MIC21LV33 Evaluation Board User's Guide

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Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our website (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXXXXA", where "XXXXXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MIC21LV33 Evaluation Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Website
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the MIC21LV33 Evaluation Board as a development tool. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MIC21LV33 Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with the MIC21LV33 Evaluation Board and a description of each function.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MIC21LV33 Evaluation Board.
- **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the MIC21LV33 Evaluation Board.
- **Appendix C. "Board Waveforms and Performance Curves"** – Includes the board waveforms and performance curves for the MIC21LV33 Evaluation Board.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

RECOMMENDED READING

This user's guide describes how to use the MIC21LV33 Evaluation Board, EV93M52A. Another useful document is listed below. The following Microchip document is available and recommended as a supplemental reference resource.

- **MIC21LV33 Data Sheet – *"36V Dual Phase, Advanced COT Buck Controller with HyperLight Load® and Phase Shedding"* (DS20006512).**

THE MICROCHIP WEBSITE

Microchip provides online support via our website at www.microchip.com. This website is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the website contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the website at:
http://www.microchip.com/support.

DOCUMENT REVISION HISTORY

Revision A (October 2021)

- Initial release of this document.

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Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MIC21LV33 Evaluation Board and covers the following:

- MIC21LV33 Device Overview
- MIC21LV33 Device Key Features
- MIC21LV33 Evaluation Board Kit Contents

1.2 MIC21LV33 DEVICE OVERVIEW

The MIC21LV33 is constant on-time, dual phase synchronous buck controller featuring a unique adaptive ON-time control architecture with Hyperlight load and phase shedding features enabled. The MIC21LV33 can be used with external MOSFETs and output filter to create Dual phase single output, high current switch mode power supply. MIC21LV33 operates over an input supply range from 4.5V to 36V and can be used to supply up to 50A of output current. The output voltage is adjustable down to 0.6V with a guaranteed accuracy of ±1%. The device operates with programmable switching frequency from 100 kHz to 800 kHz per phase. The MIC21LV33 is available in a 32-pin 5 mm x 5 mm QFN with a junction operating range from –40°C to +125°C.

1.3 MIC21LV33 DEVICE KEY FEATURES

- Input Voltage Range: 4.5V to 36V
- Adjustable Output From 0.6V To 28V
- Adaptive Constant on Time Control
  - High Delta V Operation
  - Any Capacitor™ Stable
- 0.6V Internal Reference with ±1% Accuracy
- Ripple Injection from Third Node, allowing Greater Than 50% Duty Cycles
- Hyperlight Load and Phase Shedding
- Automatic Phase Shedding of Secondary Phase
- Accurate Current Balancing Between Phases
- Accurate Phasing Between Phases that Are Always 180° Out Of Phase
- 100 kHz To 800 kHz Switching Frequency Per Phase
- High Voltage Internal 5V LDO for Single Supply Operation
- Secondary LDO for Improved System Efficiency
- Supports Start Up To Pre-bias Output
- Remote Sense Amplifier for Tight Output Regulation
- Supports Adaptive Voltage Positioning (AVP) or Droop
- Precision Enable Function For Low Standby Current
- External Programmable Soft Start To Reduce Inrush Current
- Programmable Current Limit And Hiccup Short Circuit Protection
- Thermal Shut Down With Hysteresis

- Die Temperature Sense on MIC21LV33
- Compact size: 5 x 5 mm 32-pin QFN Package
- -40°C to +125°C Junction Temperature Range

1.4 MIC21LV33 EVALUATION BOARD KIT CONTENTS

The MIC21LV33 Evaluation Board kit includes the:

- MIC21LV33 Evaluation Board PCB
- Important Information Sheet
- China RoHS Declaration

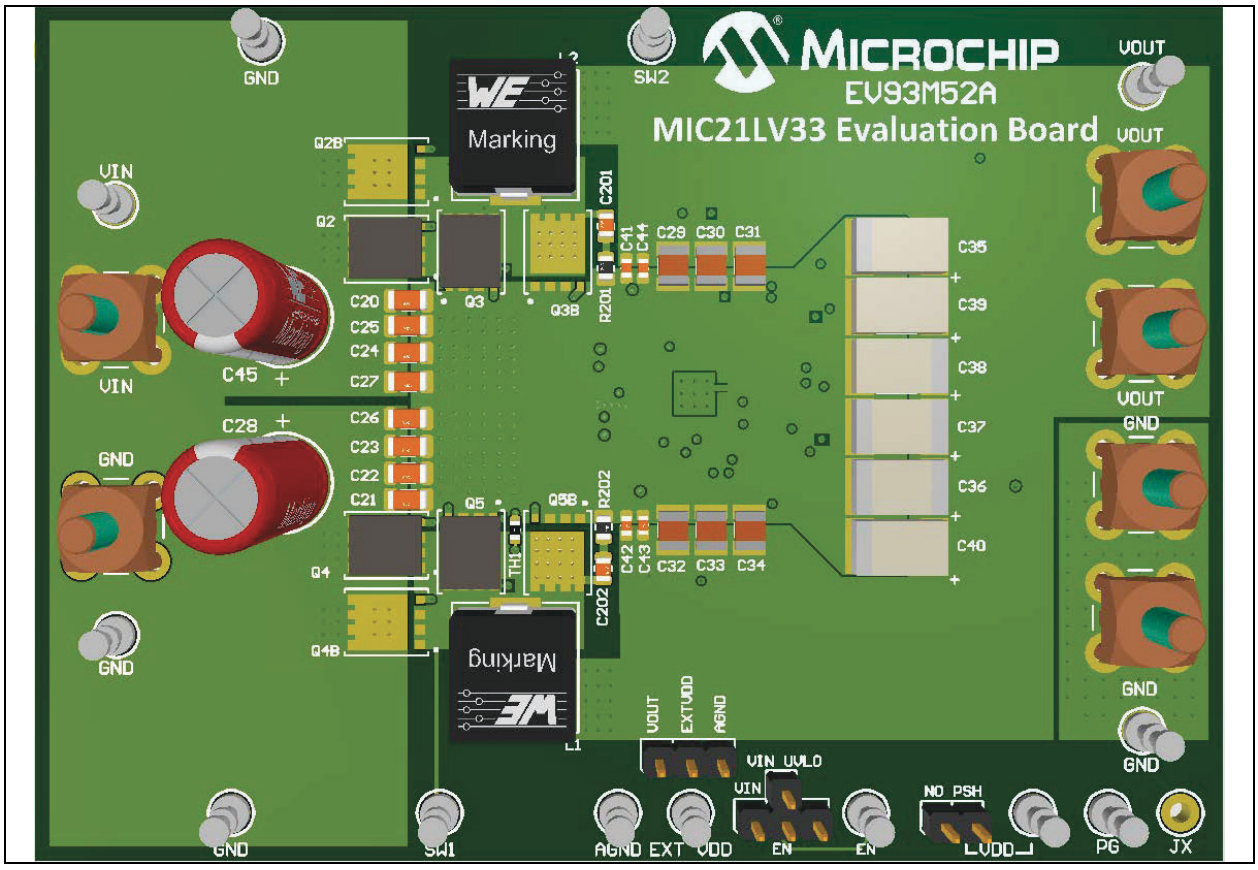

FIGURE 1-1: *Typical MIC21LV33 Evaluation Board Evaluation Board, EV93M52A (Top 3D View).*

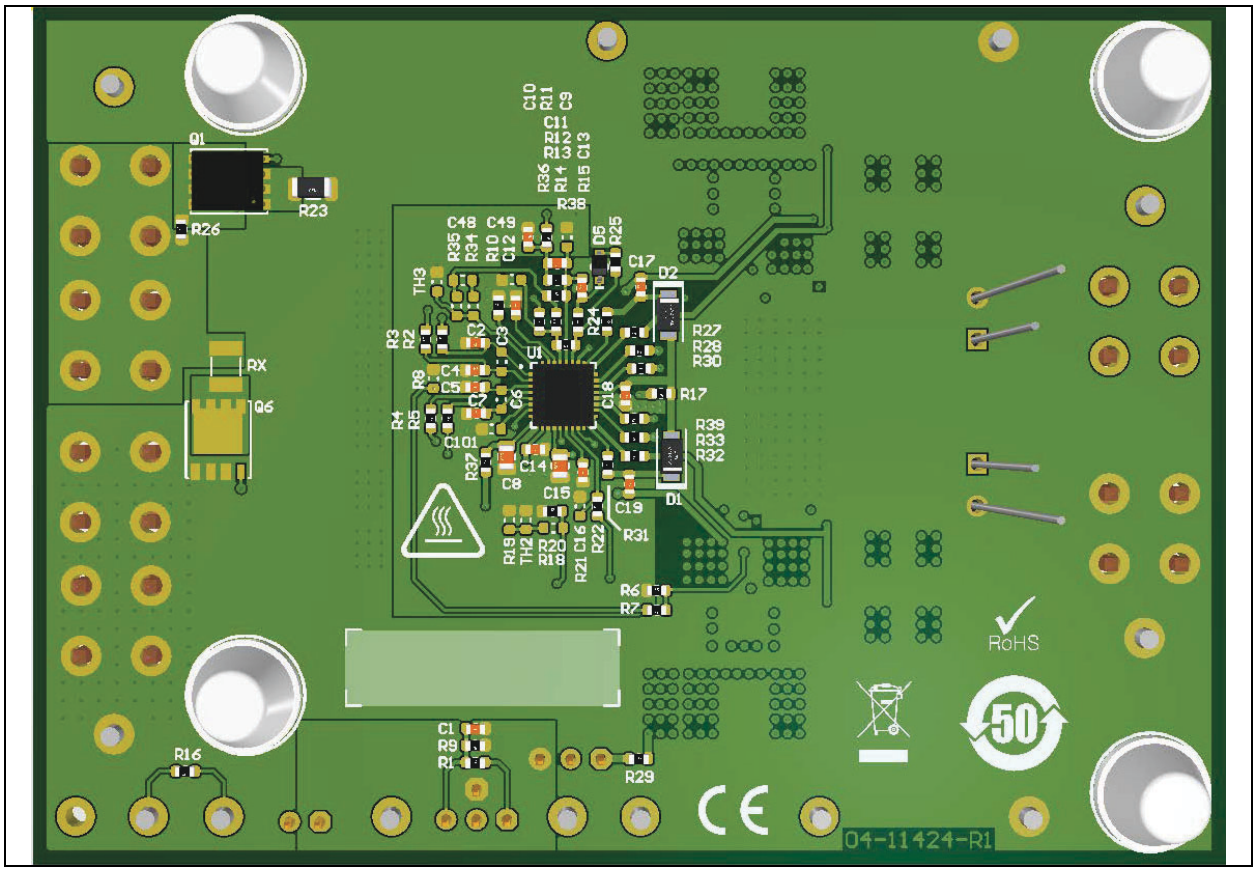

FIGURE 1-2: *Typical MIC21LV33 Evaluation Board, EV93M52A (Bottom 3D View).*

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Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MIC21LV33 Evaluation Board (EV93M52A) is fully assembled and tested to evaluate and demonstrate the MIC21LV33 part capabilities. The board is based on a buck topology and can deliver an adjustable output voltage between 0.6 and 28V, with a maximum current of 50A when supplied with 4.5-36V at the input. However, the board is tuned and optimized for 0.82V/40A output.

