



EVM54504-BS-00A

5A, 16V, 4-Channel Output, 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

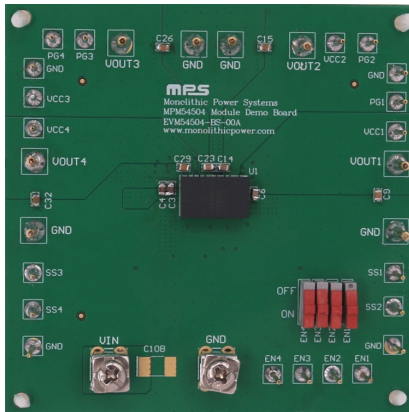
- Wide 3V to 16V Operating Input Voltage Range
- 0.6 to 5.5V Output Voltage
- Continuous Output Current (I_{OUT})
 - Four-Channel Output
 - 5A I_{OUT} per Channel
- Constant-On-Time Control (COT) for Fast Transient Response
- Internal Auto-Compensation
- Configurable External Soft-Start (SS) Time
- Enable (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

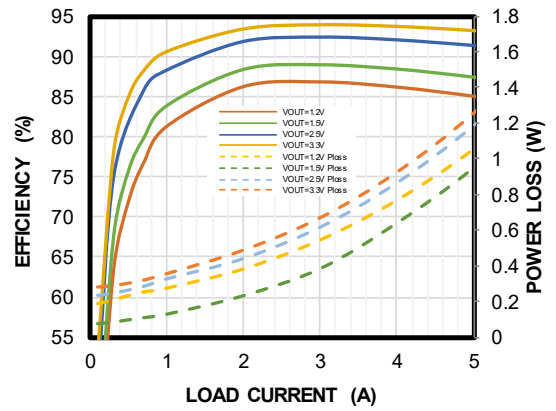


LxWxH (92mmx92mmx1.6mm)

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

Efficiency vs. Load Current vs. Power Loss

$V_{IN} = 12V$



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 ($\leq 5A$) 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.

