



# EVM54524-CQ-00A

## 4V to 16V, 5A Quad-Output, Step-Down Power Module with an I<sup>2</sup>C Interface Evaluation Board

### DESCRIPTION

The EVM54524-CQ-00A evaluation board is designed to demonstrate the capabilities of the MPM54524, a 5A quad-output, integrated power module with an I<sup>2</sup>C interface. The MPM54524 offers a complete power solution with built-in, on/off sequencing control, configurable soft start (SS), compensation, and various protection thresholds.

The MPM54524 offers configurable active voltage positioning (AVP) to generate a droop voltage that allows on-demand parallel operation, where four outputs, three outputs paralleled, or two outputs can operate in

parallel in any combination without pre-setting the registers. The paralleled channels' current is inherently balanced by the AVP droop voltage. Full protection features include under-voltage lockout (UVLO), over-current protection (OCP), over-voltage protection (OVP), under-voltage protection (UVP), and thermal shutdown.

The MPM54524 is available in a compact ECLGA-51 (8mmx8mmx2.9mm) package. It is recommended to read the MPM54524 datasheet prior to making any changes to the EVM54524-CQ-00A.

### PERFORMANCE SUMMARY

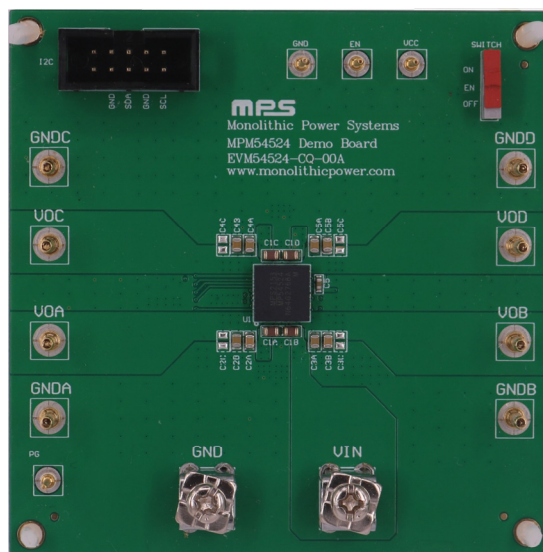
Specifications are at  $T_A = 25^{\circ}\text{C}$ , unless otherwise noted.

| Parameters                           | Conditions                                                                                                              | Value                    |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Input voltage ( $V_{IN}$ ) range     |                                                                                                                         | 4V to 16V                |
| Output voltage ( $V_{OUT}$ )         | Default configuration                                                                                                   | $V_{OUT} = 3.34\text{V}$ |
| Maximum output current ( $I_{OUT}$ ) | $V_{IN} = 4\text{V to } 16\text{V}$                                                                                     | 20A <sup>(1)</sup>       |
| Typical efficiency                   | $V_{IN} = 12\text{V}$ , $V_{OUT} = 3.34\text{V}$ , $I_{OUT} = 5\text{A}$ , $f_{SW} = 1\text{MHz}$ , independent channel | 92.20%                   |
| Peak efficiency                      | $V_{IN} = 12\text{V}$ , $V_{OUT} = 3.34\text{V}$ , $I_{OUT} = 4\text{A}$ , $f_{SW} = 1\text{MHz}$ , independent channel | 92.43%                   |
| Switching frequency ( $f_{SW}$ )     | Default configuration                                                                                                   | 1MHz                     |

**Note:**

1) The maximum  $I_{OUT}$  can reach 20A in 4-phase paralleled mode.

## EVM54524-CQ-00A EVALUATION BOARD



LxWxH (8cmx8cmx1.6mm)

| Board Number    | MPS IC Number |
|-----------------|---------------|
| EVM54524-CQ-00A | MPM54524GCQ   |

## QUICK START GUIDE

The EVM54524-CQ-00A evaluation board is easy to set up and use to evaluate the MPM54524's performance. For the proper measurement equipment set-up, refer to Figure 1 and follow the steps below:

1. Preset the power supply ( $V_{IN}$ ) between 4V and 16V, then turn off the power supply.
2. Connect the power supply terminals to:
  - a. Positive (+):  $V_{IN}$
  - b. Negative (-): GND
3. Connect the load terminals (no initial load) to:
  - a. Positive (+):  $V_{OA}$ ,  $V_{OB}$ ,  $V_{OC}$ ,  $COD$
  - b. Negative (-):  $GNDA$ ,  $GNDB$ ,  $GNDC$ ,  $GNDD$
4. After making the connections, turn on the power supply. The board should automatically start up.
5. Once the proper output voltage ( $V_{OUT}$ ) is established, adjust the load within the operating range and measure the efficiency, output ripple voltage, and other parameters.