2.1.1 Powering the MIC21LV33 Evaluation Board

The board is connected directly to a variable DC power supply that can deliver 4.5 to 36V DC and an output capability of at least 10A. The load could either be a power resistor or an electronic load. In the case of an electronic load, the maximum current that can be drawn is reduced due to the low output voltage.

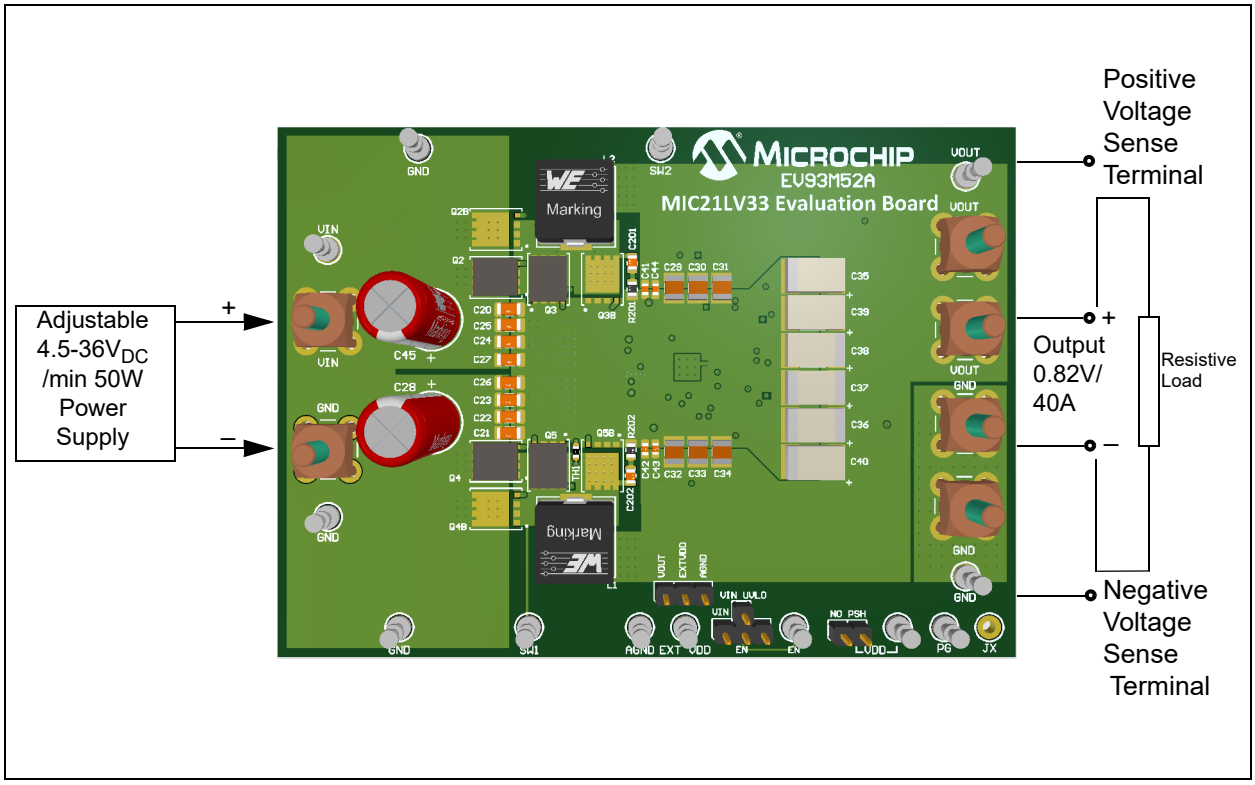


FIGURE 2-1: *MIC21LV33 Evaluation Board Connection Digram.*

2.2 SETUP AND CONFIGURATION

The output voltage delivered by the MIC21LV33 Evaluation Board is set to 0.82V. To enable the IC, a jumper on J10 must be placed vertically, between J10-1and J1-2 as shown in Figure 2-1. MIC21LV33 also features an internal high voltage LDO. To bypass this LDO, a jumper can be plugged on J2-1(VOUT) and J2-2(EXTVDD), but only if the board output voltage is greater than 4.7V. If the internal high voltage LDO is to be used, the jumper should be placed on J2-2 (EXTVDD) and J2-3 (AGND) or left unconnected. EXTVDD can also be connected to an external voltage through the test pin provided.

EXAMPLE 2-1: CALCULATION OF R_{ILIM} FOR BOTTOM MOSFET R_{DSON} CURRENT SENSING

$$I_{LIM} = \frac{0.3V - (0.25 \cdot V_{ILIM})}{R_{dson}} \quad (1)$$

$$V_{ILIM} = 1.2V - (4 \cdot R_{dson} \cdot I_{LIM}) \quad (2)$$

For I_{LIM} = 20A per phase, R_{dson} = 1 mΩ at 25°C, using equation (2)
V_{ILIM} = 1.2V - (4 * 1 mΩ * 20A).

To obtain 1.12V on the ILIM pin with a 10 uA constant-current source over a constant temperature, a programming equivalent resistor R_{ILIM} = 1.12V/10µA = 112 kΩ is required.

EXAMPLE 2-2: CALCULATION OF THE FEEDBACK DIVIDER FOR 0.82V

$$R_{FB(BOT)} = \frac{R_{FB(TOP)}}{\frac{V_{OUT}}{V_{REF}} - 1} \quad (3)$$

For V_{OUT} = 0.82V having $R_{FB(TOP)}$ = 20 kΩ and V_{REF} = 0.6V, using equation (3)
$R_{FB(BOT)}$ = 56.6 kΩ. Due to tolerances, a 56 kΩ and 300Ω resistor in series give a calculated output voltage of 0.82V.

