EVM54504-BS-00A

5A, 16V, 4-Channel Ouput, Step-Down Power Module with Internal Auto-Compensation Evaluation Board

DESCRIPTION

The EVM54504-BS-00A is an evaluation board designed to demonstrate the capabilities of the MPM54504, a four-channel output, step-down power module. Each channel can deliver up to 5A of continuous output current across a wide input voltage range (3V to 16V), with excellent load and line regulation. The MPM54504 integrates monolithic power stages and inductors that support passive components to achieve high efficiency.

The MPM54504 features internal auto-compensation, and does not require any external compensation components.

Constant-on-time (COT) control provides fast load transient response, simple loop design, and tight output regulation.

The MPM54504's protection features include short-circuit protection (SCP), over-current protection (OCP), over-voltage protection (OVP), under-voltage protection (UVP), over-temperature protection (OTP), and thermal shutdown (TSD).

The MPM54504 is available in a FCMBGA (9mmx15mmx5mm) package.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	12	V
Output voltage (channels 1, 2, 3, and 4)	V_{OUT}	3.3, 2.5, 1.5, 1.2	V
Output current (channels 1, 2, 3, and 4)	I_{OUT}	5, 5, 5, 5	A

FEATURES

- Wide 3V to 16V Operating Input Voltage Range
- 0.6 to 5.5V Output Voltage
- Continuous Output Current (I_{OUT})
  - Four-Channel Output
  - 5A I_{OUT} per Channel
- Constant-On-Time Control (COT) for Fast Transient Response
- Internal Auto-Compensation
- Configurable External Soft-Start (SS) Time
- Enable (EN) and Power Good (PG) for Power Sequencing
- Protection Features: Over-Voltage Protection (OVP), Under-Voltage Protection (UVP), Over-Current Protection (OCP), Short-Circuit Protection (SCP), Over-Temperature Protection (OTP), Thermal Shutdown (TSD)
- Available in a FCMBGA (9mmx15mmx5mm) Package

APPLICATIONS

- Field-Programmable Gate Arrays (FPGAs)
- Digital Signal Processors (DSPs)
- Application-Specific Integrated Circuits (ASICs)
- Multi-Rail Point-of-Load (POL) Power Systems

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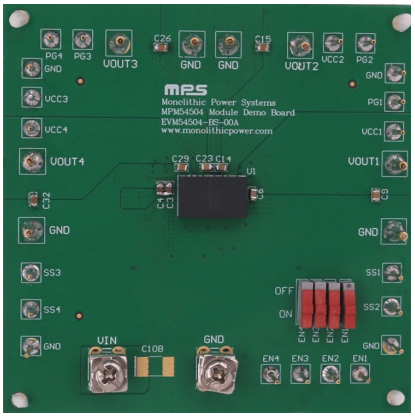
EVM54504-BS-00A EVALUATION BOARD

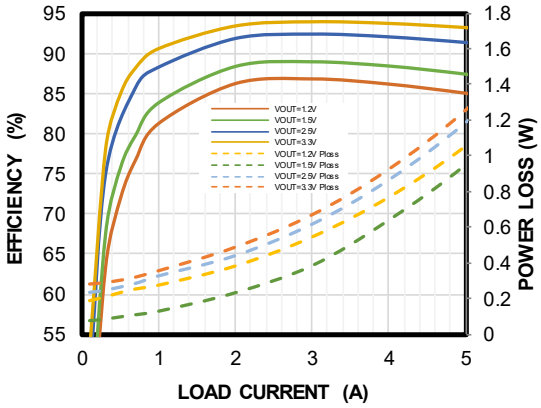


LxWxH (92mmx92mmx1.6mm)

Board Number	MPS IC Number
EVM54504-BS-00A	MPM54504GBS

Efficiency vs. Load Current vs. Power Loss

V_{IN} = 12V



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QUICK START GUIDE

1. Preset the power supply between 3V and 16V, then turn off the power supply.
2. Connect the power supply terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
3. Connect the load terminals (≤5A) of channels 1, 2, 3, and 4 to:
   a. Positive (+): VOUT
   b. Negative (-): GND
4. After making the connections, turn on the power supply. The board should automatically start up.