### Notes:

- 2) Ensure that  $V_{IN}$  does not exceed 16V.
- 3) When measuring the  $V_{OUT}$  or  $V_{IN}$  ripple, do not use the oscilloscope probe's long ground lead.

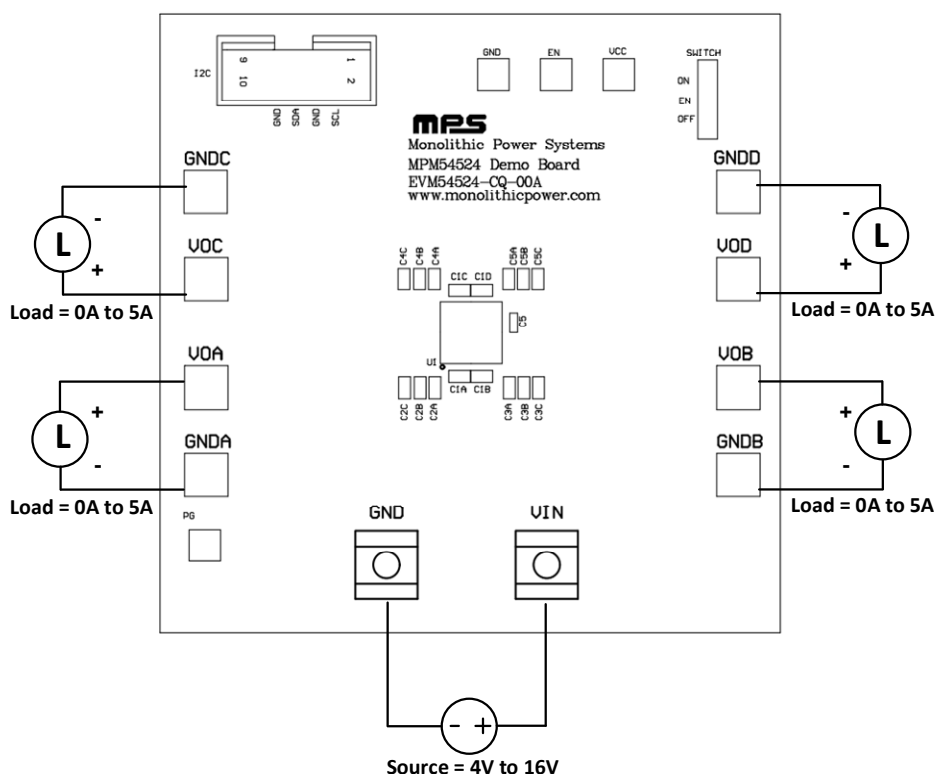


**Figure 1: Proper Measurement Equipment Set-Up**

