

ENVISIONING • EMPOWERING • EXCELLING



Quad MxL7218
140A Multiphase
EVK User Manual

Revision History

Document No.	Release Date	Change Description
026UMR00	12/7/20	Initial Preliminary Release

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Introduction

The Quad MxL7218 140A Multiphase Evaluation Board provides a platform to evaluate the features and performance of four MxL7218 Power Modules connected in parallel to supply up to a 140A load. Each MxL7218 is a dual 18A Power Module which are optimized for powering Telecom, Networking and Industrial equipment. This manual covers both the BGA and LGA evaluation boards versions of this 140A multiphase application.

Quick EVK Set Up and Start Up

Factory Settings

In addition to utilizing the 4.5V to 15V input voltage range of the MxL7218's and the 140A maximum load current rating capabilities of using the four MxL7218 Power Modules together, the evaluation board has been set up with the factory default configurations shown below for quick set up and operation. **Do not exceed the EVK maximum load current rating.**

The factory default configuration (Table 2) for the Quad MxL7218 Evaluation Board is:

- V_{IN} = 4.5V to 15V
- V_{OUT} = 1.0V \pm 1.5%. For other V_{OUT} see [Jumpers JP4 - JP8 VOUT SELECT](#).
- I_{OUT} = 0A to 140A
- 400kHz switching frequency
- Run is enabled for both channels of all 4 of the MxL7218's (all 8 channels). See [RUN](#), [Jumper JP2](#).
- Continuous current mode using internal clock. To use an external clock, see [EXT_CLK](#), [Jumper JP1](#)
- One pin output voltage ramp up and down tracking programmability
- A 6.5ms soft-start is selected for all channels
- Sensing diode biasing at 100 μ A for internal temperature sense

Quick Start Up

To quickly see the regulator in operation:

1. Use the factory settings and default configuration. If other settings or components are desired, apply them before the next steps and see [Set-Up Options](#) for more.
 2. With a power supply turned off and within a V_{IN} specification of 4.5V to 15V (12V typical), connect it to VIN and GND with short, thick leads. Use test pins VIN+ and VIN- to monitor VIN and GND respectively. See locations in [Figure 1](#).
 3. For the output, connect a meter and electronic load initially set to 0A, that will be no more than the above maximum I_{OUT} (140A), to VOUT and GND with short / thick leads capable of this current. See setup and locations in [Figure 1](#).
 4. Turn on the power supply and check V_{OUT} . Check to make sure that JP2 is on the ON position. The EVK will power up and (factory default) regulate the output at 1V \pm 1.5% (0.985V to 1.015V).
 5. Set or vary the load (do not exceed the maximum I_{OUT}) and check V_{OUT} and other desired performance levels such as regulation and efficiency.
- See [Configuration and I/O Interfaces](#) and [Load Transient Circuit](#) for more on testing and monitoring.

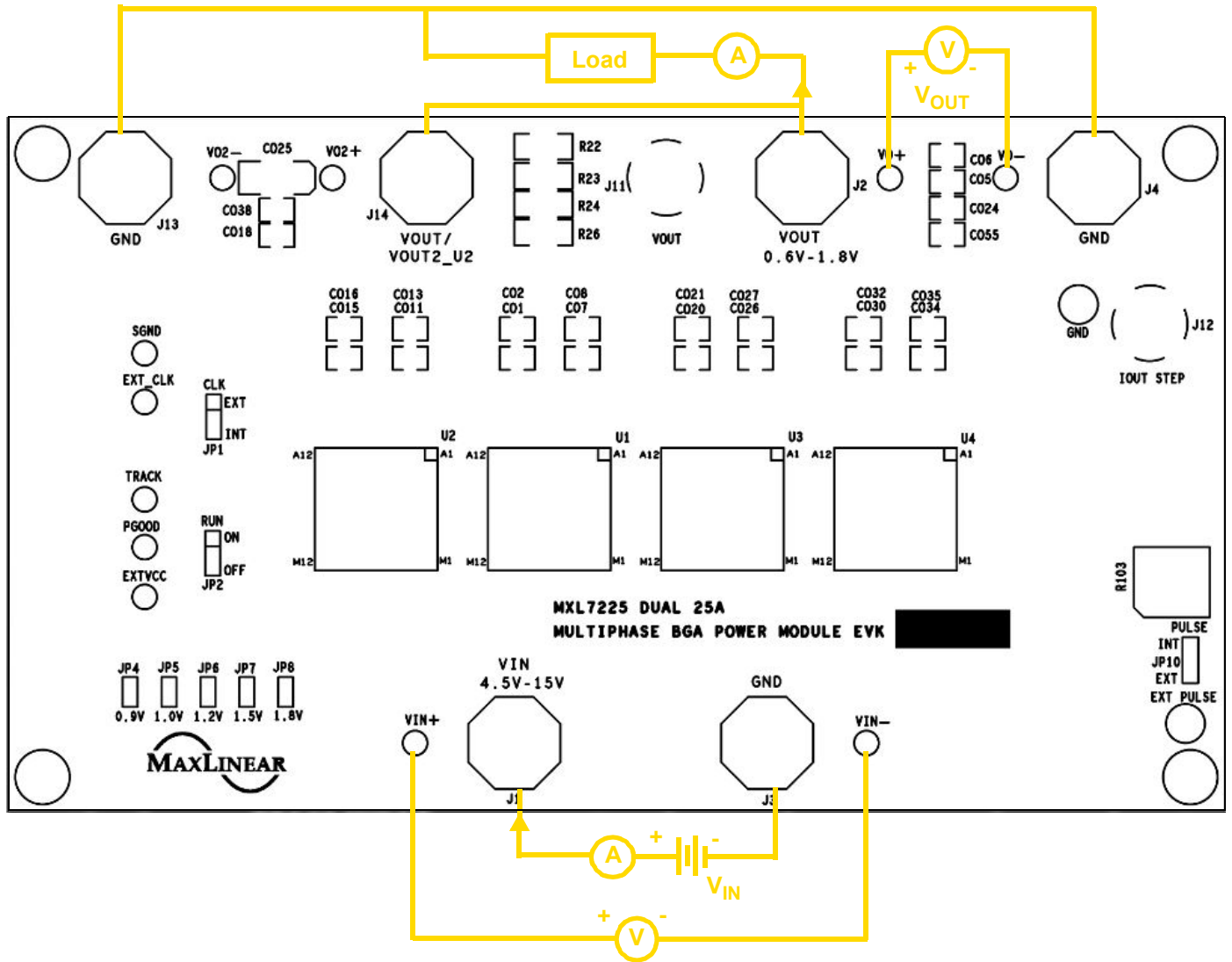


Figure 1: Monitoring V_{IN} and V_{OUT}

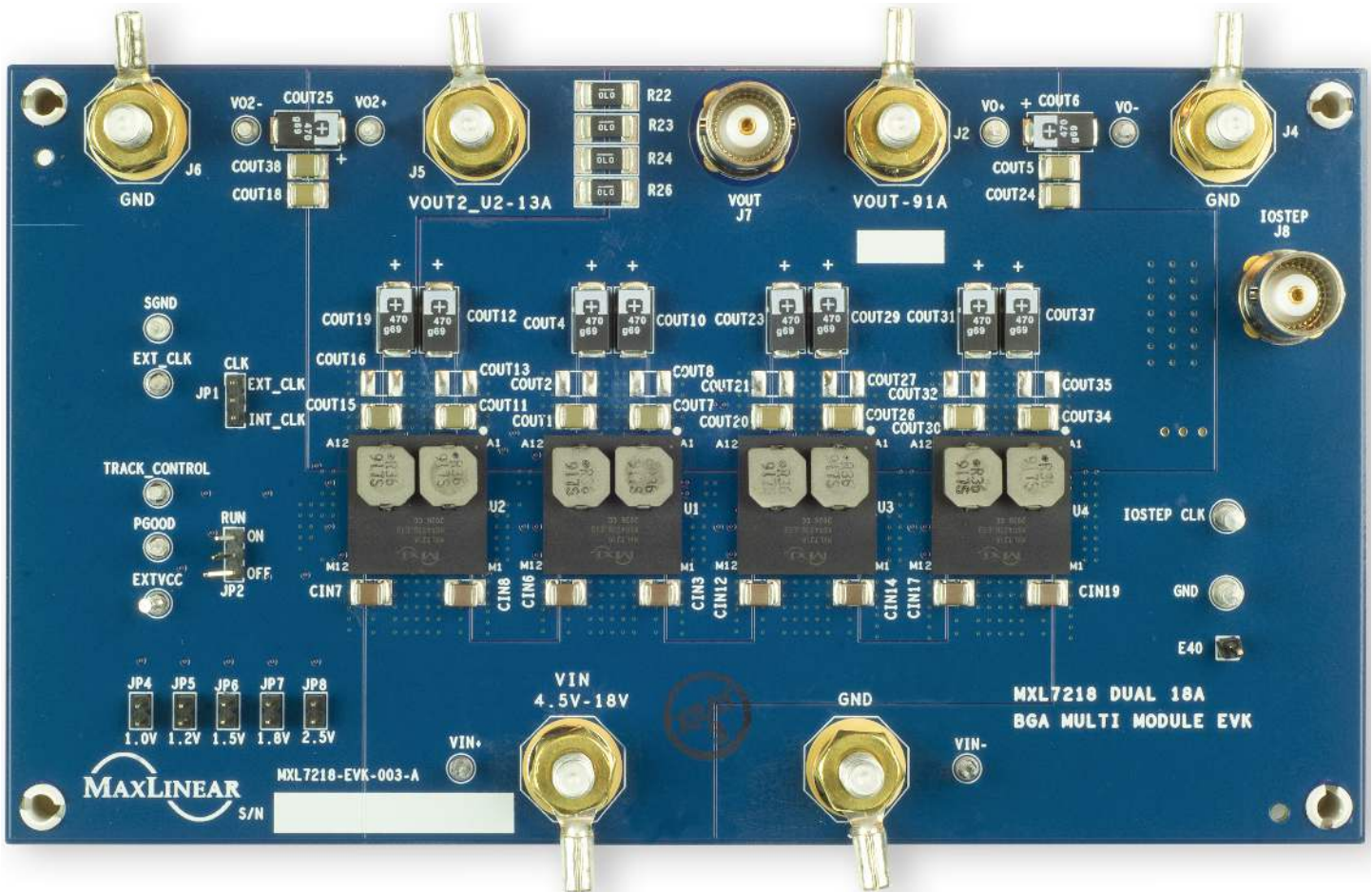


Figure 2: Top View of MxL7218 140A Multiphase EVK

Reference Documentation

Please refer to the [MxL7218 Data Sheet](#) for additional information about the MxL7218. The datasheet includes a full list of IC features, pinout, pin descriptions, typical performance characteristics and external component calculations. This manual is meant to be used in conjunction with the datasheet.