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EVALUATION BOARD SCHEMATIC

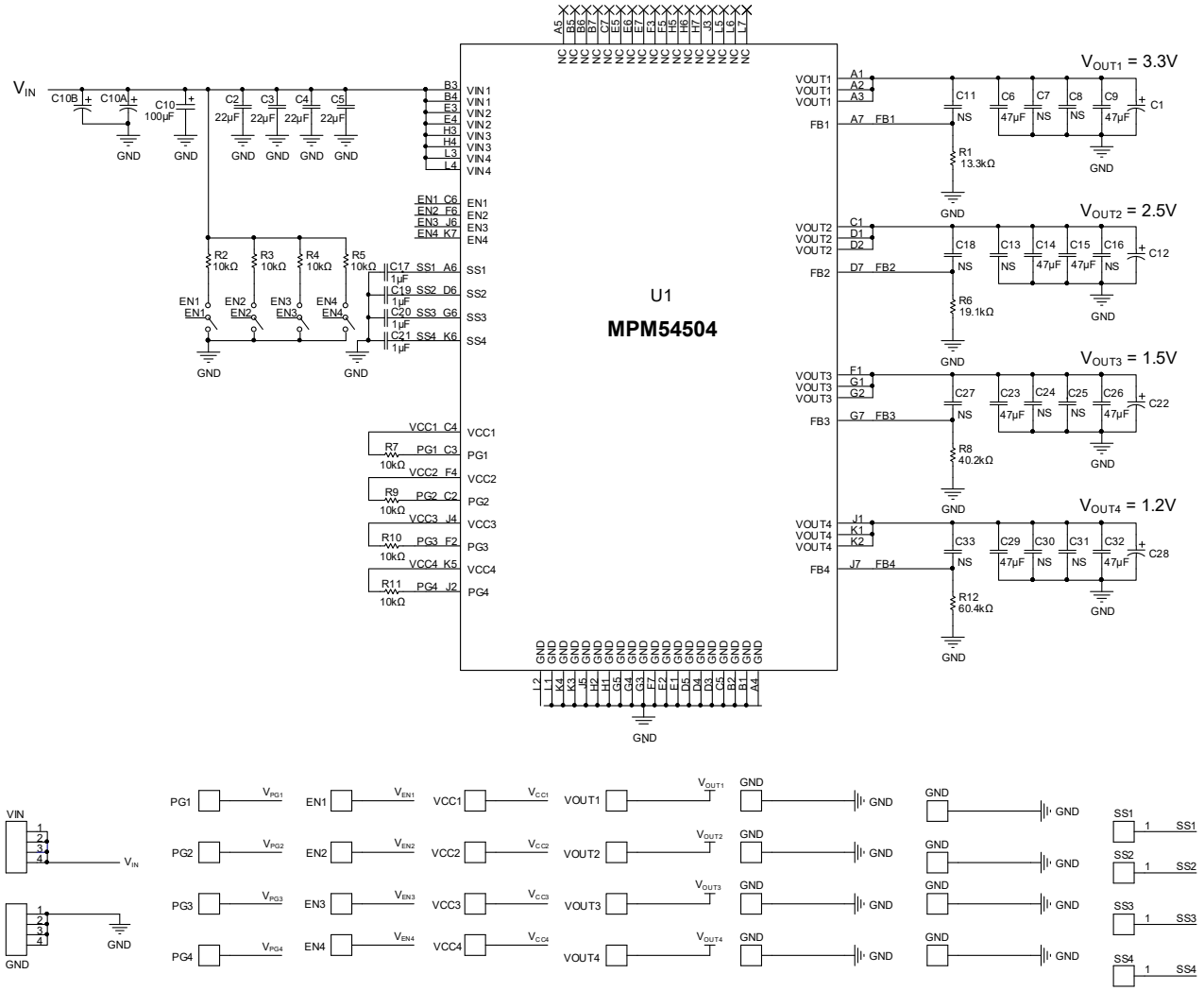

Figure 1: Evaluation Board Schematic

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EVM54504-BS-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer P/N
1	C10	100µF	Electrolytic capacitor, 35V	SMD	Chemicon	EMZJ350ADA101MF80G
4	C2, C3, C4, C5	22µF	Ceramic capacitor, 25V, X5R	0805	Murata	GRM21BR61E226ME44L
4	C17, C19, C20, C21	1µF	Ceramic capacitor, 16V, X5R	0603	Murata	GRM185R61C105KE44D
8	C6, C9, C15, C14, C23, C26, C29, C32	47µF	Ceramic capacitor, 10V, X5R	0805	Murata	GRM21BR61A476ME15L
1	R1	13kΩ	Film resistor, 1%	0603	Yageo	CRCW040213K3FKED
1	R6	19kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0719K1L
1	R8	40.2kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0740K2L
1	R12	60kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0760K4L
8	R2, R3, R4, R5, R7, R9, R10, R11	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR0710K2L
1	U1	MPM54504	Power module	FCMBGA (9mmx15mm x5mm)	MPS	MPM54504GBS

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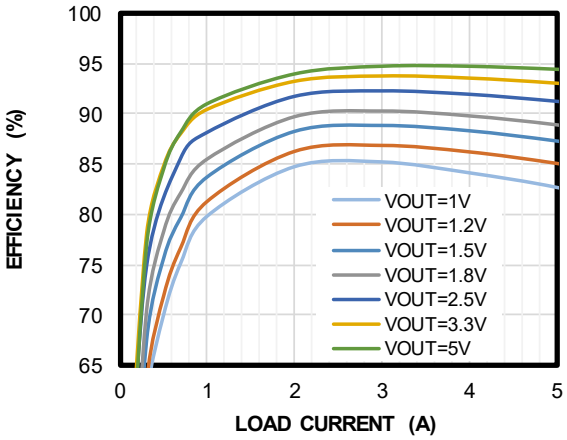
EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, V_{OUT1} = 3.3V, V_{OUT2} = 2.5V, V_{OUT3} = 1.5V, V_{OUT4} = 1.2V, T_A = 25°C, unless otherwise noted.

