EVM3698-BH-02A

16V, Peak 440A, Scalable DC/DC Power Module with PMBus and AVSBus Evaluation Board

DESCRIPTION

The EVM3698-BH-02A evaluation board is designed to demonstrate the capabilities of both the MPM3698 and MPM3699. Each power module can achieve between 4.5V and 16V of input voltage (V_{IN}), and between 0.3V and 5.5V of adjustable output voltage (V_{OUT}) with PMBus and AVSBus interfaces. These boards can provide up to 440A of peak output current (I_{OUT}) or 330A of continuous I_{OUT}.

The MPM3698 features MPS's proprietary digital, multi-phase, nonlinear control scheme to provide fast transient response to load transient with minimal output capacitors. With only one power loop control method for both steady state and load transient, the power loop compensation is very easy to configure.

The MPM3699 offers many features to simplify system design. Each phase of the MPM3699 has individual tri-state pulse-width modulation (PWM) inputs to work with the MPM3698. The MPM3699 also has a separate accurate current sense and temperature output to report the inductor current (I_L) and junction temperature (T_J) of each phase.

It is recommended to read the datasheet for both the MPM3698 and MPM3699 prior to making any changes to the EVM3698-BH-02A.

PERFORMANCE SUMMARY (1)

Specifications are at T_A = 25°C, unless otherwise noted.

Parameters	Conditions	Value
Input voltage (V_{IN}) range		4.5V to 16V
Output voltage (V_{OUT})	V_{IN} = 4.5V to 16V, I_{OUT} = 0A to 440A	0.3V to 5.5V, default V_{OUT} = 0.85V
Maximum output current (I_{OUT})	V_{IN} = 4.5V to 16V	Total 440A
Typical efficiency	V_{IN} = 12V, V_{OUT} = 0.85V, I_{OUT} = 330A	85.4%
Peak efficiency	V_{IN} = 12V, V_{OUT} = 0.85V, I_{OUT} = 150A	89.3%
Switching frequency for rail 1	Configuration code 0002	500kHz per phase

Note:

1) For different V_{IN} and V_{OUT} specifications with different output capacitors/inductors, the application circuit parameters may require changes.

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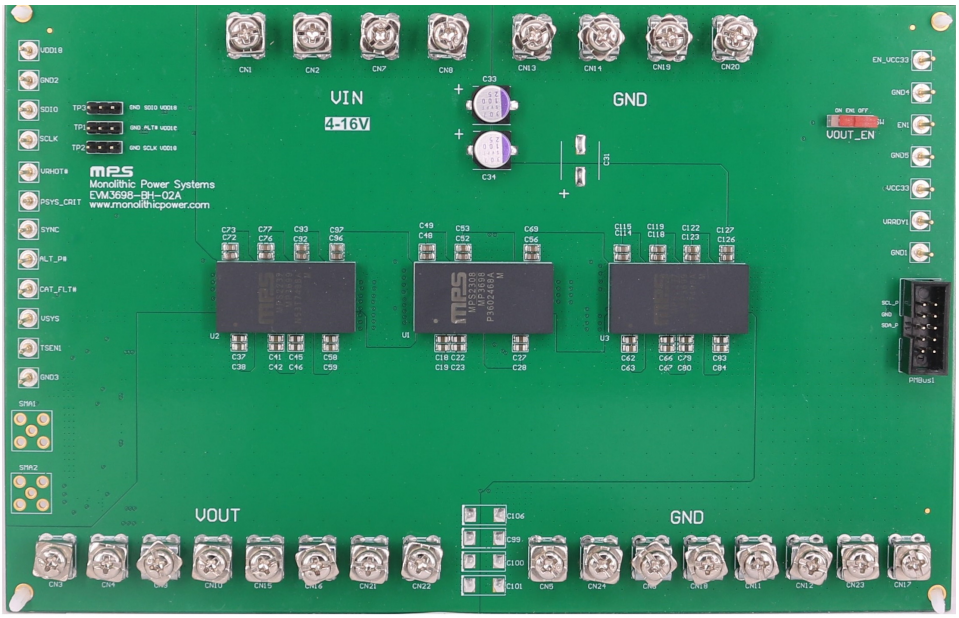
EVALUATION BOARD



LxWxH (21cmx13.5cmx2cm)

Board Number	MPS IC Number
EVM3698-BH-02A	MPM3698GBH

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QUICK START GUIDE

1. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
2. Preset the power supply output voltage (V_{OUT}) to 12V, then turn off the power supply.
3. Connect the power supply output terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
4. After making the connections, turn on the power supply. If the VOUT_EN switch is on, the MPM3698 and MPM3699 should output automatically. V_{OUT} is set to 0.85V.

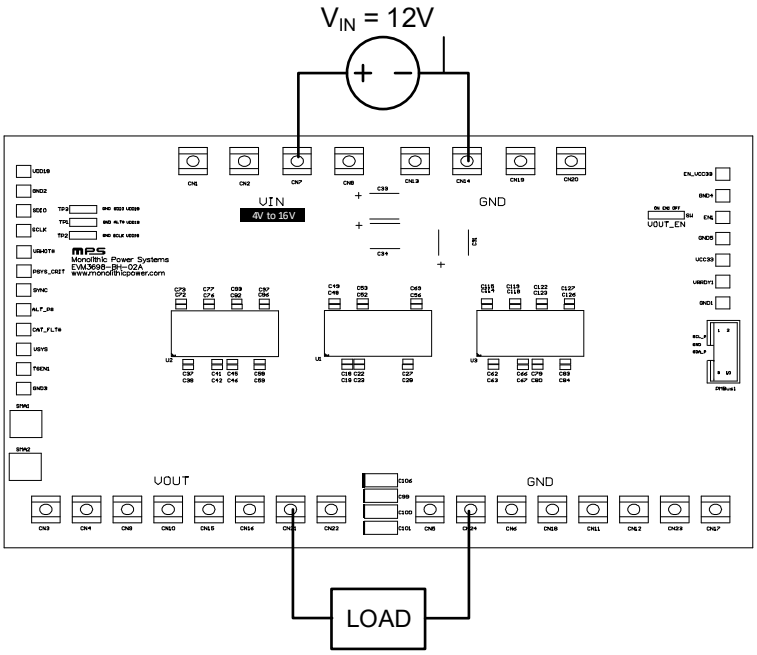

Figure 1: Measurement Equipment Set-Up

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MPM3698 GUI QUICK START GUIDE

