# 1ch Boost DC/DC Controller

# BD9615MUV-LB EVK

## BD9615MUV-EVK-002 (12V→24V, 2A)

User's Guide

## ＜High Voltage Safety Precautions＞

◇ Read all safety precautions before use

Please note that this document covers only the BD9615MUV-LB evaluation board (BD9615MUV-EVK-002) and its functions. For additional information, please refer to the datasheet.

**To ensure safe operation, please carefully read all precautions before handling the evaluation board**

Depending on the configuration of the board and voltages used,

**Potentially lethal voltages may be generated.**

Therefore, please make sure to read and observe all safety precautions described in the red box below.

**Before Use**

[1] Verify that the parts/components are not damaged or missing (i.e. due to the drops).
[2] Check that there are no conductive foreign objects on the board.
[3] Be careful when performing soldering on the module and/or evaluation board to ensure that solder splash does not occur.
[4] Check that there is no condensation or water droplets on the circuit board.

**During Use**

[5] Be careful to not allow conductive objects to come into contact with the board.
[6] **Brief accidental contact or even bringing your hand close to the board may result in discharge and lead to severe injury or death.**

**Therefore, DO NOT touch the board with your bare hands or bring them too close to the board.**
In addition, as mentioned above please exercise extreme caution when using conductive tools such as tweezers and screwdrivers.

[7] If used under conditions beyond its rated voltage, it may cause defects such as short-circuit or, depending on the circumstances, explosion or other permanent damages.
[8] Be sure to wear insulated gloves when handling is required during operation.

**After Use**

[9] The ROHM Evaluation Board contains the circuits which store the high voltage. Since it stores the charges even after the connected power circuits are cut, please discharge the electricity after using it, and please deal with it after confirming such electric discharge.
[10] Protect against electric shocks by wearing insulated gloves when handling.

This evaluation board is intended for use only in research and development facilities and should by handled **only by qualified personnel familiar with all safety and operating procedures.**
We recommend carrying out operation in a safe environment that includes the use of high voltage signage at all entrances, safety interlocks, and protective glasses.

Switching Regulator Series

# 1ch Boost DC/DC Controller BD9615MUV-LB EVK

## BD9615MUV-EVK-002 (12V→24V, 2A)

## Introduction

This user's guide will provide the steps necessary to operate the BD9615MUV-EVK-002 and evaluate ROHM's BD9615MUV-LB 1channel Boost DC/DC controller. Component selection, operating procedures and application data are included.

## Description

This EVK uses a non-synchronous rectifying boost DC / DC controller IC BD9615MUV-LB to output 24V from an input voltage of 8V to 18V. BD9615MUV-LB accepts a power supply input range of 3.5V to 60V. The output voltage can be set with an external resistor. An external resistor can adjust the switching frequency from 100kHz to 2500kHz. It reduces the total mounting area because it can operate at extremely high switching frequency. In addition, it has an external clock synchronization function to perform noise management. BD9615MUV-LB has Thermal Shutdown (TSD), Over Voltage Protection (OVP), UVLO Control Function by External Resistors, and Over Current Protection (OCP) to prevent damage caused by various abnormal modes.

## Application

General consumer devices with 12V/24V lines

Industrial distributed-power applications

Entertainment equipment

OA equipment

LED lighting

## Operating Limits

Table 1. Operating Limits

| Parameter | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|
| Input Voltage | 8 | 12 | 18 | V | |
| Output Voltage | | 24 | | V | |
| Output Current Range | | | 2 | A | |
| Operating Frequency | | 416 | | kHz | R_RT=120kΩ |
| Maximum Efficiency | | 94.9 | | % | IOUT = 2A |





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## EVK

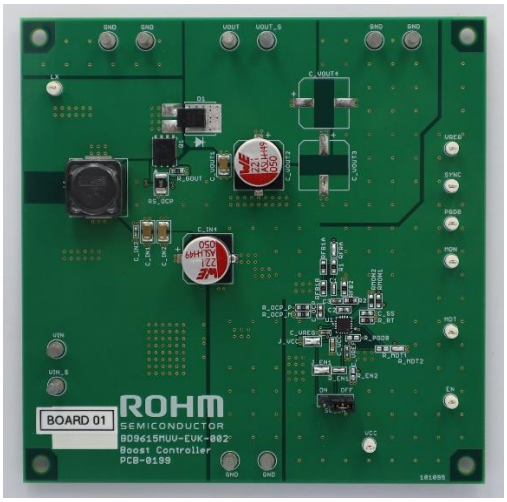


Figure 1. BD9615MUV-EVK-002(Top View)