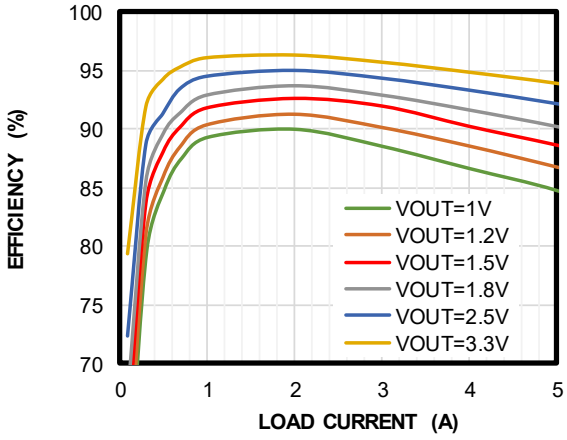
Efficiency vs. Load Current

V_{IN} = 12V



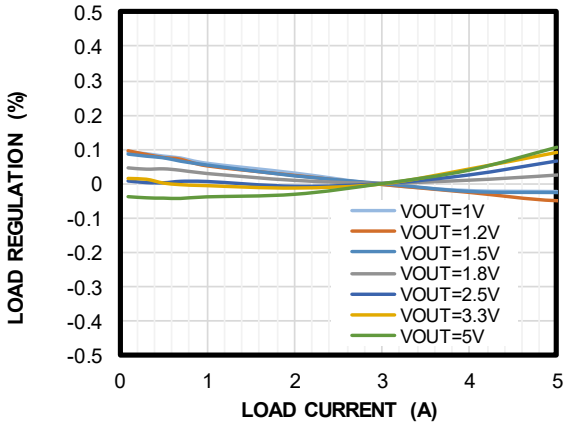
Efficiency vs. Load Current

V_{IN} = 5V



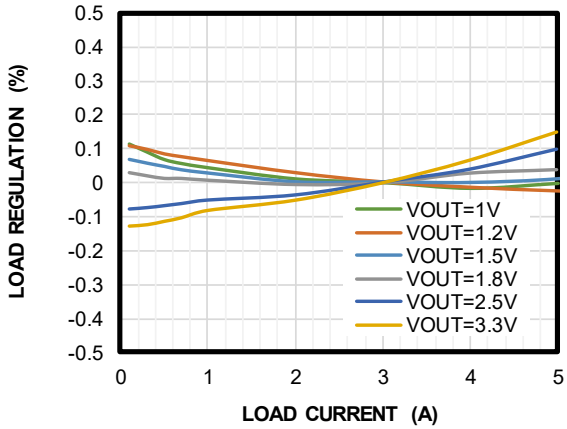
Load Regulation

V_{IN} = 12V



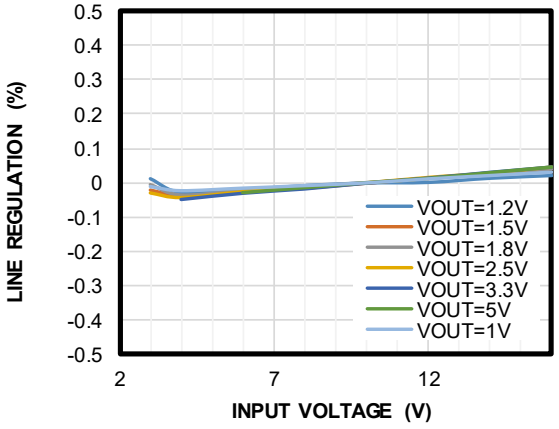
Load Regulation

V_{IN} = 5V



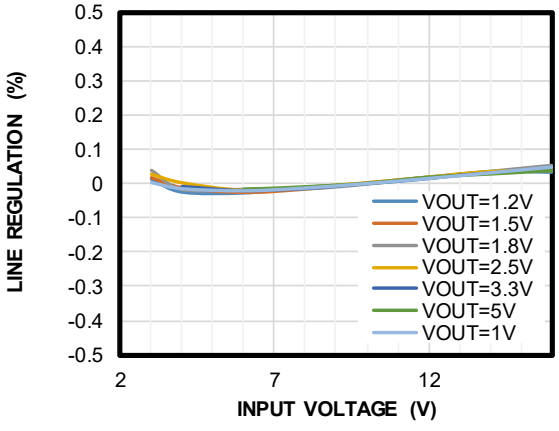
Line Regulation

I_{OUT} = 0A



Line Regulation

I_{OUT} = 2.5A