1. Ensure that all the components listed in Table 1 are present:

Table 1: Required Components to Use the MPM3698 GUI

Item	Part Number	Quantity
EVB	EVM3698-BH-02A	1
PMBus kit	EVKT-USBI2C-02	1
USB cable	-	1
PMBus wire	-	1

2. Connect the PMBus wires to the EVB.

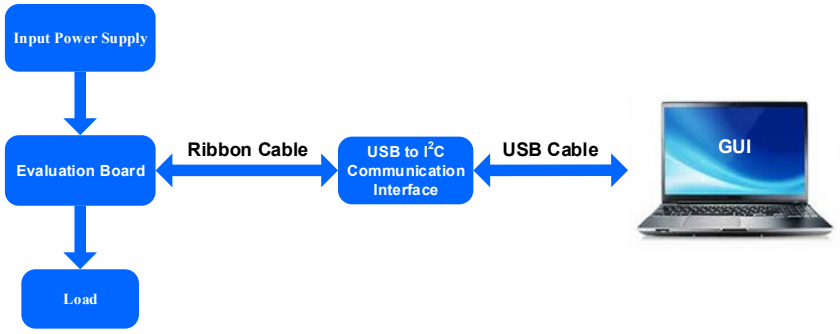

Figure 2: Configuration to Use the MPM3698 GUI

3. Click “Virtual Bench Pro.exe,” then add the device. (1)
4. When the part is found, the part number will appear on the screen. The GUI allows users to modify the module’s internal parameters. For more register details, refer to the MPM3698 datasheet.
5. The operating conditions, including V_{OUT}, V_{IN}, I_{OUT}, and temperature, can be monitored on the right-side panel of the GUI (see Figure 3).

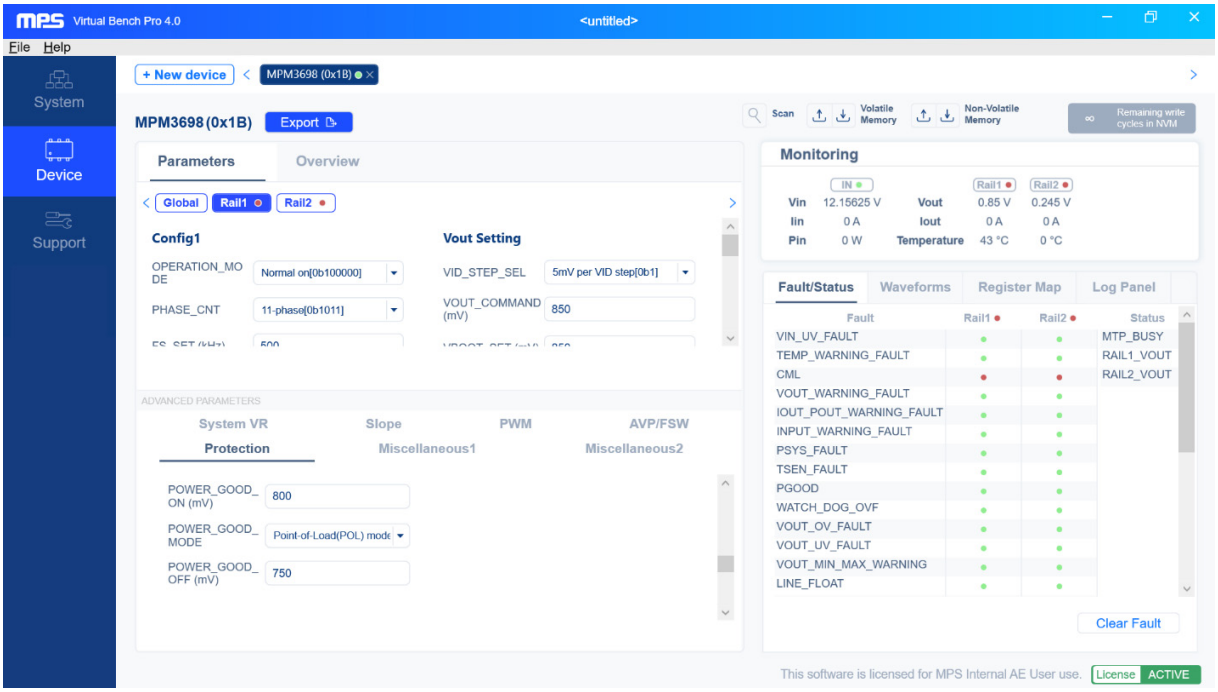

Figure 3: MPM3698 GUI Screen

Note:

1. Visit the MPS website to download Virtual Bench 4.0.

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EVALUATION BOARD SCHEMATIC

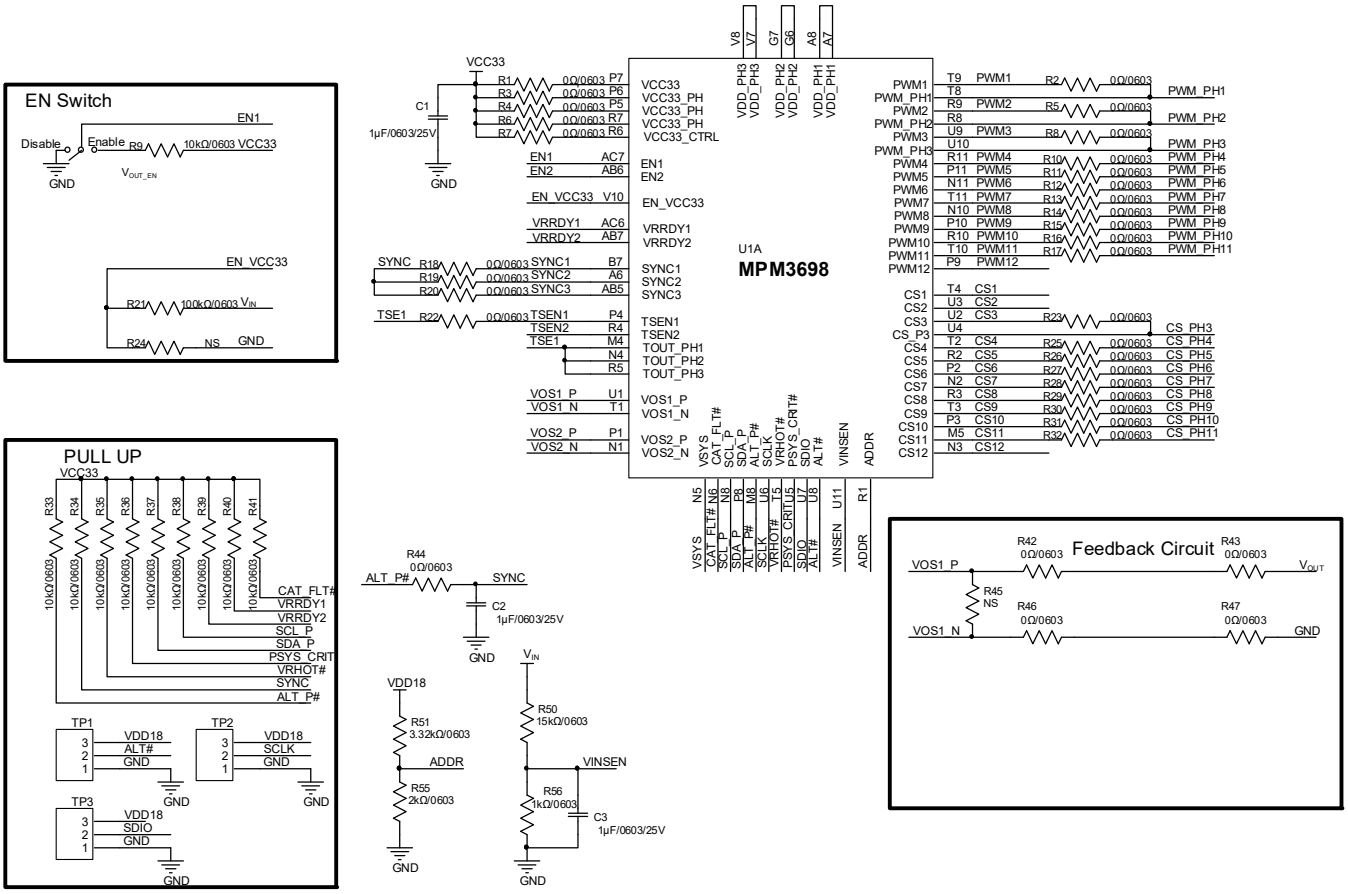

Figure 4: Evaluation Board Schematic (Part 1)

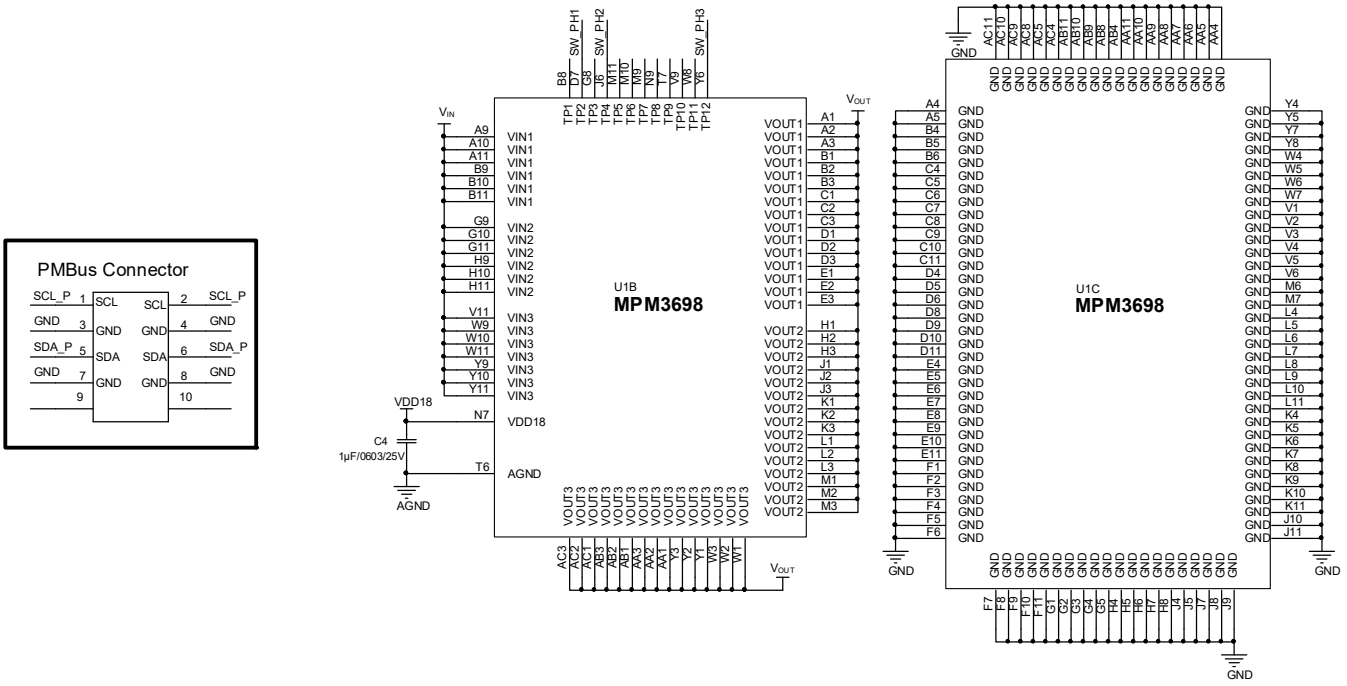

Figure 5: Evaluation Board Schematic (Part 2)

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EVALUATION BOARD SCHEMATIC *(continued)*

