo	RC0402FR-07100KL
2	R7, R6	0Ω	Film resistor, 1%	0402	Yageo	RC0402FR-070RL
1	R3	20kΩ	Film resistor, 1%	0402	Yageo	RC0402FR-0720KL
1	R5	30kΩ	Film resistor, 1%	0402	Yageo	RC0402FR-0730KL
1	EN	2.54mm	3-pin, single-row, straight socket header	DIP	Wurth	61300311821
1	V_{OUT} ripple	NS				
5	VIN, VEMI, GND x 2, VOUT	φ2mm	Copper pin	DIP	Custom	
4	EN, GND, VCC, PG	Φ1mm	Copper pin	DIP	Custom	
1	U1	MPM3650	Step-down power module, 17V, 6A	QFN-24 (4mmx 6mm)	MPS	MPM3650GQW

EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board, V_{IN} = 5V, V_{OUT} = 1V, T_A = 25°C, unless otherwise noted.

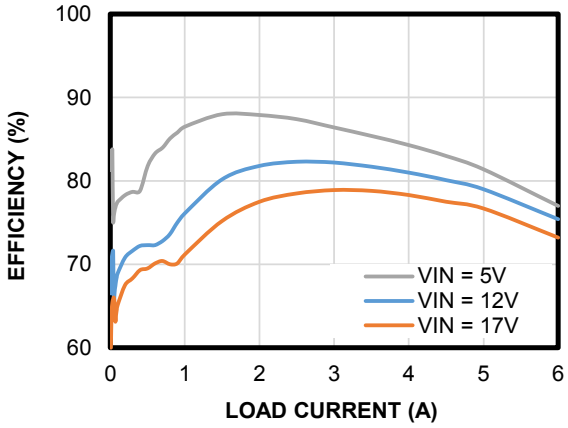
Thermal Derating

V_{OUT} = 1V



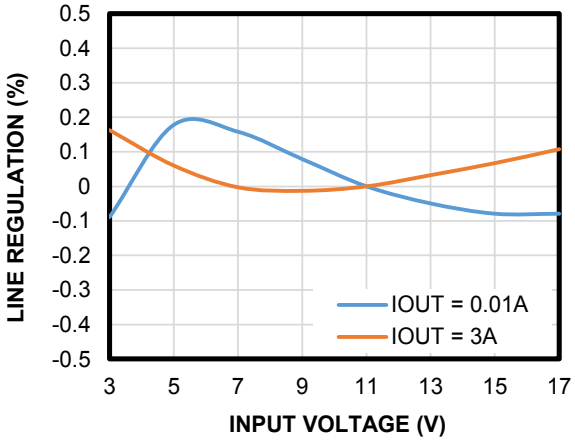
Efficiency vs. Load Current