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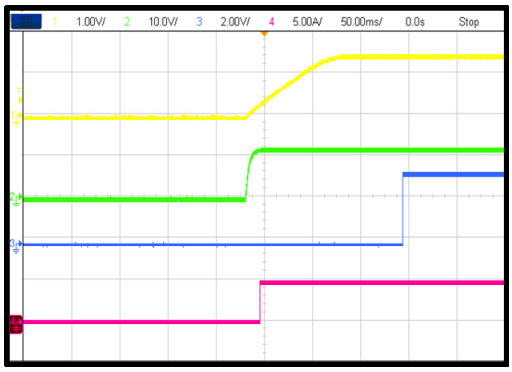
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, V_{OUT1} = 3.3V, V_{OUT2} = 2.5V, V_{OUT3} = 1.5V, V_{OUT4} = 1.2V, T_A = 25°C, unless otherwise noted.

Start-Up through VIN

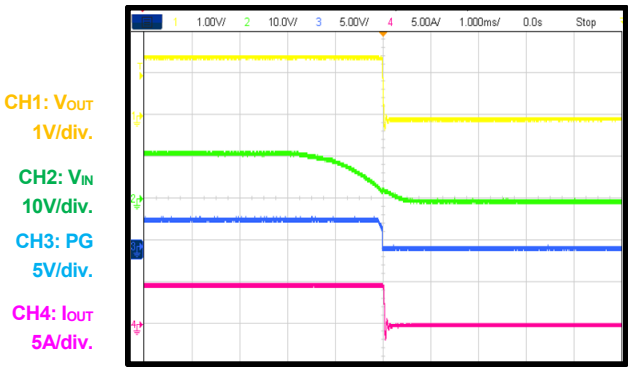
V_{OUT} = 1.5V, I_{OUT} = 5A



50ms/div.

Shutdown through VIN

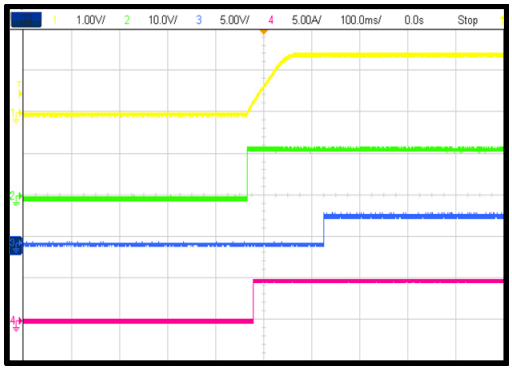
V_{OUT} = 1.5V, I_{OUT} = 5A



1ms/div.