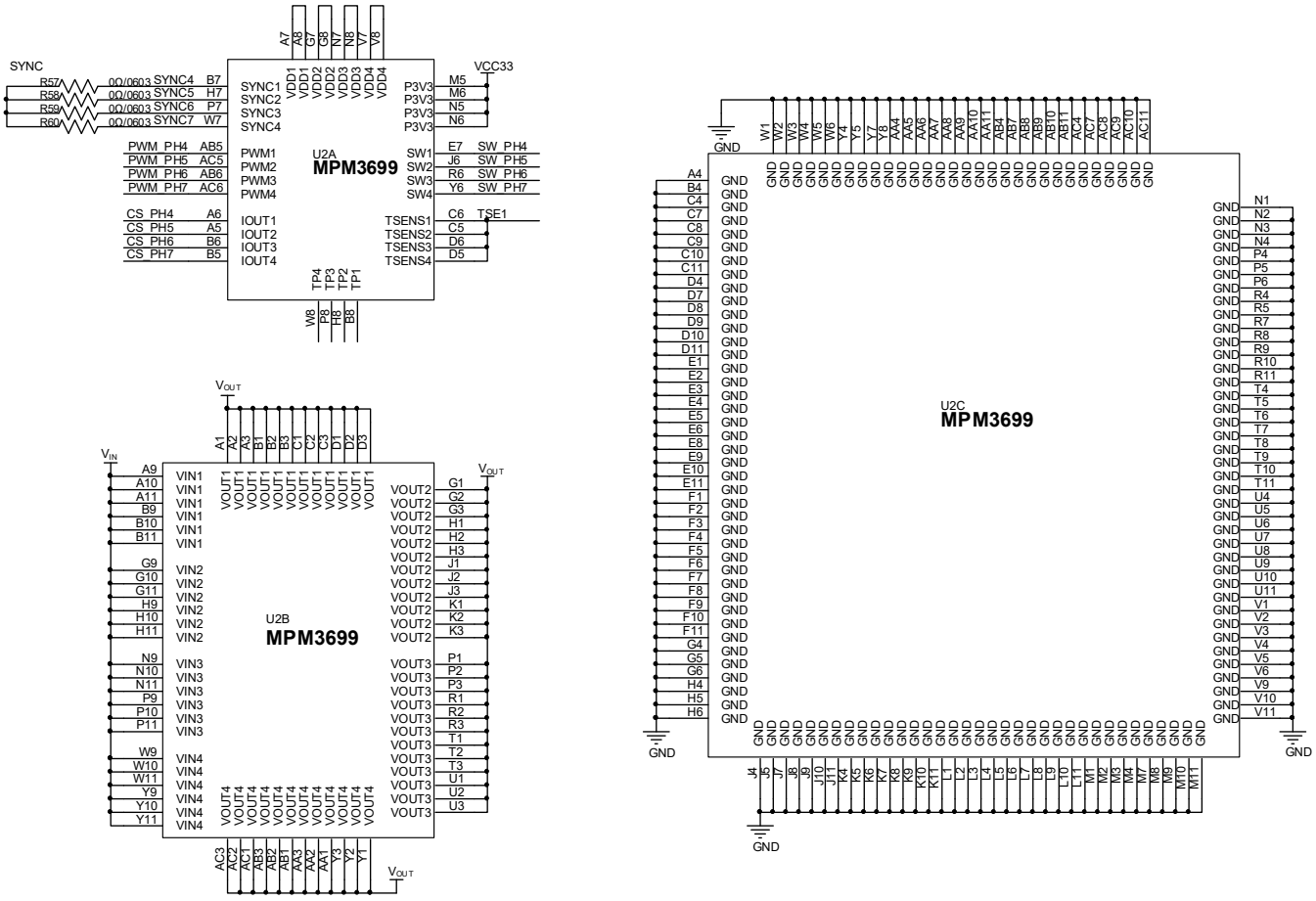

Figure 6: Evaluation Board Schematic (Part 3)

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EVALUATION BOARD SCHEMATIC *(continued)*

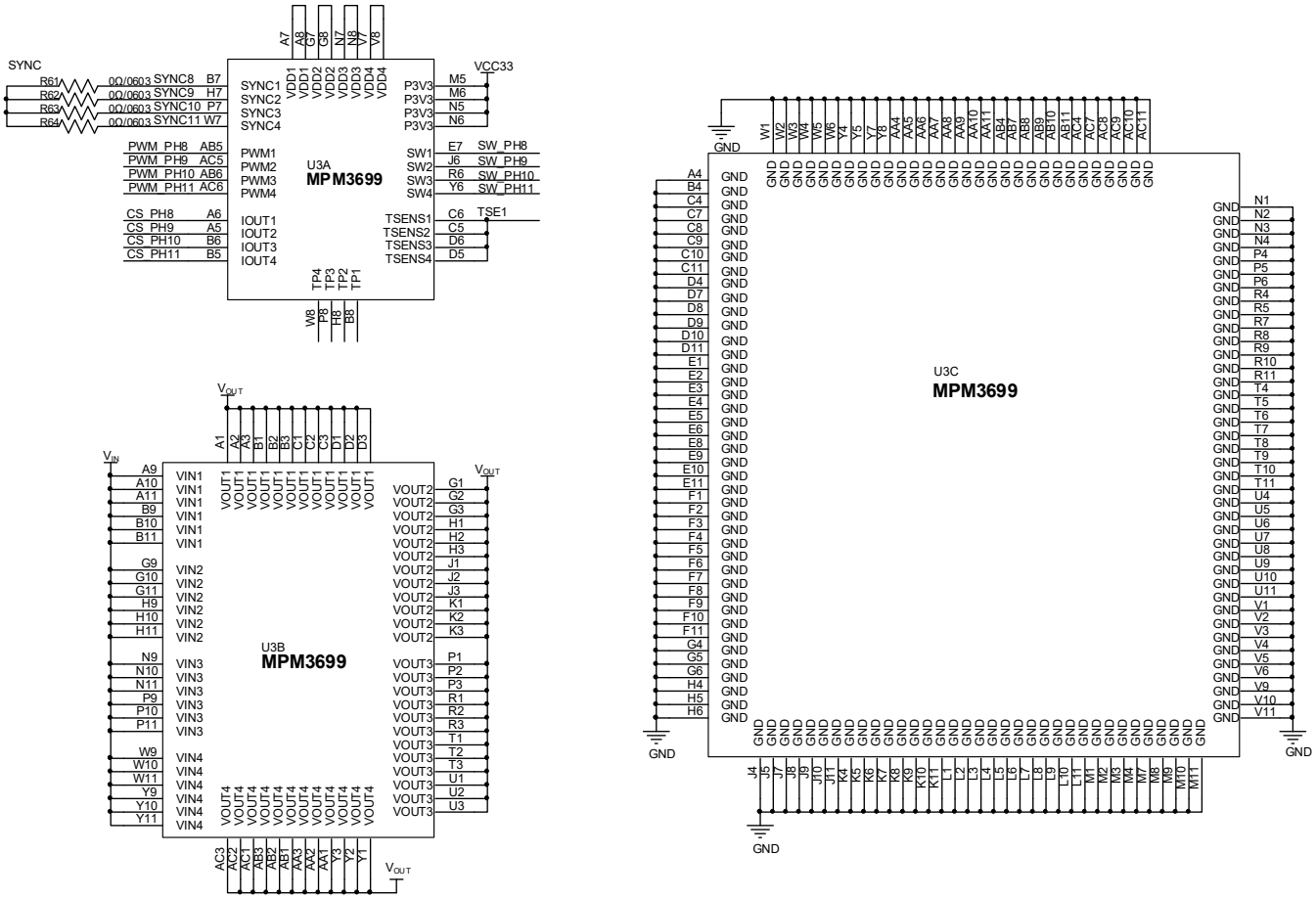

Figure 7: Evaluation Board Schematic (Part 4)