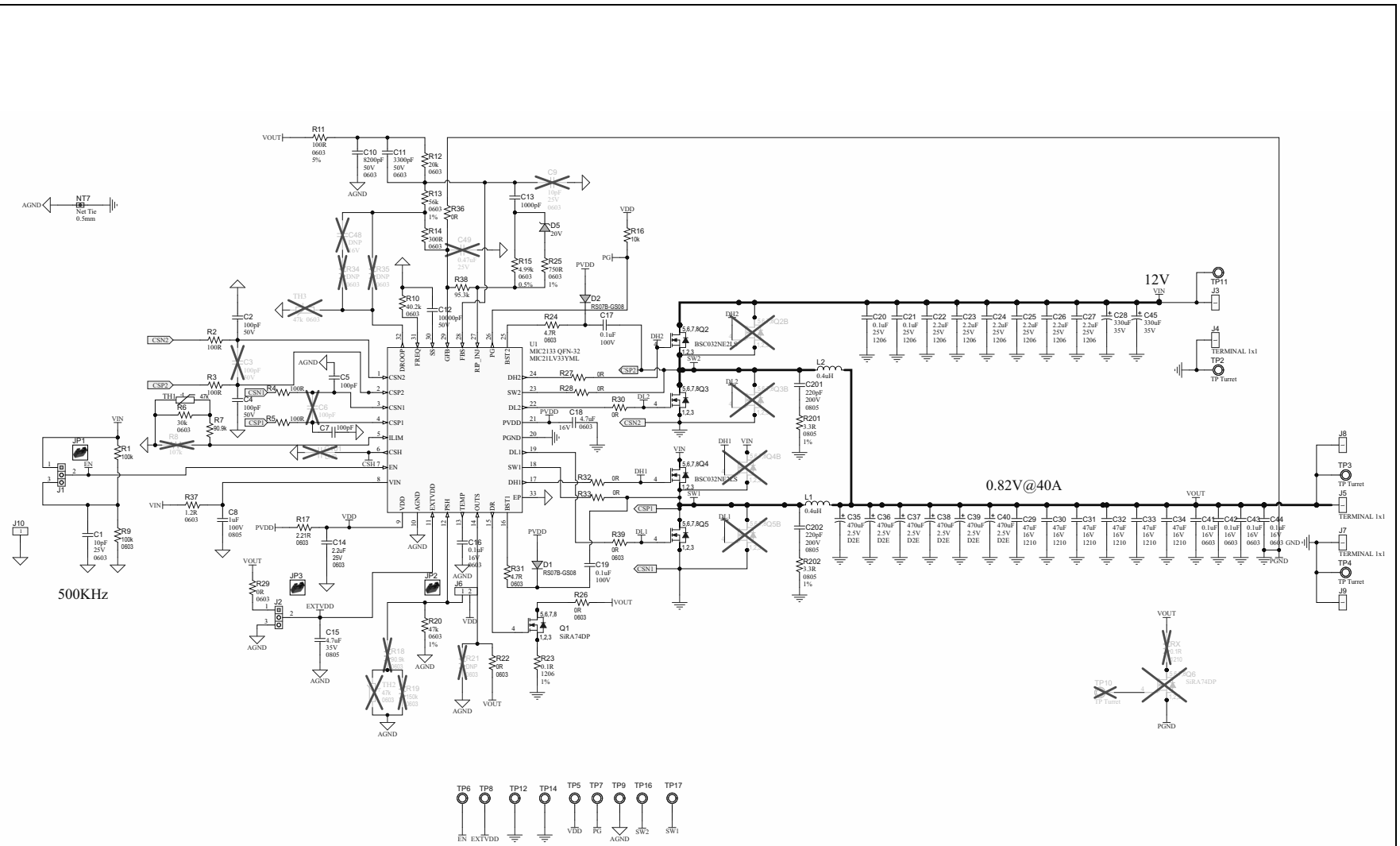
Appendix A. Schematic and Layouts

A.1 INTRODUCTION

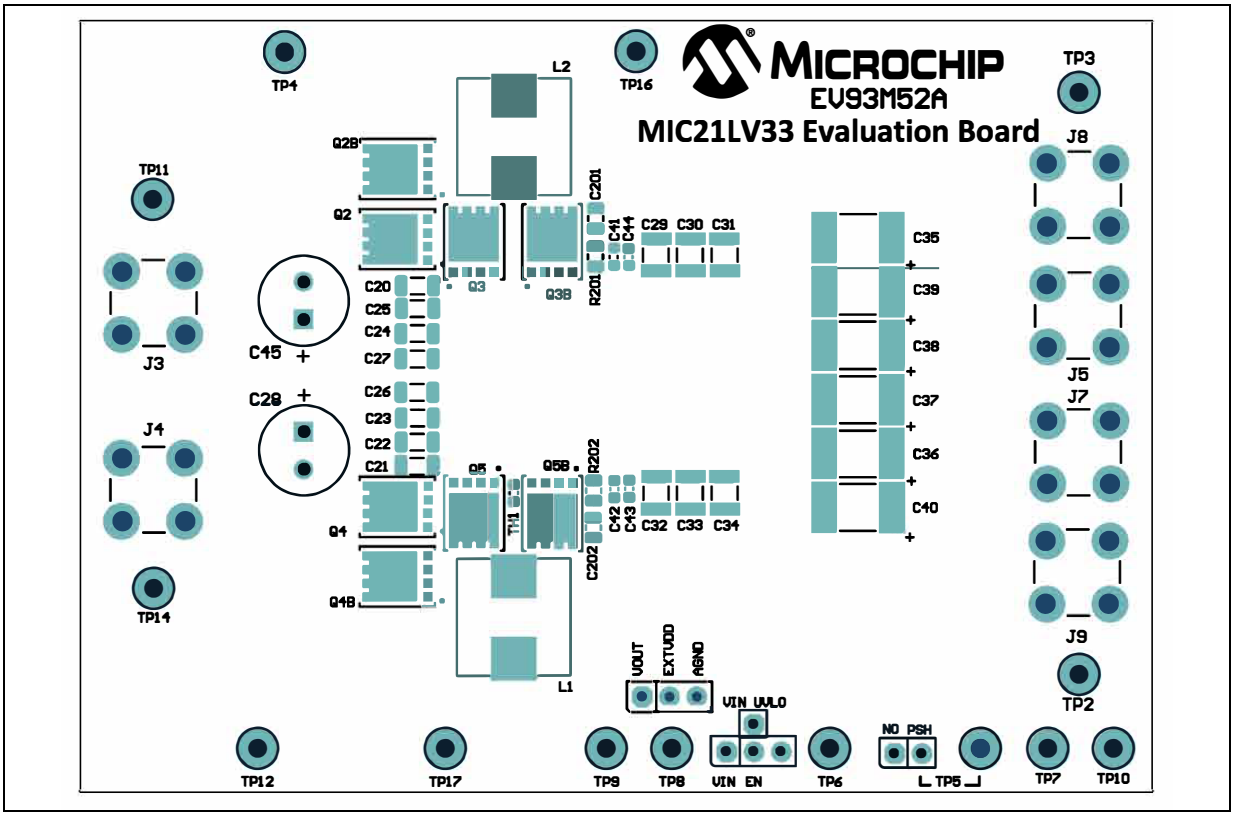
This appendix contains the schematics and layouts of the MIC21LV33 Evaluation Board:

- EV93M52A Board – Schematic
- EV93M52A Board – Top Silk
- EV93M52A Board – Top Copper and Silk
- EV93M52A Board – Top Copper
- EV93M52A Board – Inner 1 Copper
- EV93M52A Board – Inner 2 Copper
- EV93M52A Board – Inner 3 Copper
- EV93M52A Board – Inner 4 Copper
- EV93M52A Board – Bottom Silk
- EV93M52A Board – Bottom Copper and Silk
- EV93M52A Board – Bottom Copper