EVALUATION BOARD SCHEMATIC

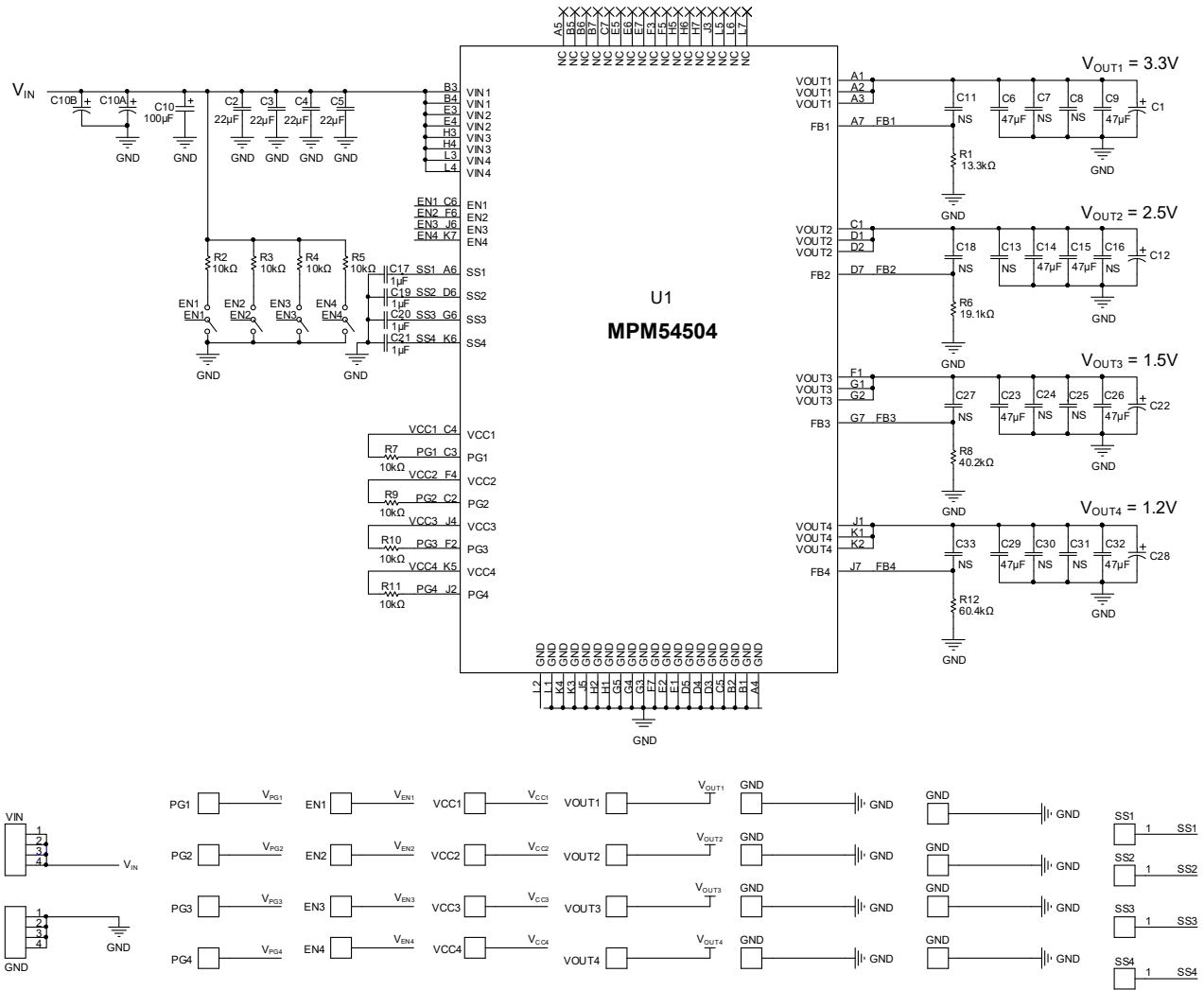


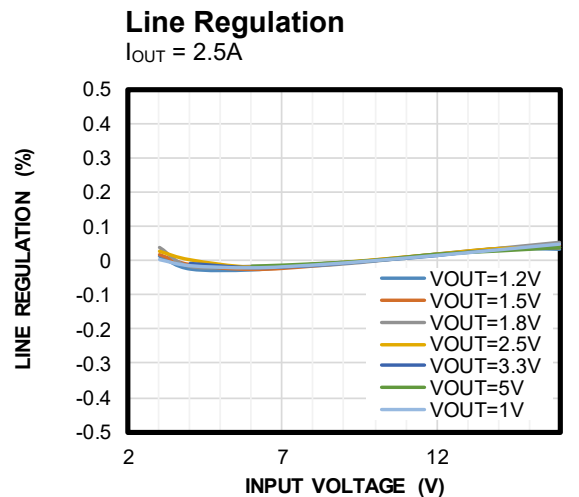
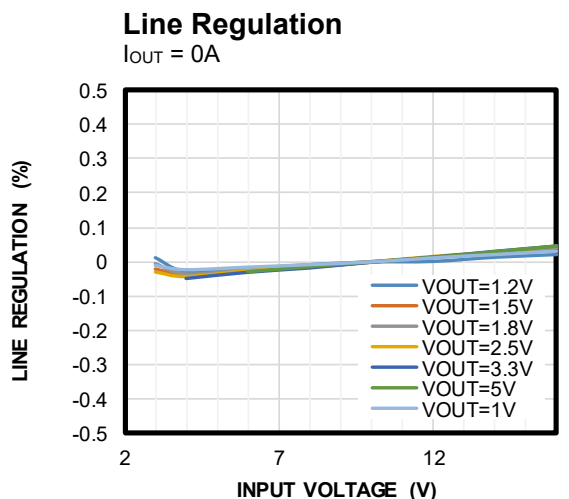
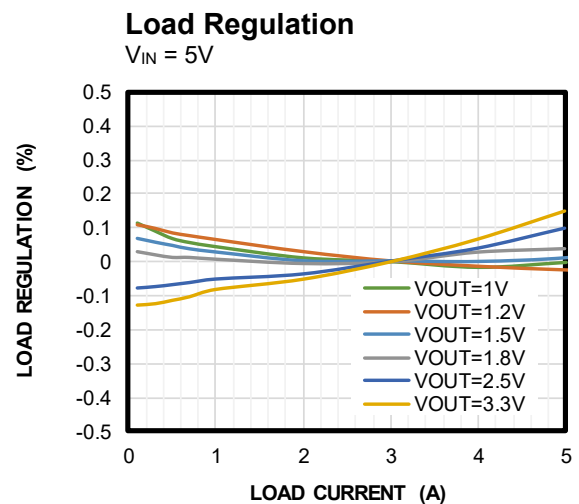