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EVALUATION BOARD SCHEMATIC *(continued)*

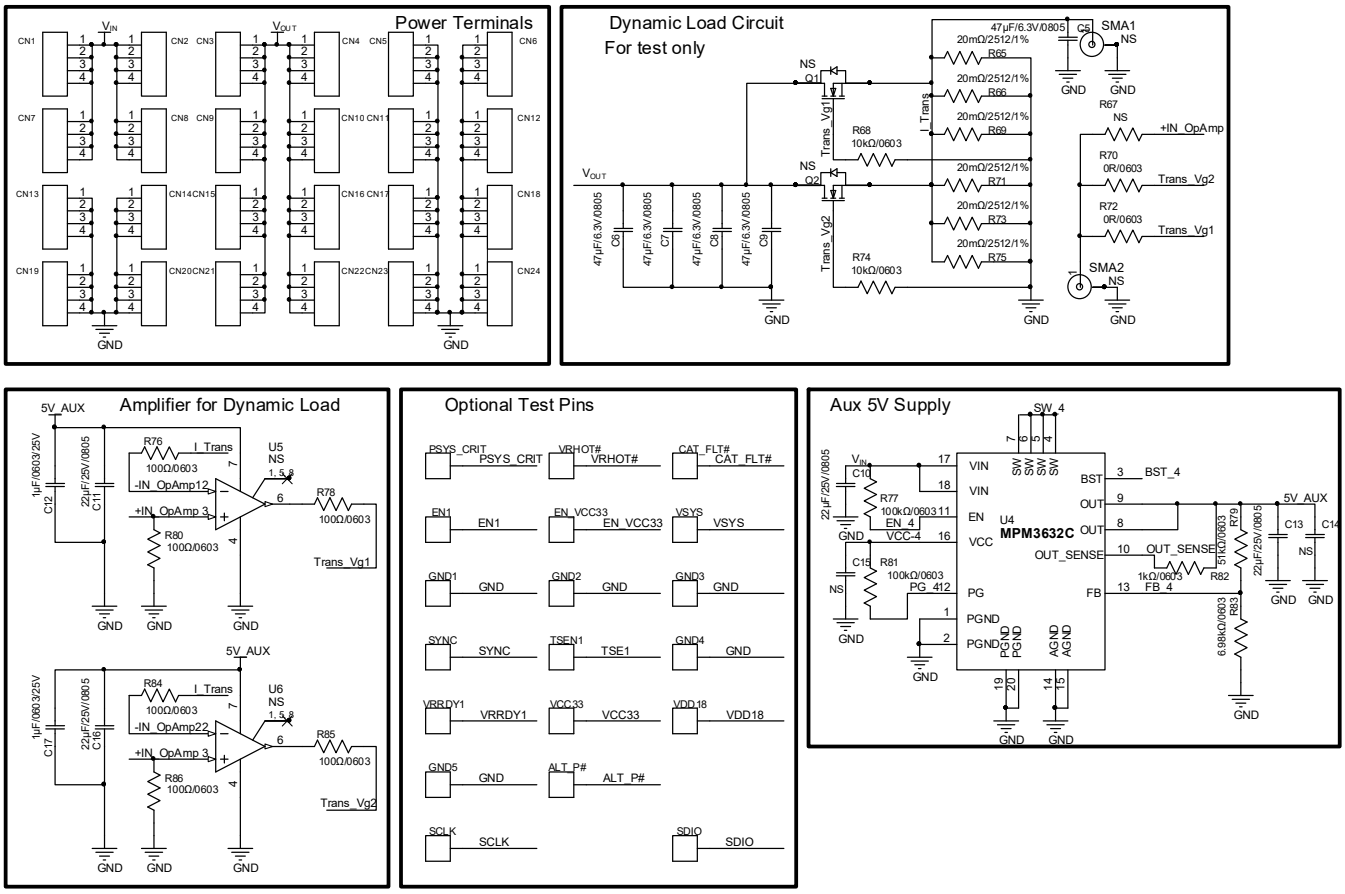

Figure 8: Evaluation Board Schematic (Part 5)

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EVALUATION BOARD SCHEMATIC *(continued)*