This manual provides [Quad MxL7218 EVK Schematic](#), [Quad MxL7218 EVK PCB Layers](#) and [Quad MxL7218 EVK Bill of Materials](#) that can be utilized to assist in your board design. The schematics are also available on the [MxL7218 product page](#).

Ordering Information

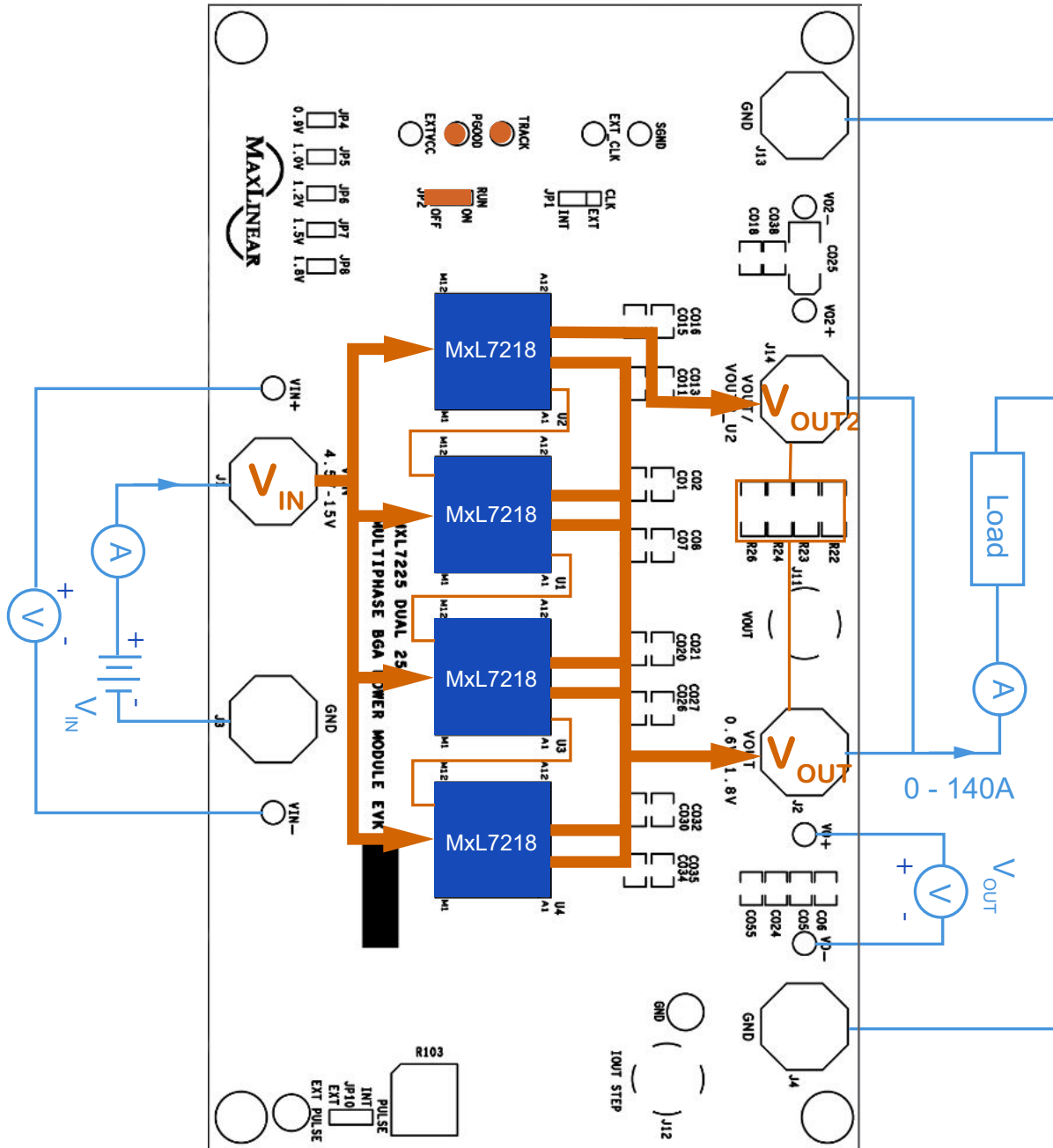
Table 1: Evaluation Board Ordering Part Number⁽¹⁾

Power Module	Evaluation Board	Description
MxL7218-ABA-T	MxL7218-EVK-2	Quad MxL7218 BGA Power Module Multiphase EVK

1. Refer to www.maxlinear.com/MxL7218 for most up-to-date Ordering Information.

Evaluation Board Overview

The block diagram shown in **Figure 3** illustrates the 7 MxL7218 channels connected in parallel with the 8th channel as the master and the connection points for V_{IN} , V_{OUT} , and V_{OUT2} . Also represented are the CLKOUT to MODE_PLLIN connections between the 4 MxL7218 ICs.



V_{OUT} and V_{OUT2} connected via R22, R23, R24 and R26

VFB of all 8 channels connected

RUN of all 8 channels connected and connected to JP2

TRACK of all 8 channels connected and connected to TRACK_CONTROL point on board

PGOOD of all 8 channels (with pullups) connected and connected to PGOOD point on board

Figure 3: Quad MxL7218 140A Multiphase EVK Block Diagram

Configuration and I/O Interfaces

EXT_CLK, Jumper JP1

Jumper J1 provides an option to connect and synchronize to an external clock or use an internal clock (default). See [EXT_CLK, Jumper JP1](#).

RUN, Jumper JP2

Jumper JP2 enables (ON) or disables (OFF) all 8 channels. See [RUN, Jumper JP2](#).

TRACK_CONTROL

The board's output voltage tracks the voltage on the TRACK_CONTROL test point when applied.

PGOOD

A PGOOD test point is provided for all 8 channels. PGOOD signals are tied to INTVCC through 10k Ω resistors.

EXTVCC

A connection point is provided to inject EXTVCC, if desired.

EXT PULSE

Used to test load transients. See [Load Transient Circuit](#).

Set-Up Options

Jumpers are factory installed per [Table 2](#) to configure the EVK for operation. Jumper and testing options are described in the next sections. Refer to the [product datasheet](#) for additional information.

Table 2: Factory Settings

Jumper	Label	Factory Setting	Description
JP1	CLK	Jumper 2-3	Internal clock
JP2	RUN	Jumper 1-2	On
VOUT SELECT			
JP4	0.9V	No Jumper	V _{OUT} = 1.0V selected
JP5	1.0V	Jumper 1-2	
JP6	1.2V	No Jumper	
JP7	1.5V	No Jumper	
JP8	1.8V	No Jumper	

Jumper JP1 CLK

Table 3: JP1 Options

Jumper Options	Description
Jumper 1-2	External clock may be applied to synchronize to.
Jumper 2-3 (default)	Internal clock.

Jumper JP2 RUN

Table 4: JP2 Options

Jumper Options	Description
Jumper 1-2 (default)	On, all channels are enabled.
Jumper 2-3	Off, all channels are disabled.

Jumpers JP4 - JP8 VOUT SELECT

Table 5: JP4 - JP8 Options

Jumper	Jumper Options	Description
JP4	Jumper 1-2	V _{OUT} = 0.9V selected only.
	No jumper (default)	V _{OUT} = 0.9V not selected.
JP5	Jumper 1-2 (default)	V _{OUT} = 1.0V selected only.
	No jumper	V _{OUT} = 1.0V not selected.
JP6	Jumper 1-2	V _{OUT} = 1.2V selected only.
	No jumper (default)	V _{OUT} = 1.2V not selected.
JP7	Jumper 1-2	V _{OUT} = 1.5V selected only.
	No jumper (default)	V _{OUT} = 1.5V not selected.
JP8	Jumper 1-2	V _{OUT} = 1.8V selected only.
	No jumper (default)	V _{OUT} = 1.8V not selected.

Test Interfaces

Load Transient Circuit

A load transient circuit is provided to allow optional testing of load transients. The EXT PULSE (E33) clock input is used to drive the transient signal. The load step generated by the FETs (Q1 and Q2) is very fast; the step slew rate is $>40\text{A}/\mu\text{s}$ for a 50A transient load test case.

To measure load transient response, use the circuit shown in [Figure 4](#). Populate R101 and R102 and apply a small duty cycle pulse signal to the EXT PULSE (E33) input ($\sim 1\%$). Adjust the amplitude of the EXT PULSE (E33) pulse to set the load current. Start at a pulse amplitude of 2V and increase while monitoring the IOSTEP (J12) voltage. The load current at IOSTEP (J12) is 5mV/A. For an example, a 100A load will occur when a 500mV pulse is observed at J12.