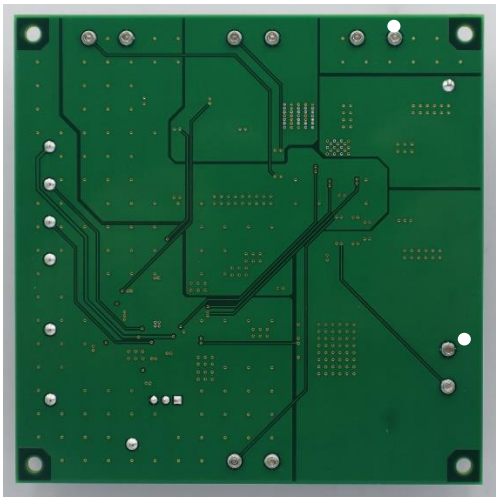

Figure 2. BD9615MUV-EVK-002(Bottom View)

## EVK Schematic

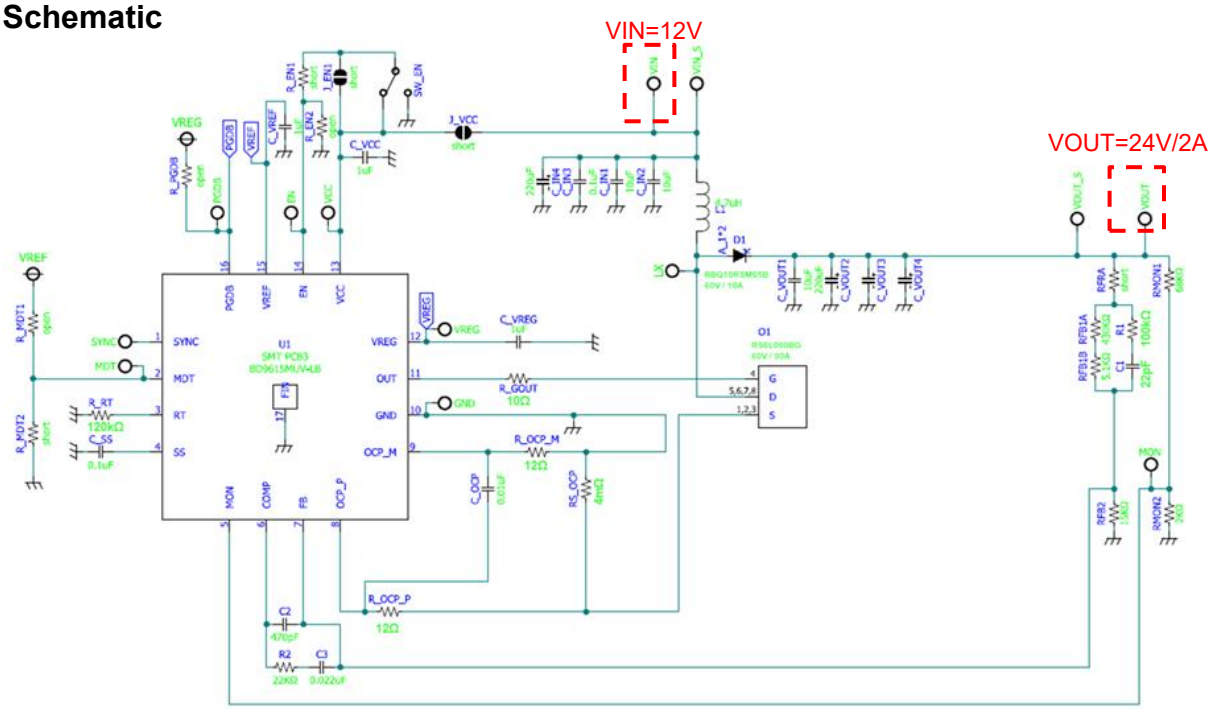


Figure 3. BD9615MUV-EVK-002 schematic

## Operating Procedure

Below is the procedure to operate the EVK.

1. Turn off the power supply and connect the power supply's GND pin to the GND pin of the EVK.
2. Connect the power supply's positive terminal to the VIN pin of the EVK.
3. Check if the electronic load is turned off and connect the electronic load to the VOUT pin and the GND pin of the EVK.
4. Connect the voltmeter to the VOUT pin and the GND pin of the EVK.
5. Turn on the power supply and check if the measured value of the voltmeter is 24V.
6. Turn on the electronic load.