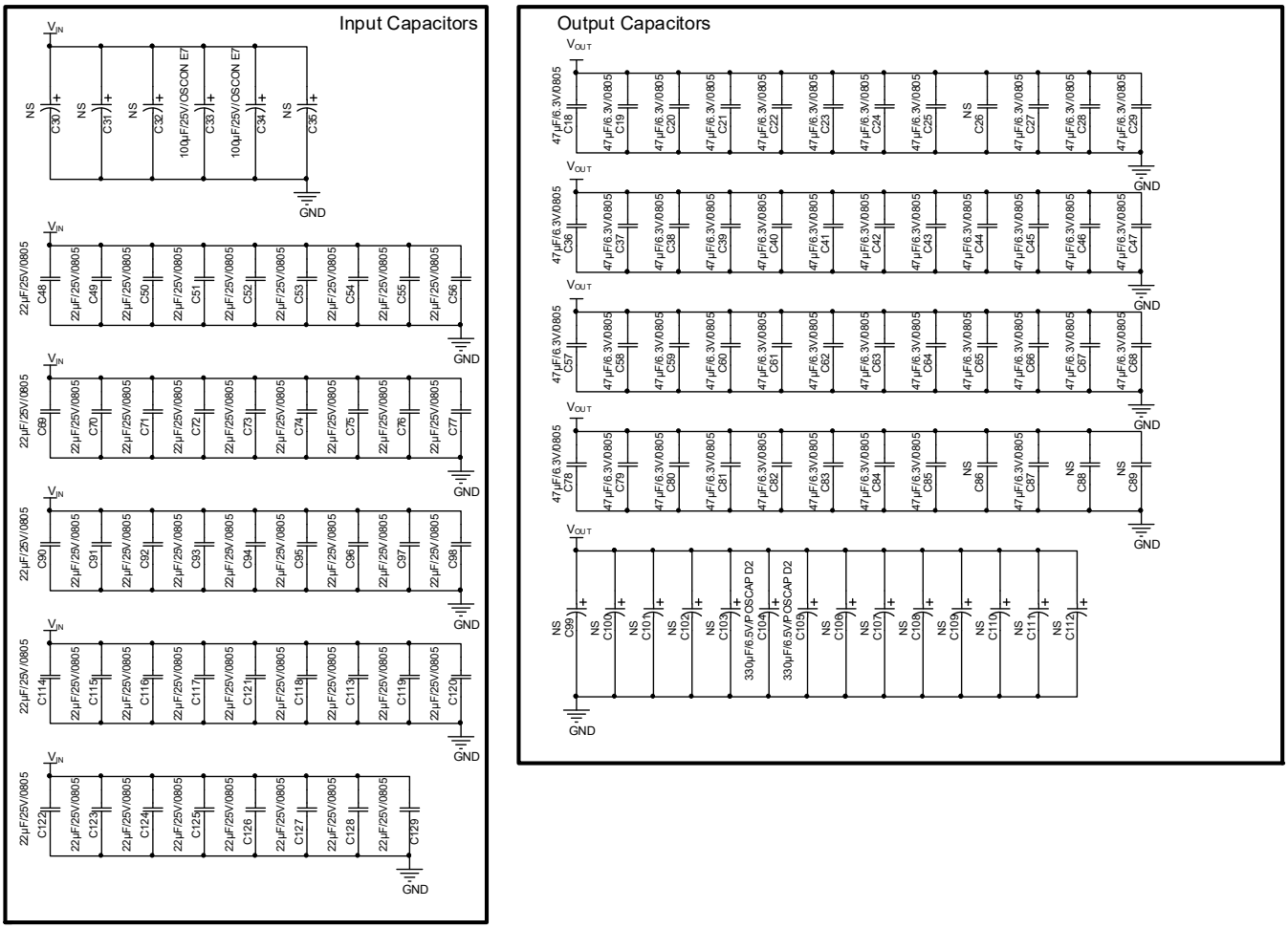

Figure 9: Evaluation Board Schematic (Part 6)

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EVM3698-BH-02A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
6	C1, C2, C3, C4, C12, C17	1μF	Ceramic capacitor, 25V, X7R	0603	Wurth	885012206076
49	C5, C6, C7, C8, C9, C18, C19, C20, C21, C22, C23, C24, C25, C27, C28, C29, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C57, C58, C59, C60, C61, C62, C63, C64, C65, C66, C67, C68, C78, C79, C80, C81, C82, C83, C84, C85, C87	47μF	Ceramic capacitor, 6.3V, X5R	0805	Murata	GRM21BR60J476ME01L
49	C10, C11, C13, C15, C16, C48, C49, C50, C51, C52, C53, C54, C55, C56, C69, C70, C71, C72, C73, C74, C75, C76, C77, C90, C91, C92, C93, C94, C95, C96, C97, C98, C113, C114, C115, C116, C117, C118, C119, C120, C121, C122, C123, C124, C125, C126, C127, C128, C129	22μF	Ceramic capacitor, 25V, X5R	0805	TDK	C2012X5R1E226M
2	C33, C34	100μF	Capacitor, 25V	SMD	Panasonic	25SVPF100M
4	C102, C103, 104, C105	330μF	POSCAP capacitor, 6.3V	SMD	Panasonic	6TPE330ML
24	CN1, CN2, CN3, CN4, CN5, CN6, CN7, CN8, CN9, CN10, CN11, CN12, CN13, CN14, CN15, CN16, CN17, CN18, CN19, CN20, CN21, CN22, CN23, CN24	15A	Power connector	DIP	Keystone	KEYSTONE7697-75
1	PMBus1	10 pins	Straight box header THT, 10-pin	DIP	Wurth	612010235121
5	R1, R3, R4, R6, R7	0Ω	Film resistor, 1%	0402	Yageo	RC0402FR-070RL
39	R2, R5, R8, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R22, R23, R25, R26, R27, R28, R29, R30, R31, R32, R42, R43, R44, R46, R47, R57, R58, R59, R60, R61, R62, R63, R64, R70, R72	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
12	R9, R33, R34, R35, R36, R37, R38, R39, R40, R41, R68, R74	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL

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EVM3698-BH-02A BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
3	R21, R77, R81	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R50	15kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0715KL
1	R51	3.3kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-073K3L
1	R55	2kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-072KL
6	R76, R78, R80, R84, R85, R86	100Ω	Film resistor, 1%	0603	Yageo	RC0603FR-07100RL
1	R79	51kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0751KL
2	R56, R82	1kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-071KL
1	R83	6.98kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-076K98L
3	TP1, TP2, TP3	3 pins	3-pin header	DIP	Any	
1	VOUT_EN	10mmx 2.5mmx 6.4mm	3-pin switch	DIP	Wurth	450301014042
19	ALT_P#, CAT_FLT#, EN1, EN_VCC33, GND1, GND2, GND3, GND4, GND5, PSYS_CRIT, SCLK, SDIO, SYNC, TSEN1, VCC33, VDD18, VRHOT#, VRRDY1, VSYS	1mm	Copper pin	DIP	Custom (2)	
1	U1	MPM3698	16V, 120A peak, scalable power module with PMBUS	BGA	MPS	MPM3698GBH-0002
1	U2, U3	MPM3699	16V, 160A peak, four-phase, scalable power block module	BGA	MPS	MPM3699GBH

Note:

2) MPS custom-produces these pins. Contact an MPS FAE for more information.