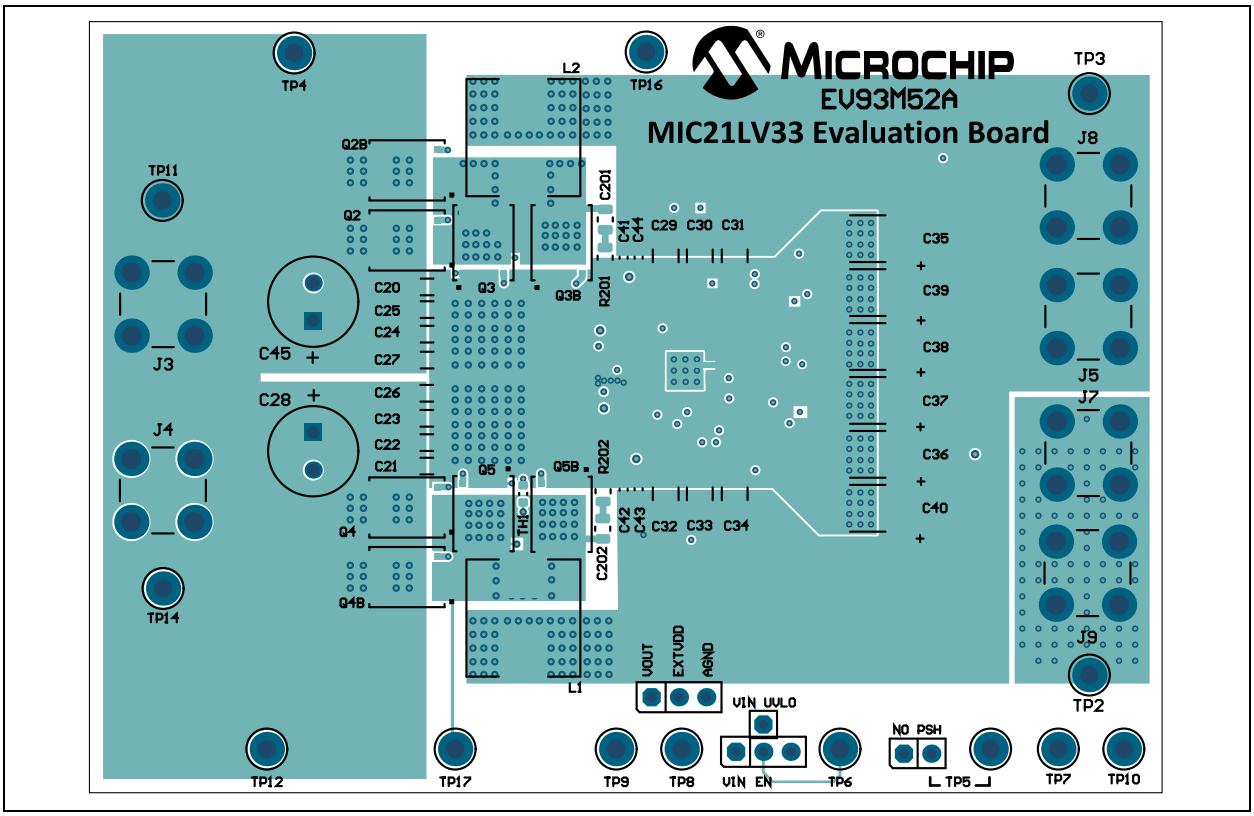
A.2 EV93M52A BOARD – SCHEMATIC



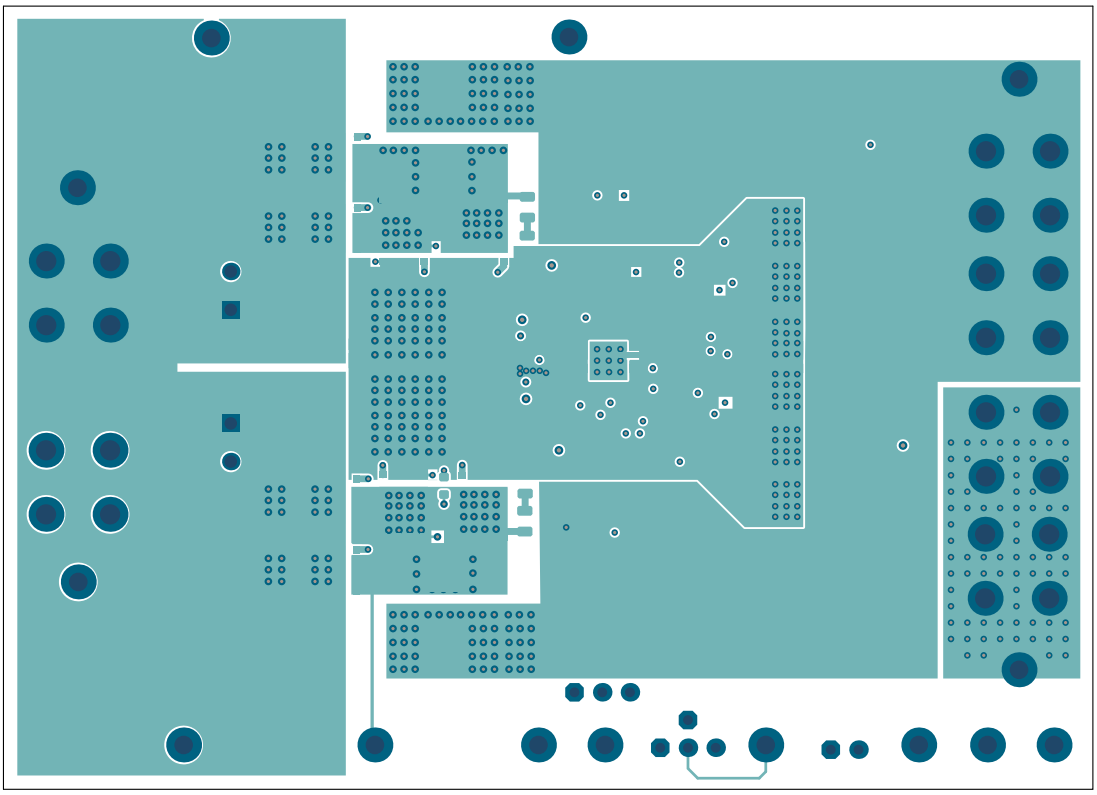
A.3 EV93M52A BOARD – TOP SILK



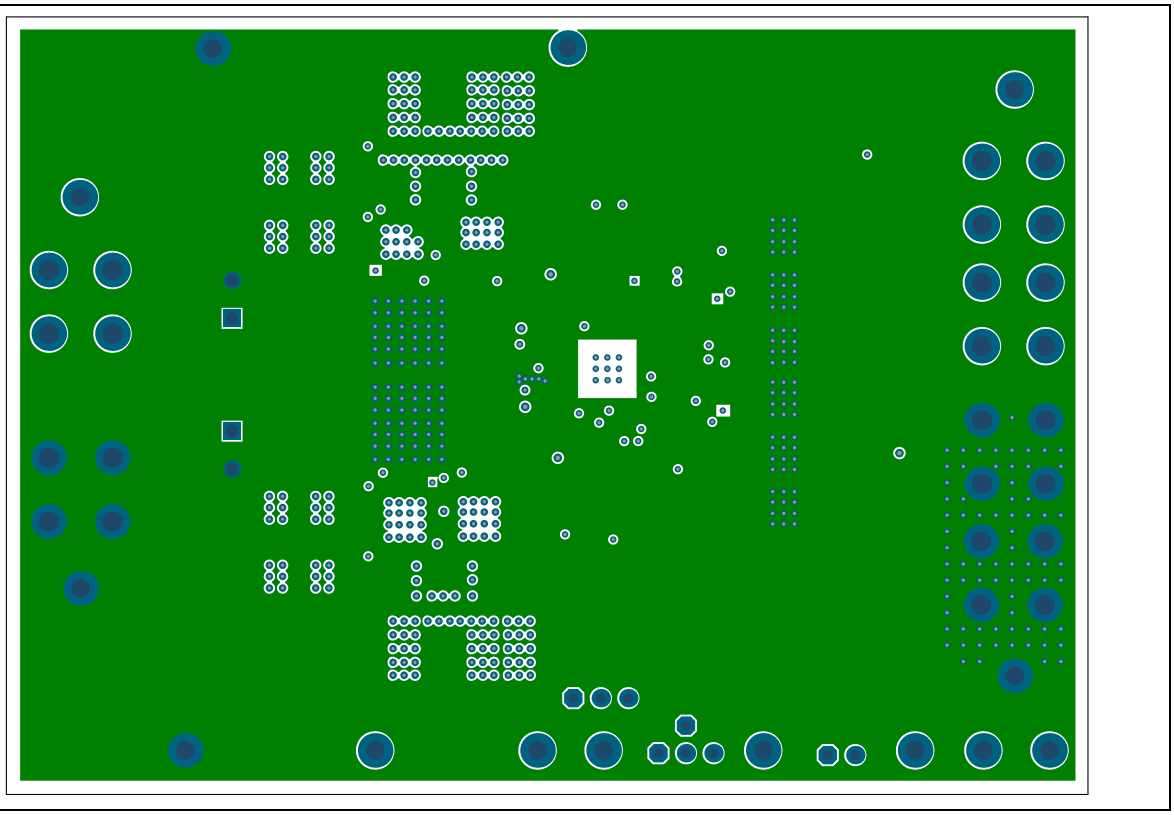
A.4 EV93M52A BOARD – TOP COPPER AND SILK