# EVALUATION BOARD SCHEMATIC

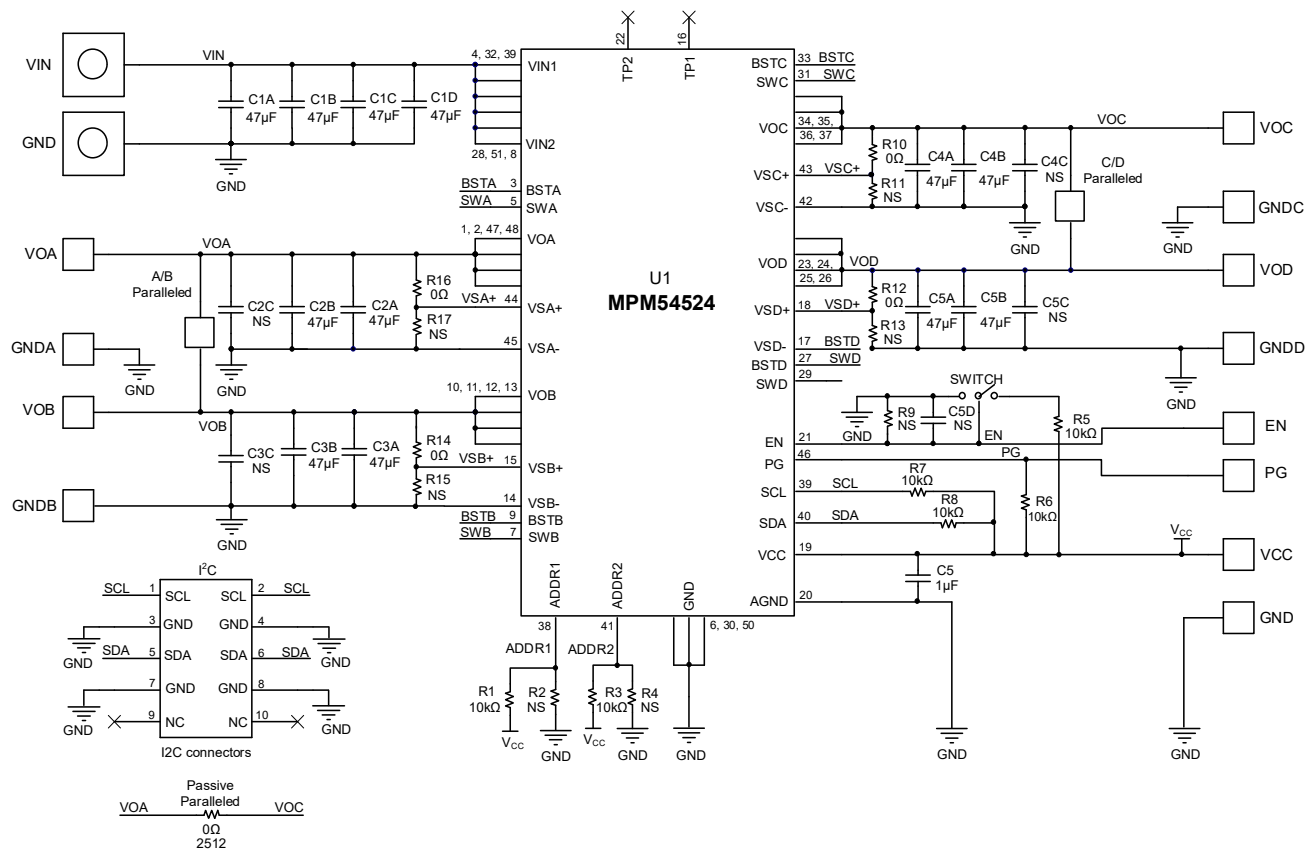
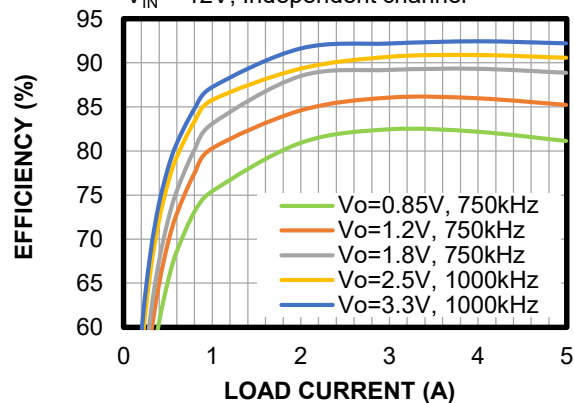
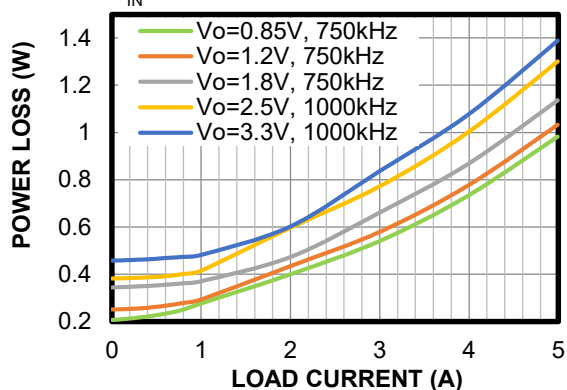
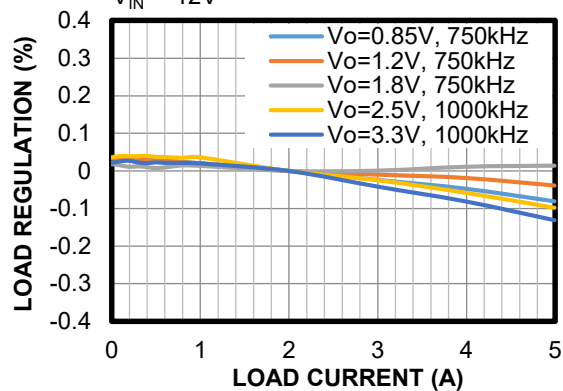
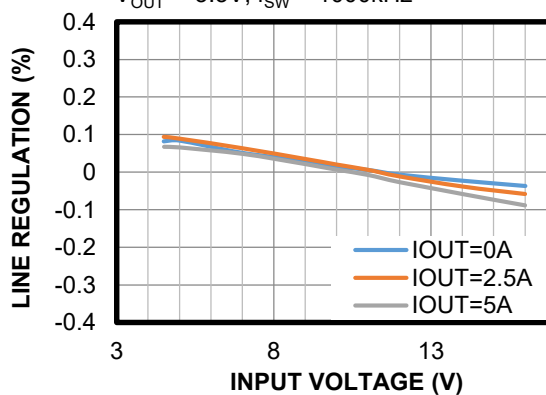
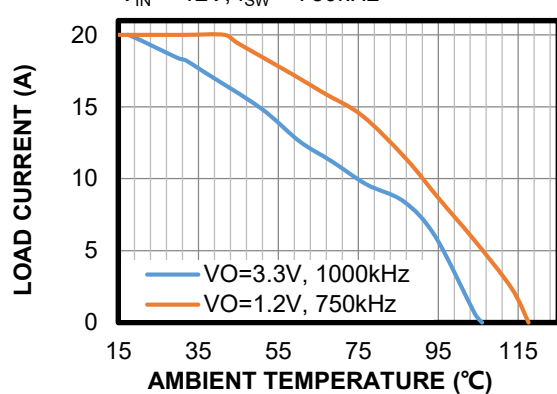