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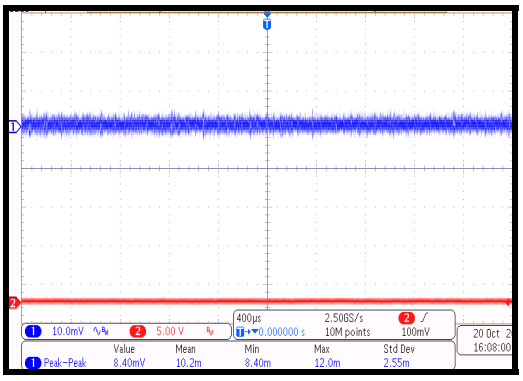
EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, V_{OUT} = 0.85V, C_{OUT} = 46 x 47μF + 4 x 330μF, T_A = 25°C, unless otherwise noted.

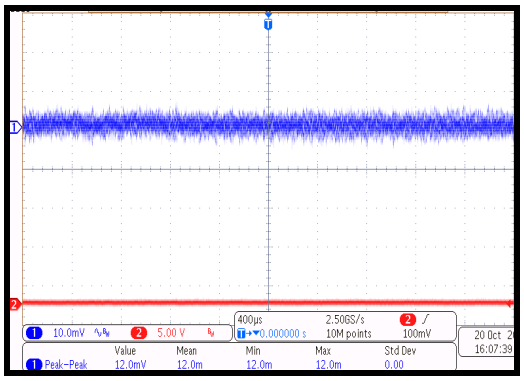
Steady Ripple

V_{OUT} = 0.85V, I_{OUT} = 0A



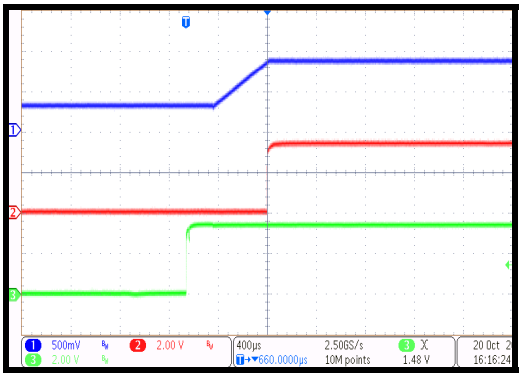
Steady Ripple

V_{OUT} = 0.85V, I_{OUT} = 330A



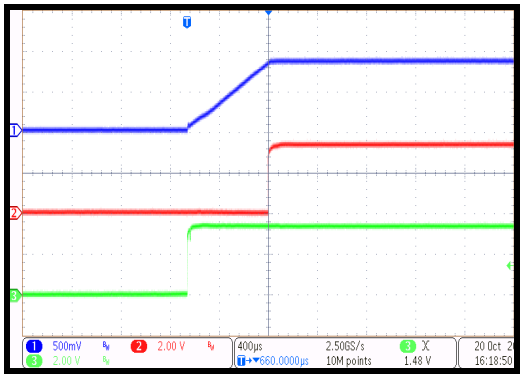
Start-Up through EN

V_{OUT} = 0.85V, I_{OUT} = 0A



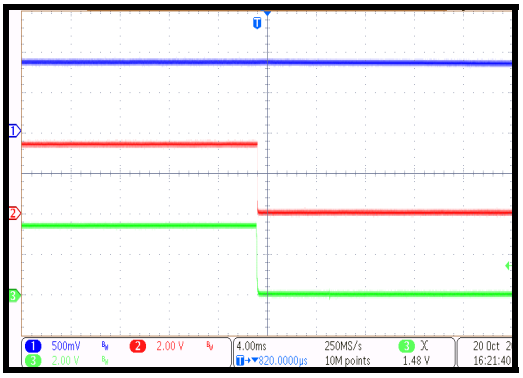
Start-Up through EN

V_{OUT} = 0.85V, I_{OUT} = 330A



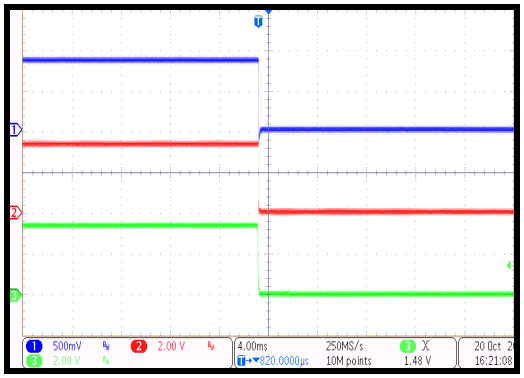
Shutdown through EN

V_{OUT} = 0.85V, I_{OUT} = 0A



Shutdown through EN

V_{OUT} = 0.85V, I_{OUT} = 330A



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PCB LAYOUT