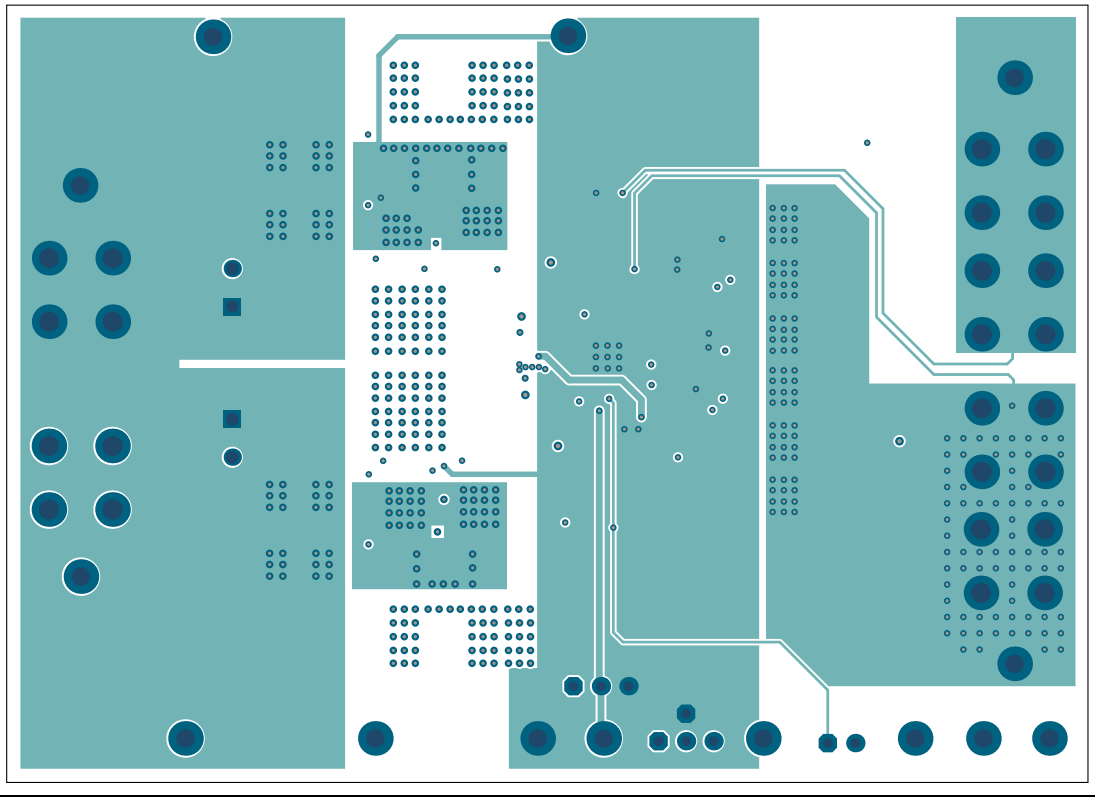
A.5 EV93M52A BOARD – TOP COPPER



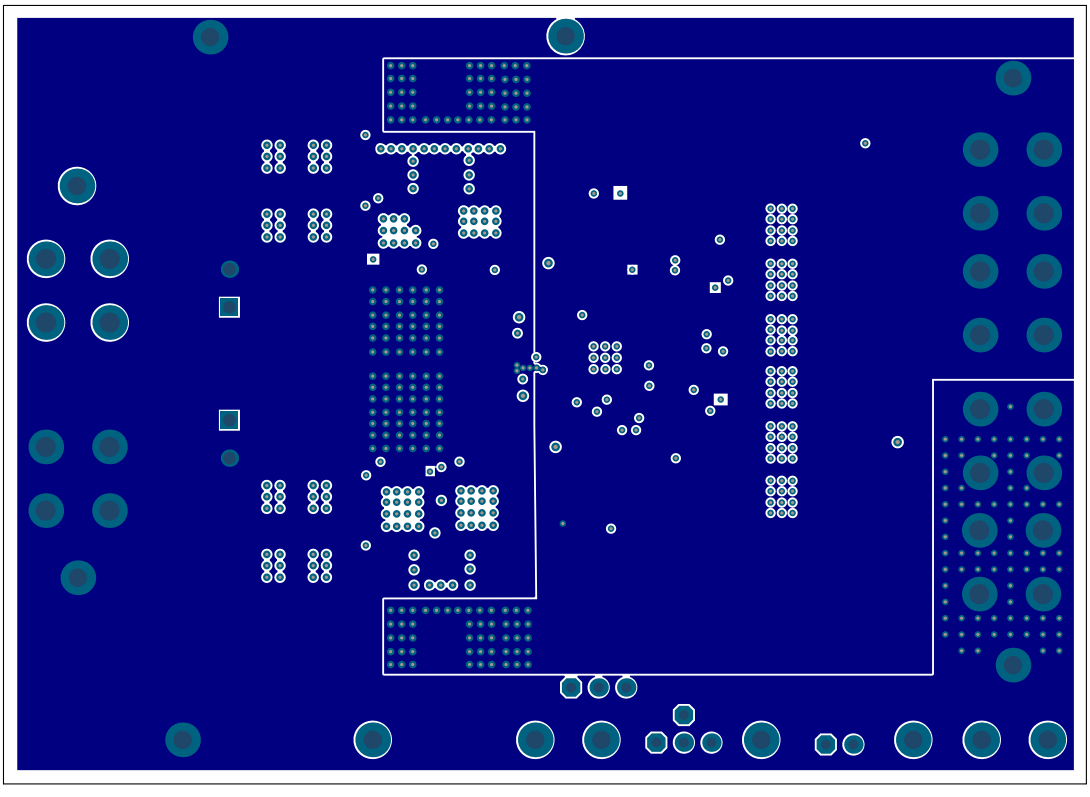
A.6 EV93M52A BOARD – INNER 1 COPPER



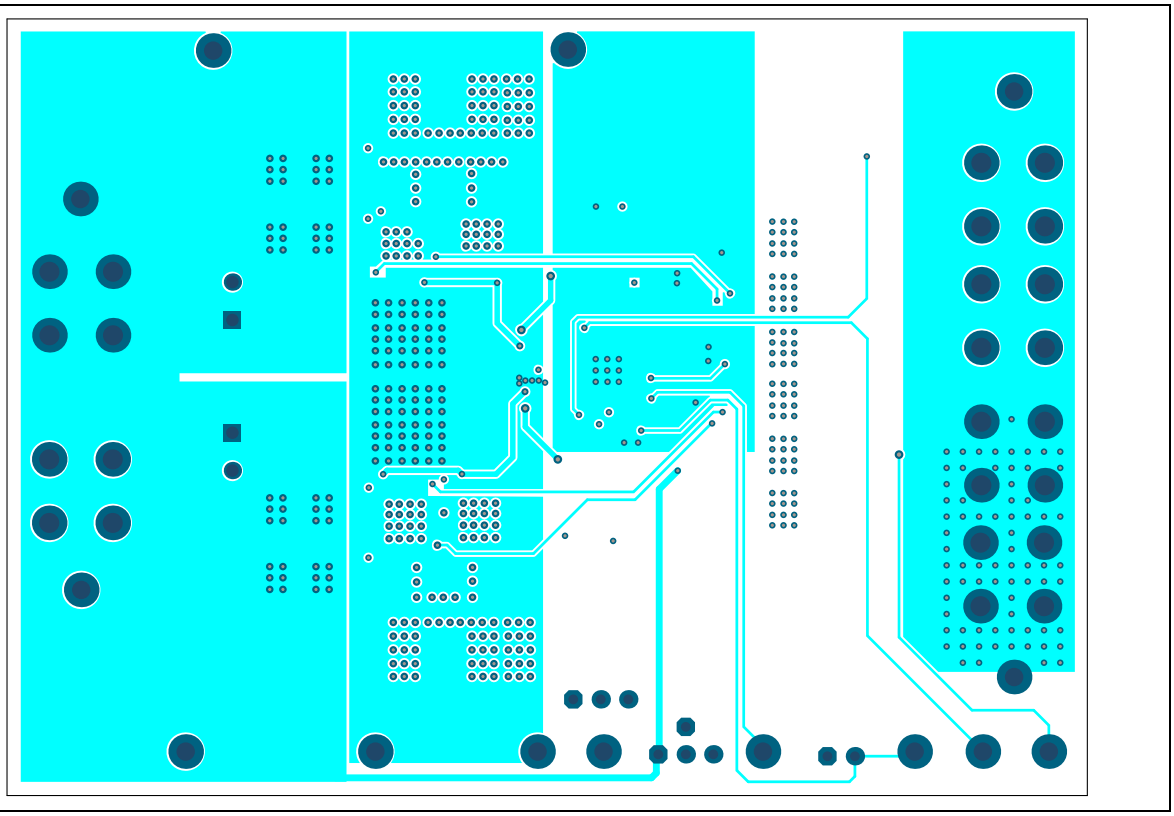
A.7 EV93M52A BOARD – INNER 2 COPPER



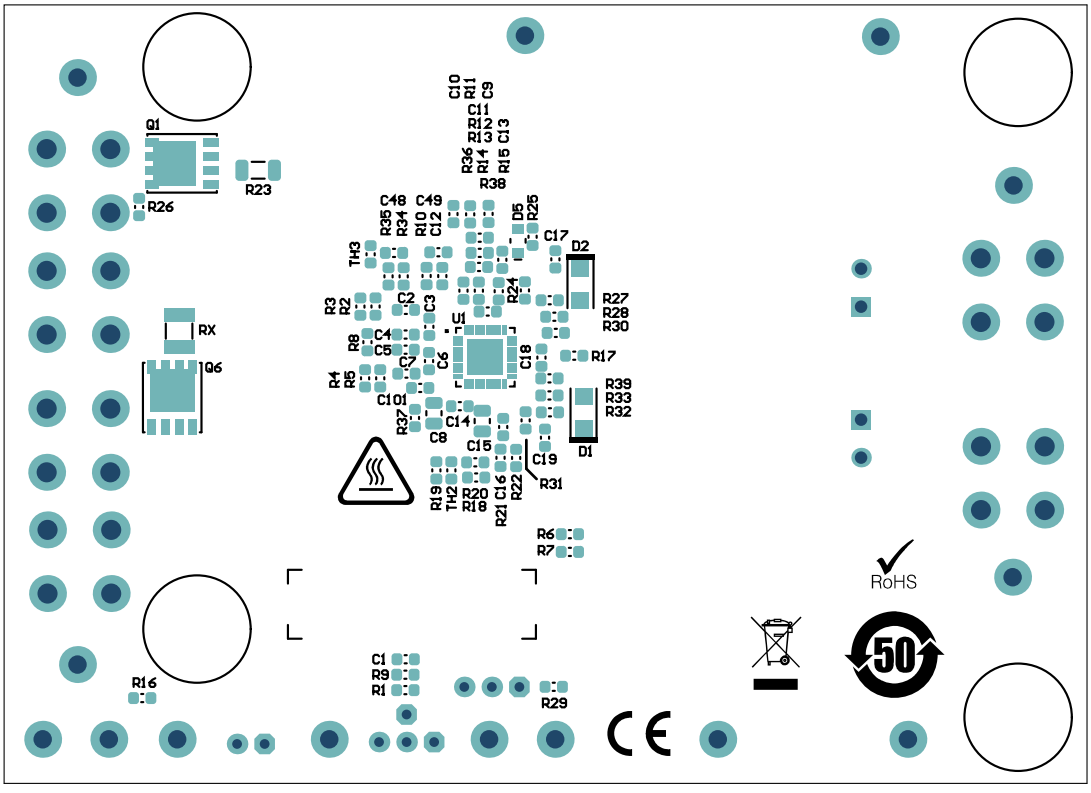
A.8 EV93M52A BOARD – INNER 3 COPPER



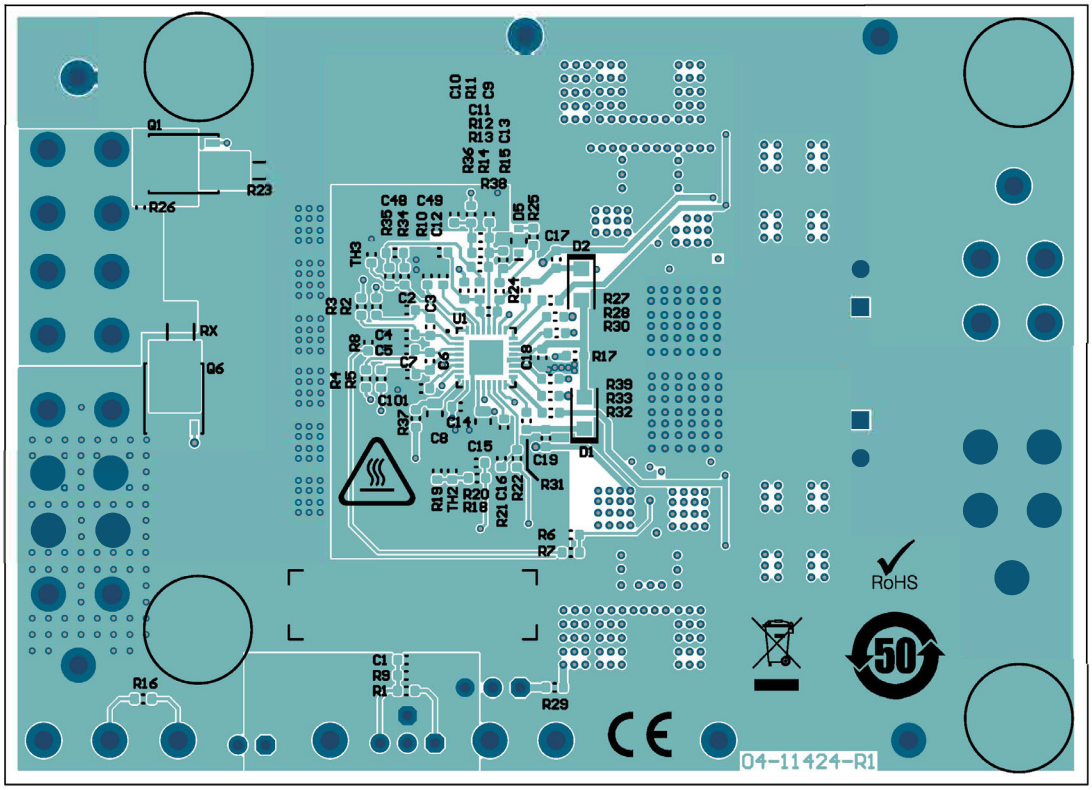
A.9 EV93M52A BOARD – INNER 4 COPPER



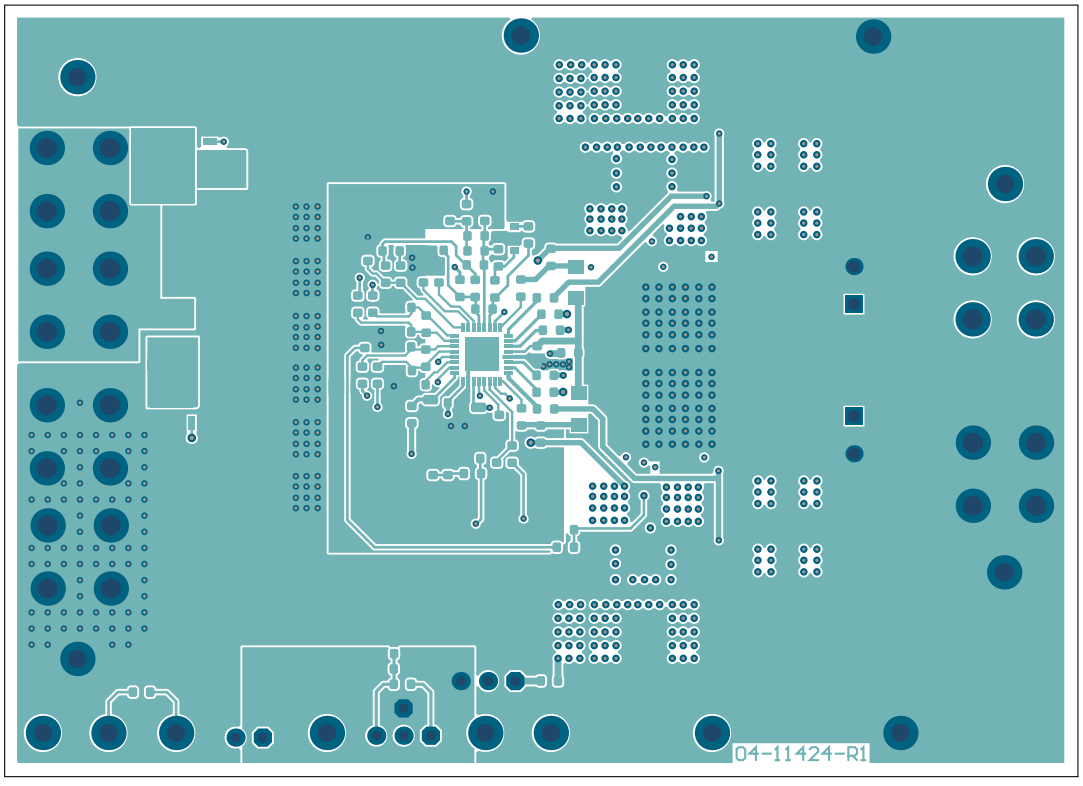
A.10 EV93M52A BOARD – BOTTOM SILK



A.11 EV93M52A BOARD – BOTTOM COPPER AND SILK



A.12 EV93M52A BOARD – BOTTOM COPPER



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Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Manufacturer	Part Number
1	C1	Capacitor, ceramic, 10pF, 25V, 5%, NP0, surface mount, 0603	Wurth Elektronik	885012006032
4	C2, C4, C5, C7	Capacitor, ceramic, 100pF, 50V, 10%, X7R, surface mount, 0603	Wurth Elektronik	885012206077
1	C8	Capacitor, ceramic, 1uF, 100V, 10%, X7S, surface mount, 0805	TDK Corporation	C2012X7S2A105K125AB
1	C10	Capacitor, ceramic, 8200pF, 50V, 5%, X7R, surface mount, 0603	Yageo Corporation	CC0603JRX7R9BB822
1	C11	Capacitor, ceramic, 3300pF, 50V, 10%, X7R, surface mount, 0603	Wurth Elektronik	885012206086
1	C12	Capacitor, ceramic, 10000pF, 50V, 10%, X7R, surface mount, 0603	Wurth Elektronik	885382206002
1	C13	Capacitor, ceramic, 1000pF, 50V, 10%, X7R, surface mount, 0603	Wurth Elektronik	885012206083
1	C14	Capacitor, ceramic, 2.2uF, 25V, 10%, X5R, surface mount, 0603	Murata Electronics®	GRM188R61E225KA12D
1	C15	Capacitor, ceramic, 4.7uF, 35V, 10%, X7R, surface mount, 0805	TDK Corporation	C2012X7R1V475K125AE
5	C16, C41, C42, C43, C44	Capacitor, ceramic, 0.1uF, 16V, 10%, X7R, surface mount, 0603	Wurth Elektronik	885012206046
2	C17, C19	Capacitor, ceramic, 0.1uF, 100V, 10%, X7R, surface mount, 0603	Wurth Elektronik	885012206120
1	C18	Capacitor, ceramic, 4.7uF, 16V, 10%, X5R, surface mount, 0603	TDK Corporation	C1608X5R1C475K080AC
2	C20, C21	Capacitor, ceramic, 0.1uF, 25V, 10%, X7R, surface mount, 1206	Wurth Elektronik	885012208058
6	C22, C23, C24, C25, C26, C27	Capacitor, ceramic, 2.2uF, 25V, 10%, X7R, surface mount, 1206	KEMET	C1206C225K3RACTU
	C28, C45	Capacitor, aluminum, 330uF, 35V, 20%, RAD, P3.5D8H20	Wurth Elektronik	860080574014
6	C29, C30, C31, C32, C33, C34	Capacitor, ceramic, 47uF, 16V, 20%, X5R, surface mount, 1210	Wurth Elektronik	885012109011
6	C35, C36, C37, C38, C39, C40	Capacitor, tantalum, 470uF, 2.5V, 20%, 0.007 Ohm, surface mount, D2E	Panasonic® - ECG	2R5TPE470M7
2	C201, C202	Capacitor, ceramic, 220pF, 200V, 5%,C0G,NP0,surfacemount,0805	Wurth Elektronik	885342007001
2	D1, D2	Diode, rectifier, RS07B-GS08, 100V, 500mA, surface mount, DO-219AB	Vishay Semiconductors	RS07B-GS08