**Figure 2: Evaluation Board Schematic**

## EVM54524-CQ-00A BILL OF MATERIALS

| Qty | Ref                                                                       | Value                        | Description                                                       | Package                             | Manufacturer | Manufacturer PN    |
|-----|---------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------|-------------------------------------|--------------|--------------------|
| 12  | C1A, C1B,<br>C1C, C1D,<br>C2A, C2B,<br>C3A, C3B,<br>C4A, C4B,<br>C5A, C5B | 47µF                         | Ceramic capacitor,<br>10V, X5R                                    | 0805                                | Murata       | GRM21BR61A476ME15L |
| 1   | C5                                                                        | 1µF                          | Ceramic capacitor,<br>16V, X5R                                    | 0603                                | Murata       | GRM185R61C105KE44D |
| 0   | C2C, C3C,<br>C4C, C5C,<br>C5D                                             | NS                           |                                                                   |                                     |              |                    |
| 1   | SWITCH                                                                    | 2.54mm                       | Slide switch, 3-pin                                               | DIP                                 | Würth        | 450301014042       |
| 0   | R2, R4                                                                    | NS                           |                                                                   |                                     |              |                    |
| 0   | R11, R13,<br>R15, R17                                                     | NS                           |                                                                   |                                     |              |                    |
| 4   | R10, R12,<br>R14, R16                                                     | 0Ω                           | Film resistor, 1%,<br>0603                                        | 0402                                | Yageo        | RC0603FR-070RL     |
| 6   | R1, R3,<br>R5, R6,<br>R7, R8                                              | 10kΩ                         | Film resistor, 1%,<br>0603                                        | 0402                                | Yageo        | RC0603FR-0710KL    |
| 8   | VOUTA,<br>GNDA,<br>VOUTB,<br>GNDB,<br>VOUTC,<br>GNDC,<br>VOUTD,<br>GNDD   | 2mm                          | Copper pin, φ =<br>2mm                                            | DIP                                 | Any          | Any                |
| 4   | PG, EN,<br>GND, VCC                                                       | 1mm                          | Copper pin, φ =<br>1mm                                            | DIP                                 | Any          | Any                |
| 1   | I2C                                                                       | 2.54mm                       | Connector, 10-pin                                                 | DIP                                 | Würth        | 612010235121       |
| 2   | VIN, GND                                                                  | 7.87mmx<br>7.87mmx<br>5.33mm | Power connector                                                   | DIP                                 | Any          | Any                |
| 1   | U1                                                                        | MPM54524                     | 16V, quad 5A, step-<br>down power module<br>with I <sup>2</sup> C | ECLGA-51<br>(8mmx<br>8mmx<br>2.9mm) | MPS          | MPM54524           |

