MIC2129 Evaluation Board User's Guide

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Preface

NOTICE TO CUSTOMERS

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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 "DSXXXXXA", where "XXXXX" 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 MIC2129 Evaluation Board (EV23R43A). Items discussed in this chapter include:

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

DOCUMENT LAYOUT

This document describes how to use the MIC2129 Evaluation Board (EV23R43A) as a development tool. The manual layout is as follows:

- **Chapter 1. "Product Overview"** - Important information about the MIC2129 Evaluation Board (EV23R43A).
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with the MIC2129 Evaluation Board (EV23R43A) and a description of each function.
- **Appendix A. "Schematics and Layouts"** – Shows the schematic and layout diagrams for the MIC2129 Evaluation Board (EV23R43A).
- **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the MIC2129 Evaluation Board (EV23R43A).
- **Appendix C. "Board Performance Curves and Waveforms"** – Includes the board performance curves and waveforms for the MMIC2129 Evaluation Board (EV23R43A).

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

<table>
<tr><th>Description</th><th>Represents</th><th>Examples</th></tr>
<tr><td colspan="3">Arial font:</td></tr>
<tr><td rowspan="2">Italic characters</td><td>Referenced books</td><td>MPLAB® IDE User’s Guide</td></tr>
<tr><td>Emphasized text</td><td>...is the only compiler...</td></tr>
<tr><td rowspan="3">Initial caps</td><td>A window</td><td>the Output window</td></tr>
<tr><td>A dialog</td><td>the Settings dialog</td></tr>
<tr><td>A menu selection</td><td>select Enable Programmer</td></tr>
<tr><td>Quotes</td><td>A field name in a window or dialog</td><td>“Save project before build”</td></tr>
<tr><td>Underlined, italic text with right angle bracket</td><td>A menu path</td><td><u>File>Save</u></td></tr>
<tr><td rowspan="2">Bold characters</td><td>A dialog button</td><td>Click OK</td></tr>
<tr><td>A tab</td><td>Click the Power tab</td></tr>
<tr><td>N‘Rnnnn</td><td>A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.</td><td>4‘b0010, 2‘hF1</td></tr>
<tr><td>Text in angle brackets < ></td><td>A key on the keyboard</td><td>Press <Enter>, <F1></td></tr>
<tr><td colspan="3">Courier New font:</td></tr>
<tr><td rowspan="7">Plain Courier New</td><td>Sample source code</td><td>#define START</td></tr>
<tr><td>Filenames</td><td>autoexec.bat</td></tr>
<tr><td>File paths</td><td>c:\mcc18\h</td></tr>
<tr><td>Keywords</td><td>_asm, _endasm, static</td></tr>
<tr><td>Command-line options</td><td>-Opa+, -Opa-</td></tr>
<tr><td>Bit values</td><td>0, 1</td></tr>
<tr><td>Constants</td><td>0xFF, ‘A’</td></tr>
<tr><td>Italic Courier New</td><td>A variable argument</td><td>file.o, where file can be any valid filename</td></tr>
<tr><td>Square brackets [ ]</td><td>Optional arguments</td><td>mcc18 [options] file [options]</td></tr>
<tr><td>Curly brackets and pipe character: { | }</td><td>Choice of mutually exclusive arguments; an OR selection</td><td>errorlevel {0|1}</td></tr>
<tr><td rowspan="2">Ellipses...</td><td>Replaces repeated text</td><td>var_name [, var_name...]</td></tr>
<tr><td>Represents code supplied by user</td><td>void main (void)
{ ...
}</td></tr>
</table>

RECOMMENDED READING

This user's guide describes how to use the MIC2129 Evaluation Board (EV23R43A). Another useful document is listed below. The following Microchip document is available and recommended as supplemental reference resources:

- **MIC2129 Data Sheet – *"100V, DC-DC Step-Down Controller with Selectable Gate Drive Voltage and Remote Sense"* (DS20006835)**

THE MICROCHIP WEB SITE

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- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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- Technical Support

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

DOCUMENT REVISION HISTORY

Revision A (December 2023)

- Initial Release of this Document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MIC2129 Evaluation Board (EV23R43A) and covers the following:

- MIC2129 Device Overview
- MIC2129 Device Key Features
- MIC2129 Evaluation Board (EV23R43A) Kit Contents

1.2 MIC2129 DEVICE OVERVIEW

The MIC2129 is a wide input voltage range, 4.5V to 100V, Step-down synchronous DC-to-DC controller with Adaptive On-time control architecture. The output voltage is adjustable from 0.6V to $D_{MAX} \times V_{IN}$ with ±1% reference accuracy. The selectable gate driver voltage feature allows customers to use either logic level MOSFETs or standard MOSFETs. The precision enable feature allows the user to turn on the MIC2129 at desired input voltage. Internal bootstrap diode eliminates the need for an external bootstrap diode. Output voltage remote sensing feature improves output voltage regulation by compensating for the voltage drop in ground returns in high current applications. The device operates with a programmable switching frequency from 100 kHz to 800 kHz. The MIC2129 is available in 24-pin 4 mm x 4 mm VQFN and 24-pin 7.8 mm x 6.4 mm TSSOP package, with a -40°C to +125°C junction operating temperature range. The 100V rating of this device makes it attractive for applications such as communications, automotive and industrial, which have increasing requirements for additional voltage safety headroom.

1.3 MIC2129 DEVICE KEY FEATURES

The MIC2129 Evaluation Board (EV23R43A) has the following features:

- 4.5V to 100V Wide Input Range
- Adjustable Output Voltage from 0.6V to $D_{MAX} \times V_{IN}$
- 100 kHz to 800 kHz Adjustable Switching Frequency
- Selectable Gate Driver Voltage (5.2V/7.5V/10.5V)
- Output Voltage Remote Sensing
- Precision Enable
- Internal Bootstrap Diode
- Internal Bootstrap LDO
- Selectable Light Load Operating Mode
- Adjustable Soft Start Time
- Adjustable Positive and Negative Current Limit Threshold
- Selectable Current Limit Mode (Hiccup, Latched, Cycle-by-Cycle)
- Output Overvoltage Protection
- Internal Compensation
- ±1% Internal Reference Accuracy from -40°C to +125°C
- Power Good (PG) Output

- -40°C to +125°C Junction Temperature Range
- Available in 24-Lead, VQFN and TSSOP Packages
- AEC-Q100 Qualified

1.4 MIC2129 EVALUATION BOARD (EV23R43A) KIT CONTENTS

The MIC2129 Evaluation Board (EV23R43A) kit includes the following items:

- MIC2129 Evaluation Board (EV23R43A)
- Important Information Sheet

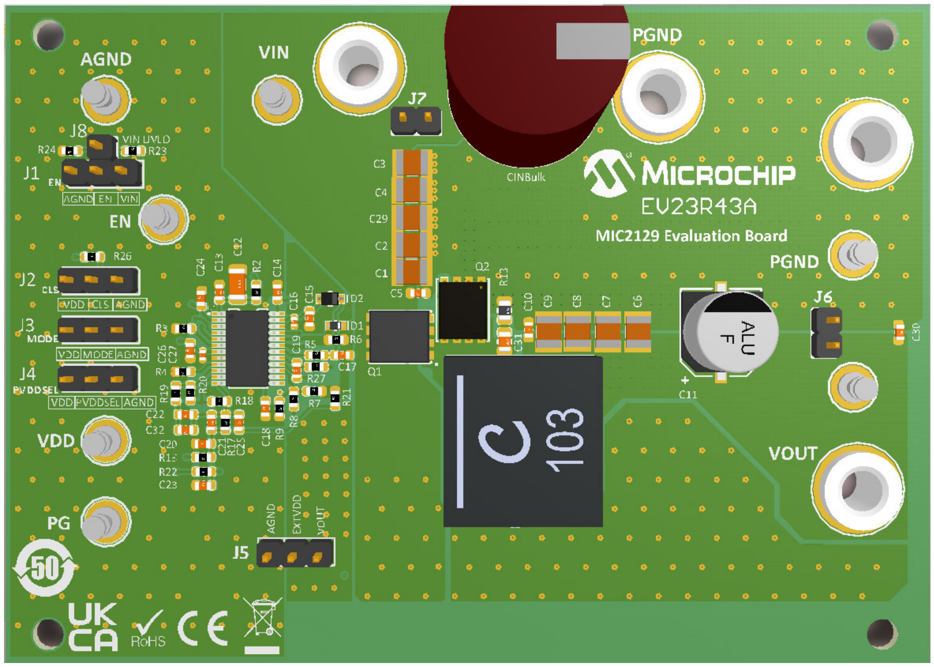


FIGURE 1-1: *MIC2129 Evaluation Board (EV23R43A) - Top.*

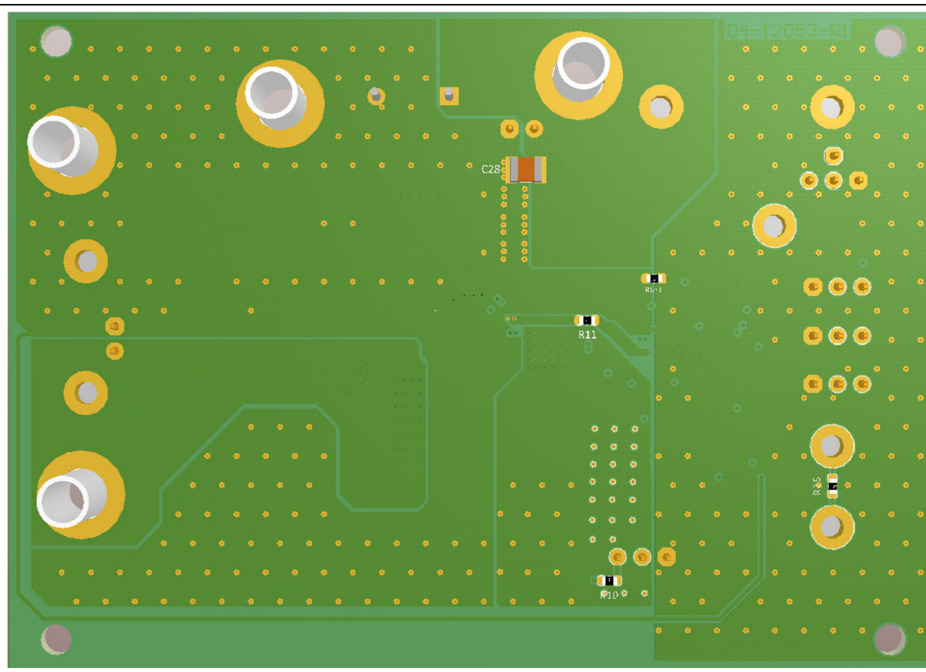


FIGURE 1-2: *MIC2129 Evaluation Board (EV23R43A) - Bottom.*

Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MIC2129 Evaluation Board (EV23R43A) is fully assembled and tested to evaluate and demonstrate the MIC2129 capabilities. The board is based on a buck converter topology and optimized for a 12V output with 10A maximum output current from a 48V nominal input power supply. The input power supply voltage range to the evaluation board is 18V to 60V.

2.2 POWERING THE MIC2129 EVALUATION BOARD

The MIC2129 Evaluation Board (EV23R43A) requires an input power supply adjustable over 18V to 60V with at least 150W output power capability (at least 3.2A output current at 48V output voltage; 8.5A output current at 18V output voltage; 2.5A output current at 60V output voltage). The output loads can be either an active electronic load or a passive resistor load with the ability to dissipate the maximum load power of 120W or more while keeping accessible surfaces ideally <70°C (see Figure 2-1).

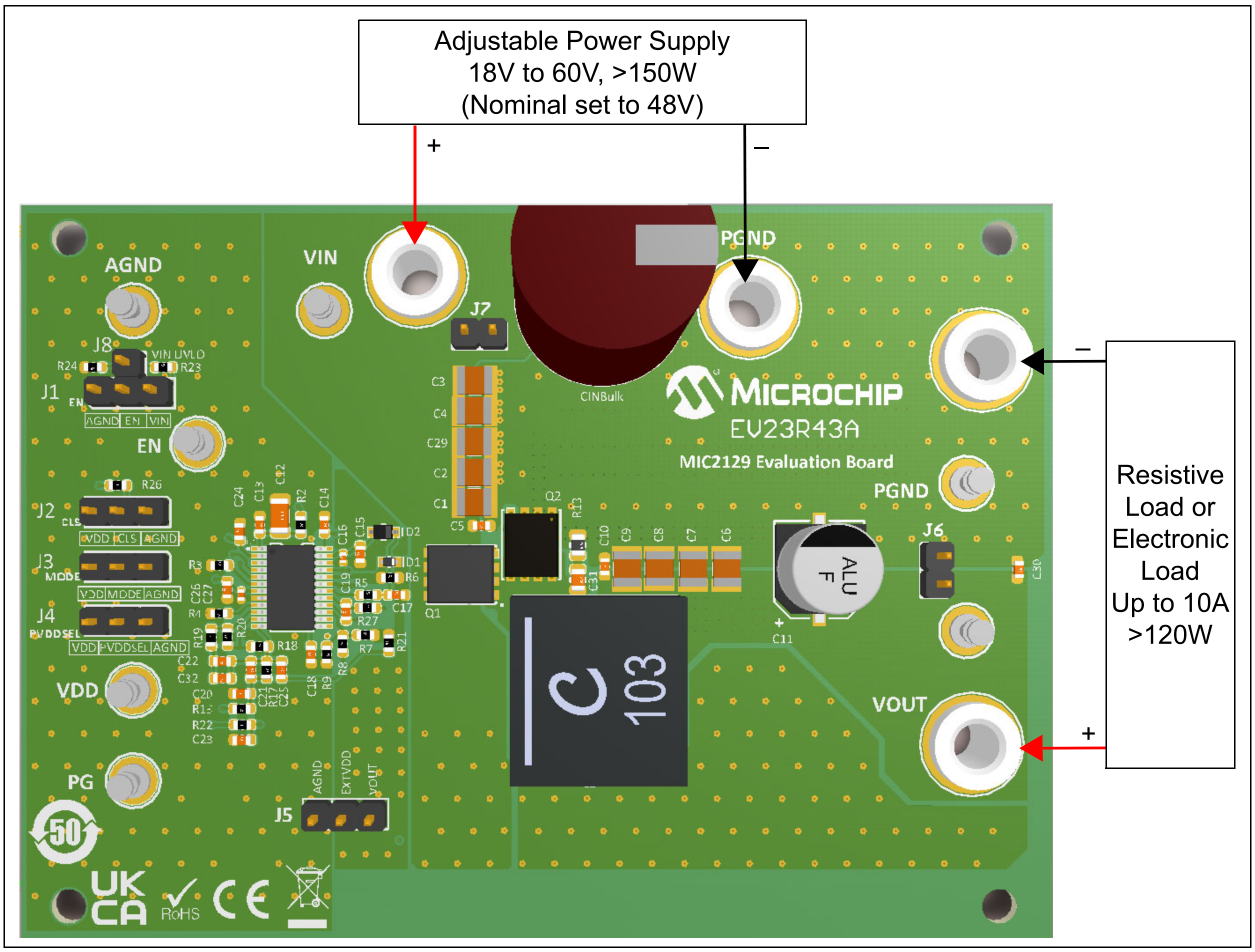


FIGURE 2-1: *MIC2129 Evaluation Board (EV23R43A) Connection Diagram.*

2.3 SETUP AND CONFIGURATION

2.3.1 Enable the IC (J1, J8)

The output voltage delivered by the MIC2129 Evaluation Board is set to 12V. To enable the IC, a jumper on J1 is placed between J1-2 and J1-3 (to pull the enable to VIN) or placed vertically between J1-2 and J8 (in order to pull the enable (EN) to the voltage divider between VIN and GND; in this case the IC will be enabled when the VIN is 15V or above).