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

TABLE B-1: BILL OF MATERIALS (BOM) (CONTINUED)

Qty.	Reference	Description	Manufacturer	Part Number
1	D5	Diode, Zener, MM3Z20VT1G, 20V, 300mW, SOD-323	ON Semiconductor	MM3Z20VT1G
2	J1, J2	Connector, hardware-2.54, male, 1x3, gold, 5.84MH, thru hole, vertical	Amphenol ICC	68000-103HLF
6	J3, J4, J5, J7, J8, J9	Connector, terminal, WE, 74651173R, 50A, male, 1x1, thru hole, vertical	Wurth Elektronik	74651173R
1	J6	Connector, hardware-2.54, male, 1x2, gold, 5.84MH, thru hole, vertical	Amphenol ICC (FCI)	77311-118-02LF
1	J10	Connector, hardware-2.54, male, 1x1, gold, 5.84MH, thru hole, vertical	Samtec, Inc.	TSW-101-07-S-S
2	L1, L2	Inductor, 0.4uH, 24A, 20%, surface mount, L10.5W10.2H4.7, AEC-Q200	Wurth Elektronik	744325040
1	Q1	Transistor, FET N-Channel, SIRA74DP, 40V, 24A, 46.2W, PPAK SO-8	Vishay Siliconix	SIRA74DP-T1-GE3
2	Q2, Q4	Transistor, FET N-Channel, BSC032NE2LS, 25V, 84A, 37W, TDSON-8	Infineon Technologies AG	BSC032NE2LSATMA1
2	Q3, Q5	Transistor, FET N-Channel, BSC010NE2LSIATMA1, 25V, 38A, 96W, TDSON-8	Infineon Technologies AG	BSC010NE2LSIATMA1
2	R1, R9	Resistor, TF, 100k, 1%, 1/8W, surface mount, 0603	Vishay Beyschlag	MCT06030C1003FP500
4	R2, R3, R4, R5	Resistor, TKF 100R 1% 1/10W surface mount, 0603	Panasonic - ECG	ERJ3EKF1000V
1	R6	Resistor, TKF 30k 5% 1/10W surface mount, 0603	Panasonic - ECG	ERJ3GEYJ303V
1	R7	Resistor, TKF 90.9k 1% 1/10W surface mount, 0603	Panasonic - ECG	ERJ-3EKF9092V
1	R10	Resistor, TKF 40.2k 1% 1/10W surface mount, 0603	Yageo Corporation	RC0603FR-0740K2L
1	R11	Resistor, TKF 100R 5% 1/10W surface mount, 0603	Vishay/Dale	CRCW0603100RJNEA
1	R12	Resistor, TKF 20k 1% 1/10W surface mount, 0603	Panasonic - ECG	ERJ3EKF2002V
1	R13	Resistor, TKF 56k 1% 1/10W surface mount, 0603	Stackpole Electronics Inc.	RMCF0603FT56K0
1	R14	Resistor, TKF 300R 1% 1/10W surface mount, 0603	Yageo Corporation	RC0603FR-07300RL
1	R15	Resistor, TF 4.99k 0.5% 0.15W surface mount, 0603 AEC-Q200	Vishay Beyschlag	MCT0603MD4991DP500
1	R16	Resistor, TF, 10k, 1%, 1/16W, surface mount, 0603	TE Connectivity - Neohm	CPF0603F10KC1
1	R17	Resistor, TF, 2.21R, 0.1%, 1/16W, surface mount, 0603	Stackpole Electronics	RNCF0603BKC2R21

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

TABLE B-1: BILL OF MATERIALS (BOM) (CONTINUED)

Qty.	Reference	Description	Manufacturer	Part Number
1	R20	Resistor, TKF, 47k, 1%, 1/4W, surface mount, 0603	Vishay	CRCW060347K0FKEAHP
10	R22, R26, R27, R28, R29, R30, R32, R33, R36, R39	Resistor, TKF, 0R, 1/10W, surface mount, surface mount, 0603	Panasonic - ECG	ERJ-3GEY0R00V
1	R23	Resistor, TF, 0.1R, 1%, 1/2W, surface mount, 1206	Susumu Co., LTD.	RL1632R-R100-F
2	R24, R31	Resistor, TKF, 4.7R, 1%, 1/10W, surface mount, 0603	Panasonic - ECG	ERJ-3RQF4R7V
1	R25	Resistor, TKF, 750R, 1%, 1/10W, surface mount, 0603	Vishay	CRCW0603750RFKEA
1	R37	Resistor, TKF, 1.2R, 1%, 1/10W, AEC-Q200, surface mount, 0603	Panasonic - ECG	ERJ-3RQF1R2V
1	R38	Resistor, TKF, 95.3k, 1%, 1/10W, surface mount, 0603	Panasonic - ECG	ERJ-3EKF9532V
2	R201, R202	Resistor, TKF, 3.3R, 1%, 1/8W, surface mount, 0805, AEC-Q200	Stackpole Electronics	RMCF0805FT3R30
1	TH1	Resistor, Thermistor, 47k, 1%, 100mW, surface mount, 0603	Murata Electronics®	NCU18WB473F60RB
13	TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP11, TP12, TP14, TP16, TP17	Connector, TP Pin, tin, thru-hole	Harwin Plc.	H2121-01

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

TABLE B-2: BILL OF MATERIALS (BOM) – MICROCHIP PARTS

Qty.	Reference	Description	Manufacturer	Part Number
1	U1	Microchip, Analog, 36V, Dual Phase COT Switching Buck Controller, MIC21LV33YML-TR QFN-32	Microchip Technology Inc.	MIC21LV33YML-TR

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

TABLE B-3: BILL OF MATERIALS (BOM) – MECHANICAL PARTS

Qty.	Reference	Description	Manufacturer	Part Number
3	JP1, JP2, JP3	Mechanical, hardware, jumper, 2.54mm, 1x2	3M	969102-0000-DA
1	LABEL	1 label, assembly w/revision level (small modules), per MTS-0002	–	–
4	PAD1, PAD2, PAD3, PAD4	Mechanical, hardware, rubber pad, cylindrical, 0.374" x 0.189", clear	Essentra Plc.	RBS-35
1	PCB1	Printed Circuit Board	–	04-11424-R1

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

TABLE B-4: BILL OF MATERIALS (BOM) – DO NOT POPULATE PARTS

Qty.	Reference	Description	Manufacturer	Part Number
0	C3, C6	Capacitor, ceramic, 100pF, 50V, 10%, X7R, surface mount, 0603	Wurth Elektronik	885012206077
0	C9	Capacitor, ceramic, 10pF, 25V, 5%, NP0, surface mount, 0603	Wurth Elektronik	885012006032
0	C48	Capacitor, ceramic, 1uF, 16V, 10%, X5R, surface mount, 0603	Kyocera AVX	0603YD105KAT2A/4K
0	C49	Capacitor, ceramic, 0.47uF, 25V, 10%, X7R, surface mount, 0603	Murata Electronics®	GRM188R71E474KA12D
0	C101	Capacitor, ceramic, 0.1uF, 16V, 10%, X7R, surface mount, 0603	Taiyo Yuden	CEEMK107B7104KA-T
0	Q2B, Q4B	Transistor, FET, N-Channel, BSC032NE2LS, 25V, 84A, 37W, TDSON-8	Infineon	BSC032NE2LSATMA1
0	Q3B, Q5B	Transistor, FET, N-Channel, BSC010NE2LSIATMA1, 25V, 38A, 96W, TDSON-8	Infineon	BSC010NE2LSIATMA1
0	Q6	Transistor, FET, N-Channel, SIRA74DP, 40V, 24A, 46.2W, PPAK, SO-8	Vishay Siliconix	SIRA74DP-T1-GE3
0	R8	Resistor, TKF, 107k, 1%, 1/10W, surface mount, 0603	Panasonic - ECG	ERJ-3EKF1073V
0	R18	Resistor, TKF, 90.9k, 1%, 1/10W, surface mount, 0603	Panasonic - ECG	ERJ-3EKF9092V
0	R19	Resistor, TKF, 150k, 1%, 1/8W, surface mount, 0603	KOA Speer	SG73S1JTTD1503F
0	R21	Resistor, TKF, 0R, 1/10W, surface mount, 0603	Panasonic - ECG	ERJ-3GEY0R00V
0	R34, R35	Resistor, TKF, 39k,1%, 1/10W, surface mount, 0603	Panasonic - ECG	ERJ-3EKF3902V
0	RX	Resistor, TKF, 0.1R, 1%, 1/3W, surface mount, 1210	Panasonic - ECG	ERJ-L14KF10CU
0	TH2, TH3	Resistor, Thermistor, 47k, 1%, 100mW, surface mount, 0603	Murata Electronics®	NCU18WB473F60RB
0	TP10	Connector, TP, Pin, Tin, thru-hole	Harwin	H2121-01
0	Q6	Transistor, FET, N-Channel, SIRA74DP, 40V, 24A, 46.2W, PPAK, SO-8	Vishay Siliconix	SIRA74DP-T1-GE3
0	R8	Resistor, TKF, 107k, 1%, 1/10W, surface mount, 0603	Panasonic - ECG	ERJ-3EKF1073V