V_{OUT} = 1V



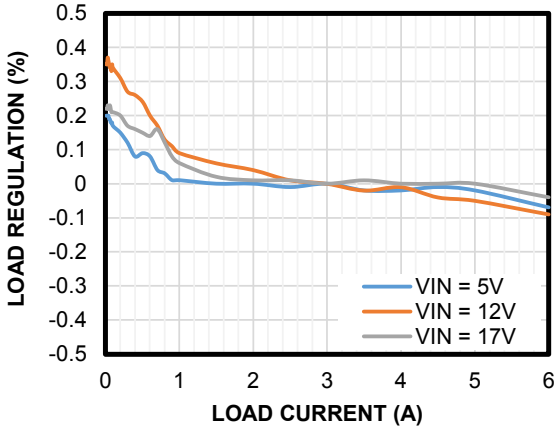
Line Regulation

V_{OUT} = 1V



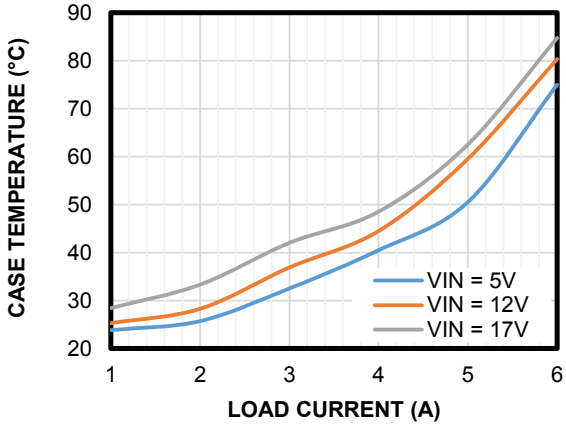
Load Regulation

V_{OUT} = 1V



Case Temperature Rise vs. Load Current

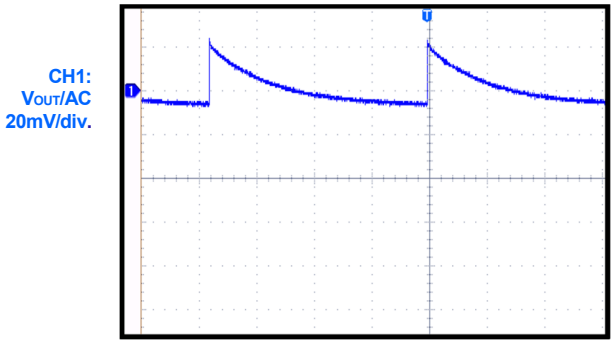
V_{OUT} = 1V, T_A = 15°C



EVB TEST RESULTS *(continued)*

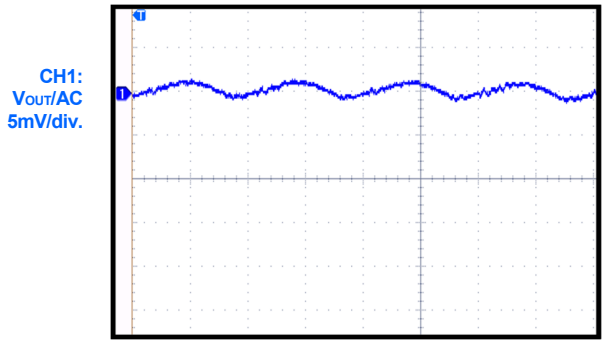
Performance curves and waveforms are tested on the evaluation board, V_{IN} = 5V, V_{OUT} = 1V, T_A = 25°C, unless otherwise noted.

V_{OUT} Ripple
I_{OUT} = 0A



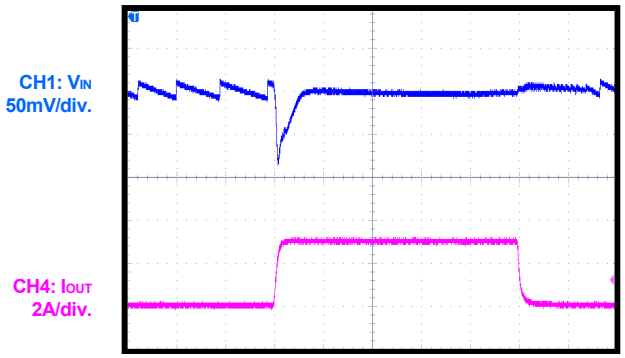
20ms/div.

V_{OUT} Ripple
I_{OUT} = 6A



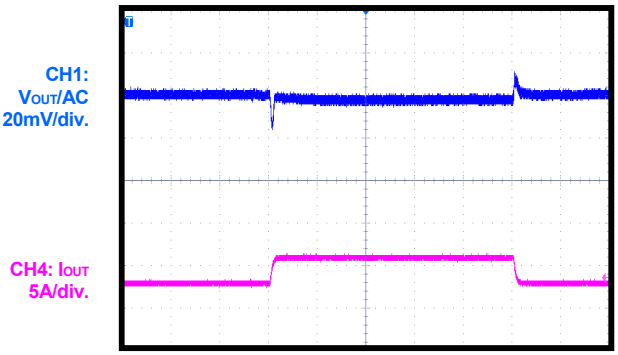
400ns/div.

Load Transient
I_{OUT} = 0A to 3A



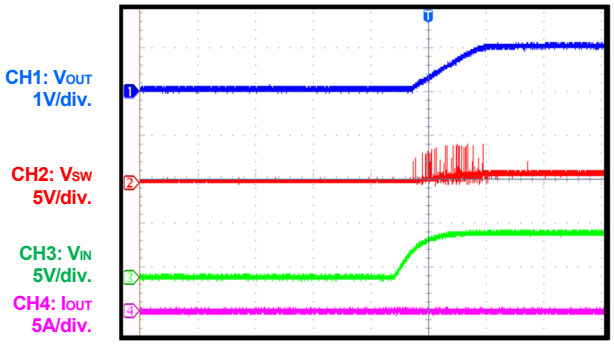
100µs/div.