Start-Up through EN

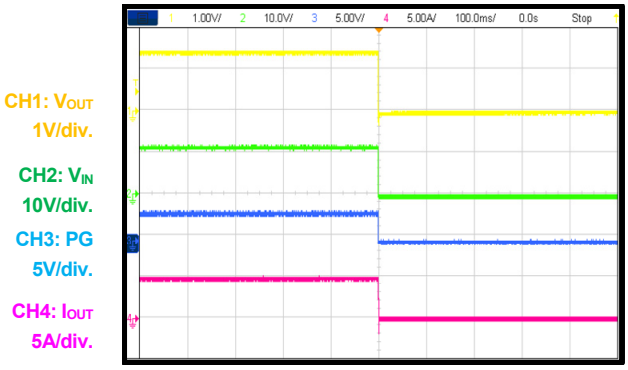
V_{OUT} = 1.5V, I_{OUT} = 5A



100ms/div.

Shutdown through EN

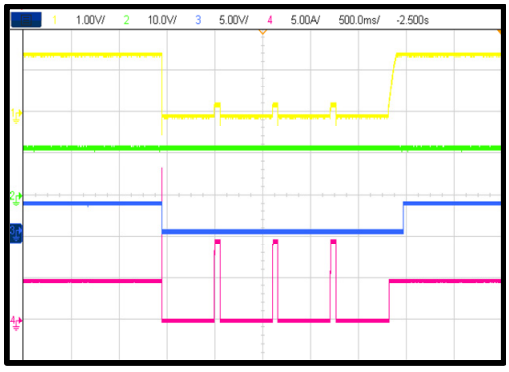
V_{OUT} = 1.5V, I_{OUT} = 5A



100ms/div.

SCP Entry and Recovery

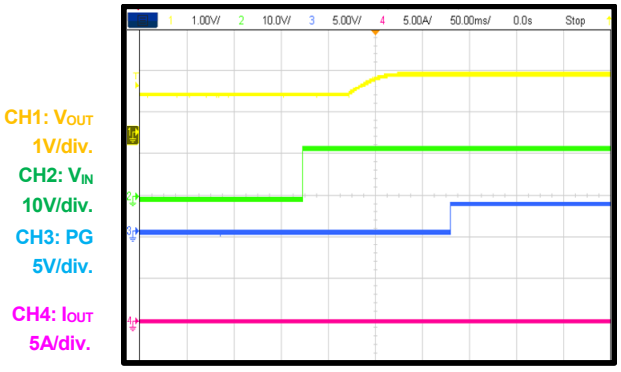
V_{OUT} = 1.5V



500ms/div.

Pre-Biased Load

V_{OUT} = 1.5V, V_{PR} = 1V



50ms/div.

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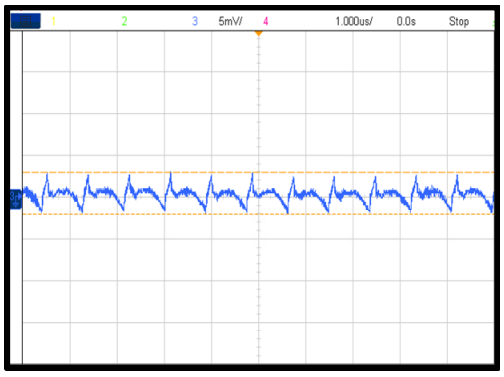
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, V_{OUT1} = 3.3V, V_{OUT2} = 2.5V, V_{OUT3} = 1.5V, V_{OUT4} = 1.2V, T_A = 25°C, unless otherwise noted.