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

Appendix C. Board Waveforms and Performance Curves

C.1 MAIN WAVEFORMS

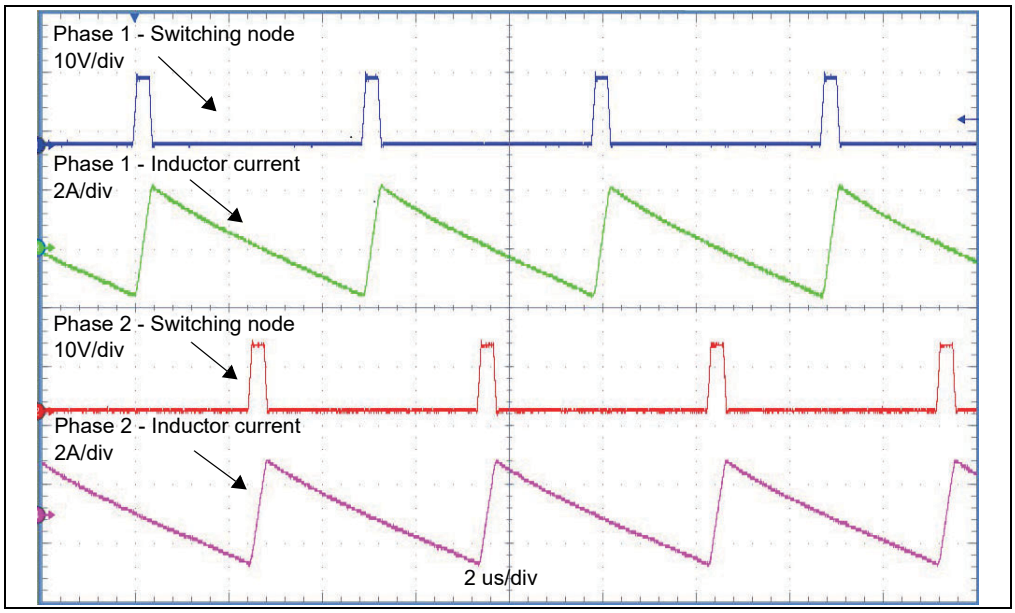

FIGURE C-1: *Switching Node Waveforms for Vin 12V, Vout 0.82V and No Load.*

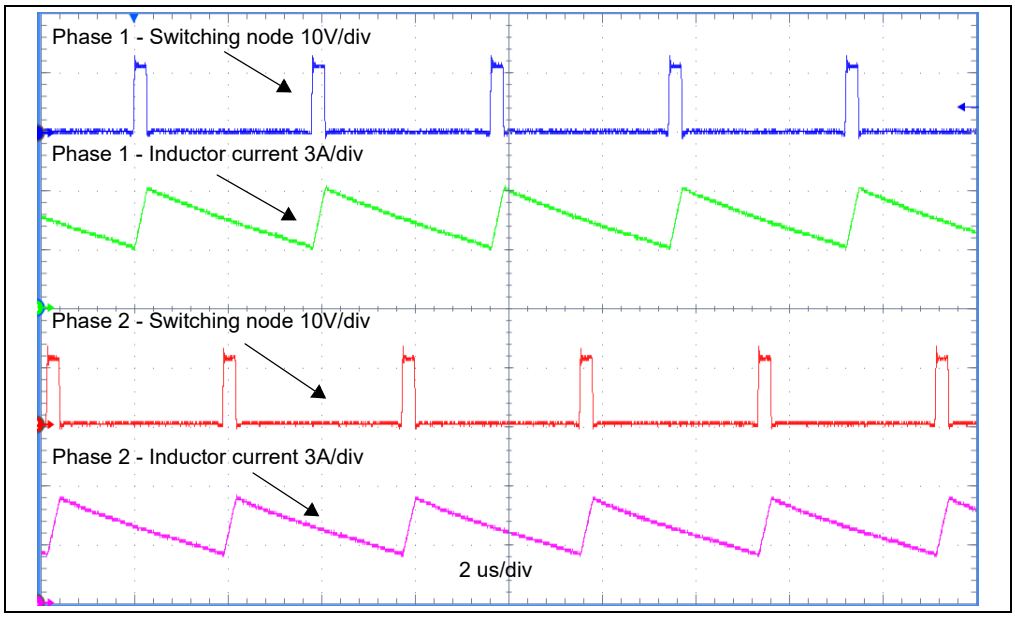

FIGURE C-2: *Switching Node Waveforms for Vin = 12V, Vout = 0.82V and Iout = 8A.*