2.3.2 High-Voltage LDO/Low-Voltage LDO Selection (J5)

The MIC2129 features an internal high-voltage LDO powered from the VIN and an internal low-voltage LDO powered from an external voltage from 4.6V to 14V. To bypass the high-voltage LDO, a jumper can be plugged on J5 between J5-2 and J5-3; this will power the low-voltage LDO from the evaluation board's 12V output voltage. If the internal high-voltage LDO is to be used, the jumper should be connected between J5-1 and J5-2 or left unconnected. The EXTVDD pin on J5-2 can also be connected to an external voltage source from 4.6V up to 14V to supply the low-voltage LDO.

2.3.3 Current Limit Operation Selection (J2)

Hiccup, Latch-off, and Cycle-by-cycle can be selected for the current limit operation. To select Hiccup, a jumper is plugged on J2 between J2-2 and J2-3. To select Latch-off, the J2 is left unconnected. To select Cycle-by-cycle current limit, the jumper is plugged between J2-2 and J2-1.

2.3.4 Mode Selection (J3)

HLL, CCM, and CCM Switched can be selected for the mode selection. To select HLL, a jumper is plugged on J3 between J3-2 and J3-3. To select CCM, the jumper is plugged between J3-2 and J3-1. To select CCM Switched, the J3 is left unconnected. It should be noted that the CCM Switched mode is intended for feedback ripple voltage injection with an RC network from the switching node. The evaluation board is configured to use feedback ripple voltage injection with an RC network from the INJ pin.

2.3.5 PV_{DD} Voltage Selection (J4)

10.5V, 7.5V, and 5.2V can be selected for the PV_{DD} voltage for the gate driver supply voltage. To select 10.5V, a jumper is plugged on J4 between J4-2 and J4-3. To select 7.5V, the J4 is left unconnected. To select 5.2V, the jumper is plugged between J4-2 and J4-1.

2.3.6 VIN Voltage Probing (J7)

The VIN supply voltage can be probed across the J7-2 and J7-1.

2.3.7 VOUT Voltage Probing (J6)

The VOUT output voltage can be probed across the J6-2 and J6-1.

2.3.8 VOUT Voltage Adjustment

The output voltage can be modified from its preset 12V. The VOUT output voltage feedback divider can be set using Equation 2-1.

EQUATION 2-1:

$$R_{FB(BOT)} = \frac{R_{FB(TOP)}}{\left[\frac{V_{OUT}}{V_{REF}} - 1\right]}$$

For target V_{OUT} = 12V, V_{REF} = 0.6V, $R_{FB(TOP)}$ = 28 kΩ, using the above equation,
$R_{FB(BOT)}$ = 28 kΩ/(12V/0.6V - 1) = 1.47 kΩ.

2.3.9 Current Limit Setting Resistor

The current limit of the board is programmable and the board is preset with an output current limit of 12.5A in either Hiccup or Latch-off mode. The current limit setting resistor R_{ILIM} can be calculated using Equation 2-2 for DC overload in Hiccup or Latch-off CLS setting.

EQUATION 2-2:

For DC overload current in Hiccup or Latch-off CLS settings:

$$R_{ILIM} = \frac{\left\{\left(I_{CLIM} + \frac{\Delta I_{LPP}}{2}\right) \times R_{SENSE} \times F_{HEAT} + V_N\right\} \times 4}{I_{ILIM}}$$

For target output current (at which the current limit is triggered), I_{CLIM} = 12.5A, ΔI_{LPP} = 3A,
$R_{SENSE} = R_{DSON}$ = 5 mΩ (for low-side MOSFET R_{DSON} sensing and PV_{DD} = 5.2V),
F_{HEAT} = 1.5, V_N = 10 mV, I_{ILIM} = 19.2 µA, using the above equation,
R_{ILIM} = {(12.5A + 3A/2) × 5 mΩ × 1.5 + 10 mV} × 4/19.2 µA = 23.96 kΩ.
Then, R_{ILIM} = 24 kΩ is used for rounding up to the closest standard value.

If changing J2 to Cycle-by-cycle CLS setting, the current limit setting resistor R_{ILIM} can be calculated using Equation 2-3 for DC overload limit.

EQUATION 2-3:

For DC overload current in Cycle-by-cycle CLS setting or output short-circuit current limit:

$$R_{ILIM} = \frac{\left(I_{CLIM} - \frac{\Delta I_{LPP}}{2}\right) \times R_{SENSE} \times F_{HEAT} \times 4}{I_{ILIM}}$$

For target output current (at which the current limit is triggered), I_{CLIM} = 12.5A, ΔI_{LPP} = 3A,
$R_{SENSE} = R_{DSON}$ = 5 mΩ (for low-side MOSFET R_{DSON} sensing and PV_{DD} = 5.2V),
F_{HEAT} = 1.5, V_N = 10 mV, I_{ILIM} = 19.2 µA, using the above equation,
R_{ILIM} = (12.5A - 3A/2) × 5 mΩ × 1.5 × 4/19.2 µA = 17.2 kΩ.

It should be noted that the set current limit in Hiccup or Latch-off is lower than the set current limit in Cycle-by cycle CLS setting for the same R_{ILIM} resistor value.

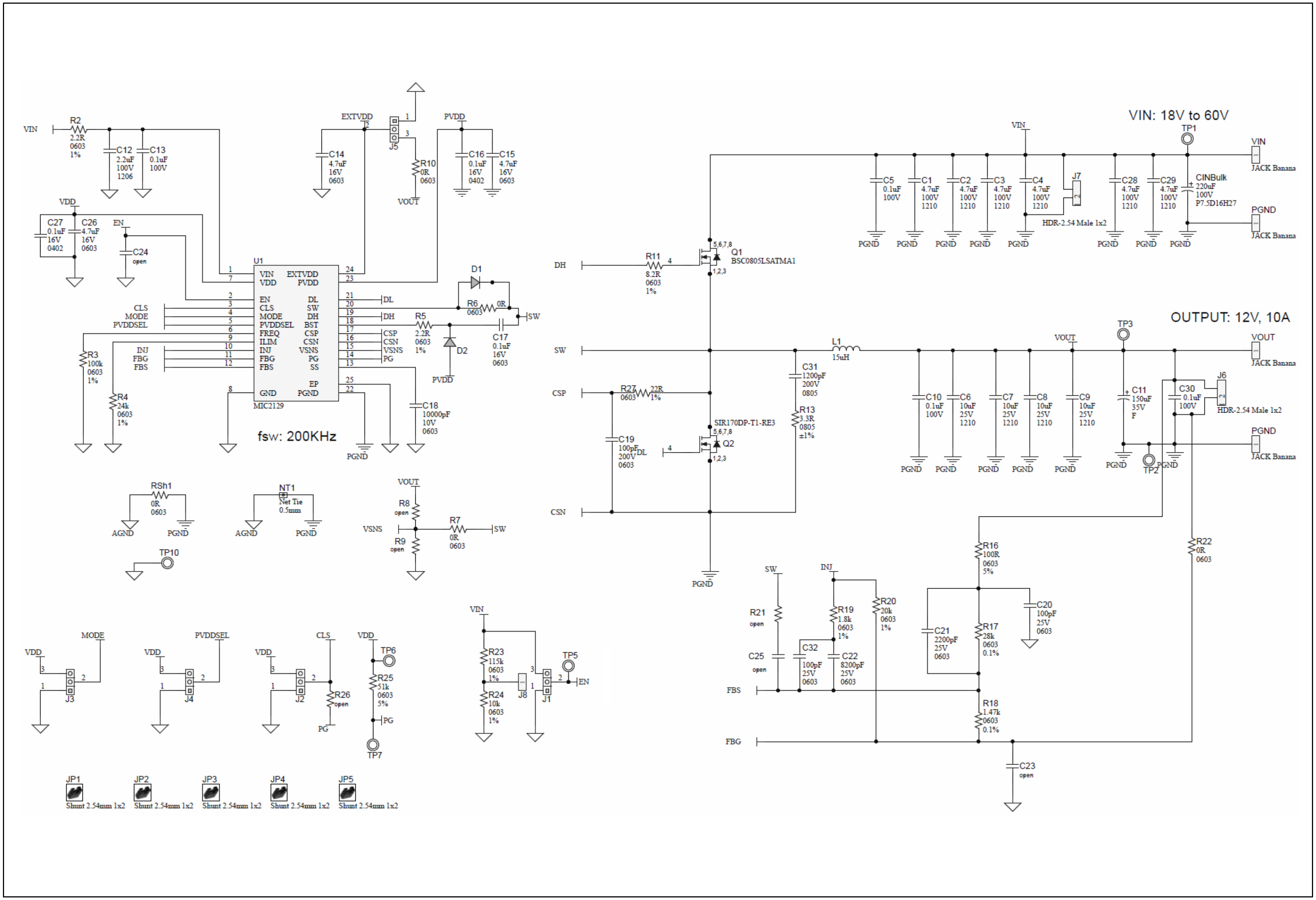
NOTES:

Appendix A. Schematics and Layouts

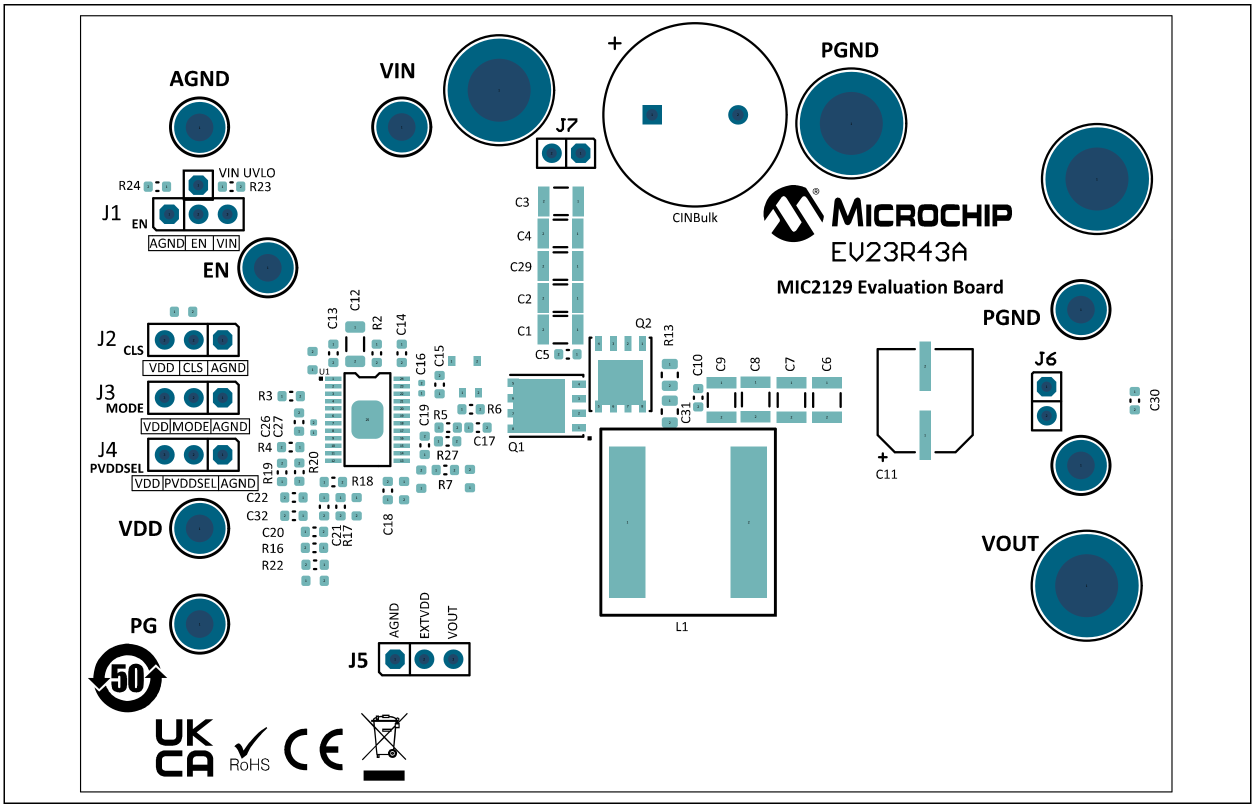
A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MIC2129 Evaluation Board (EV23R43A):