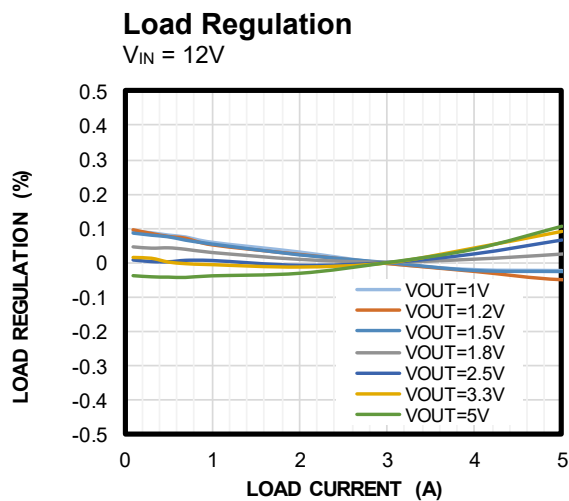
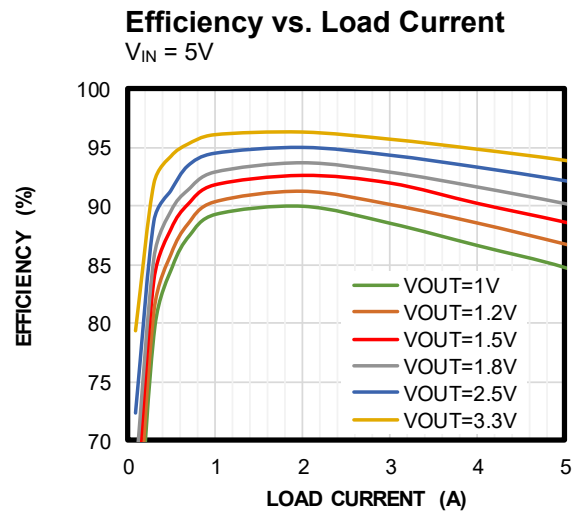
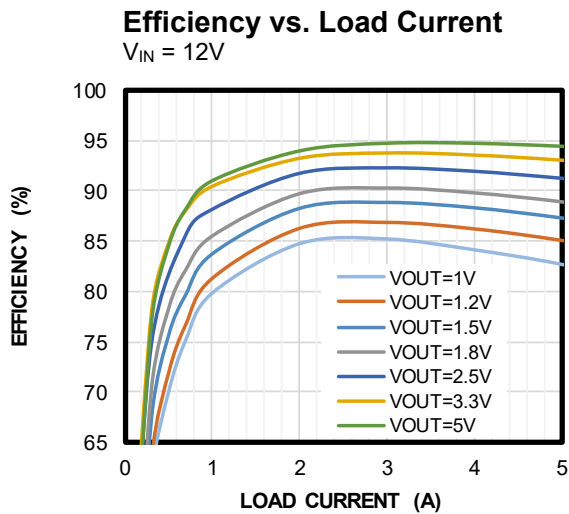
Figure 1: Evaluation Board Schematic