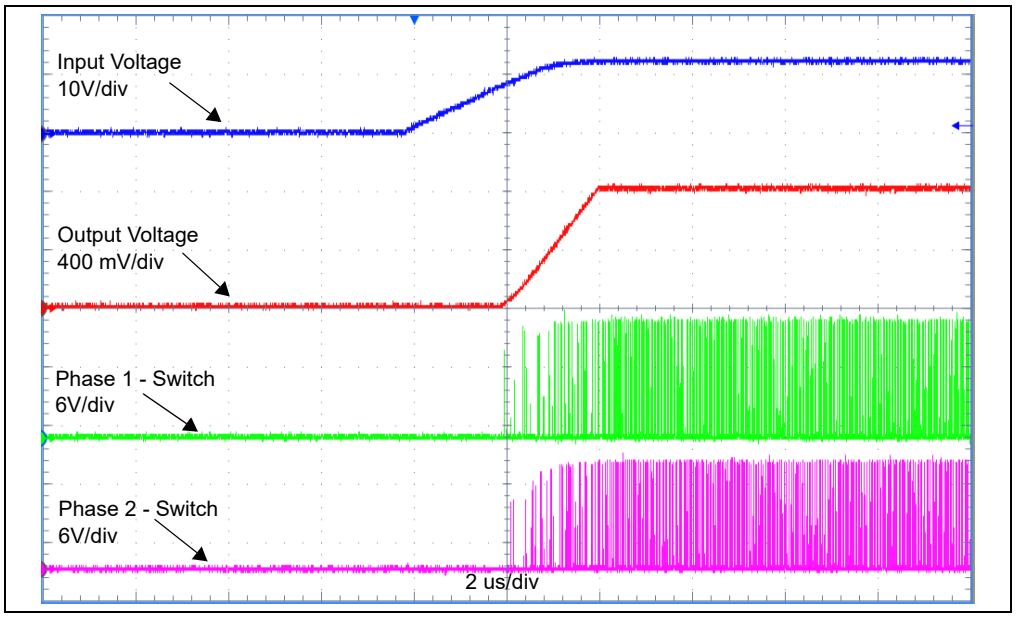

FIGURE C-3: *Soft Start.*

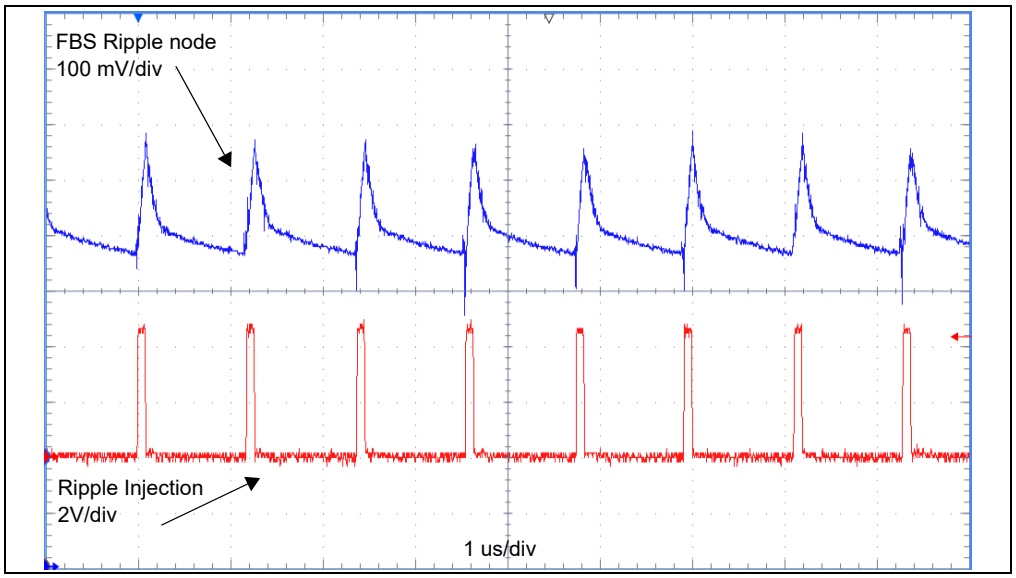

FIGURE C-4: *Ripple Injection 12V In, 0.82V Out, 0A.*

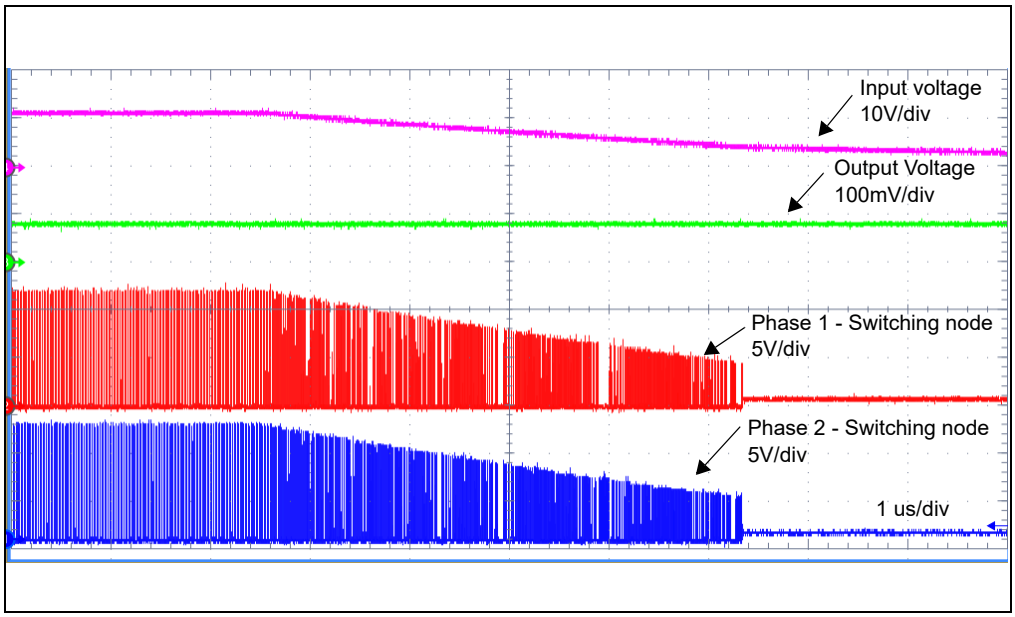

FIGURE C-5: *Power Down.*

C.2 PERFORMANCE CURVES

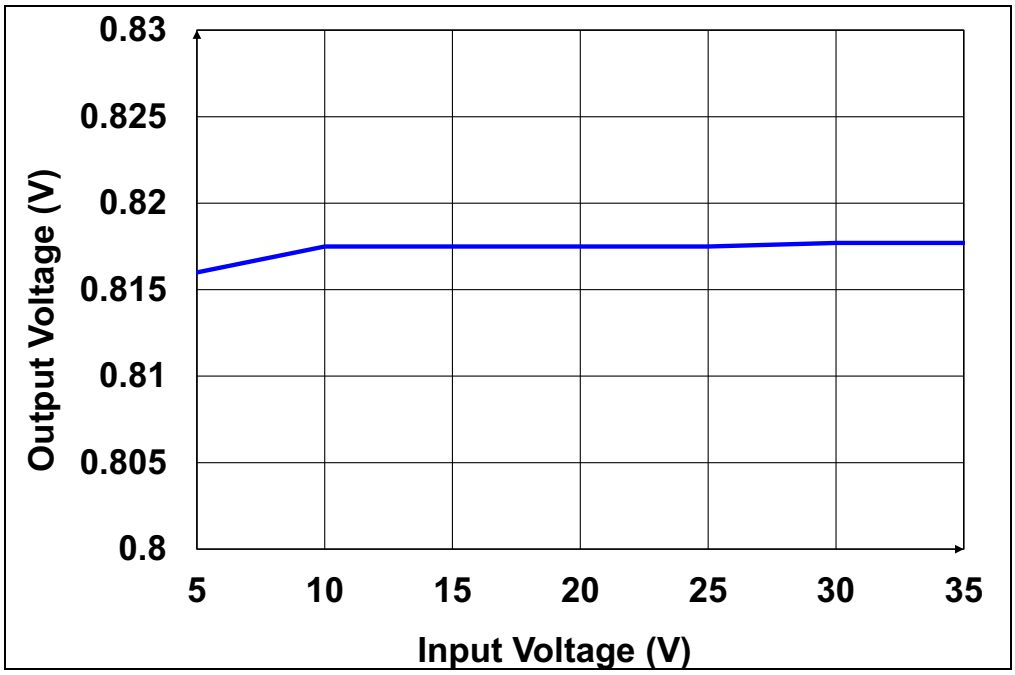

FIGURE C-6: *Output Voltage vs Input Voltage with No Load.*

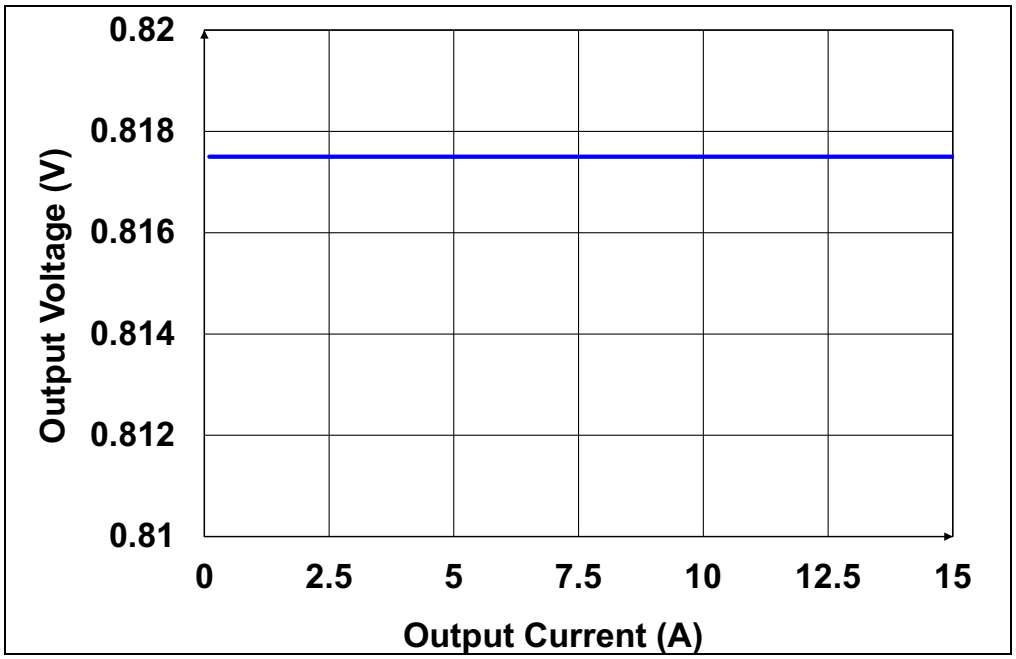

FIGURE C-7: *Output Voltage vs Output Current (Vin = 12V).*

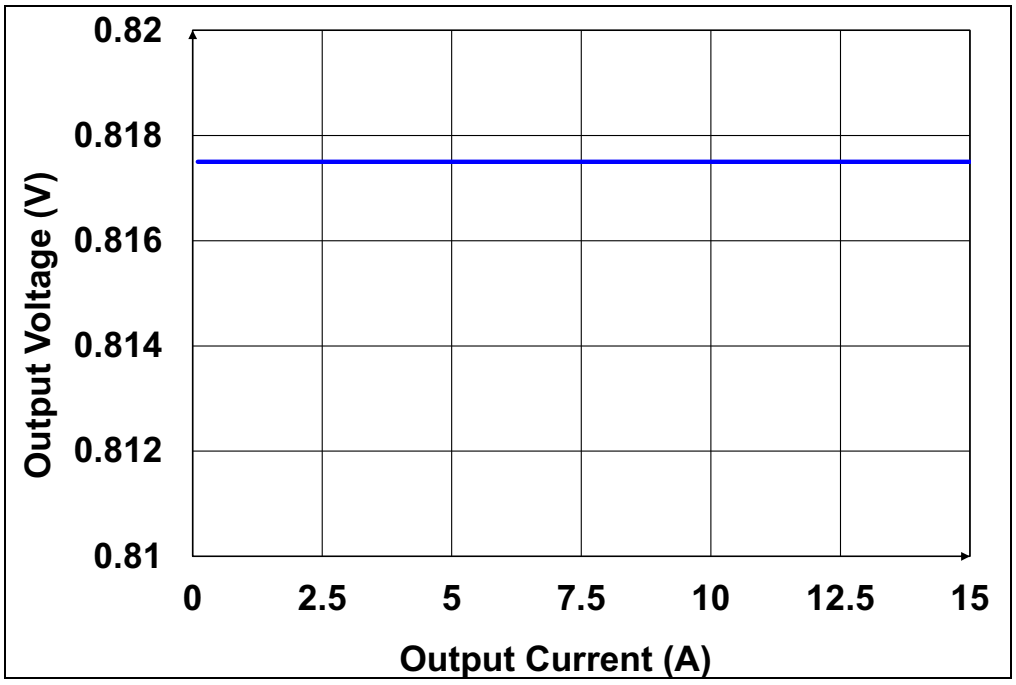

FIGURE C-8: *Output Voltage vs Output Current (Vin = 20V).*

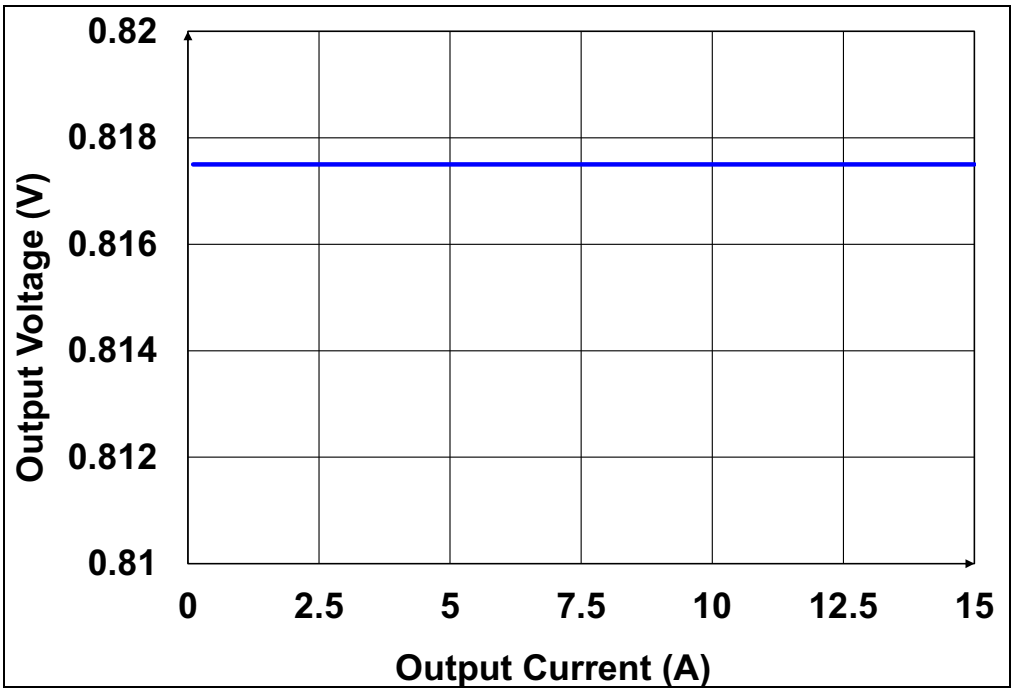

FIGURE C-9: *Output Voltage vs Output Current (Vin = 35V).*

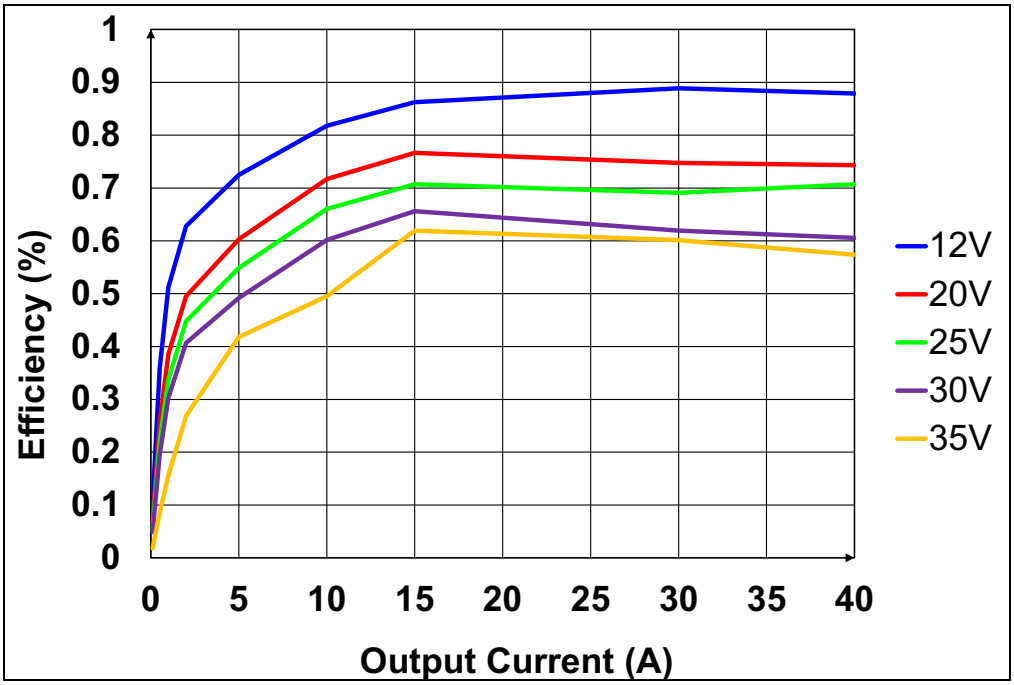

FIGURE C-10: *Efficiency vs Output Current.*

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