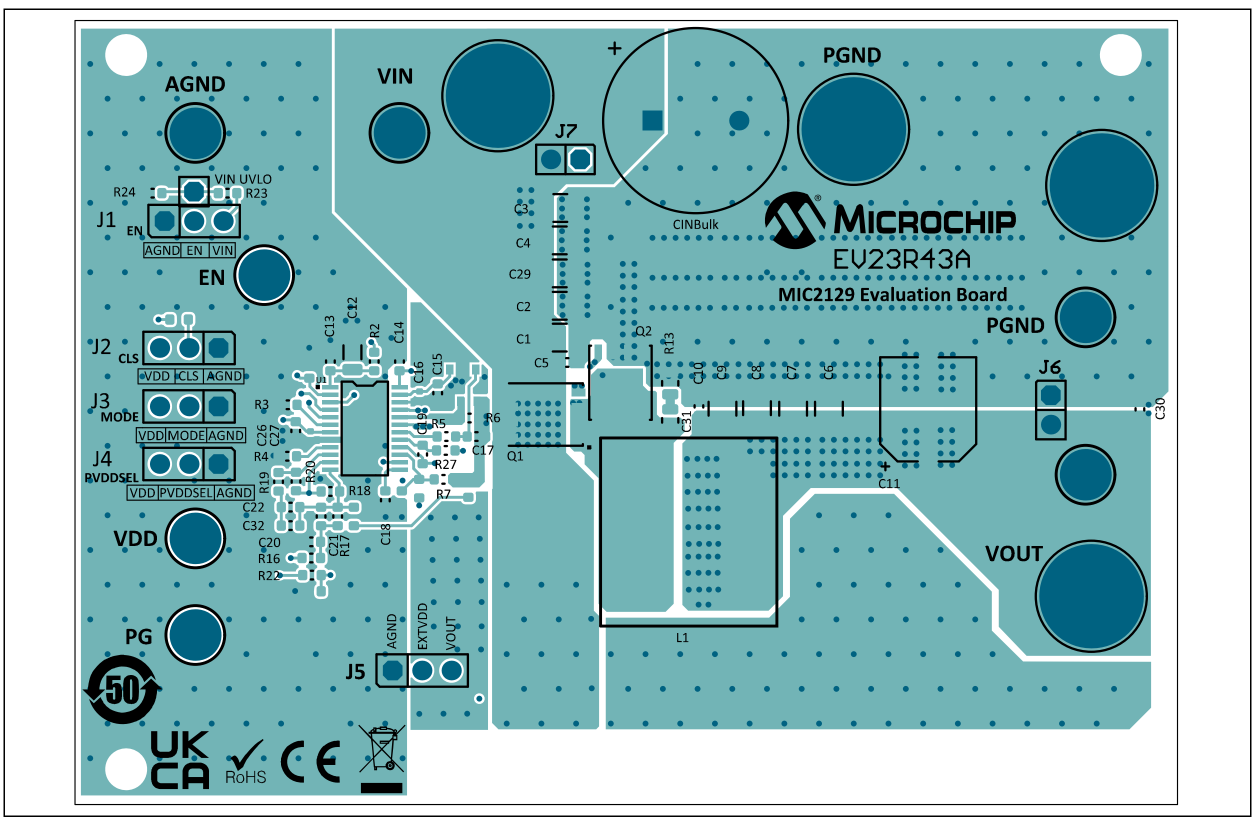
A.2 EV23R43A BOARD – SCHEMATIC



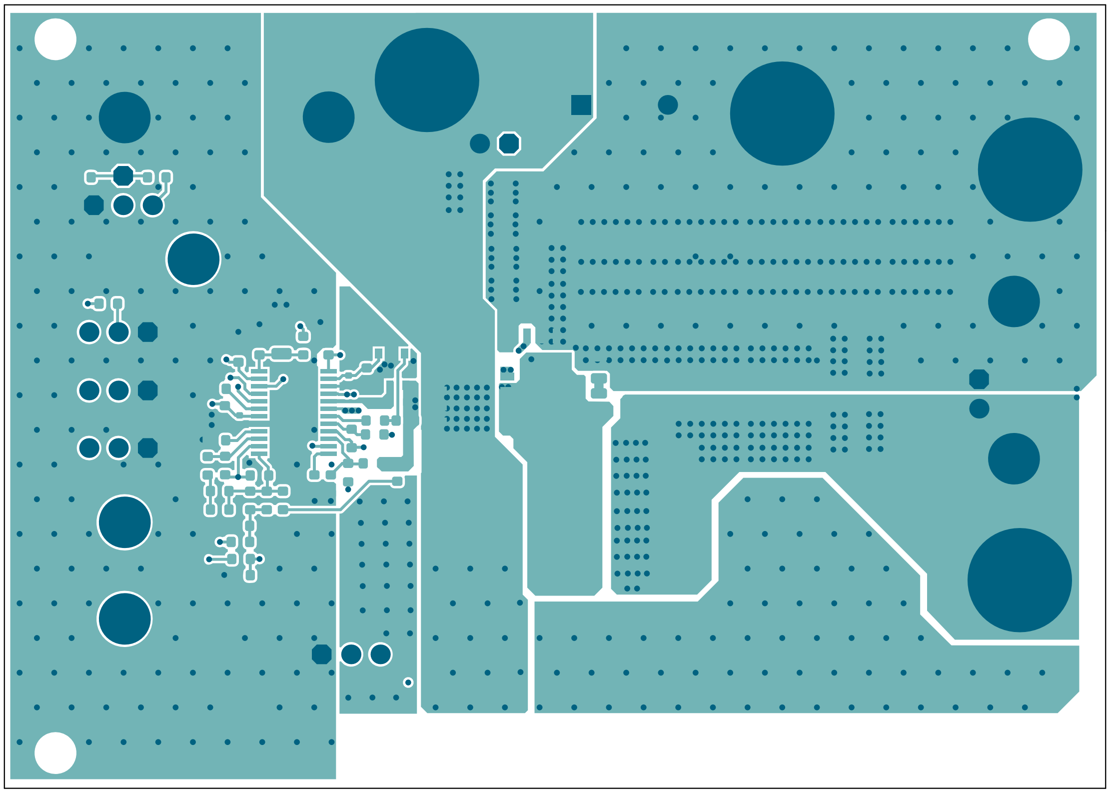
A.3 EV23R43A BOARD – TOP SILK



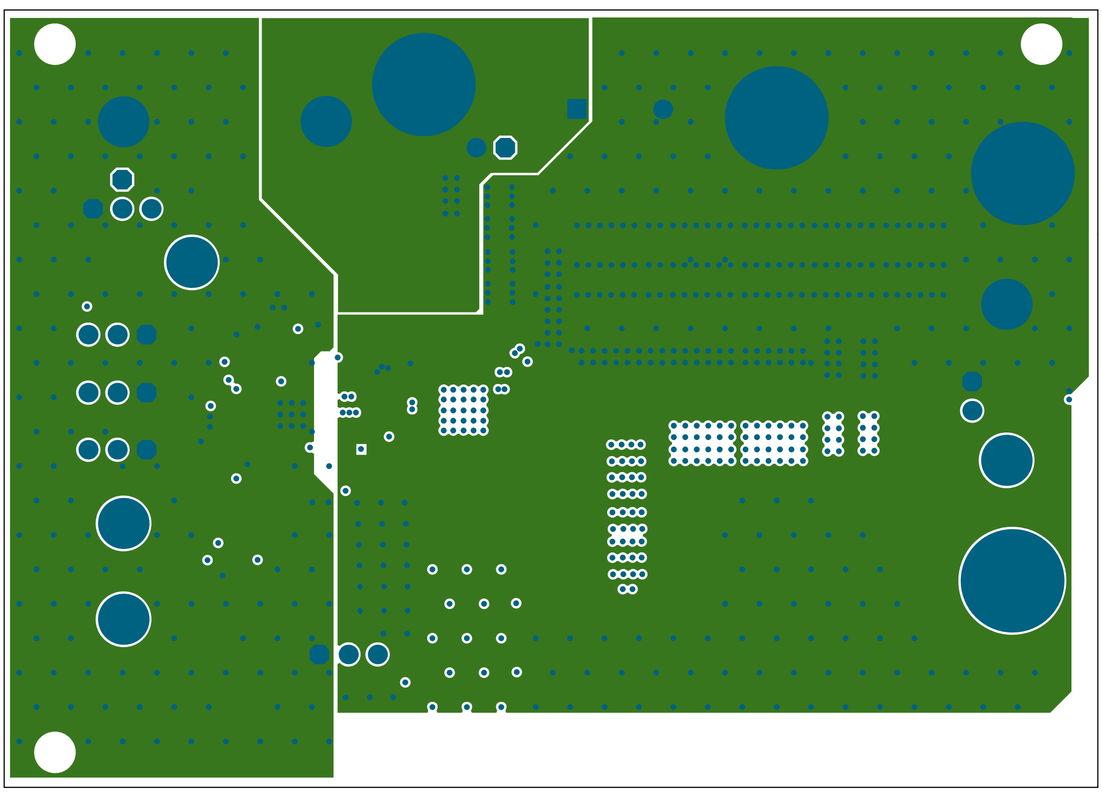
A.4 EV23R43A BOARD – TOP COPPER AND SILK