# TYPICAL PERFORMANCE CHARACTERISTICS

**Efficiency vs. Load Current**
 $V_{IN} = 12V$ , Independent channel

**Power Loss vs. Load Current**
 $V_{IN} = 12V$ 

**Load Regulation**
 $V_{IN} = 12V$ 

**Line Regulation**
 $V_{OUT} = 3.3V, f_{SW} = 1000kHz$ 

**Thermal Derating**
 $V_{IN} = 12V, f_{SW} = 750kHz$ 


# TYPICAL PERFORMANCE CHARACTERISTICS (continued)

## Steady State

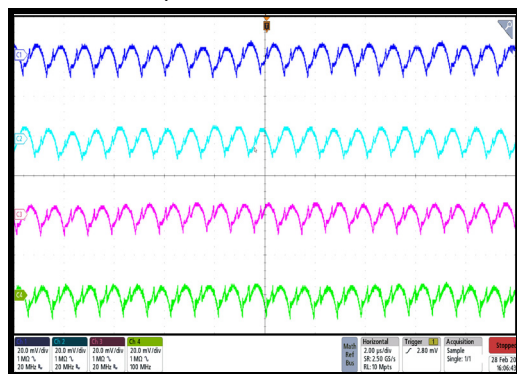
$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $f_{SW} = 1000kHz$ ,  
 $I_{OUT} = 0A$ , independent channel

CH1: VOA/AC  
20mV/div.

CH2: VOB/AC  
20mV/div.

CH3: VOC/AC  
20mV/div.

CH4: VOD/AC  
20mV/div.



2μs/div.

## Steady State

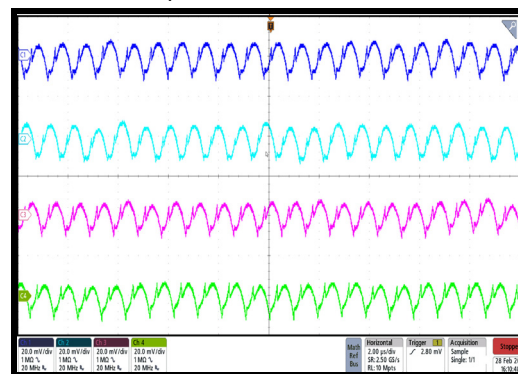
$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $f_{SW} = 1000kHz$ ,  
 $I_{OUT} = 5A$ , independent channel

CH1: VOA/AC  
20mV/div.

CH2: VOB/AC  
20mV/div.

CH3: VOC/AC  
20mV/div.

CH4: VOD/AC  
20mV/div.



2μs/div.

## Start-Up through EN

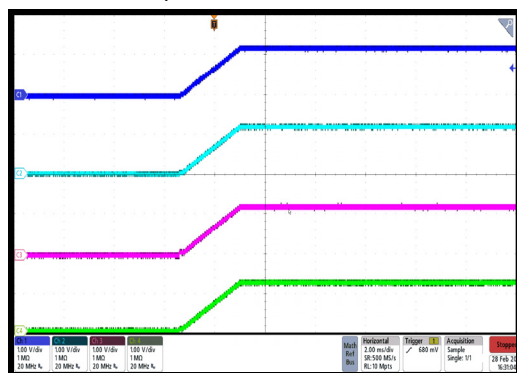
$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $f_{SW} = 1000kHz$ ,  
 $I_{OUT} = 0A$ , independent channel

CH1: VOA  
1V/div.