LOAD TRANSIENT CIRCUIT

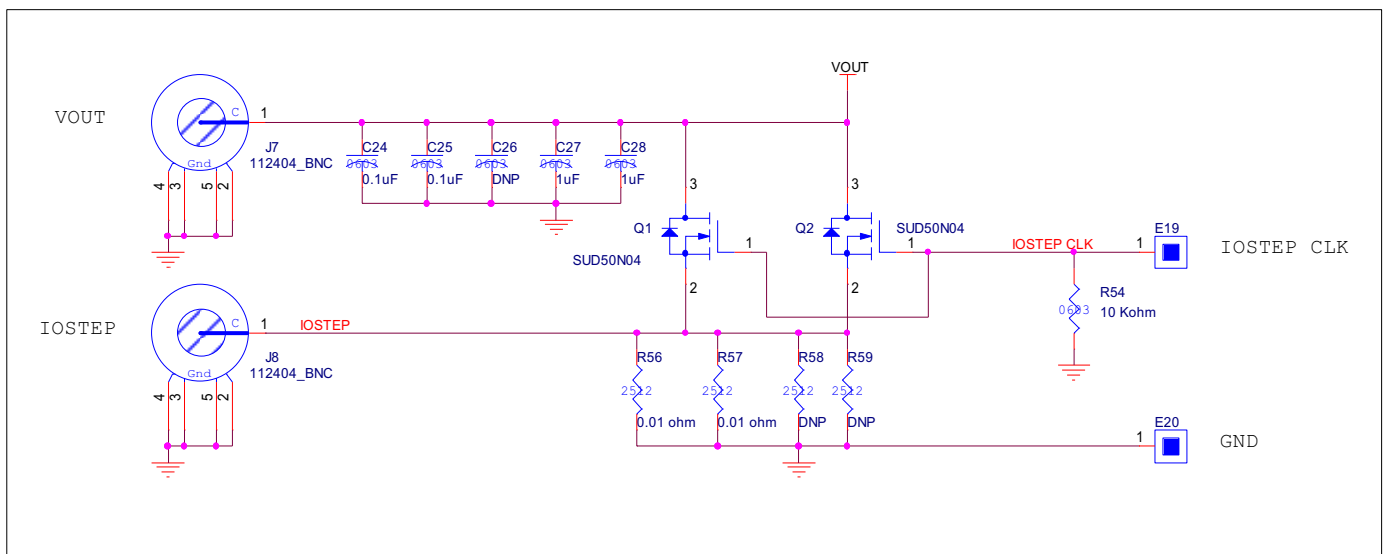


Figure 4: Load Transient Circuit

Performance

Efficiency

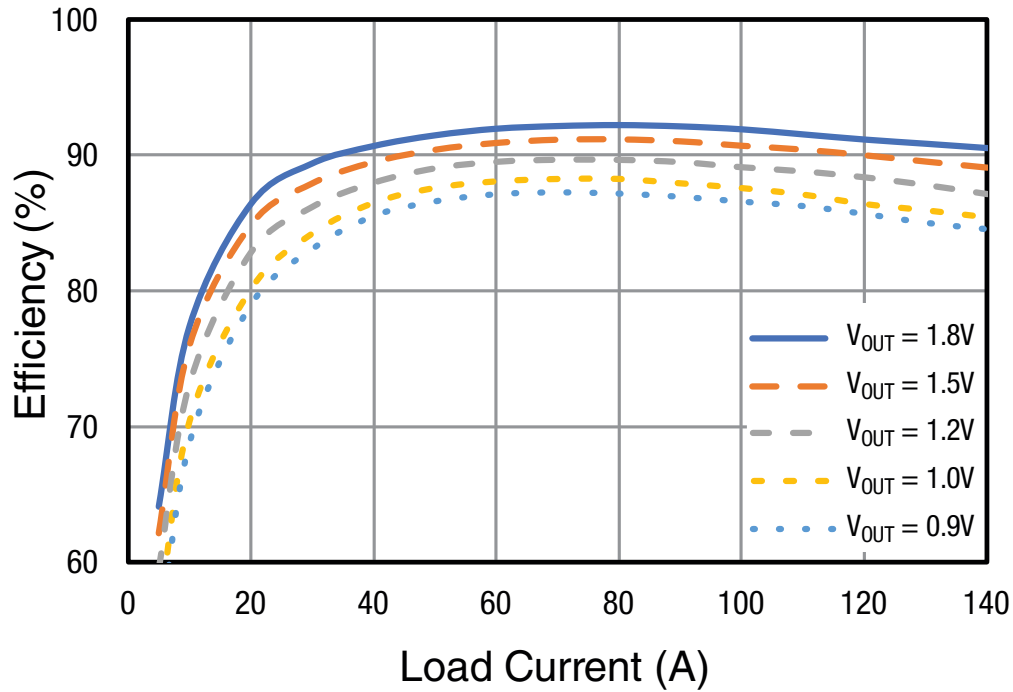


Figure 5: Measured Efficiency (V_{IN} = 12V, f_{SW} = 400kHz)

Load Transient Response

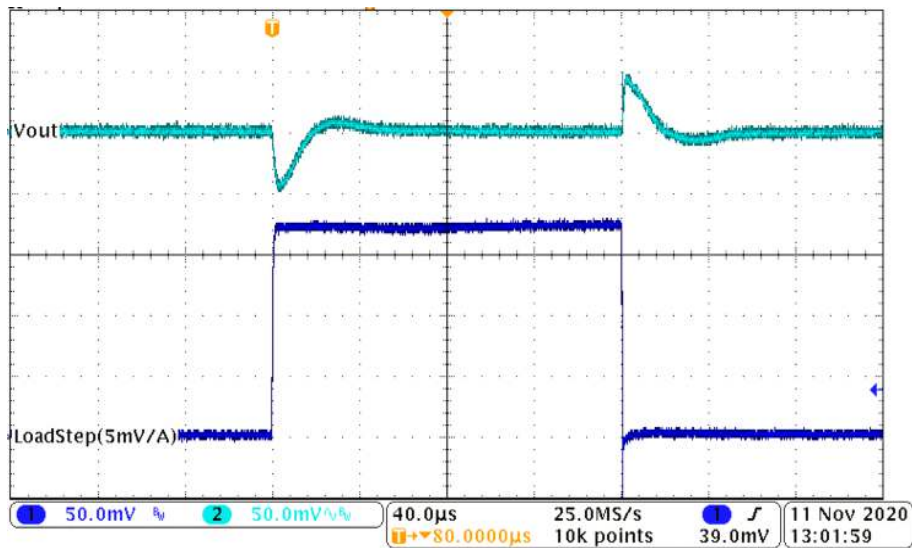
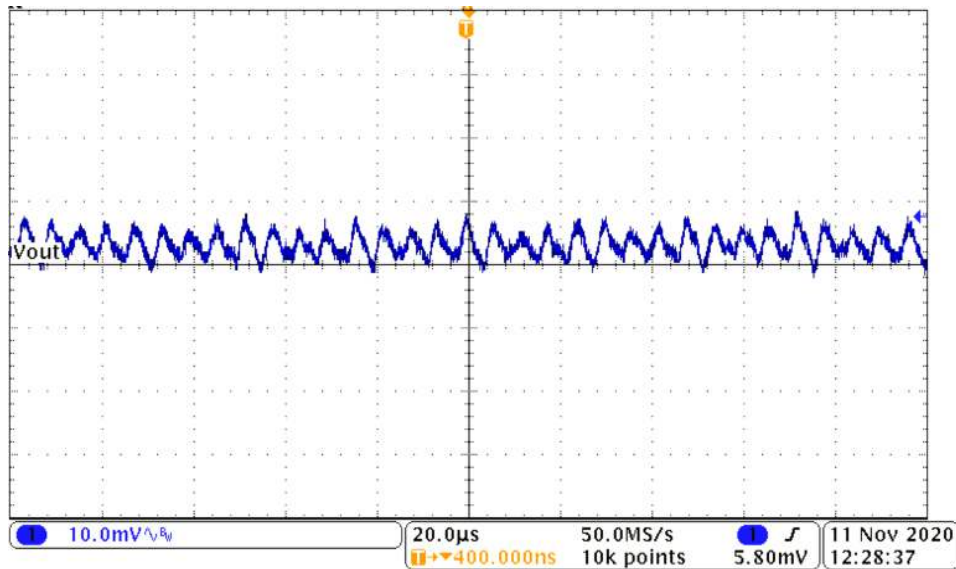


Figure 6: Load Transient Response, V_{IN} = 12V, V_{OUT} = 1V, 0A to 35A Load Step, f_{SW} = 400kHz

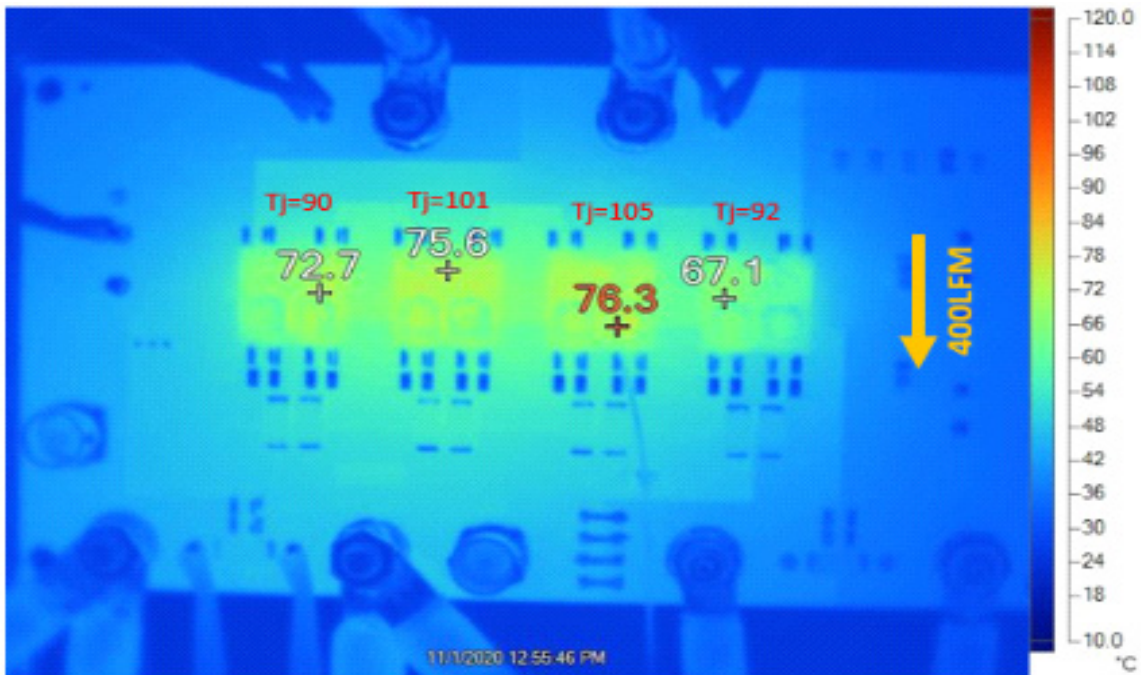
Output Ripple



2. 140A load on J7 with standard demo circuit default setup.