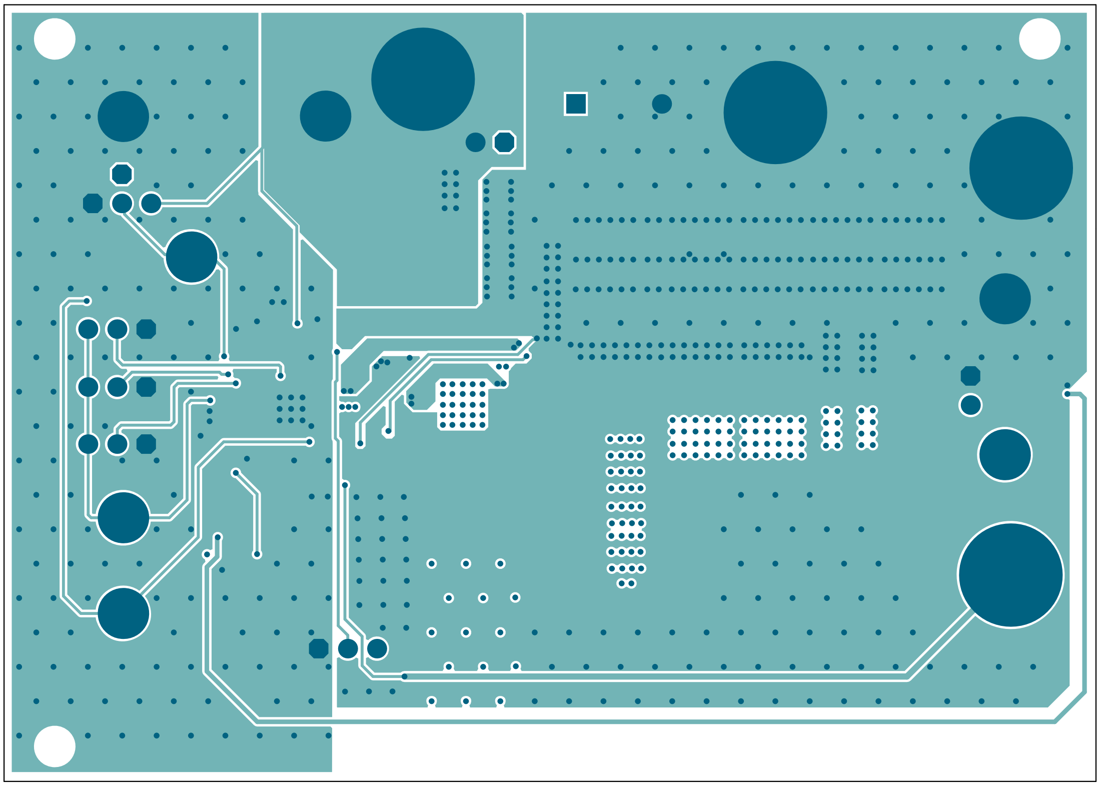
A.5 EV23R43A BOARD – TOP COPPER



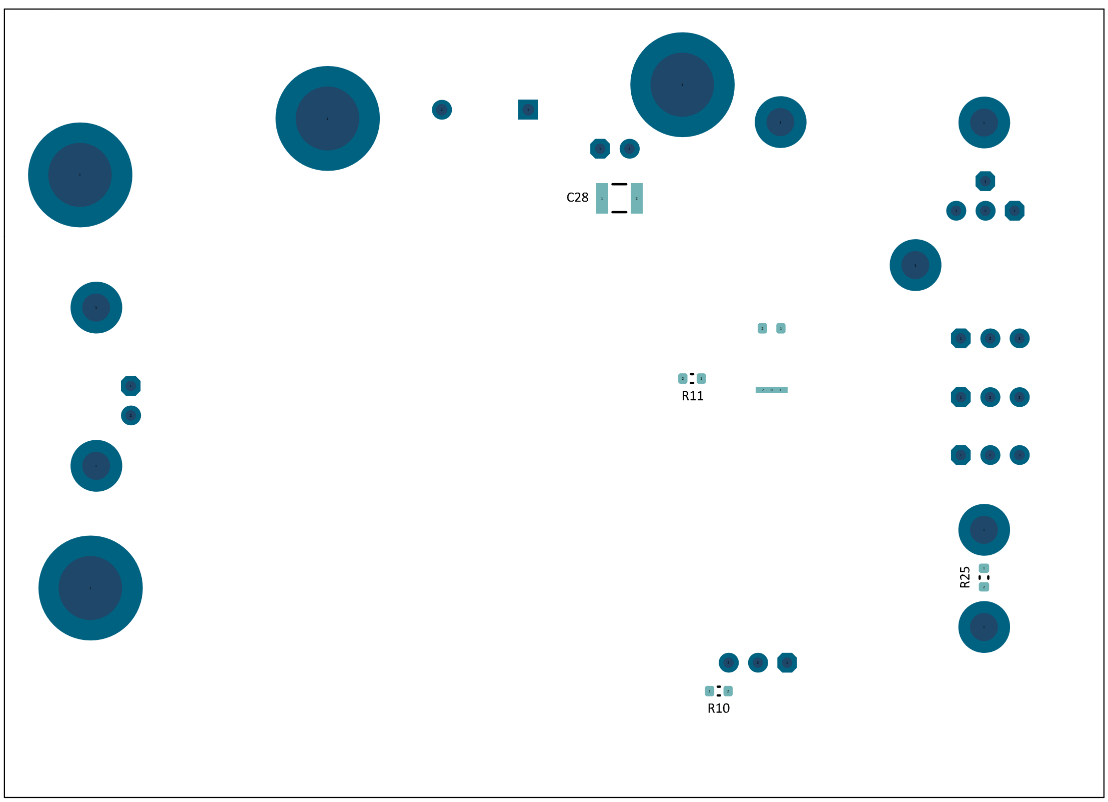
A.6 EV23R43A BOARD – INNER 1 COPPER



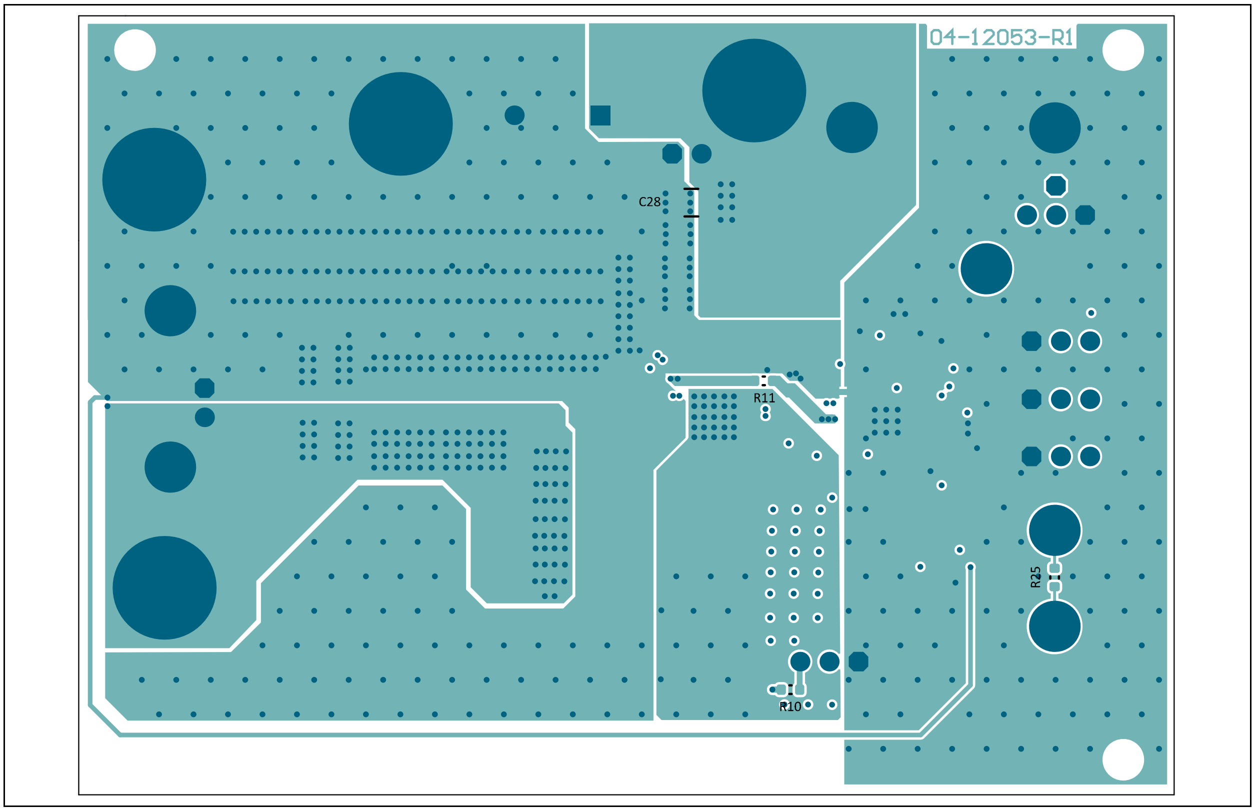
A.7 EV23R43A BOARD – INNER 2 COPPER



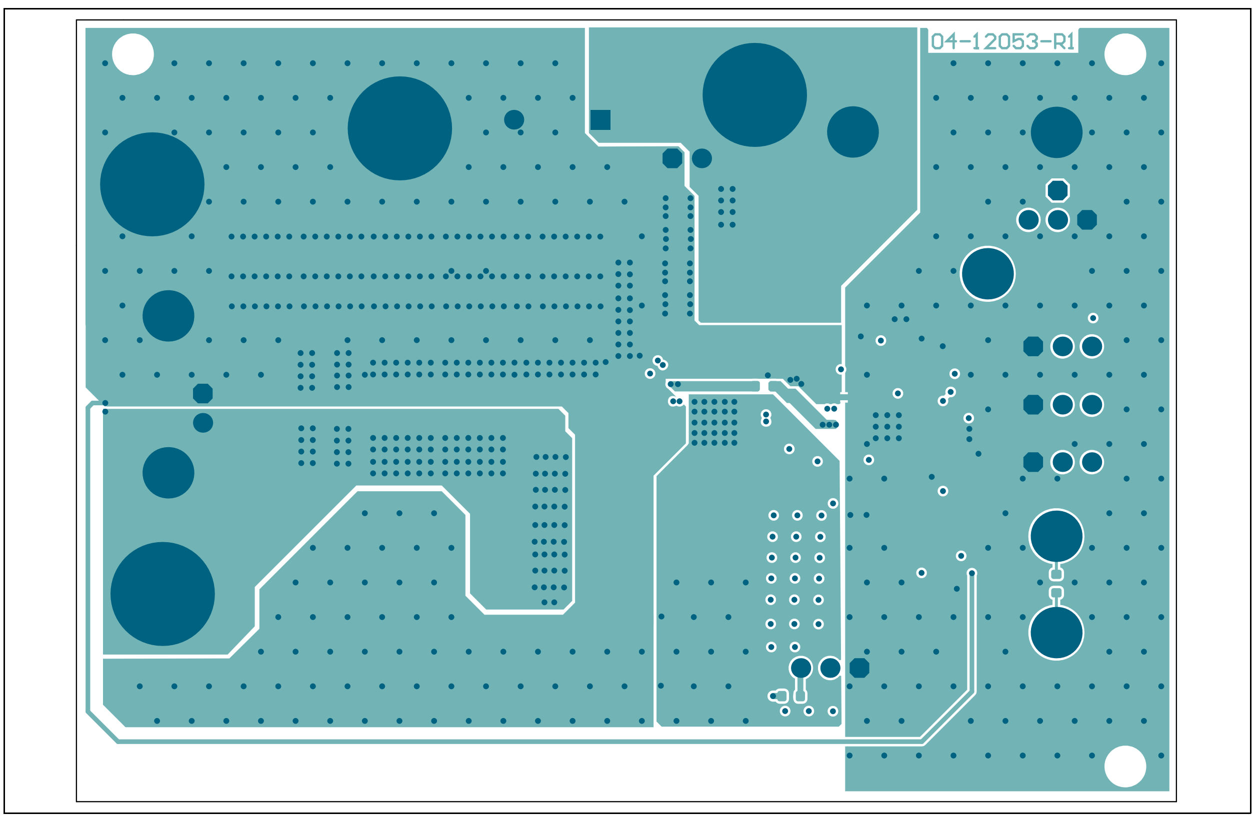
A.8 EV23R43A BOARD – BOTTOM SILK



A.9 EV23R43A BOARD – BOTTOM COPPER AND SILK



A.10 EV23R43A BOARD – BOTTOM COPPER



Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Manufacturer	Part Number
6	C1, C2, C3, C4, C28, C29	Capacitor, Ceramic, 4.7 µF, 100V, 10%, X7R, SMD, 1210, AEC-Q200	Kyocera AVX	12101C475K4T2A
4	C5, C10, C13, C30	Capacitor, Ceramic, 0.1 µF, 100V, 10%, X7R, SMD, 0603	Murata Manufacturing Co., Ltd.	GRM188R72A104KA35D
4	C6, C7, C8, C9	Capacitor, Ceramic, 10 µF, 25V, 10%, X7R, SMD, 1210	Kyocera AVX	12103C106KAT2A
1	C11	Capacitor, Aluminum, 150 µF, 35V, 20%, 22 mΩ, SMD, F, AEC-Q200	Panasonic® - ECG	EEH-ZT1V151P
1	C12	Capacitor, Ceramic, 2.2 µF, 100V, 10%, X7R, SMD, 1206	Kyocera AVX	12061C225KAT4A
3	C14, C15, C26	Capacitor, Ceramic, 4.7 µF, 16V, 10%, X7S, SMD, 0603	Murata Manufacturing Co., Ltd.	GRM188C71C475KE21D
2	C16, C27	Capacitor, Ceramic, 0.1 µF, 16V, 10%, X7R, SMD, 0402	Kyocera AVX	0402YC104KAT2A
1	C17	Capacitor, Ceramic, 0.1 µF, 16V, 10%, X7R, SMD, 0603, AEC-Q200	Kyocera AVX	0603YC104K4T4A
1	C18	Capacitor, Ceramic, 10000 pF, 10V, 10%, X7R, SMD, 0603	Kyocera AVX	0603ZC103KAT2A
1	C19	Capacitor, Ceramic, 100 pF, 200V, 5%, C0G/NP0, SMD, 0603	Vishay Intertechnology, Inc.	VJ0603A101JXCAC
2	C20, C32	Capacitor, Ceramic, 100 pF, 25V, 10%, NP0, SMD, 0603	Kyocera AVX	06033A101KAT2A
1	C21	Capacitor, Ceramic, 2200 pF, 25V, 5%, X7R, SMD, 0603	Kyocera AVX	06033C222JAT2A
1	C22	Capacitor, Ceramic, 8200 pF, 25V, 10%, X7R, SMD, 0603	Yageo Corporation	CC0603KRX7R8BB822
1	C31	Capacitor, Ceramic, 1200 pF, 200V, 10%, X7R, SMD, 0805, AEC-Q200	Kyocera AVX	08052C122K4T2A
1	CINBulk	Capacitor, Aluminum, 220 µF, 100V, 20%, RAD, P7.5D16H27, AEC-Q200	Nichicon Corporation	UBT2A221MHD8
5	J1, J2, J3, J4, J5	Connector, HDR-2.54, Male, 1x3, Tin, 5.84 MH, Through Hole, Vertical	Samtec, Inc.	TSW-103-07-T-S
2	J6, J7	Connector, HDR-2.54, Male, 1x2, Gold, 5.84 MH, Through Hole, Vertical	Samtec, Inc.	TSW-102-07-G-S
1	J8	Connector, HDR-2.54, Male, 1x1, Gold, 5.84 MH, Through Hole, Vertical	Samtec, Inc.	TSW-101-07-S-S

Note: 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	L1	Inductor, 15 µH, 22A, 20%, 0.0075R, SMD, L16.2W15.2H10, AEC-Q200	Coilcraft	XAL1513-153MED
4	PGND, VIN, VOUT	Connector, Jack Banana, 4.5 mm, Female, Through Hole, Vertical	Keystone® Electronics Corp.	575-8
1	Q1	Transistor, MOSFET, N-Channel, 100V, 79A, 0.007R, 83W, TDSON-8	Infineon Technologies AG	BSC0805LSATMA1
1	Q2	Transistor, MOSFET, N-Channel, 100V, 95A, 104W, PPAK, SO-8	Vishay Intertechnology, Inc.	SIR170DP-T1-RE3
2	R2, R5	Resistor, Thick Film, 2.2R, 1%, 1/10W, SMD, 0603, AEC-Q200	Yageo Corporation	AF0603FR-072R2L
1	R3	Resistor, Thick Film, 100k, 1%, 1/10W, SMD, 0603, AEC-Q200	Panasonic® - ECG	ERJ-3EKF1003V
1	R4	Resistor, Thick Film, 24k, 1%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3EKF2402V
4	R6, R7, R10, R22	Resistor, Thick Film, 0R, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3GEY0R00V
1	R11	Resistor, Thick Film, 8.2R, 1%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3RQF8R2V
1	R13	Resistor, Thin Film, 3.3R, 1%, 1/2W, SMD, 0805, AEC-Q200	Vishay Intertechnology, Inc.	RCS08053R30FKEA
1	R16	Resistor, Thick Film, 100R, 5%, 1/10W, SMD, 0603	Vishay Intertechnology, Inc.	CRCW0603100RJNEA
1	R17	Resistor, Thin Film, 28K, 0.1%, 1/10W, SMD, 0603, AEC-Q200	Panasonic® - ECG	ERA-3AEB2802V
1	R18	Resistor, Thin Film, 1.47k, 0.1%, 1/10W, SMD, 0603, AEC-Q200	Panasonic® - ECG	ERA-3AEB1471V
1	R19	Resistor, Thick Film, 1.8k, 1%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3EKF1801V
1	R20	Resistor, Thick Film, 20k, 1%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3EKF2002V
1	R23	Resistor, Thick Film, 115k, 1%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3EKF1153V
1	R24	Resistor, Thick Film, 10k, 1%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3EKF1002V
1	R25	Resistor, Thick Film, 51k, 5%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3GEYJ513V
1	R27	Resistor, Thick Film, 22R, 1%, 1/10W, SMD, 0603	Yageo Corporation	RC0603FR-0722RL
7	TP1, TP2, TP3, TP5, TP6, TP7, TP10	Connector, Test Point, PIN, Tin, Through Hole	Keystone® Electronics Corp.	1502-2

Note: 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	Analog, 100V DC-DC Step-down Controller, MIC2129, TSSOP-24-EP	Microchip Technology Inc.	**MIC2129T-E/2FW**

Note: 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
5	JP1, JP2, JP3, JP4, JP5	Mechanical, Headers & Wires, Jumper, 2.54 mm, 1x2	Amphenol ICC (FCI)	63429-202LF
1	PCB1	Printed Circuit Board	—	04-12053-R1

Note: 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

Qty.	Reference	Description	Manufacturer	Part Number
0	C23, C24, C25	Capacitor, Ceramic, 1000 pF, 50V, 20%, X7R, SMD, 0603	TDK Corporation	C1608X7R2A102K080AA
0	D1	Diode, General Purpose, 75V, 200 mA, SOD523F	ON Semiconductor®	1N4148WT
0	D2	Diode, Rectifier, 855 mV, 300 mA, 75V, SOD-323	Diodes Incorporated	1N4148WS-7-F
0	R8, R9, R21, R26	Resistor, Thick Film, 100R, 5%, 1/10W, SMD, 0603	Vishay Intertechnology, Inc.	CRCW0603100RJNEA
0	RSh1	Resistor, Thick Film, 0R, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3GEY0R00V

Note: 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.