CH2: VOB  
1V/div.

CH3: VOC  
1V/div.

CH4: VOD  
1V/div.



2ms/div.

## Start-Up through EN

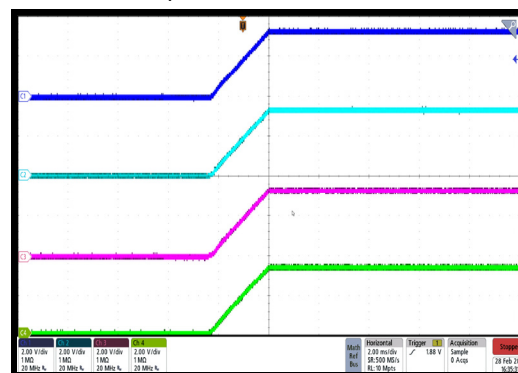
$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $f_{SW} = 1000kHz$ ,  
 $I_{OUT} = 5A$ , independent channel

CH1: VOA  
2V/div.

CH2: VOB  
2V/div.

CH3: VOC  
2V/div.

CH4: VOD  
2V/div.



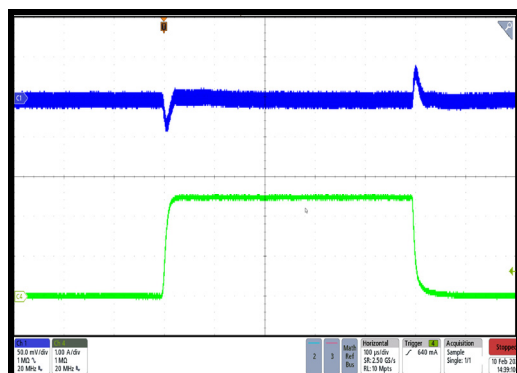
2ms/div.

## Load Transient

$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $f_{SW} = 1000kHz$ ,  
 $I_{OUT} = 0A$  to  $2.5A$ ,  $2.5A/\mu s$  e-load, independent channel

CH1: Vout  
50mV/div.

CH4: Iout  
1A/div.



100μs/div.

## Start-Up through VIN

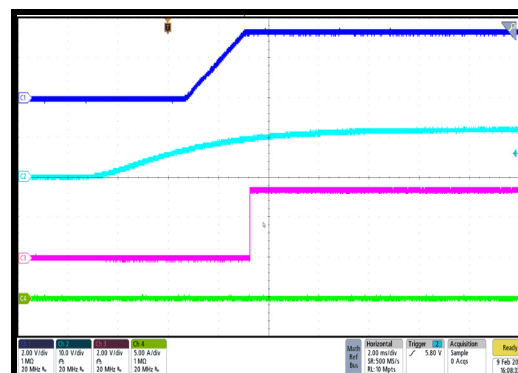
$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $I_{OUT} = 0A$ , four phases paralleled

CH1: Vout  
2V/div.

CH2: VIN  
10V/div.

CH3: PG  
2V/div.

CH4: Iout  
5A/div.



2ms/div.