Load Transient
I_{OUT} = 3A to 6A



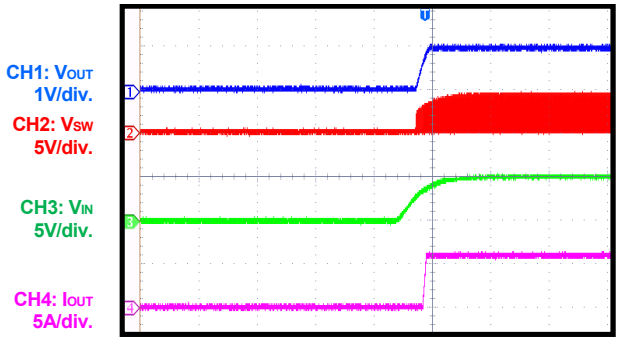
100µs/div.

Start-Up through VIN
I_{OUT} = 0A



10ms/div.

Start-Up through VIN
I_{OUT} = 6A

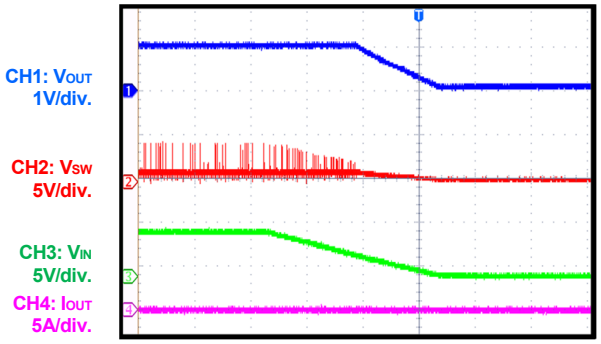


10ms/div.

EVB TEST RESULTS *(continued)*

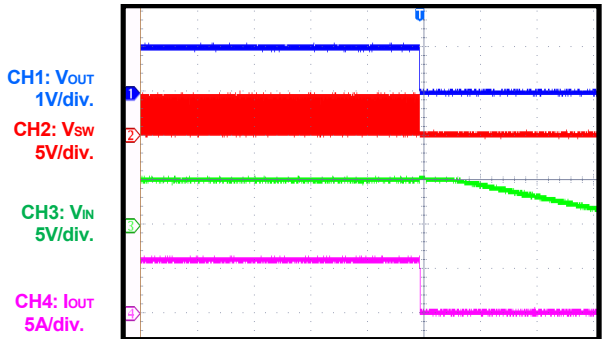
Performance curves and waveforms are tested on the evaluation board, V_{IN} = 5V, V_{OUT} = 1V, T_A = 25°C, unless otherwise noted.

Shutdown through VIN
I_{OUT} = 0A



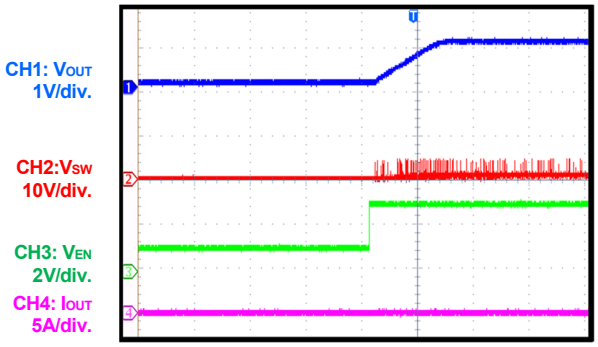
10ms/div.

Shutdown through VIN
I_{OUT} = 6A



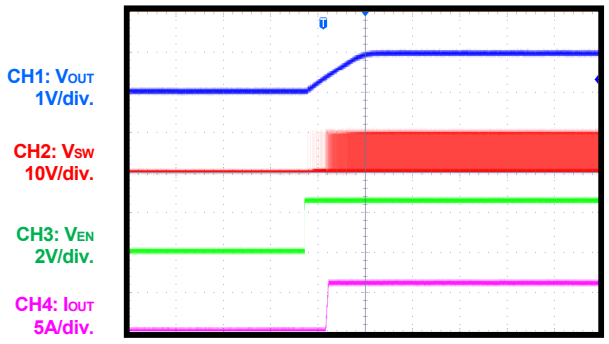
10ms/div.

Start-Up through EN
I_{OUT} = 0A



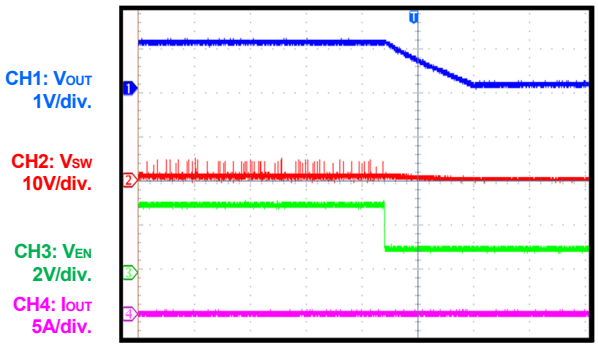
10ms/div.