Figure 7: Measured Output Voltage Ripple ($V_{IN} = 12V$, $V_{OUT} = 1V$, Load = 140A, $f_{SW} = 400kHz$)

Thermal



3. Ambient temperature = 23.3°C, airflow = 400LFM, no heat sink.

Figure 8: Thermal Capture ($V_{IN} = 12V$, $V_{OUT} = 1V$, Load = 140A, $f_{SW} = 400kHz$, 400LFM)

Quad MxL7218 EVK Schematic

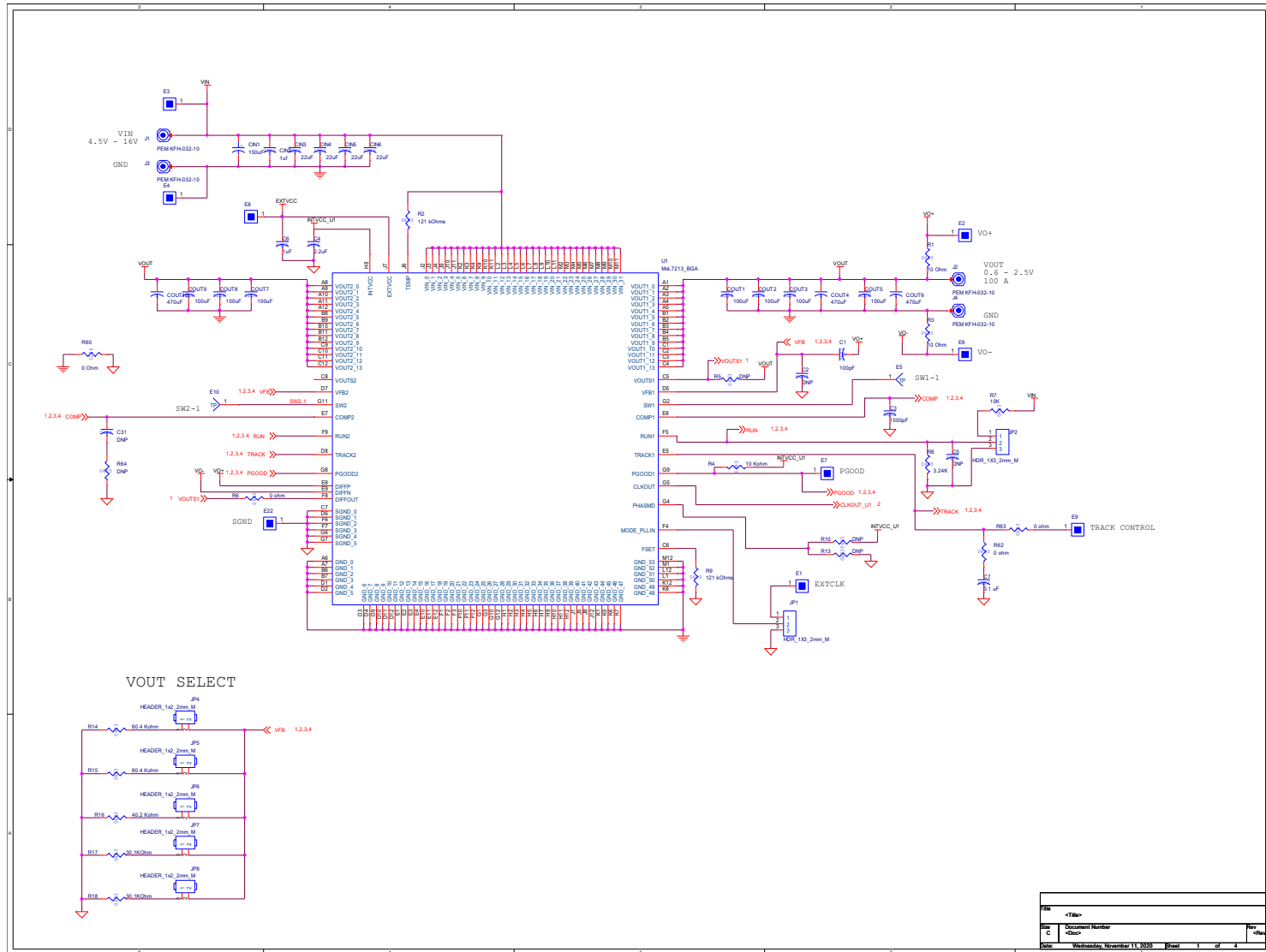


Figure 9: EVK Schematic

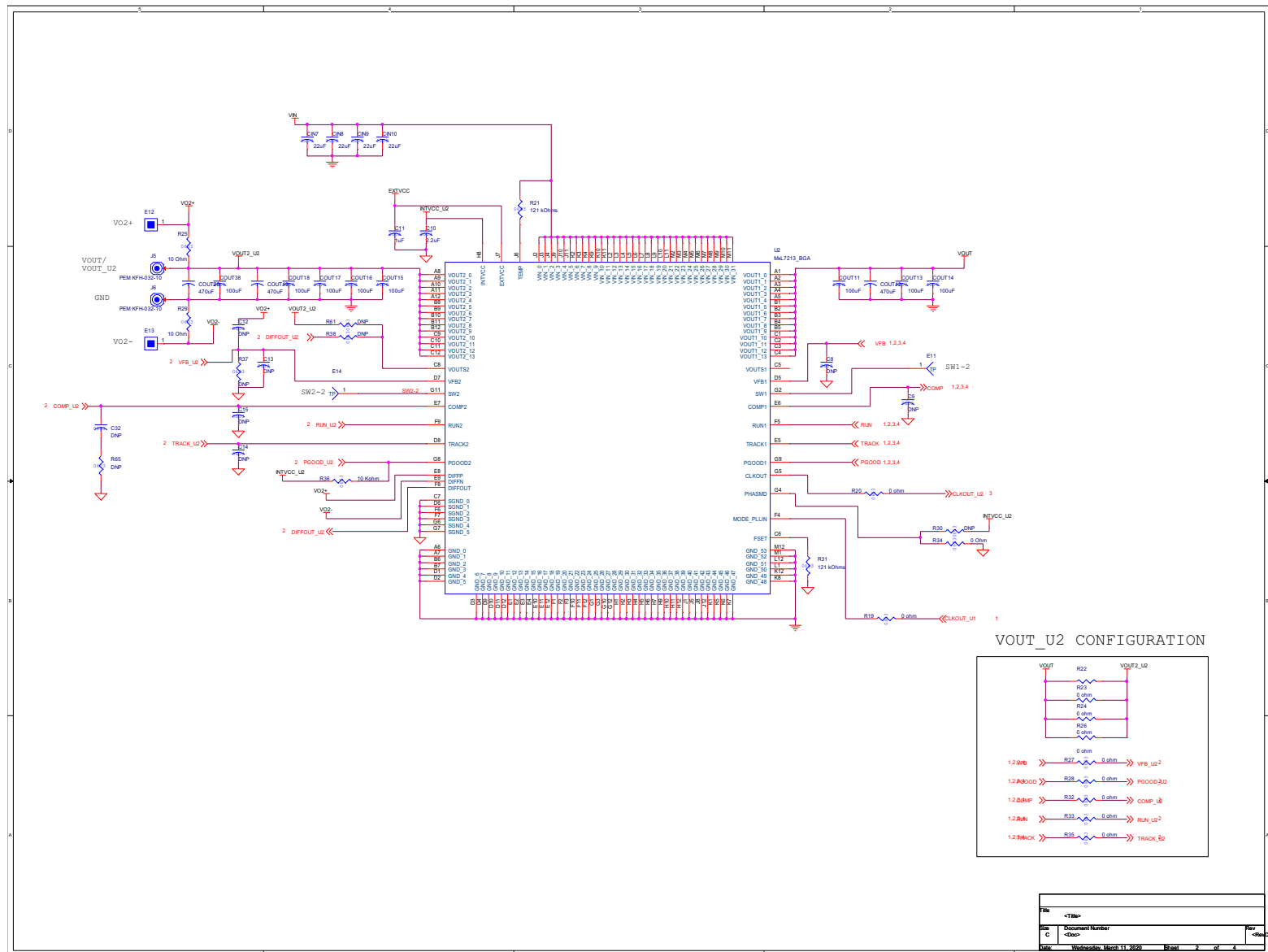


Figure 10: EVK Schematic, Continued

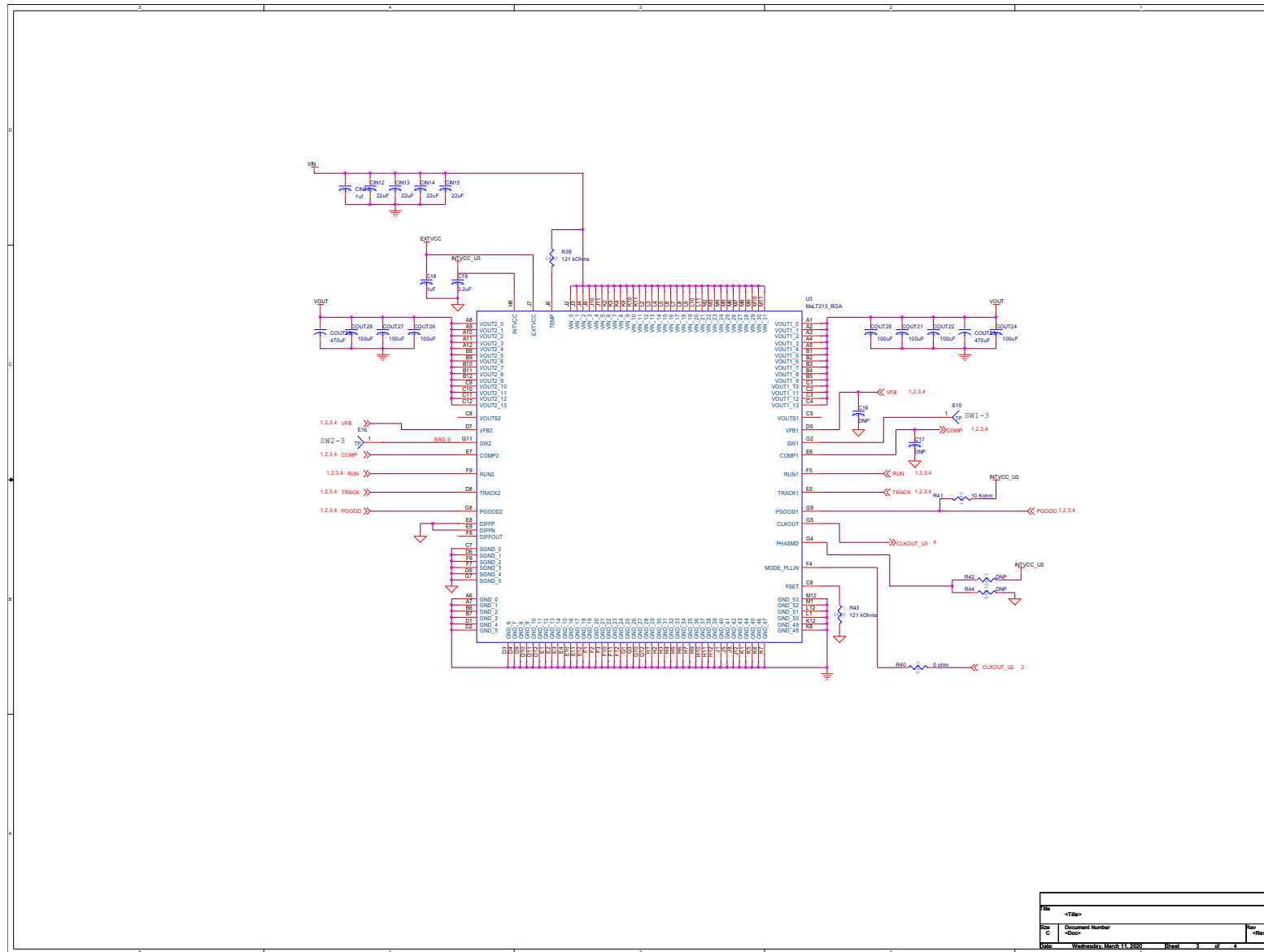


Figure 11: EVK Schematic, Continued

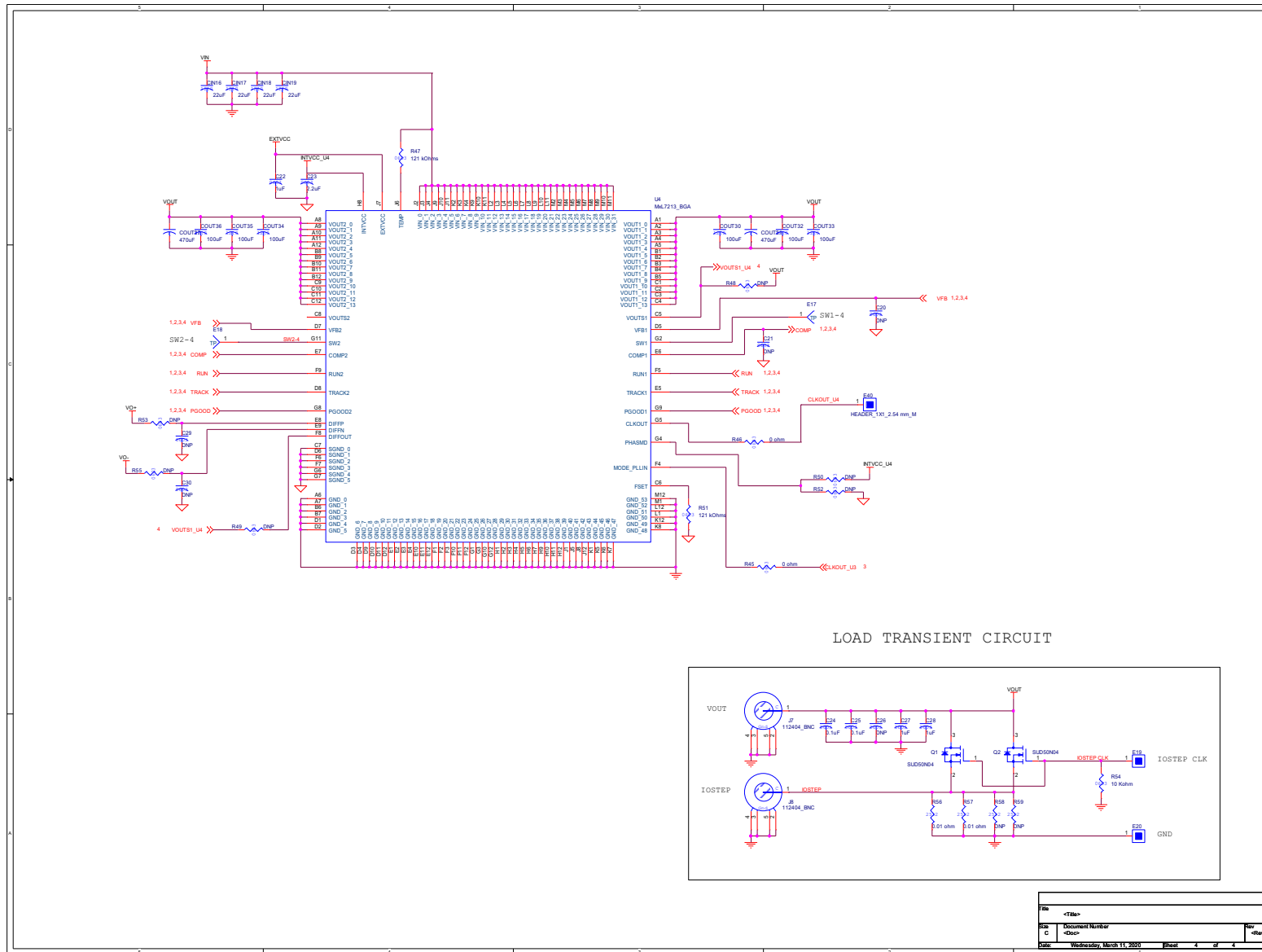


Figure 12: EVK Schematic, Continued

Quad MxL7218 EVK PCB Layers

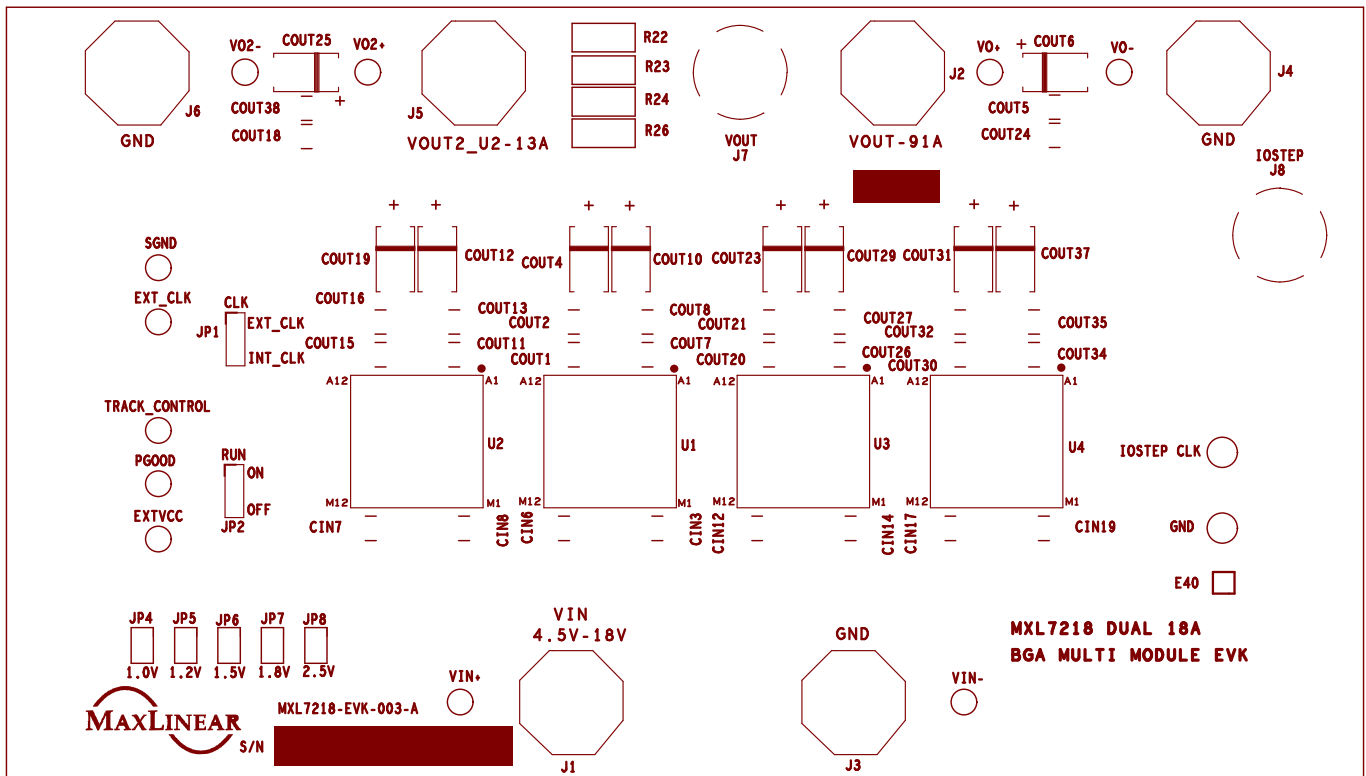


Figure 13: EVK PCB Silkscreen Top

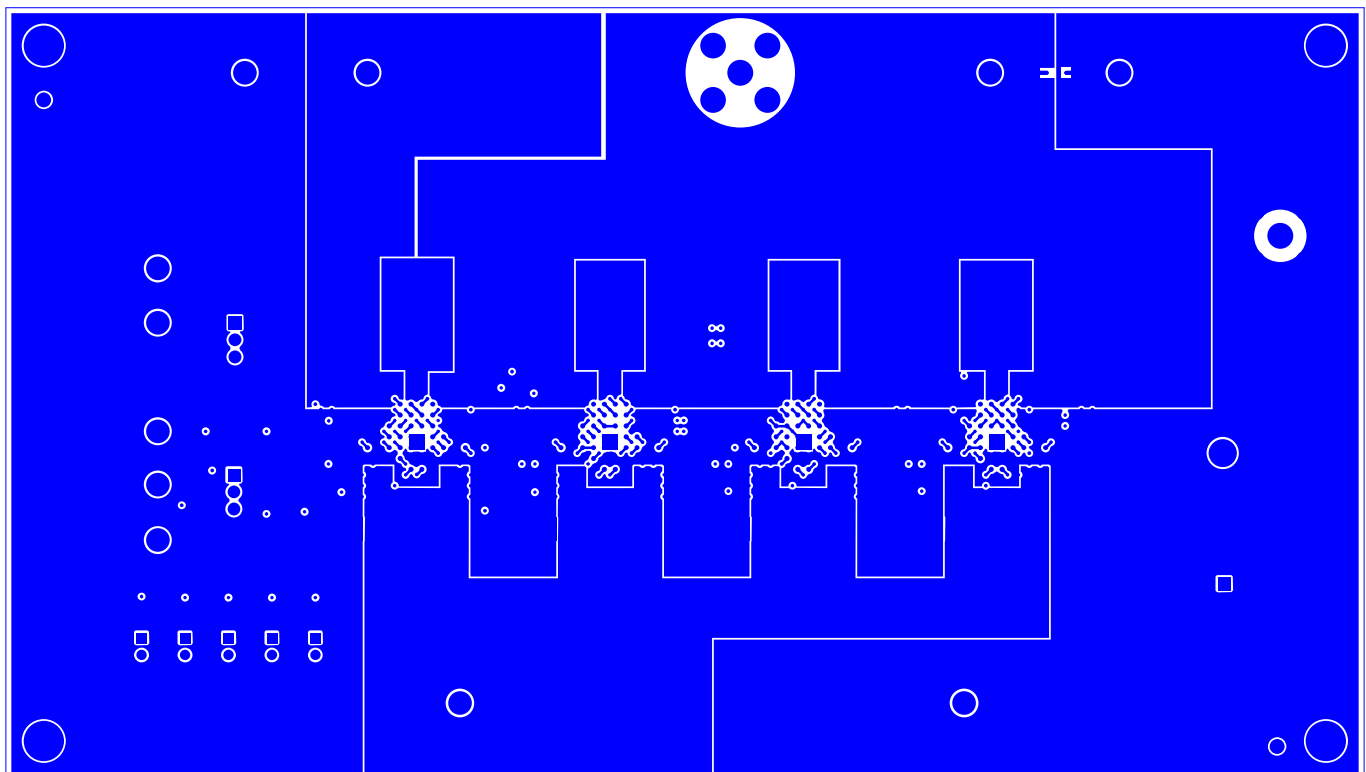


Figure 14: EVK PCB Layer 1

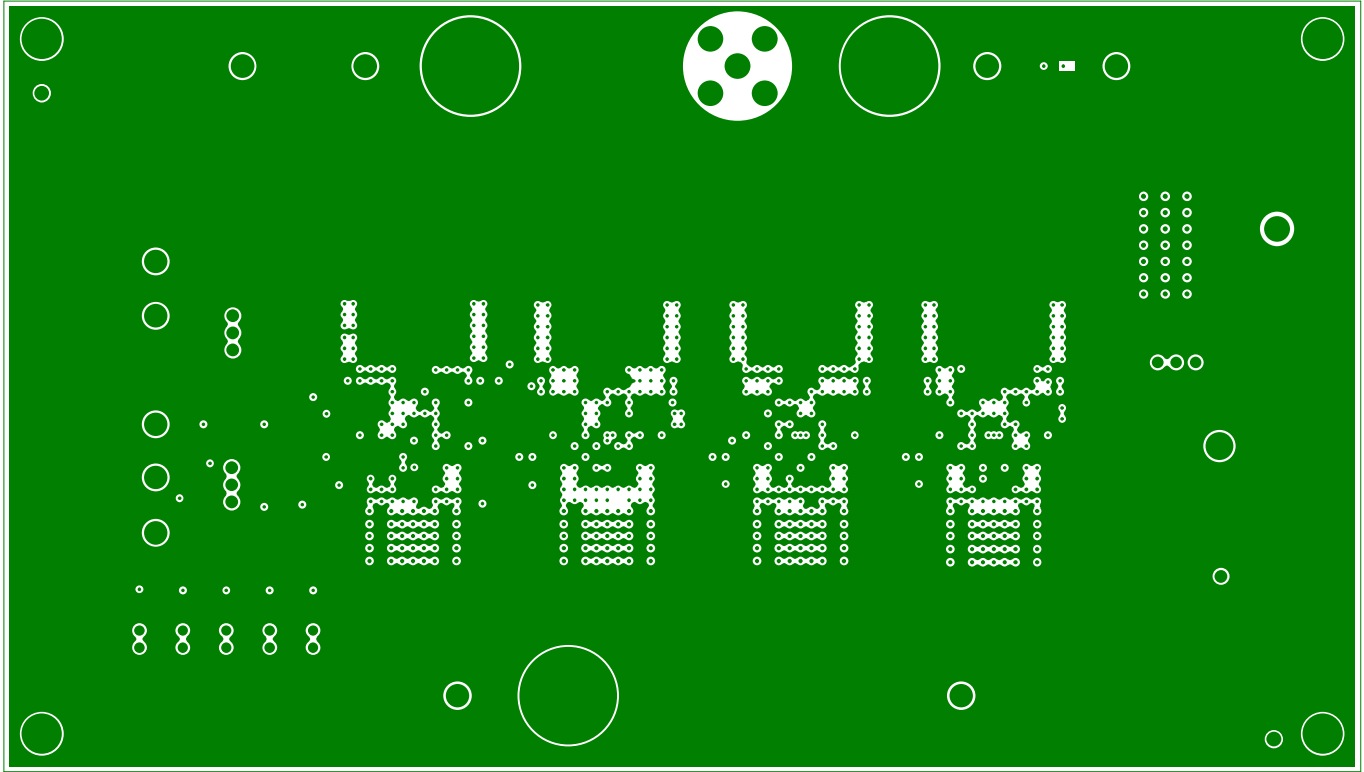


Figure 15: EVK PCB Layer 2

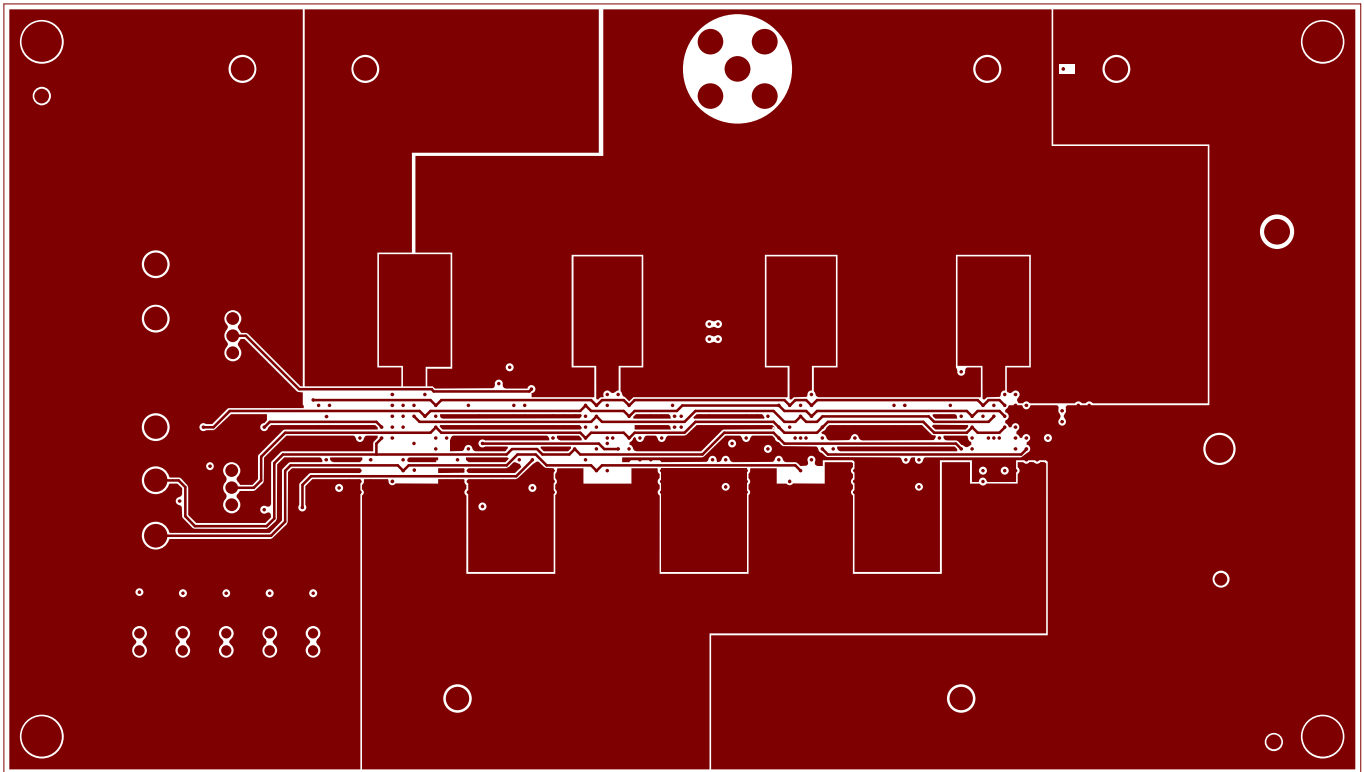