V_{OUT} Ripple

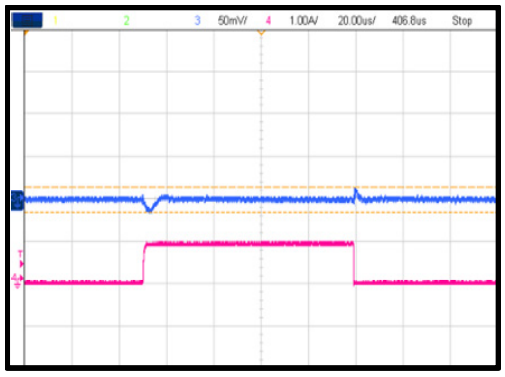
V_{OUT} = 1.5V, I_{OUT} = 5A



1µs/div.

Load Transient

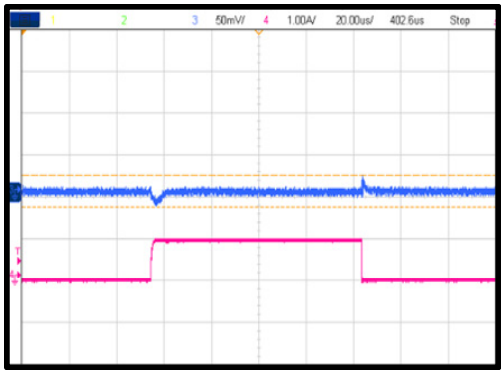
V_{OUT} = 1V, C_{FF} = 100pF, C_{OUT} = 47µF, 1A/µs slew rate



20µs/div.

Load Transient

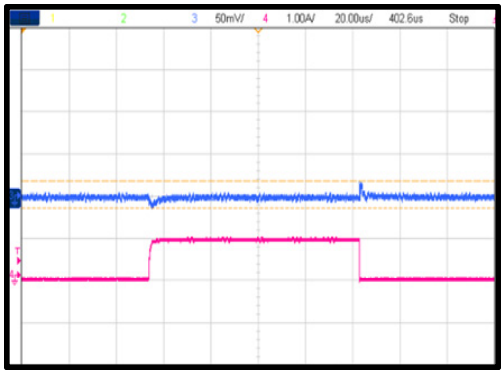
V_{OUT} = 1V, C_{FF} = 100pF, C_{OUT} = 47µF, 1A/µs slew rate



20µs/div.

Load Transient

V_{OUT} = 2.5V, C_{FF} = 100pF, C_{OUT} = 47µF, 1A/µs slew rate



20µs/div.