## PCB LAYOUT

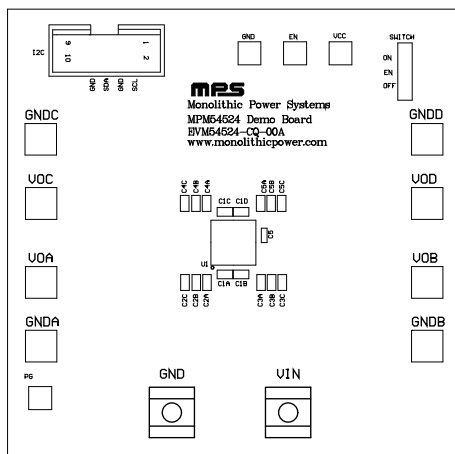


Figure 3: Top Silk

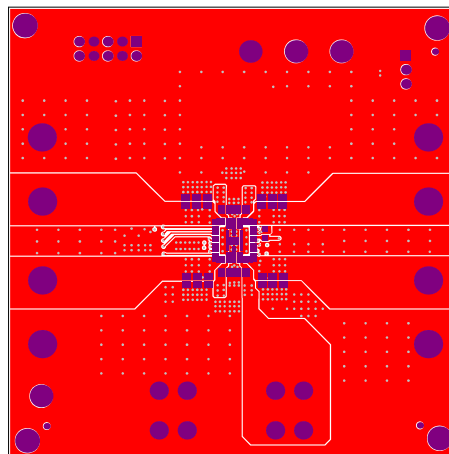


Figure 4: Top Layer

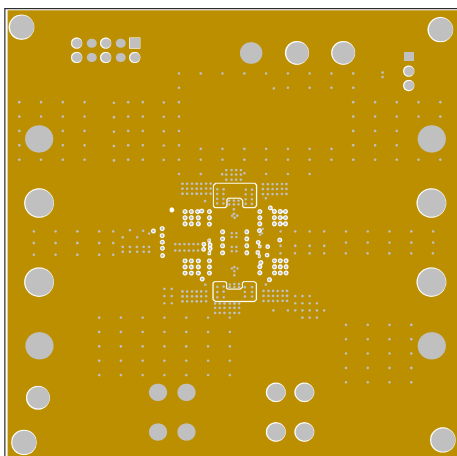


Figure 5: Mid-Layer 1

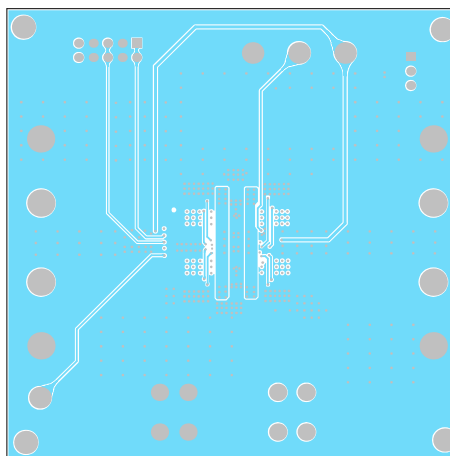


Figure 6: Mid-Layer 2

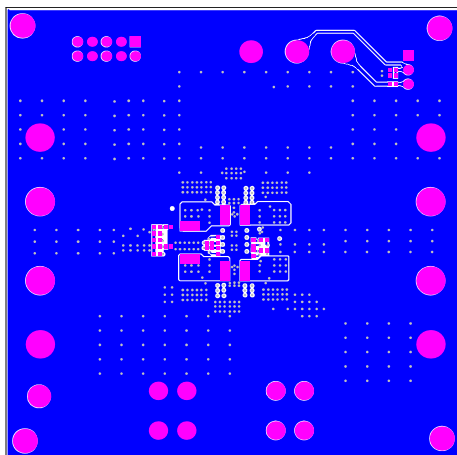


Figure 7: Bottom Layer

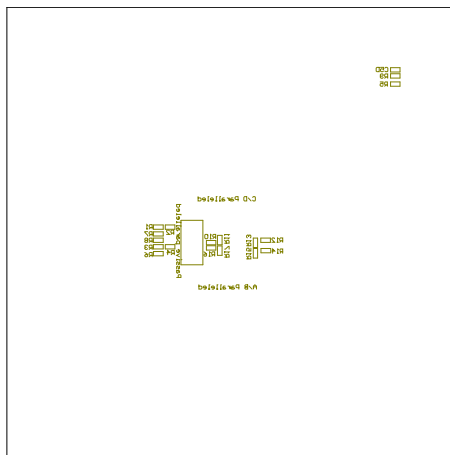


Figure 8: Bottom Silk



## REVISION HISTORY

| Revision # | Revision Date | Description     | Pages Updated |
|------------|---------------|-----------------|---------------|
| 1.0        | 10/31/2022    | Initial Release | -             |

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