Figure 16: EVK PCB Layer 3

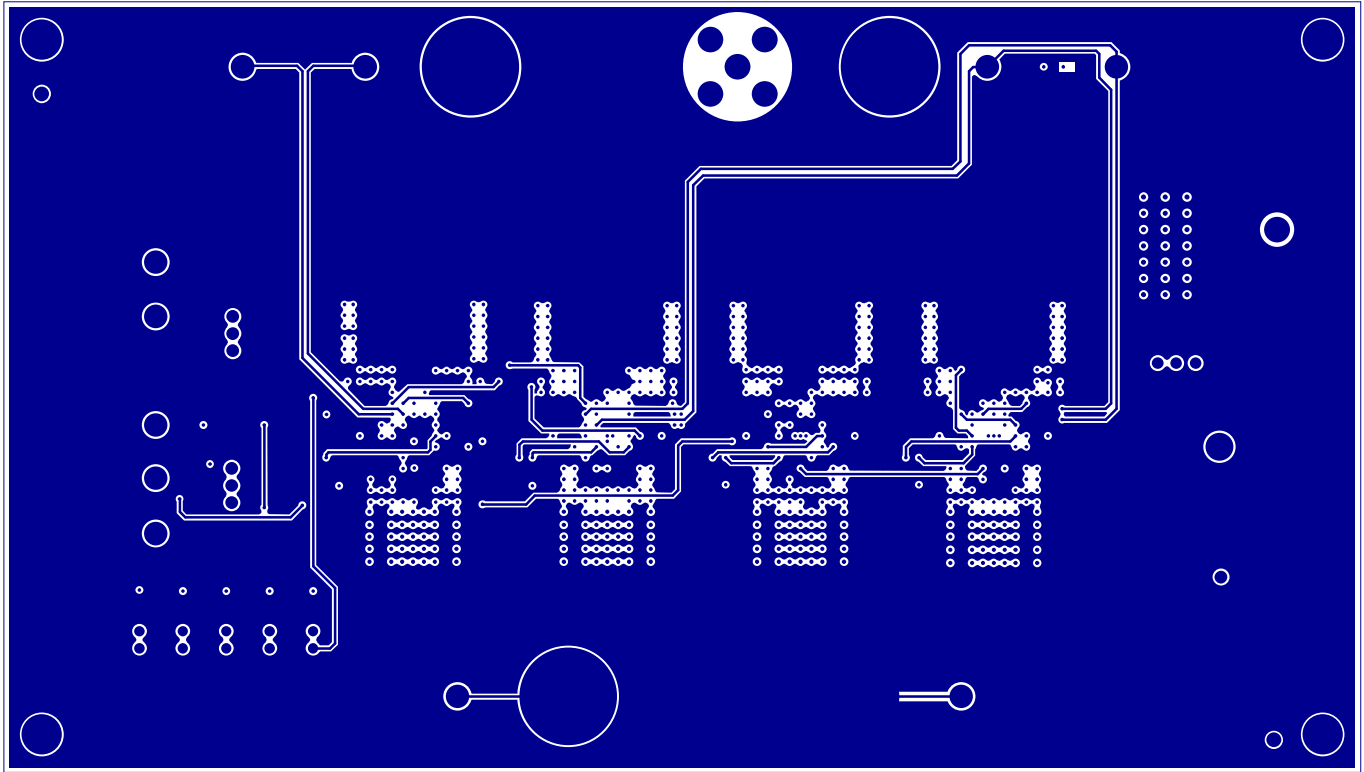


Figure 17: EVK PCB Layer 4

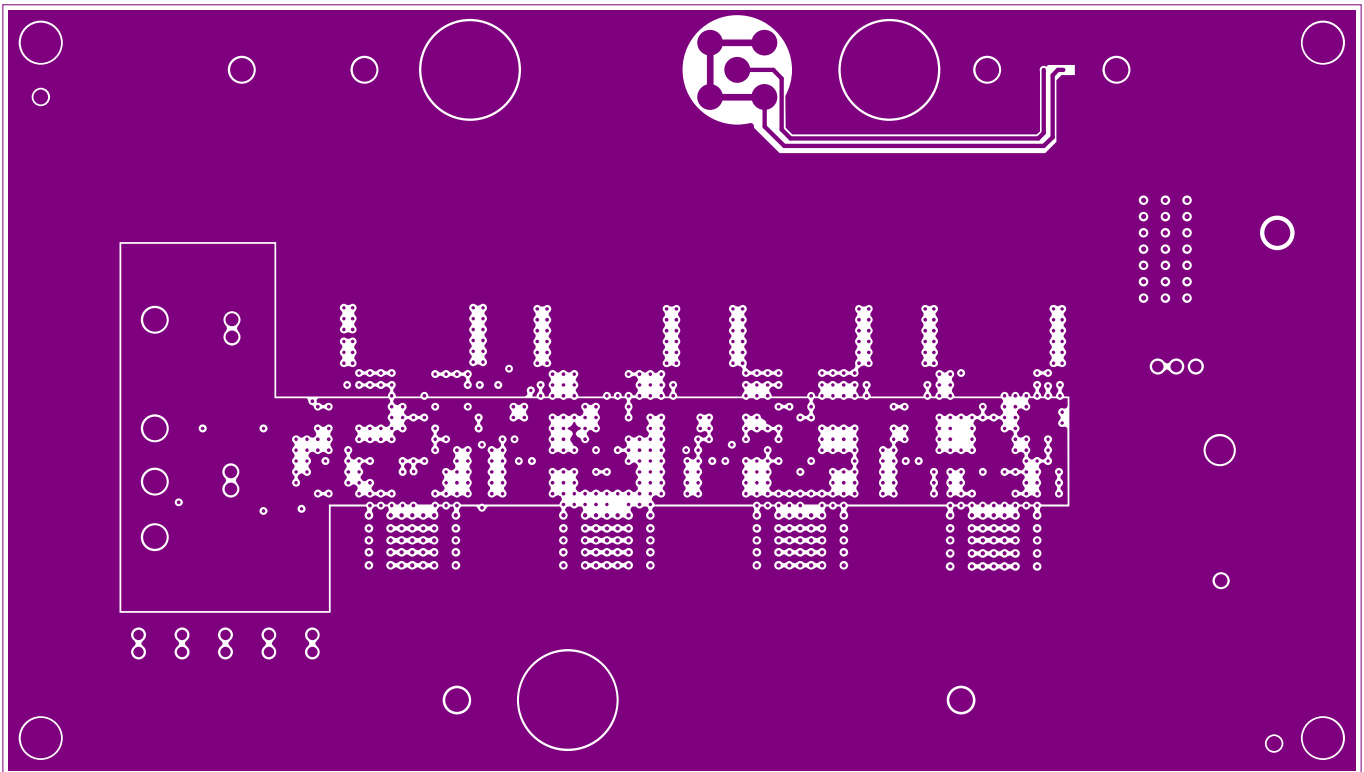


Figure 18: EVK PCB Layer 5

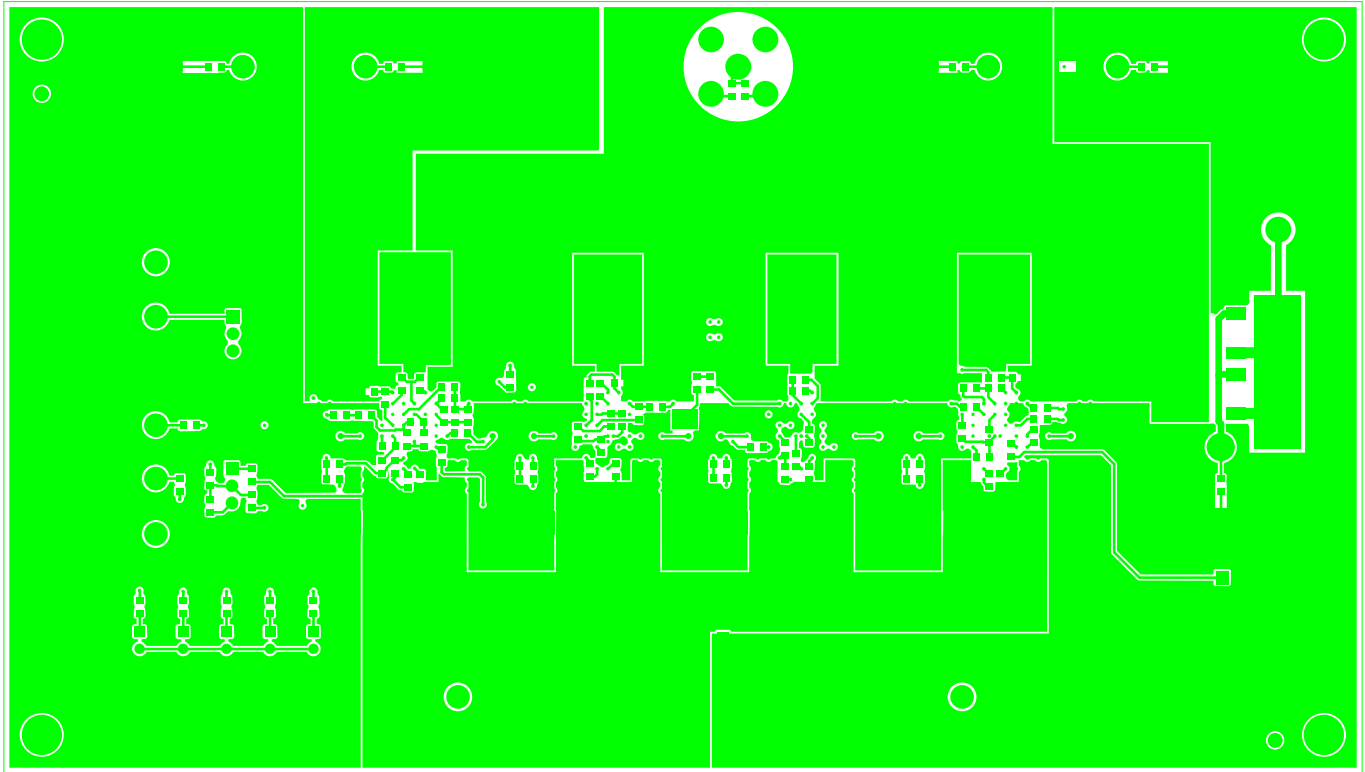


Figure 19: EVK PCB Layer 6

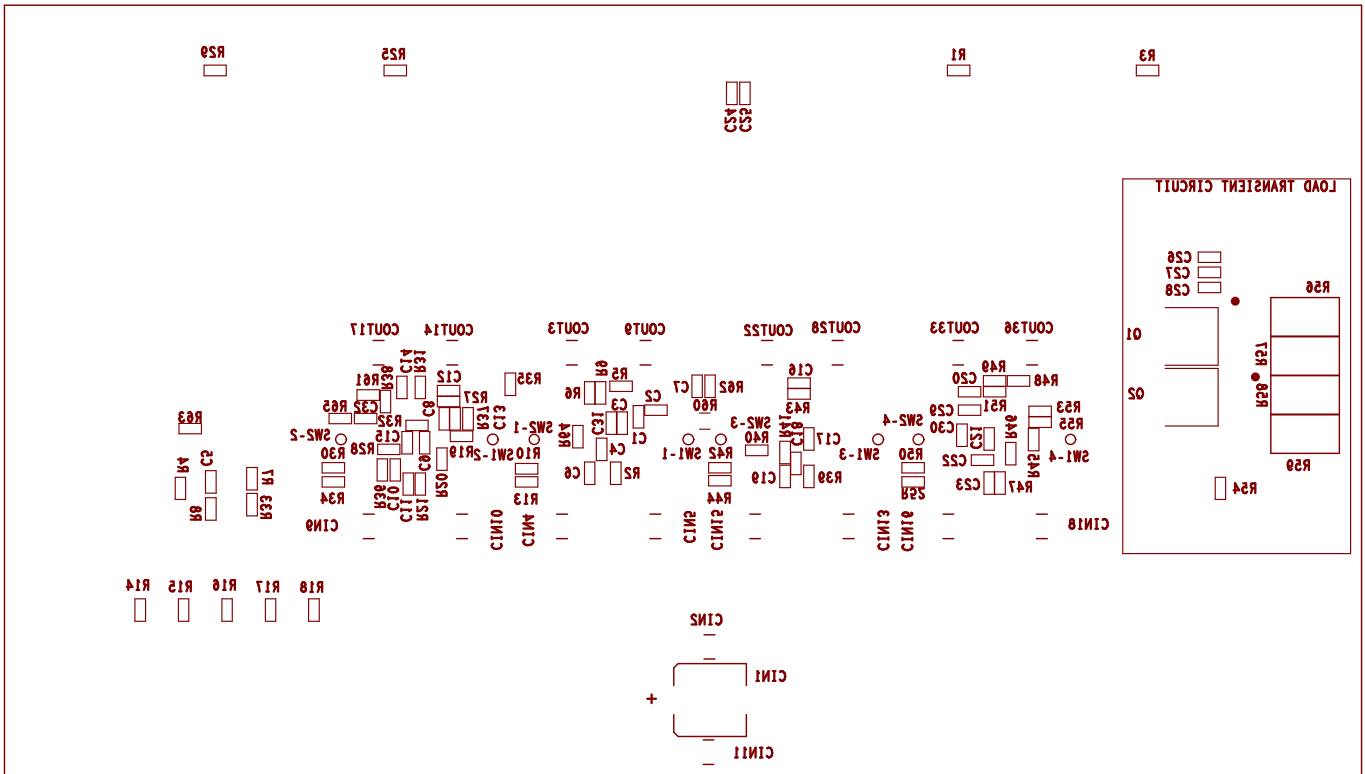


Figure 20: EVK PCB Silkscreen Bottom

Quad MxL7218 EVK Bill of Materials

Table 6: EVK Bill of Materials

Item	Qty	Reference Designator	Description	Manufacturer / Part Number	Package Size
1	1	PCB	MXL7218 Evaluation Board	MAXLINEAR	
2	4	U1, U2, U3, U4	LGA-144	MAXLINEAR MXL7218	15X15X4.41
3	2	Q1, Q2	MOSFET, N-CH, 40V, 14A	VISHAY SUD50N04	TO-252
4	1	CIN1	CAP ALUM, 150UF,25V, 20%	Nichicon UCD1E151MNL1GS	8.3X8.3MM
5	16	CIN3 - CIN10, CIN12 - CIN19	CERAMIC CAP. 22uF, 25V, X5R, 10%	MURATA GRM32ER61E226KE15L	1210
6	2	CIN2, CIN11	CERAMIC CAP. 1uF, 25V, X7R, 10%	KEMET C1210C105K3RACTU	1210