NOTES:

Appendix C. Board Performance Curves and Waveforms

C.1 REFERENCE DESIGN WAVEFORMS

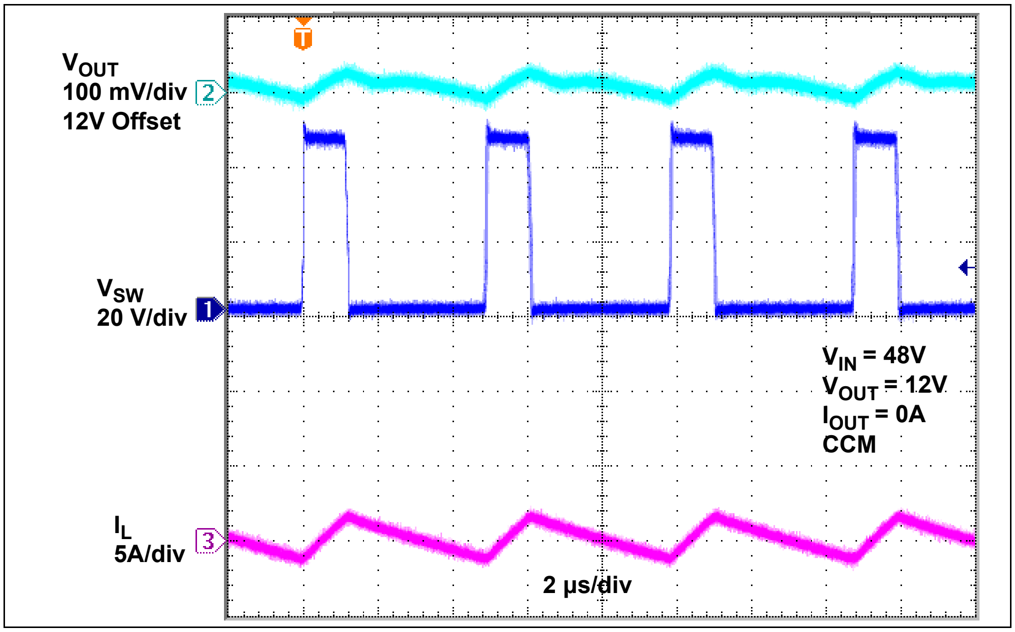


FIGURE C-1: *Switching Waveforms in CCM, PV_{DD} = 10.5V, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 0A.*

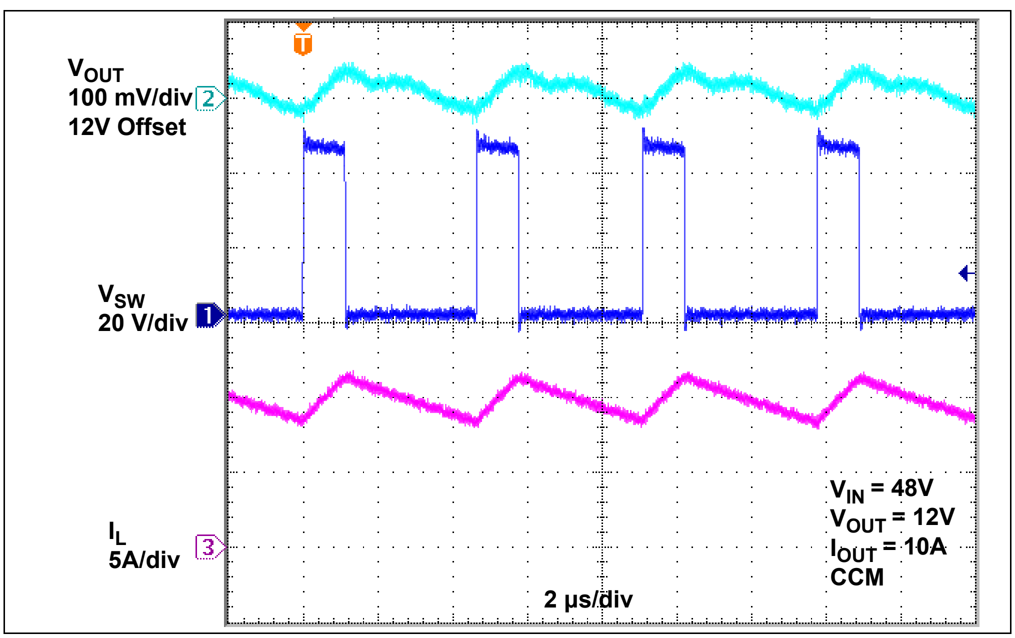


FIGURE C-2: *Switching Waveforms in CCM, PV_{DD} = 10.5V, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 10A.*

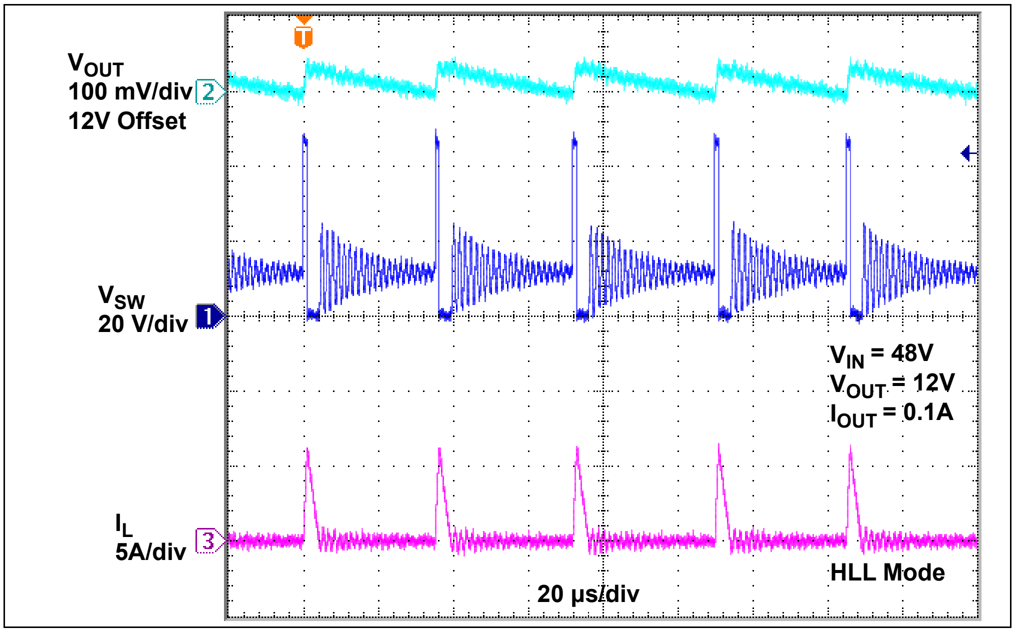


FIGURE C-3: *Switching Waveforms in HLL Mode, PV_{DD} = 10.5V, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 0.1A.*

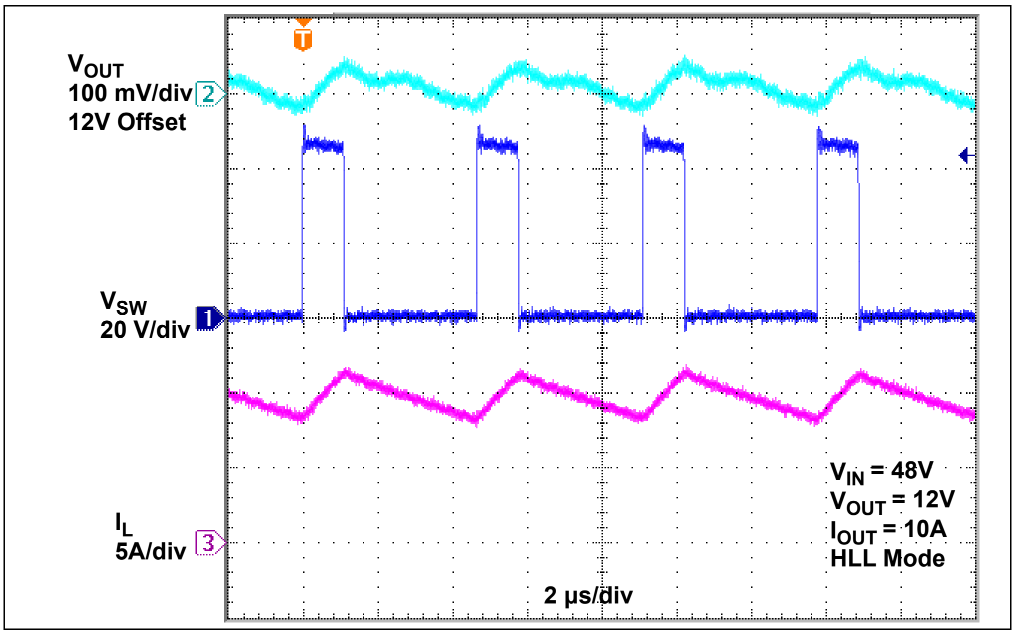


FIGURE C-4: *Switching Waveforms in HLL Mode, PV_{DD} = 10.5V, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 10A.*

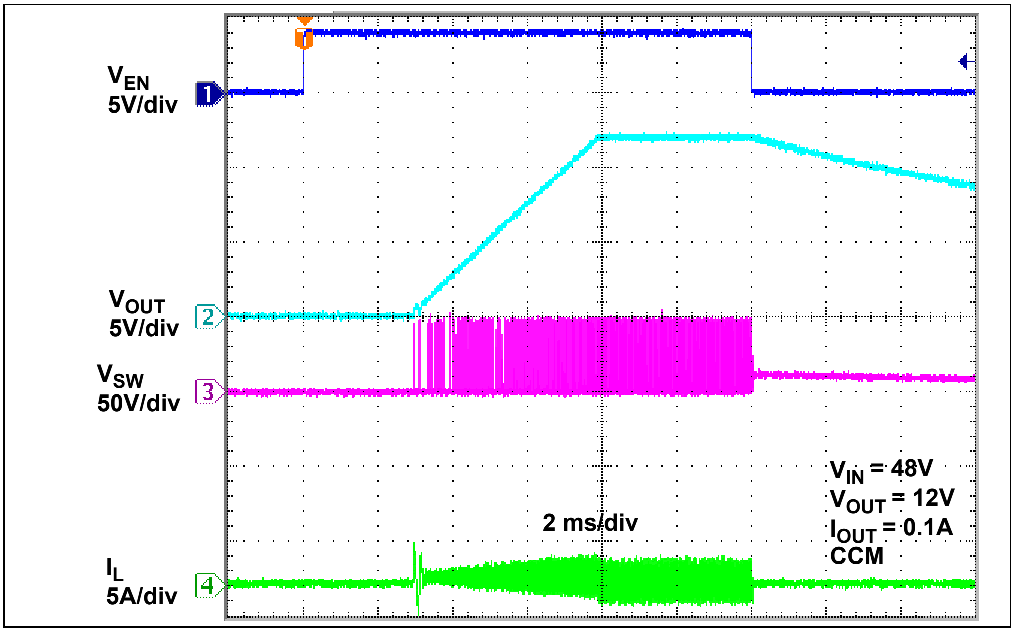


FIGURE C-5: *Enable Startup and Shutdown in CCM, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 0.1A.*

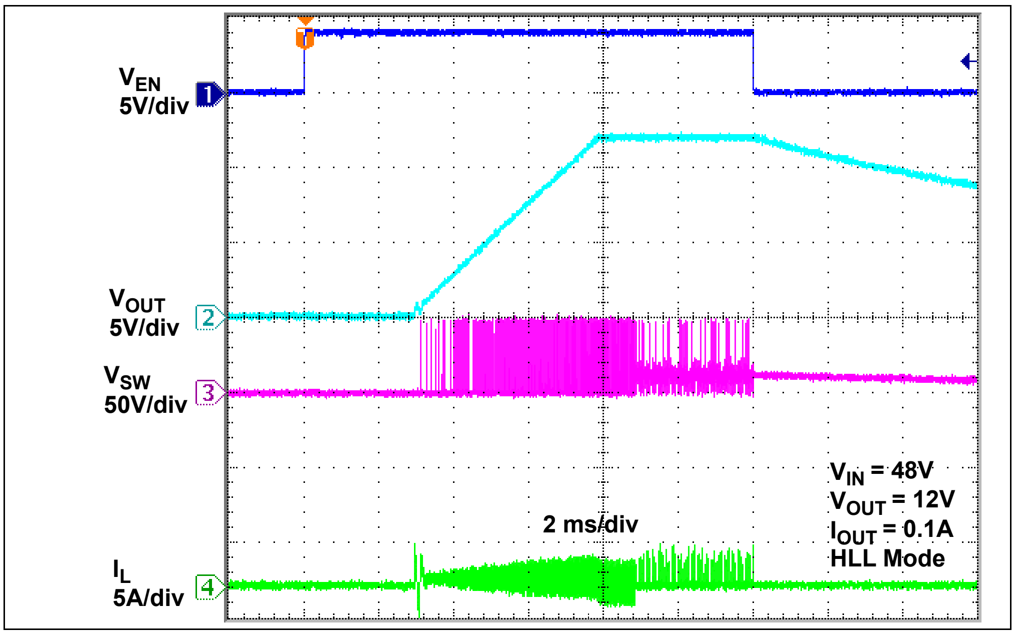


FIGURE C-6: *Enable Startup and Shutdown in HLL Mode, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 0.1A.*