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PCB LAYOUT

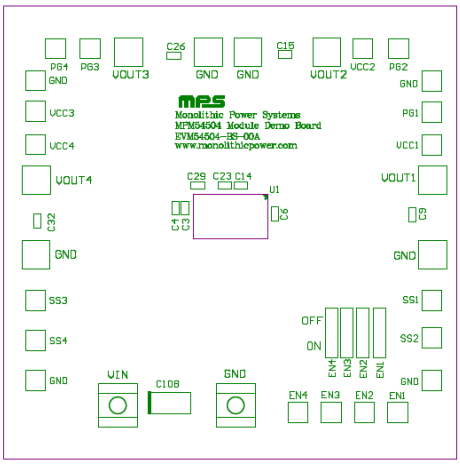

Figure 2: Top Silk

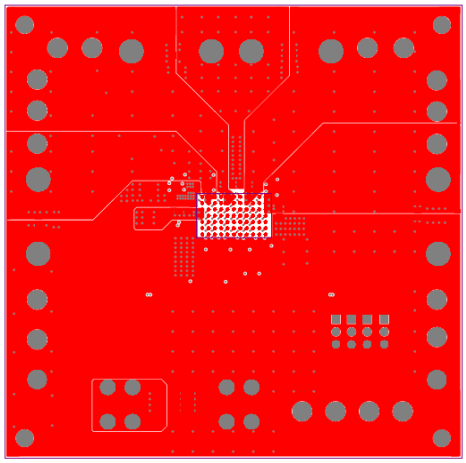

Figure 3: Top Layer

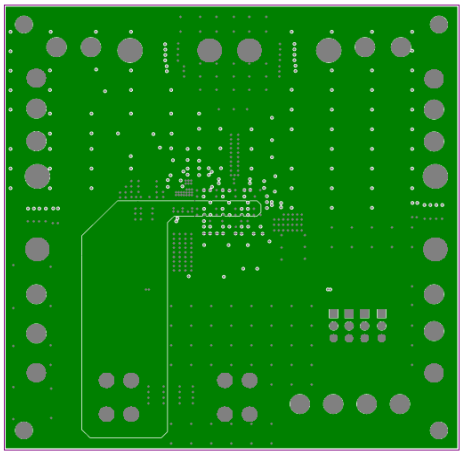

Figure 4: Mid-Layer 1

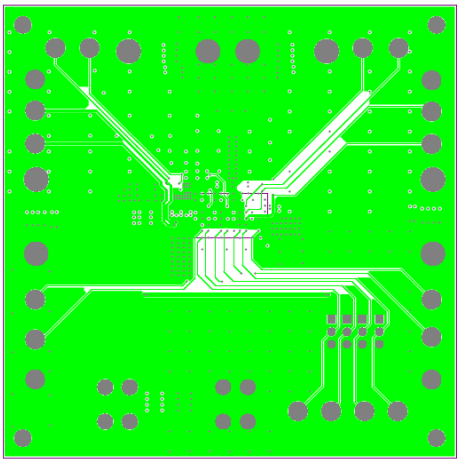

Figure 5: Mid-Layer 2

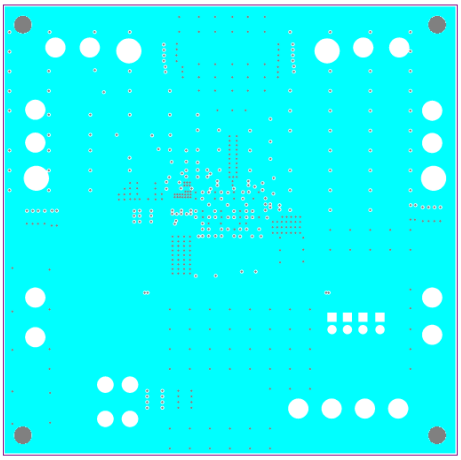

Figure 6: Mid-Layer 3

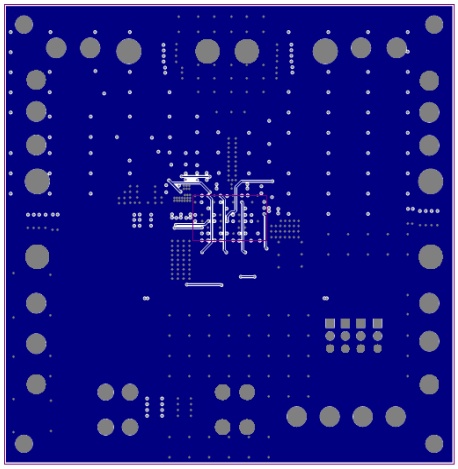

Figure 7: Mid-Layer 4

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PCB LAYOUT *(continued)*

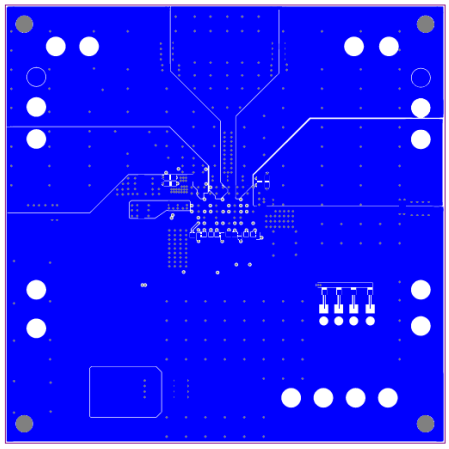

Figure 8: Bottom Layer

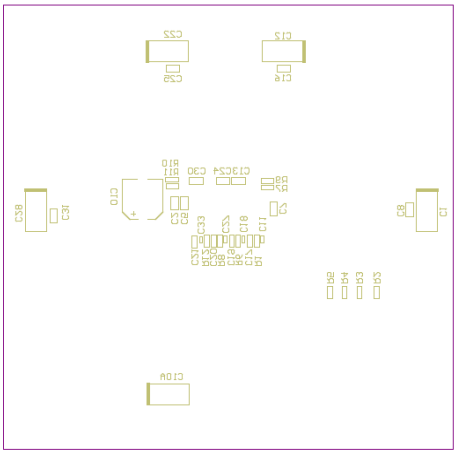

Figure 9: Bottom Silk

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REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	4/28/2021	Initial Release	-

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