7	12	COU1, COU5, COU7, COU11, COU15, COU18, COU20, COU24, COU26, COU30, COU34, COU38	CERAMIC CAP. 100uF, 6.3V, X5R, 20%	MURATA GRM32ER60J107ME20L	1210
8	10	COU4, COU6, COU10, COU12, COU19, COU23, COU25, COU29, COU31, COU37	CAP TANT POLY, 470uF, 4V, 12mOhm	PANASONIC 4TPE470MCL	2917(7343)
9	4	C4, C10, C19, C23	CERAMIC CAP. 2.2uF, 10V, X57R, 10%	MURATA GRM188R71A225KE15D	0603
10	6	C6, C11, C18, C22, C27, C28	CERAMIC CAP. 1.0uF, 16V, X7R, 10%	MURATA GCM188R71C105KA64J	0603
11	3	C7, C24, C25	CERAMIC CAP. 0.1uF, 50V, X7R, 10%	MURATA GRM188R71H104KA93D	0603
12	1	C1	CERAMIC CAP., 100pF, 50V, X7R, 10%	VISHAY VITRAMON VJ0603Y101KXACW1BC	0603
13	1	C3	CERAMIC CAP., 1500pF, 50V, X7R, 10%	AVX Corp 06035C152KAZ2A	0603
14	15	C2, C5, C8, C9, C12 - C17, C20, C21, C26, C29, C30	DNP	DNP	DNP
15	4	R1, R3, R25, R29	Resistor 10.0 Ohm, 1/10W,1%,SMD	PANASONIC ERJ-3EKF10R0V	0603
16	2	R4, R54	Resistor 10.0K Ohm, 1/10W,1%,SMD	PANASONIC ERJ-3EKF1002V	0603