Start-Up through EN
I_{OUT} = 6A



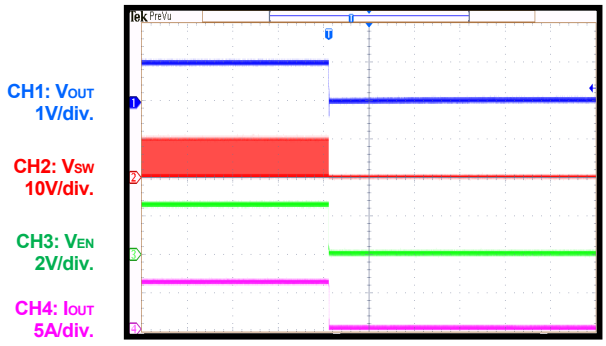
10ms/div.

Shutdown through EN
I_{OUT} = 0A



10ms/div.

Shutdown through EN
I_{OUT} = 6A

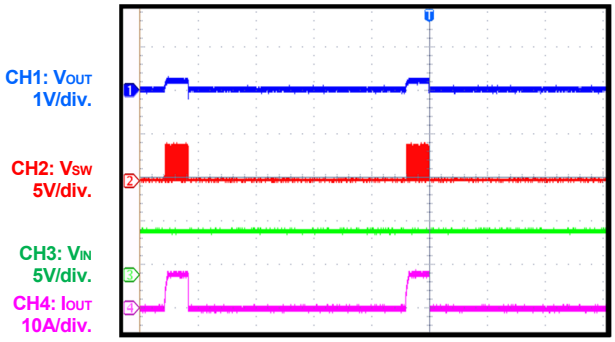


10ms/div.

EVB TEST RESULTS *(continued)*

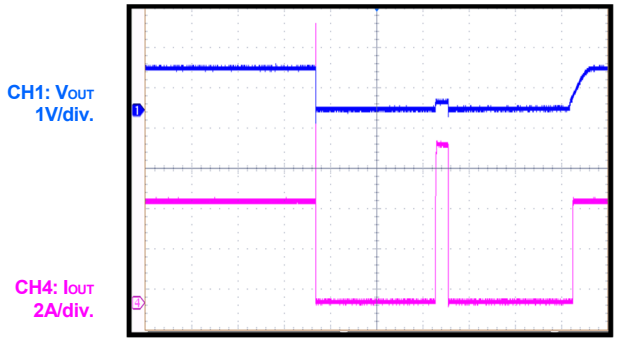
Performance curves and waveforms are tested on the evaluation board, V_{IN} = 5V, V_{OUT} = 1V, T_A = 25°C, unless otherwise noted.

SCP Steady State



20ms/div.

SCP Entry and Recovery



200ms/div.