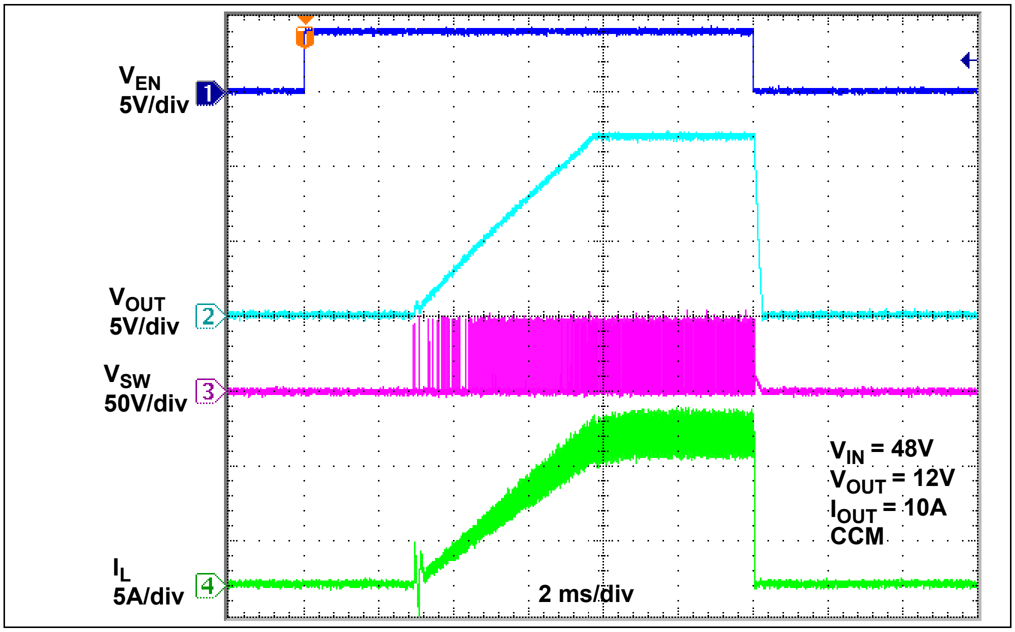


FIGURE C-7: *Enable Startup and Shutdown in CCM, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 10A.*

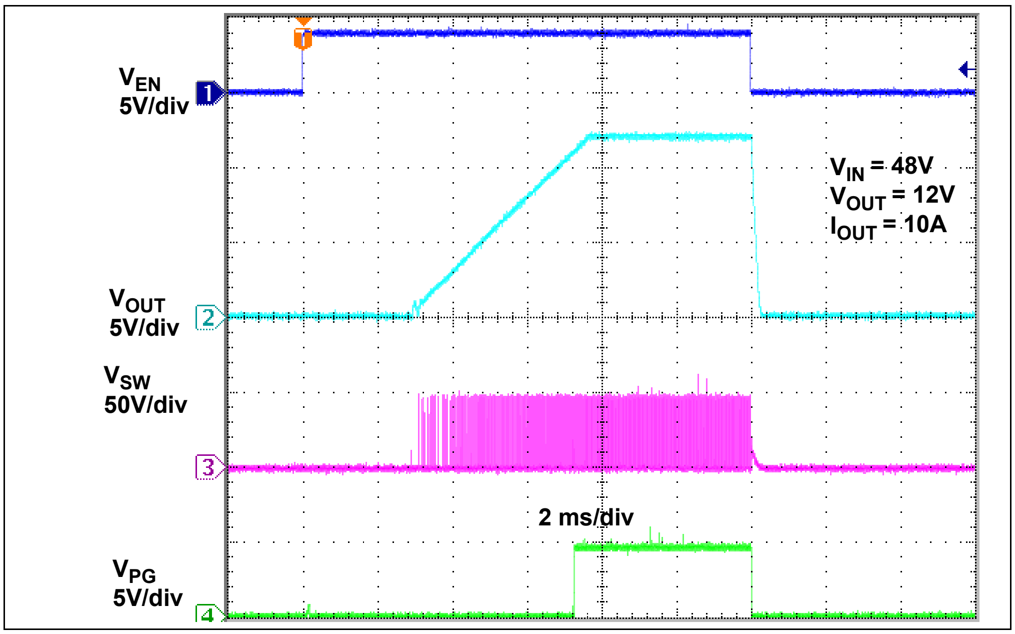


FIGURE C-8: *Enable Startup and Shutdown with Power Good, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 10A.*

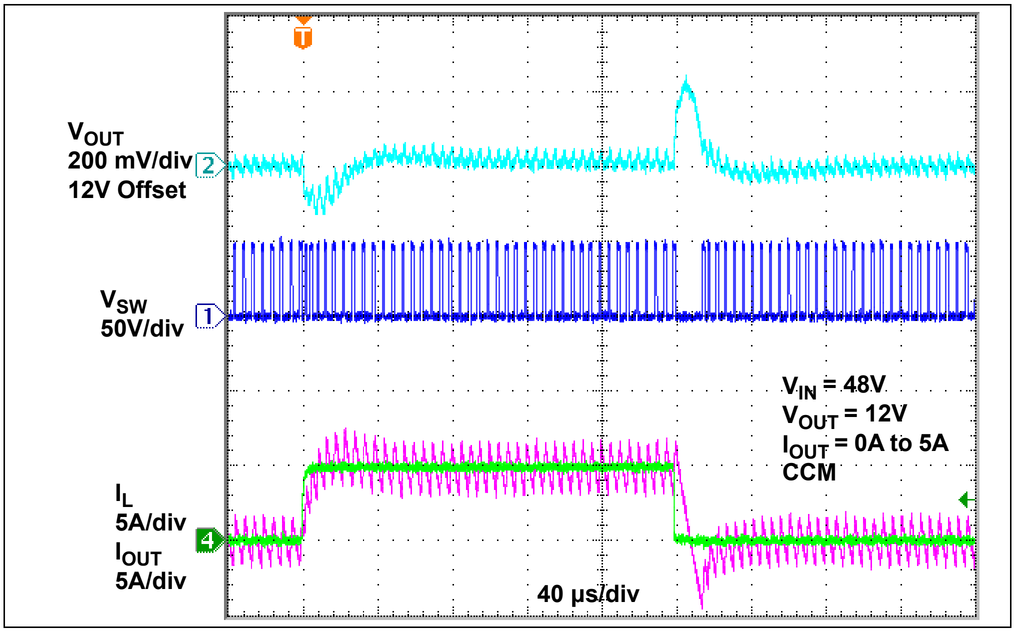


FIGURE C-9: *Load Transient in CCM, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 0A to 5A.*

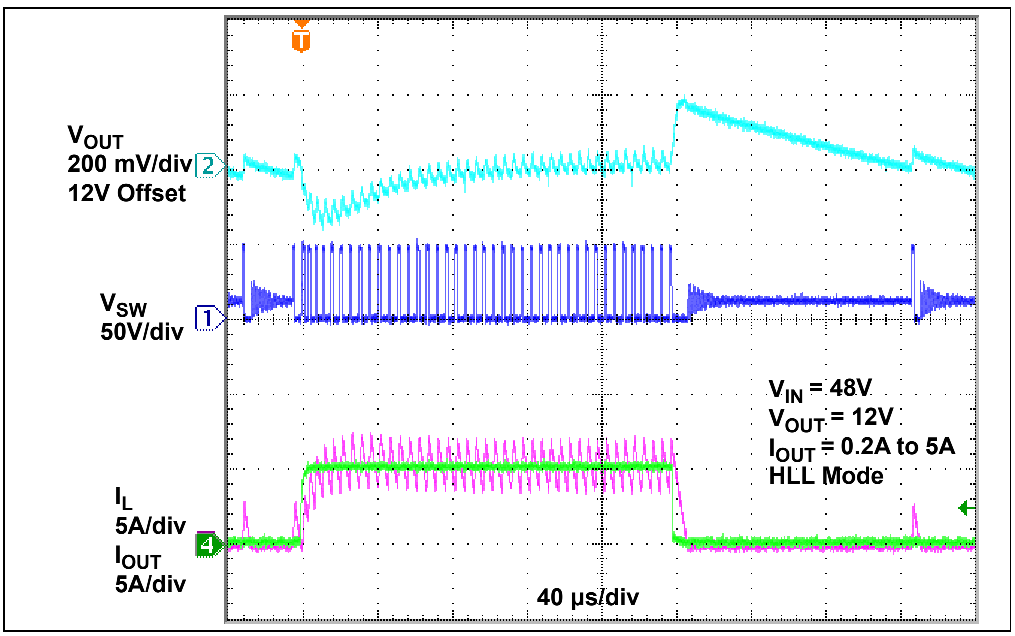


FIGURE C-10: *Load Transient in HLL Mode, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 0.2A to 5A.*

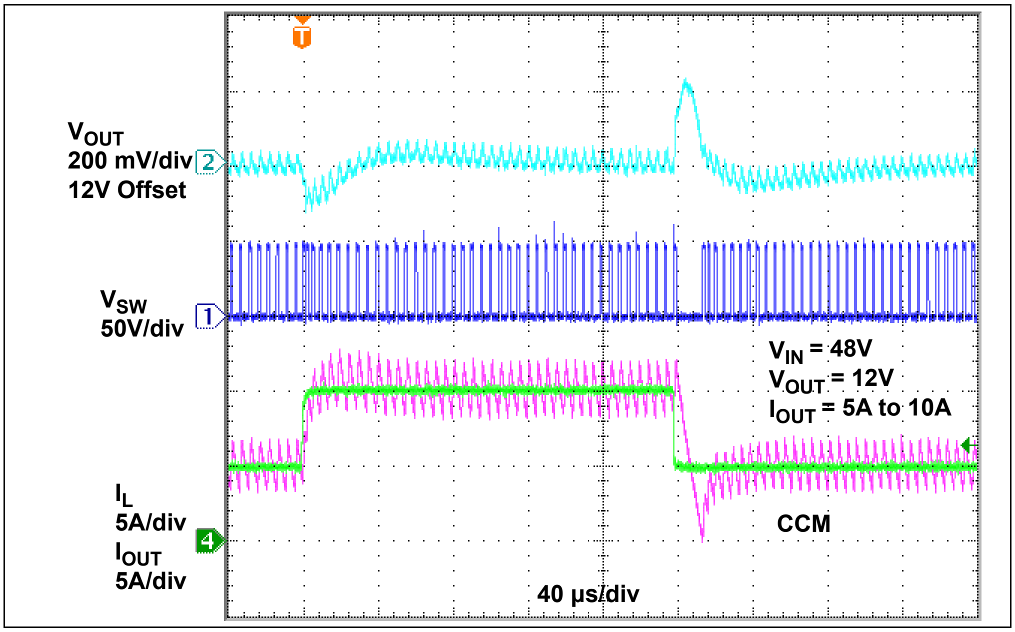


FIGURE C-11: *Load Transient in CCM, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 5A to 10A.*

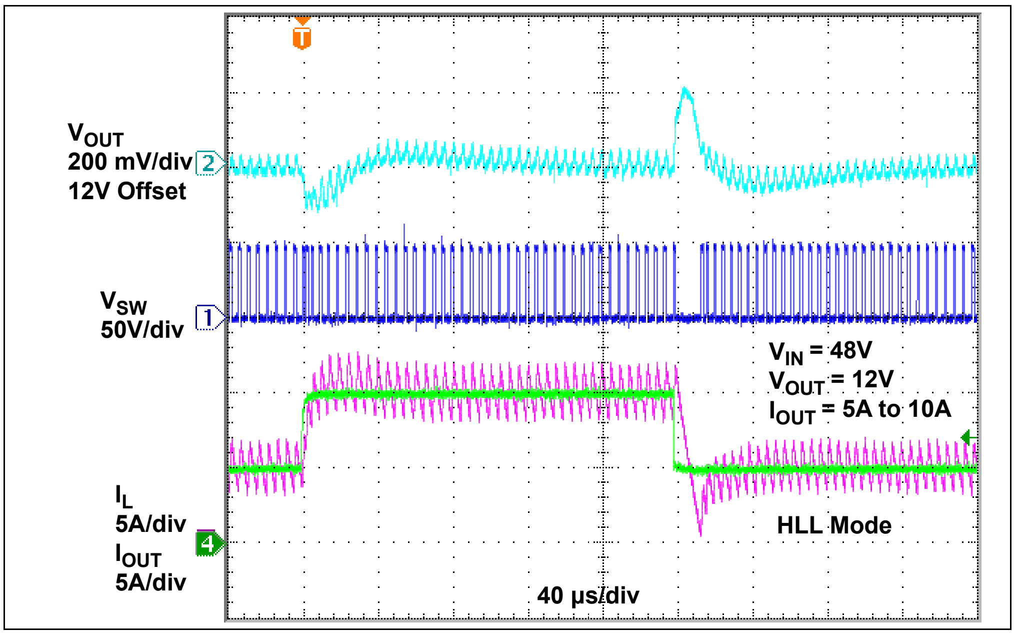


FIGURE C-12: *Load Transient in HLL Mode, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 5A to 10A.*

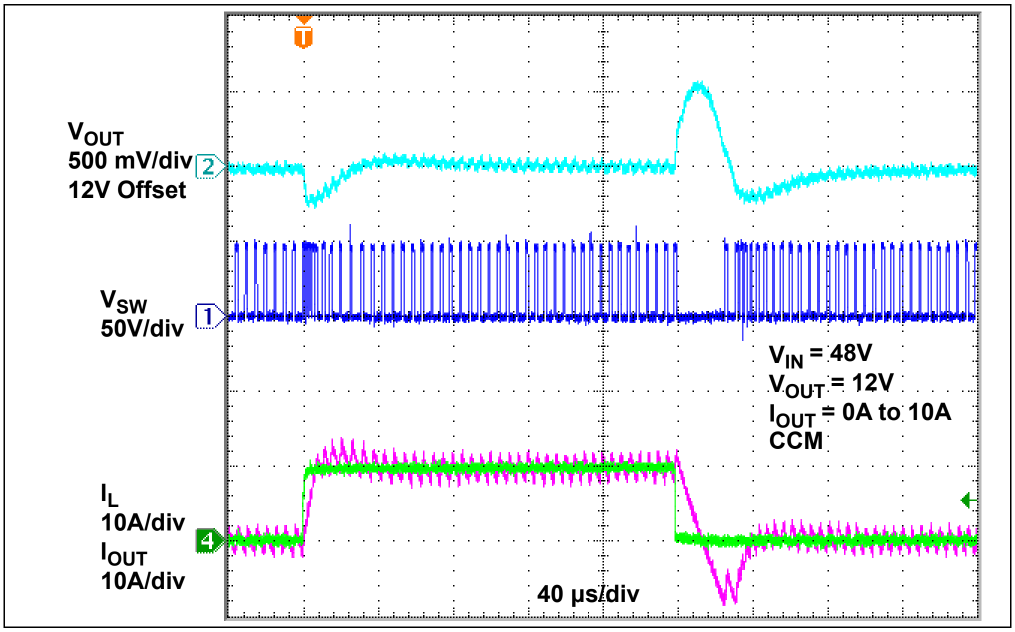


FIGURE C-13: *Load Transient in CCM, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 0A to 10A.*