17	14	R6, R19, R20, R27, R28, R32, R33 - R35, R40, R45, R46, R62, R63	Resistor 0.00 Ohm, Jumper, 1/10W, SMD	PANASONIC ERJ-3GEY0R00V	0603
18	1	R15	Resistor 90.9K Ohm, 1/10W,1%,SMD	PANASONIC ERJ-3EKF9092V	0603

Table 6: EVK Bill of Materials (Continued)

Item	Qty	Reference Designator	Description	Manufacturer / Part Number	Package Size
19	1	R16	Resistor 60.4K Ohm, 1/10W,1%,SMD	PANASONIC ERJ-3EKF6041V	0603
20	4	R22 - R24, R26	RES 0 OHM JUMPER 2010	VISHAY WSL201000000ZEA9	2010
21	1	R17	Resistor 40.2K Ohm, 1/10W,1%,SMD	PANASONIC ERJ-3EKF4022V	0603
22	1	R18	Resistor 30.1K Ohm, 1/10W,1%,SMD	PANASONIC ERJ-3EKF3012V	0603
23	1	R60	Resistor 0.00 Ohm, Jumper, 1/4W, SMD	PANASONIC ERJ-8GEY0R00V	1206
24	2	R56, R57	Resistor 0.01Ohm, 2W,1%, SMD	ROHM PMR100HZPFU10L0	2512
25	4	R9, R31, R43, R51	RES, 0603 100k 1% 1/10W	VISHAY CRCW0603100KFKEA	0603