EVM54504-BS-00A BILL OF MATERIALS

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

EVB TEST RESULTS

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

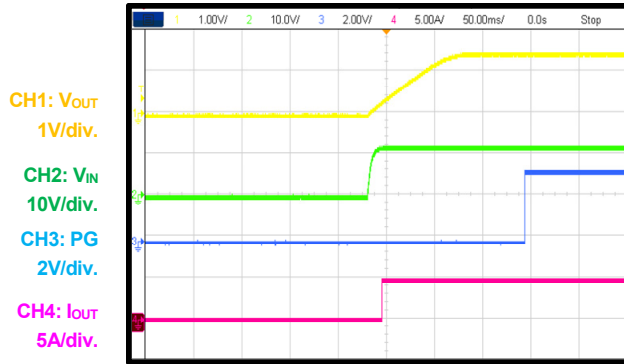


EVB TEST RESULTS (continued)

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

Start-Up through VIN

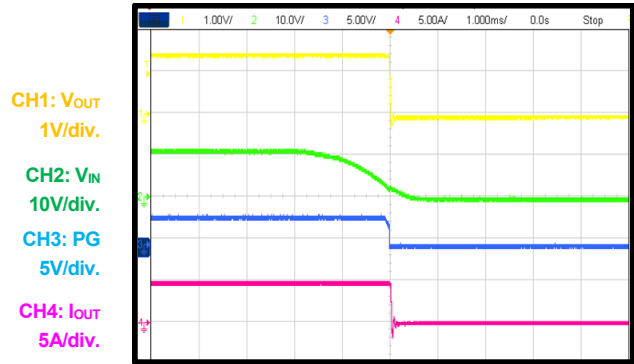
$V_{OUT} = 1.5V$, $I_{OUT} = 5A$



50ms/div.