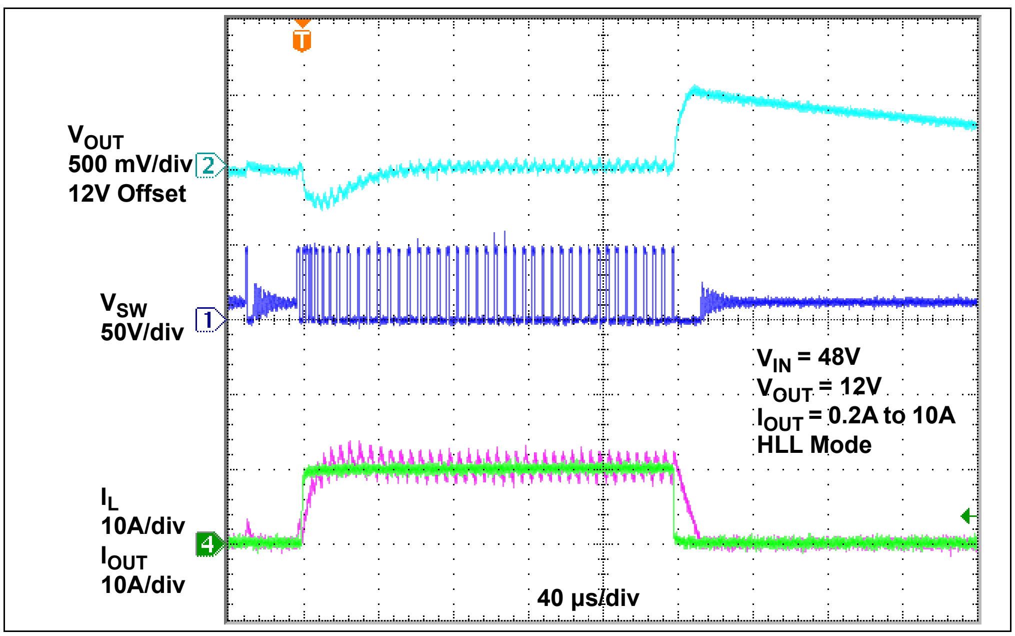


FIGURE C-14: *Load Transient in HLL Mode, V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 0.2A to 10A.*