26	5	R2, R14, R21, R39, R47	Resistor 121K Ohm, 1/10W,1%,SMD	PANASONIC ERJ-3EKF1213V	0603
27	1	R7	Resistor 10K Ohm, 1/10W,1%,SMD	PANASONIC ERJ-3EKF1002V	0603
28	1	R8	Resistor 3.24K Ohm, 1/10W,1%,SMD	PANASONIC ERJ-3EKF3241V	0603
29	14	R5, R10, R30, R37, R38, R42, R44, R48 - R50, R52, R53, R55, R61	DNP	DNP	DNP
30	2	R58, R59	DNP	DNP	DNP
31	11	E1 - E4, E6 - E9, E12, E13, E22	Terminal Turret Single Solder Terminal	Mill-Max Corp. 2308-2-00-80-00-00-07-0	
32	2	E19, E20	Terminal Turret Connector	Mill-Max Corp. 2501-2-00-80-00-00-07-0	2.39mm
33	8	E5, E10, E11, E14 - E18	DNP	DNP	DNP
34	1	E40	Single Pin	Würth Elektronik 61300111121	2.54mm
35	2	JP1, JP2	3 Pin Header Single Row	Würth Elektronik 62000311121	2MM
36	2	J7, J8	BNC Connector RCPT	DNP 112404	Through Hole
37	5	JP4 - JP8	2 Pin Header Single Row	Würth Elektronik 62000211121	2MM
38	6	J1 - J6	Broaching Stud	DNP KFH-032-10ET	0.189"



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