Shutdown through VIN

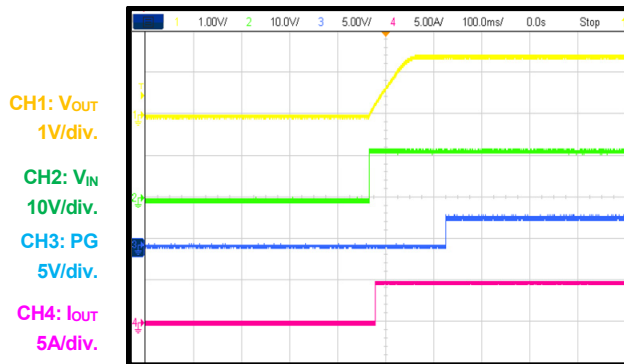
$V_{OUT} = 1.5V$, $I_{OUT} = 5A$



1ms/div.

Start-Up through EN

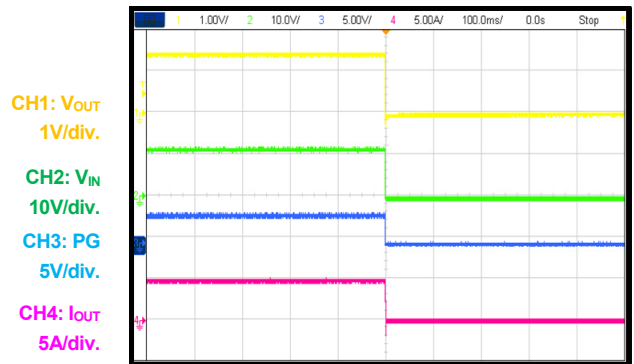
$V_{OUT} = 1.5V$, $I_{OUT} = 5A$



100ms/div.

Shutdown through EN

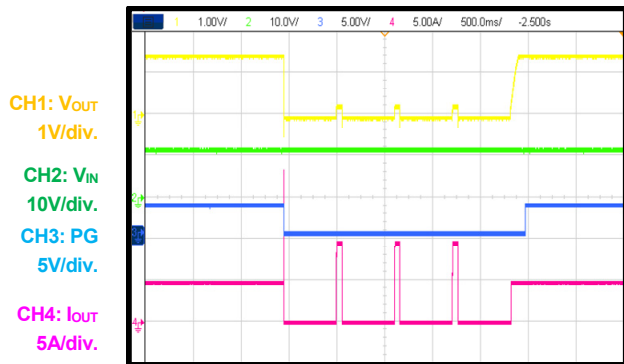
$V_{OUT} = 1.5V$, $I_{OUT} = 5A$



100ms/div.

SCP Entry and Recovery

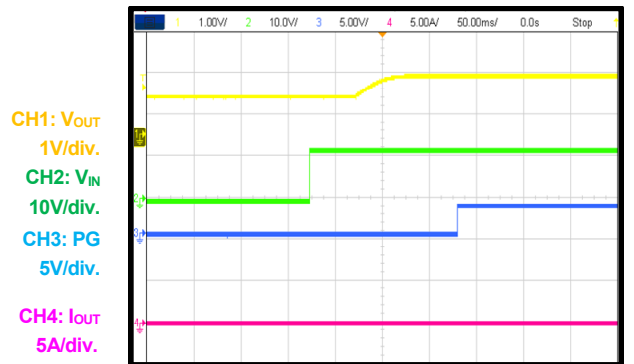
$V_{OUT} = 1.5V$



500ms/div.

Pre-Biased Load

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



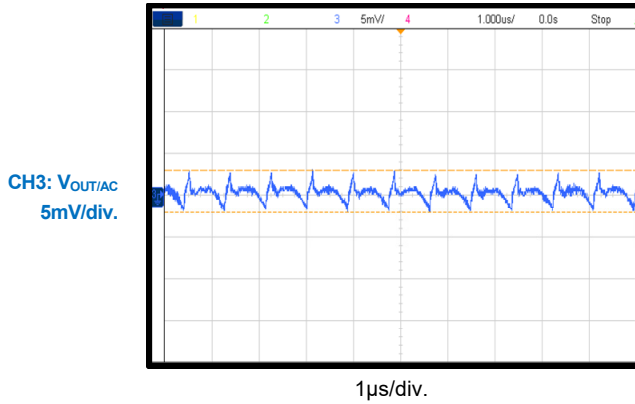
50ms/div.