C.2 PERFORMANCE CURVES

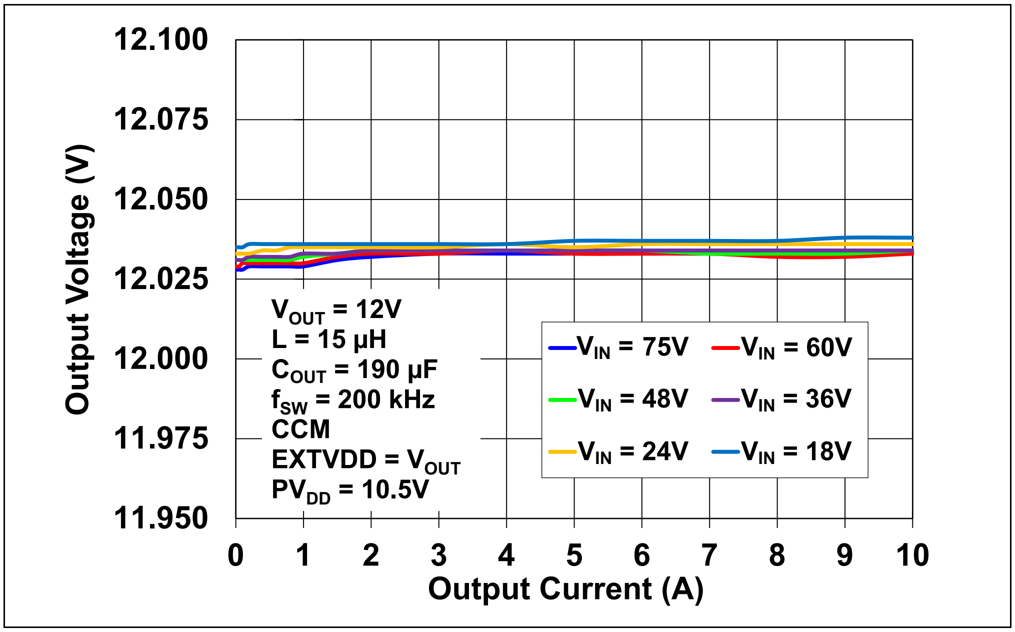


FIGURE C-15: *Output Voltage vs. Output Current (PV_{DD} = 10.5V, CCM).*

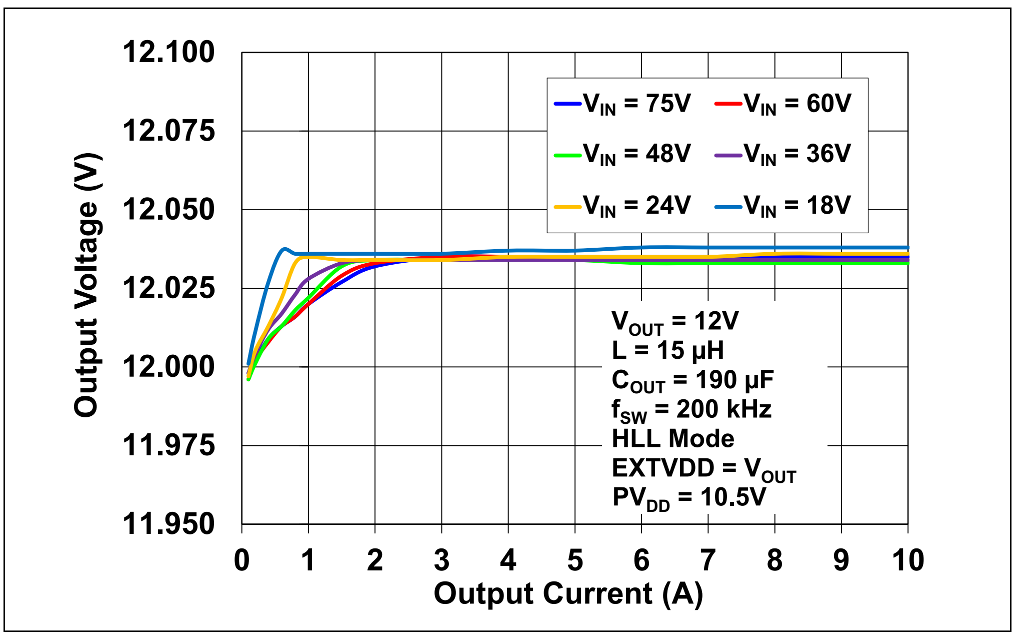


FIGURE C-16: *Output Voltage vs. Output Current (PV_{DD} = 10.5V, HLL Mode).*

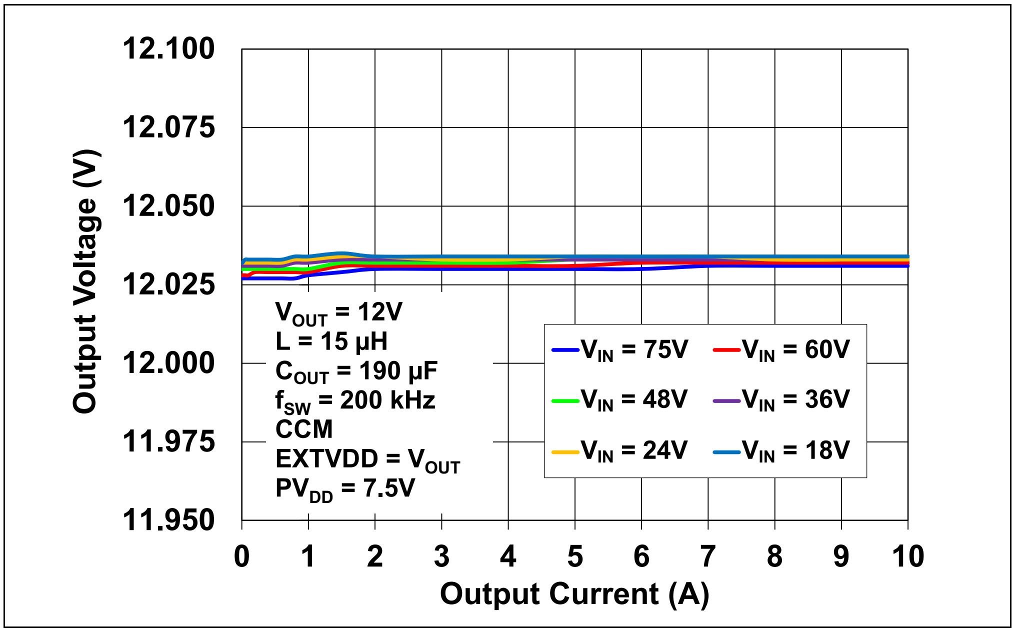


FIGURE C-17: *Output Voltage vs. Output Current (PV_{DD} = 7.5V, CCM).*

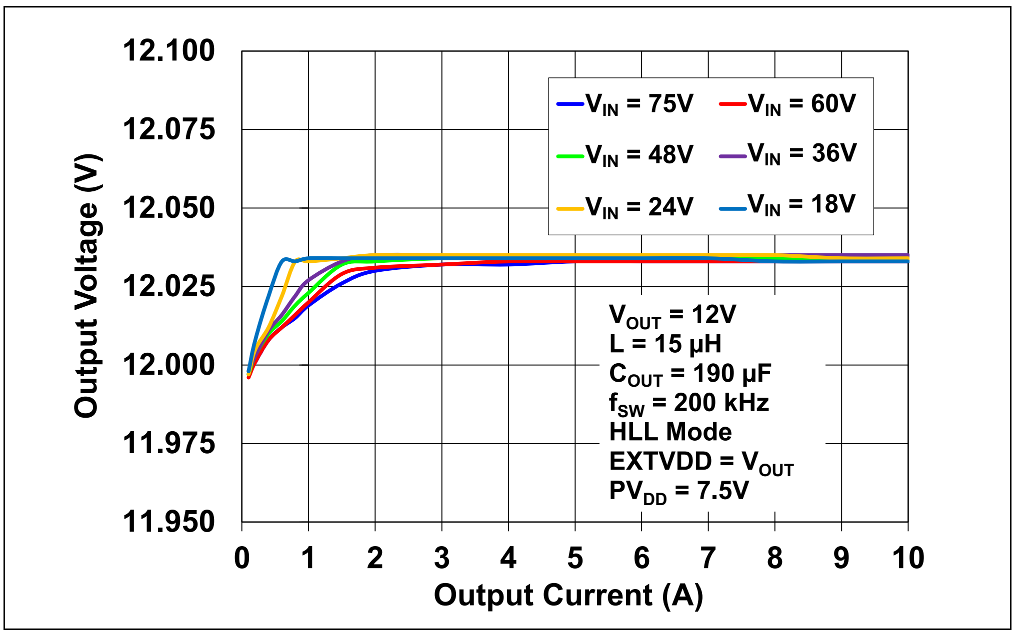


FIGURE C-18: *Output Voltage vs. Output Current (PV_{DD} = 7.5V, HLL Mode).*

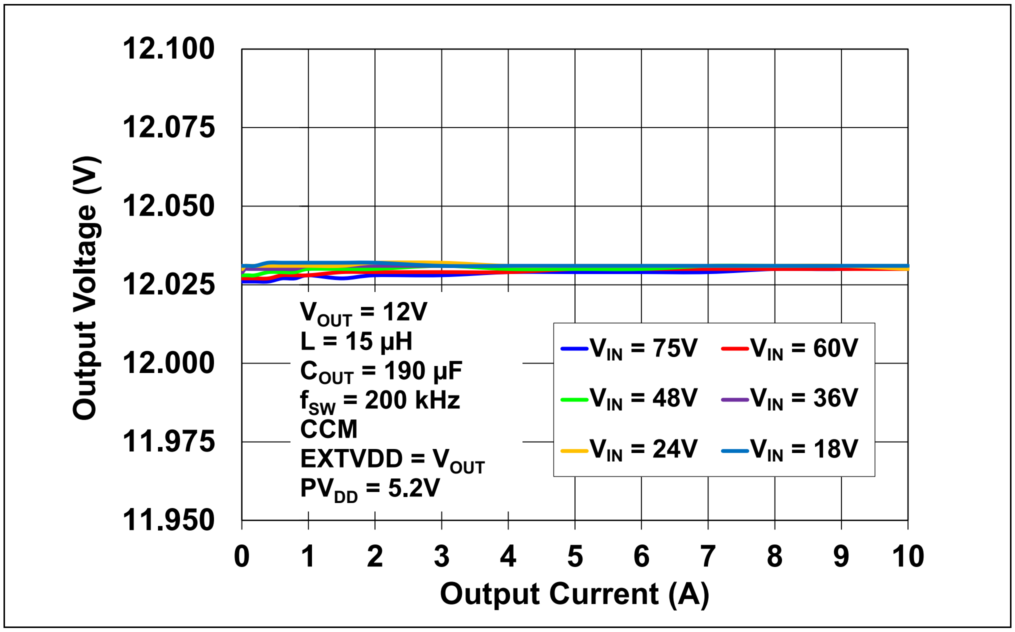


FIGURE C-19: *Output Voltage vs. Output Current (PV_{DD} = 5.2V, CCM).*

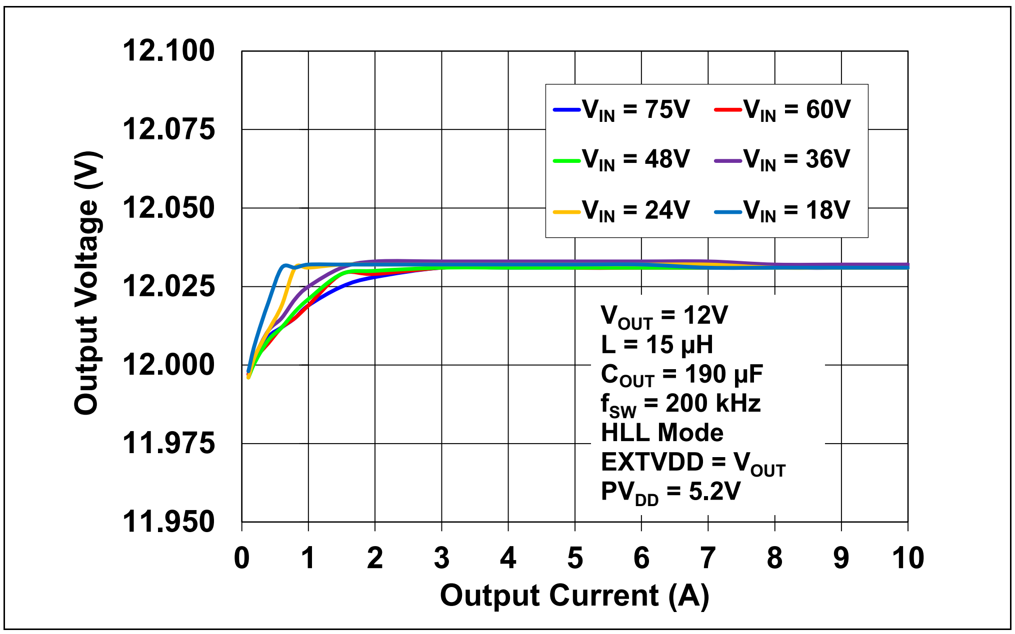


FIGURE C-20: *Output Voltage vs. Output Current (PV_{DD} = 5.2V, HLL Mode).*

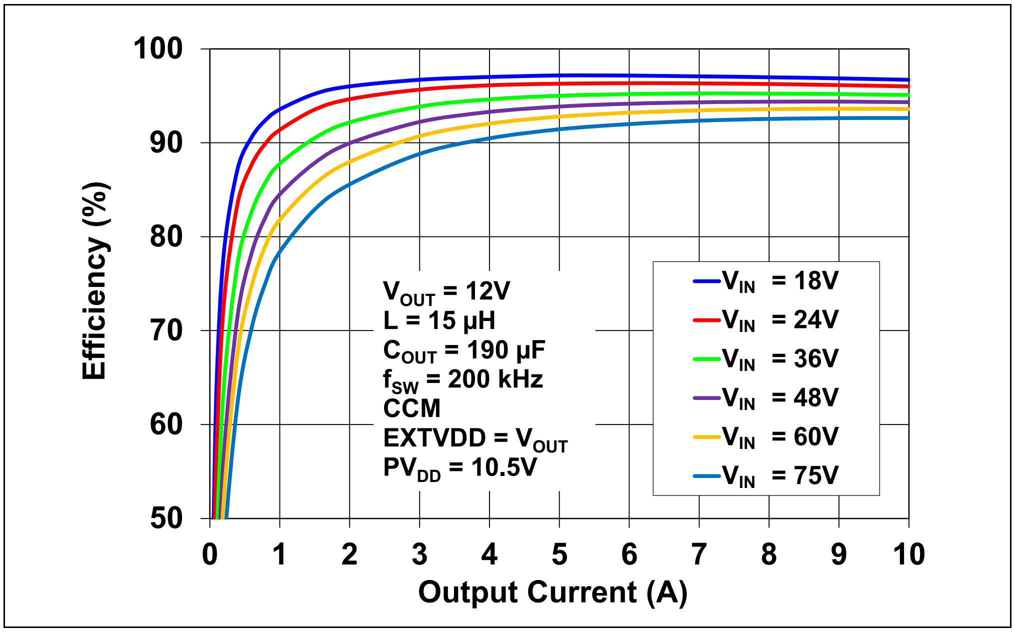


FIGURE C-21: *Efficiency vs. Output Current (PV_{DD} = 10.5V, CCM).*

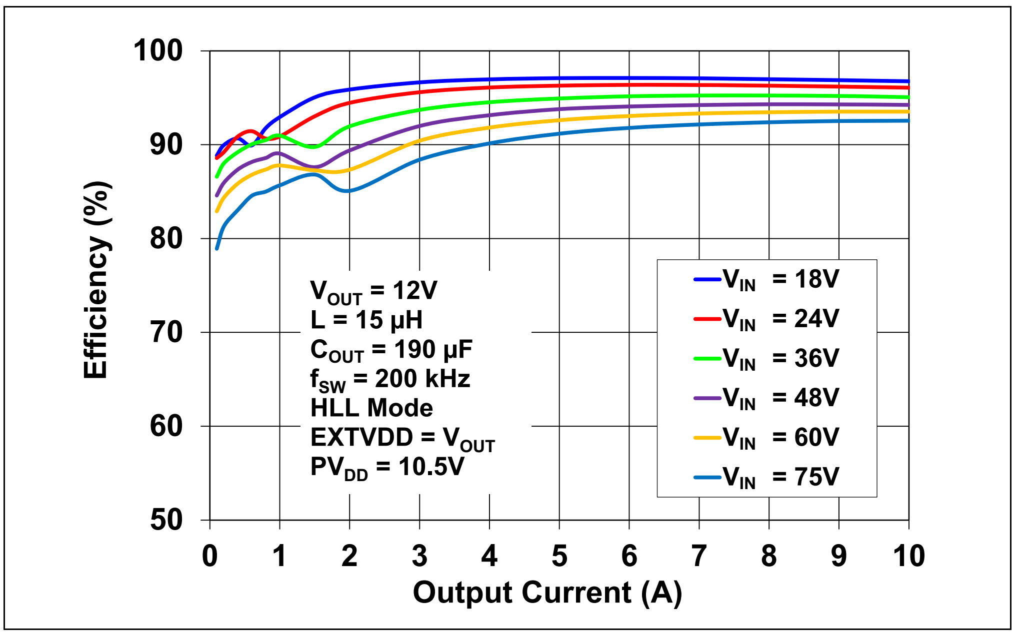


FIGURE C-22: *Efficiency vs. Output Current (PV_{DD} = 10.5V, HLL Mode).*

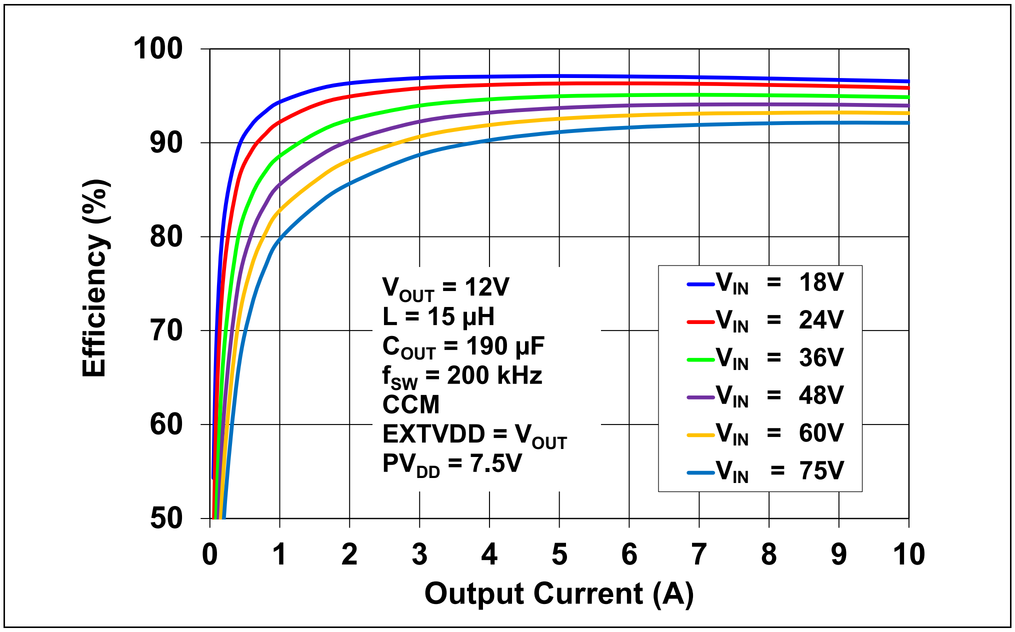


FIGURE C-23: *Efficiency vs. Output Current (PV_{DD} = 7.5V, CCM).*

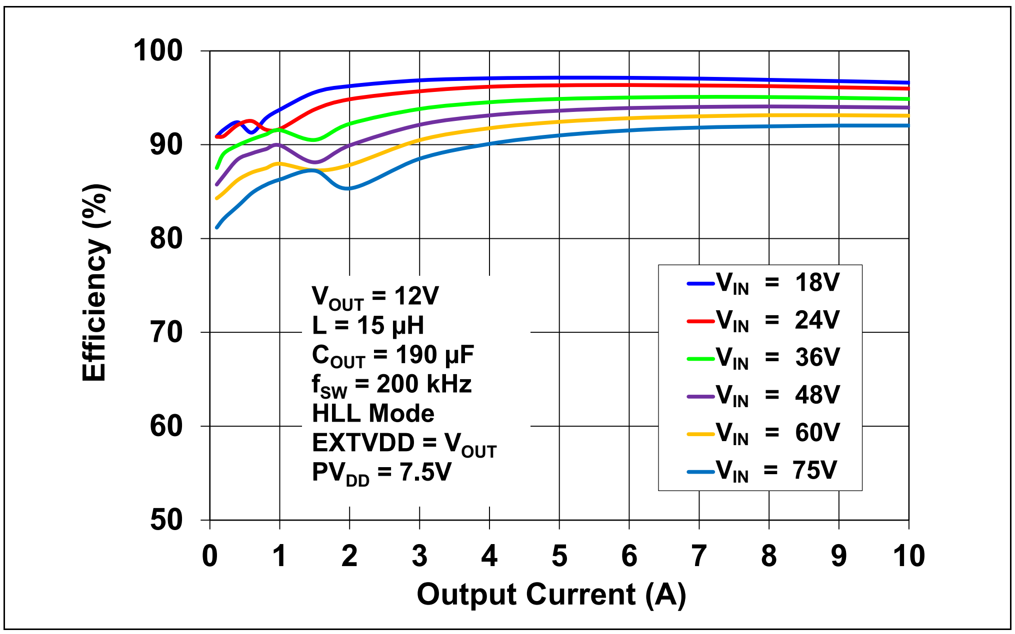


FIGURE C-24: *Efficiency vs. Output Current (PV_{DD} = 7.5V, HLL Mode).*

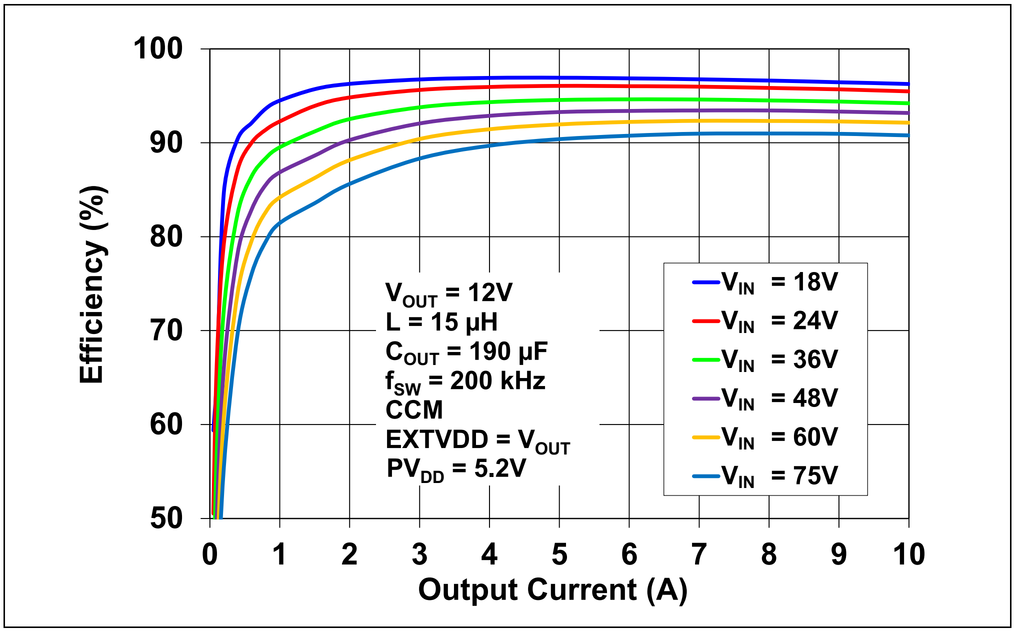


FIGURE C-25: *Efficiency vs. Output Current (PV_{DD} = 5.2V, CCM).*

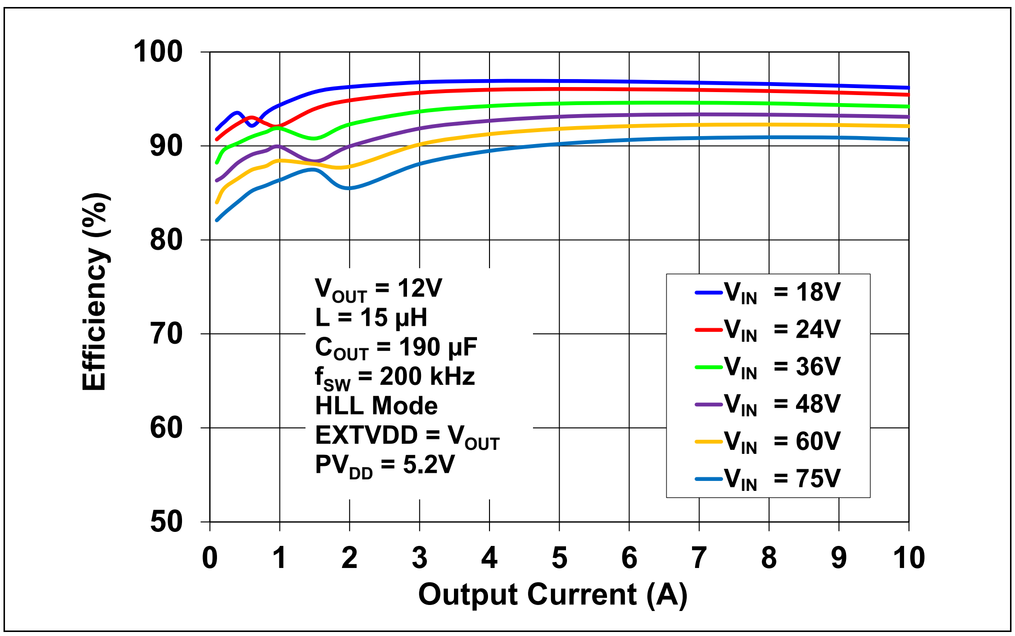


FIGURE C-26: *Efficiency vs. Output Current (PV_{DD} = 5.2V, HLL Mode).*

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