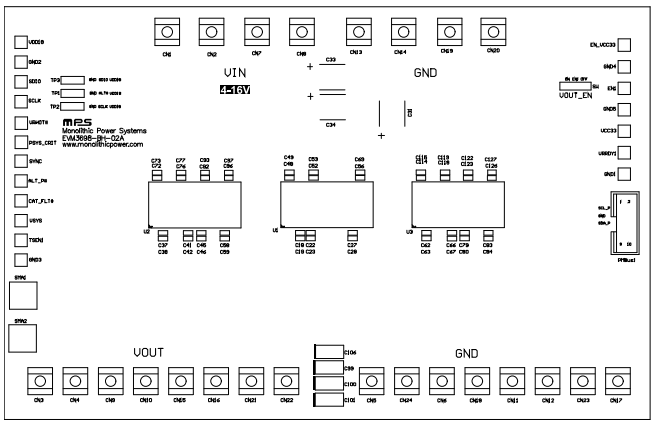

Figure 10: Top Silk

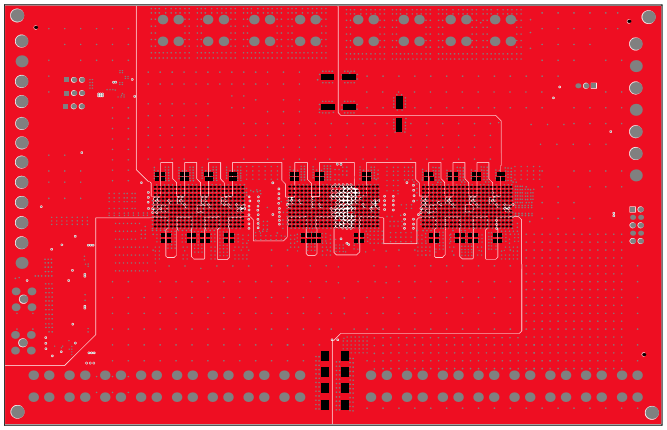

Figure 11: Top Layer

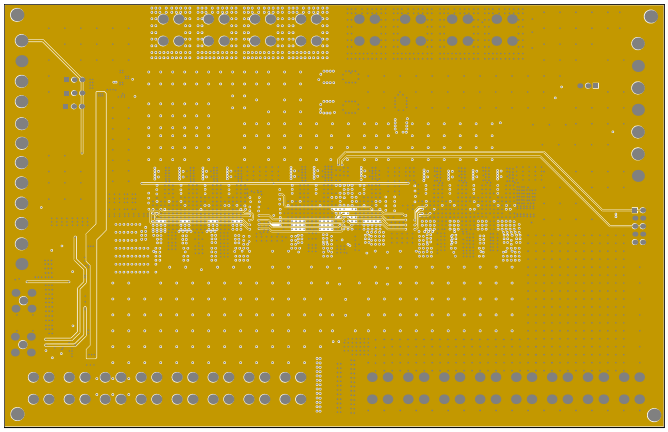

Figure 12: Mid-Layer 1

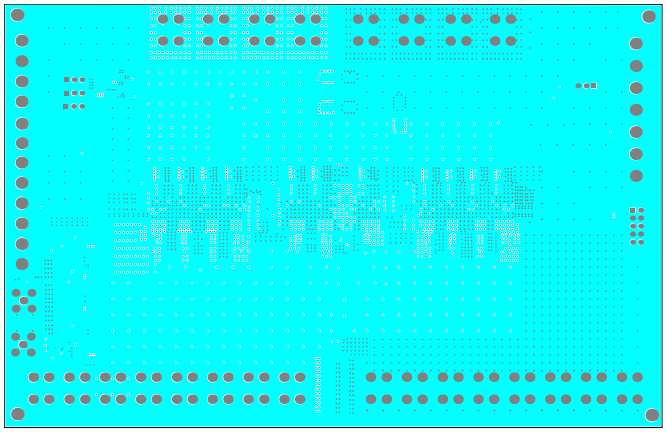

Figure 13: Mid-Layer 2

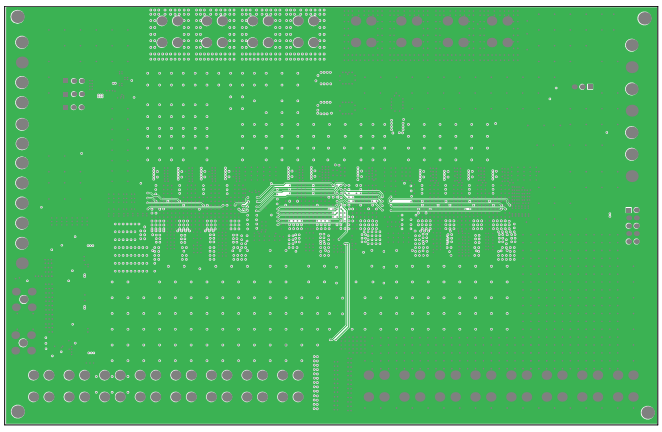

Figure 14: Mid-Layer 3

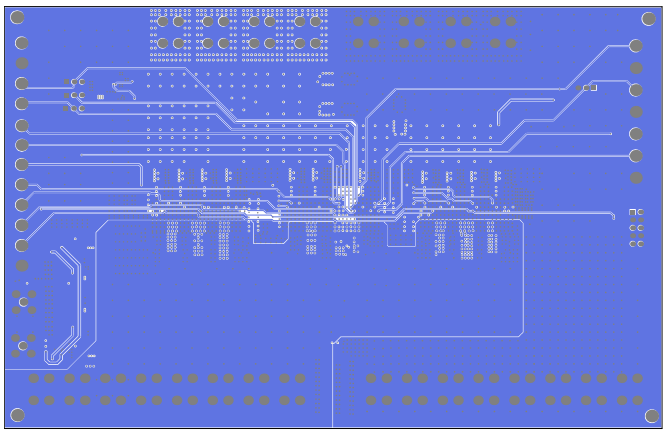

Figure 15: Mid-Layer 4

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PCB LAYOUT *(continued)*

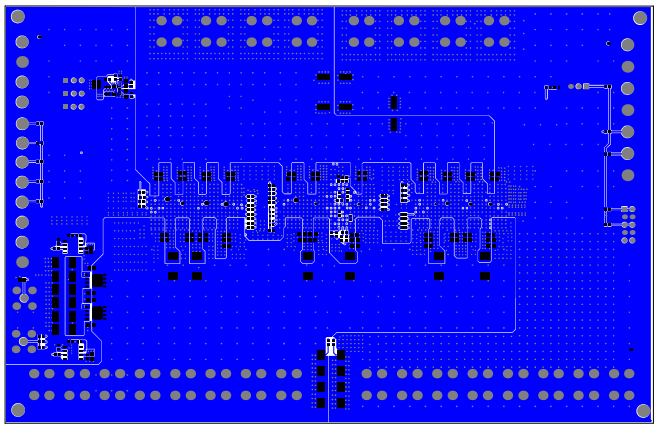

Figure 16: Bottom Layer

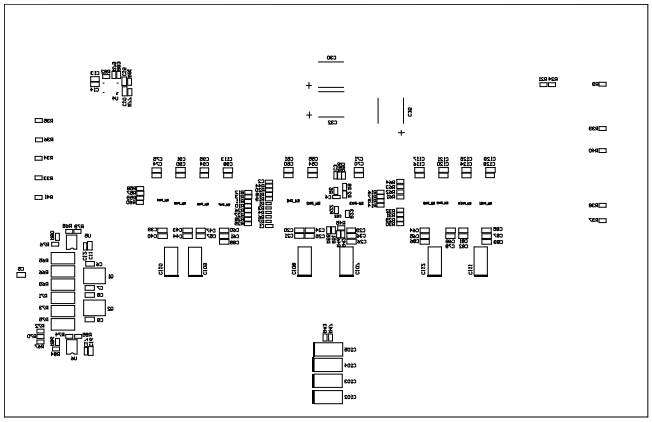

Figure 17: Bottom Silk

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REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	6/14/2024	Initial Release	-

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