EVB TEST RESULTS *(continued)*

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

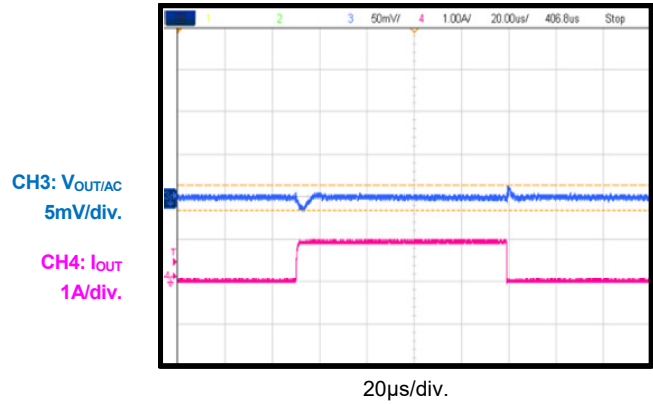
V_{OUT} Ripple

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



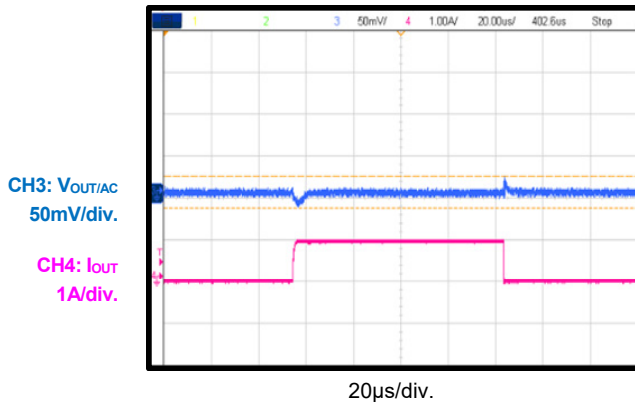
Load Transient

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



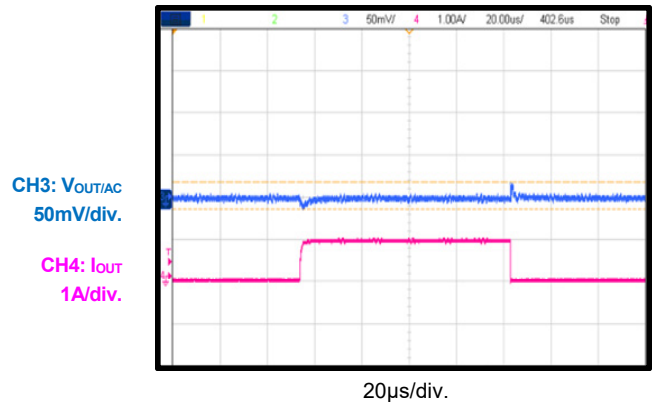
Load Transient

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



Load Transient

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



PCB LAYOUT

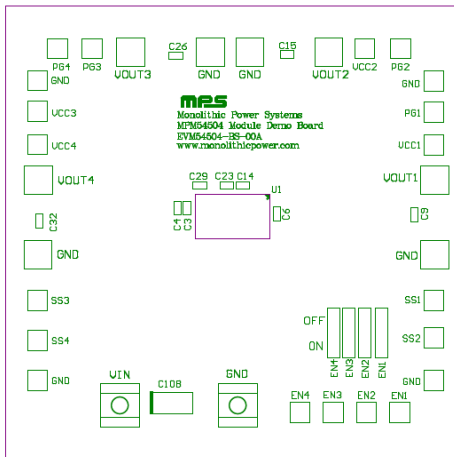


Figure 2: Top Silk

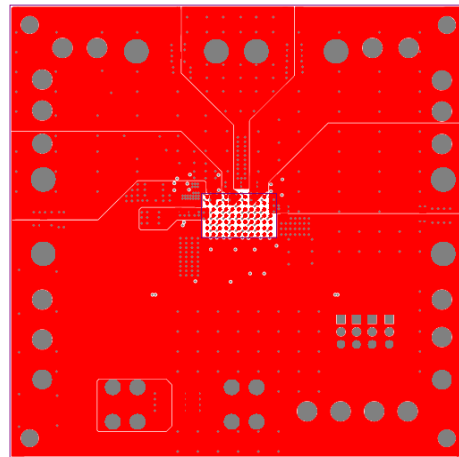


Figure 3: Top Layer

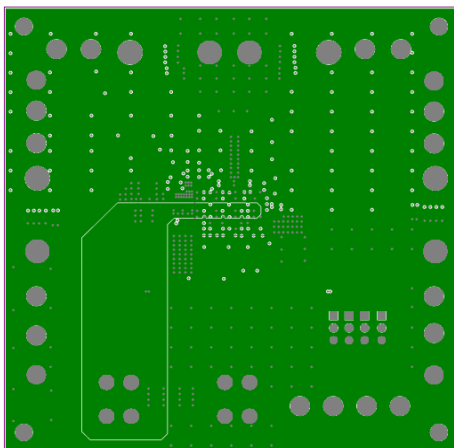


Figure 4: Mid-Layer 1

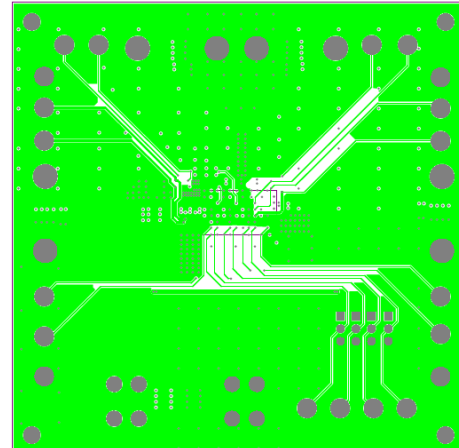


Figure 5: Mid-Layer 2

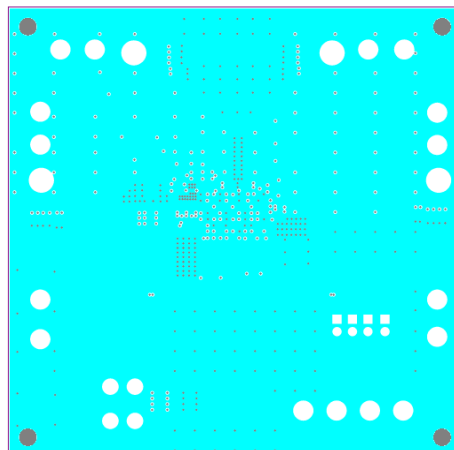


Figure 6: Mid-Layer 3

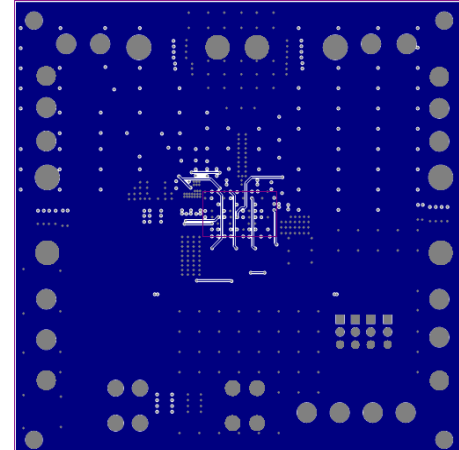


Figure 7: Mid-Layer 4

PCB LAYOUT (continued)

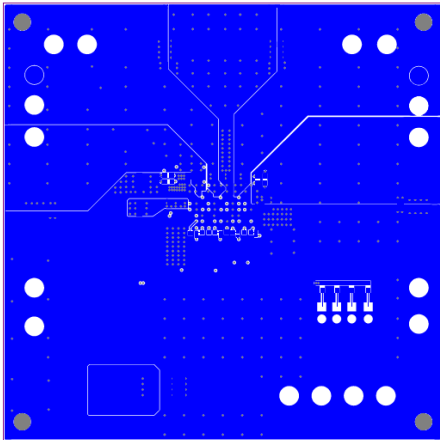


Figure 8: Bottom Layer

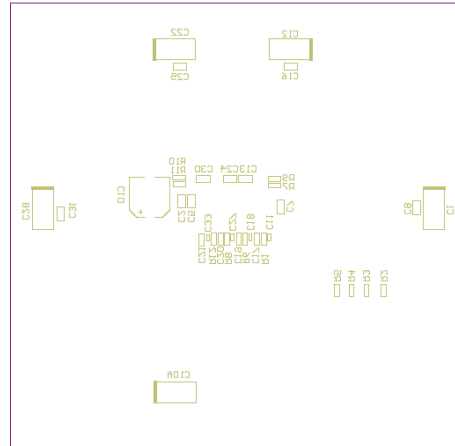


Figure 9: Bottom Silk



REVISION HISTORY

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

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