PCB LAYOUT

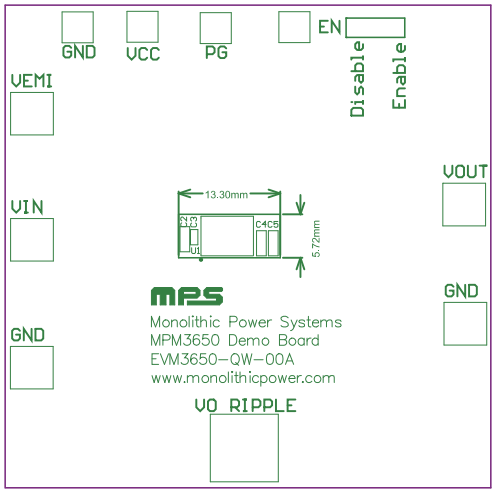


Figure 2: Top Silk

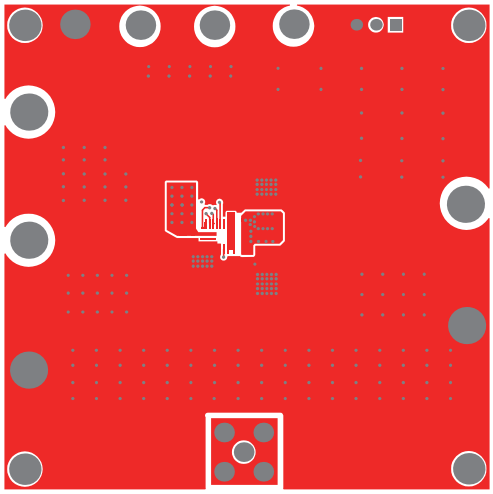


Figure 3: Top Layer

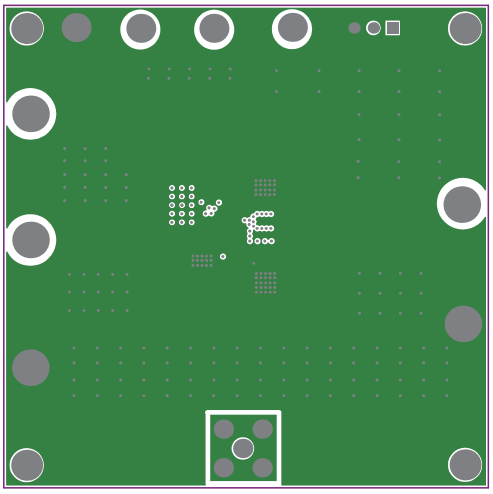


Figure 4: Mid-Layer 1

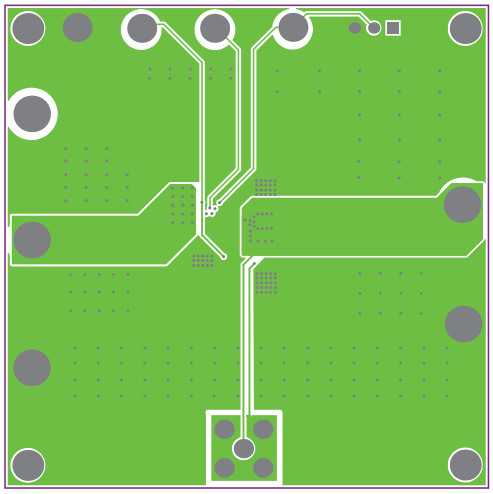


Figure 5: Mid-Layer 2

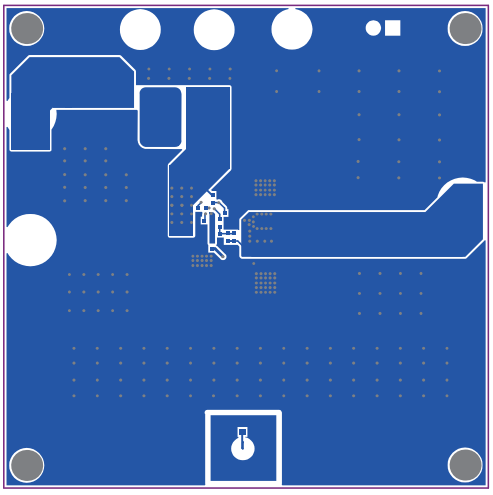


Figure 6: Bottom Layer

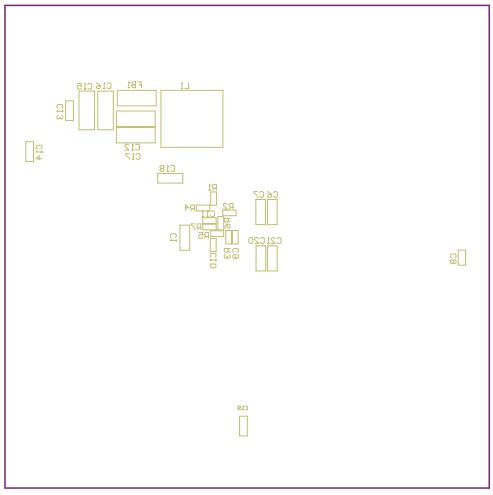


Figure 7: Bottom Silk

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	7/8/2020	Initial Release	-
1.1	6/25/2021	Updated the output current from “5A” to “6A”; updated the output current for operation above 1.8V to “5A”; updated the Efficiency vs. Load Current vs. Power Loss graph title and axes to reflect the updated 6A output current and to include a “Power Loss” axis	1
		Updated the load current from “≤5A” to “≤6A”	2
		Updated Figure 1	3
		Updated the Bill of Materials (BOM) section	4
		Updated the Case Temperature Rise vs. Output Current curve; updated the X-axis to reflect the updated 6A output current	5
		Updated the waveform descriptions from “5A” to “6A”	6–7
		Formatting updates and clerical updates; updated figure titles	All