Notes:

The board does not support hot plugging protection. Do not perform hot plugging on this board.

## BOM

Below is a table with the bill of materials.

Table 2. Bill of Materials

| Count | Parts No. | Type | Value | Description | Part Number | Manufacturer | Configuration inch(mm) |
|---|---|---|---|---|---|---|---|
| 1 | U1 | IC | - | IC for 1ch Boost DCDC Controller | BD9615MUV-LB | ROHM | 1111(3030) |
| 1 | C1 | Ceramic Capacitor | 22pF | 50V, C0G, ±5% | 885012005057 | Wurth Electronics | 0402(1005) |
| 1 | C2 | Ceramic Capacitor | 470pF | 50V, CH, ±5% | GRM1552C1H471JA01 | MURATA | 0402(1005) |
| 1 | C3 | Ceramic Capacitor | 0.022µF | 50V, X7R, ±5% | GRM155R71H223JA12 | MURATA | 0402(1005) |
| 3 | C_IN1, C_IN2, C_VOUT1 | Ceramic Capacitor | 10µF | 50V, X7T, ±10% | GRM31CD71H106KE11 | MURATA | 1206(3216) |
| 2 | C_IN3, C_SS | Ceramic Capacitor | 0.1µF | 50V, X7R, ±10% | GRM155R71H104KE14 | MURATA | 0402(1005) |
| 2 | C_IN4, C_VOUT2 | Electrolytic Capacitor | 220µF | 50V, ±20% | 865080657018 | Wurth Electronics | 0.41 x 0.44 (10.5 x 11.2) |
| 1 | C_OCP | Ceramic Capacitor | 0.01µF | 50V, X7R, ±5% | GRM155R71H103JA88 | MURATA | 0402(1005) |
| 1 | C_VCC | Ceramic Capacitor | 1µF | 50V, X7R, ±10% | 885012206126 | Wurth Electronics | 0603(1608) |
| 0 | C_VOUT3, C_VOUT4 | Electrolytic Capacitor | - | - | - | - | 0.41 x 0.44 (10.5 x 11.2) |
| 2 | C_VREF, C_VREG | Ceramic Capacitor | 1µF | 25V, X6S, ±10% | GRM155C81E105KE11 | MURATA | 0402(1005) |
| 1 | D1 | Diode | 60V / 10A | 60V / 10A | RBQ10RSM65B | ROHM | 0.18 x 0.25 (4.6 x 6.5) |
| 1 | L1 | Inductor | 4.7µH | 12A, 9.5mΩmax | 74477004 | Wurth Electronics | 0.47 x 0.47 (12x12) |
| 1 | Q1 | FET | 60V / 90A | 14nC, RDS=7.4mΩmax, VGS=4.5V | RS6L090BG | ROHM | 2024(5060) |
| 1 | R1 | Resistor | 100kΩ | 0.1W, 50V, 1% | MCR03EZPFX1003 | ROHM | 0603(1608) |
| 1 | R2 | Resistor | 22kΩ | 0.1W, 50V, 1% | MCR03EZPFX2202 | ROHM | 0603(1608) |
| 1 | RFB1A | Resistor | 430kΩ | 0.1W, 50V, 1% | MCR03EZPFX4303 | ROHM | 0603(1608) |
| 1 | RFB1B | Resistor | 5.1kΩ | 0.1W, 50V, 1% | MCR03EZPFX5101 | ROHM | 0603(1608) |
| 1 | RFB2 | Resistor | 15kΩ | 0.1W, 50V, 1% | MCR03EZPFX1502 | ROHM | 0603(1608) |
| 3 | RFRA, R_EN1, R_MDT2 | Short | - | - | - | - | 0603(1608) |
| 1 | RMON1 | Resistor | 68kΩ | 0.1W, 50V, 1% | MCR03EZPFX6802 | ROHM | 0603(1608) |
| 1 | RMON2 | Resistor | 2kΩ | 0.1W, 50V, 1% | MCR03EZPFX2001 | ROHM | 0603(1608) |
| 1 | RS_OCP | Resistor | 4mΩ | 1W, 1% | PMR25EZPFU4L00 | ROHM | 1210(3225) |
| 0 | R_EN2, R_MDT1, R_PGDB | Open | - | - | - | - | 0603(1608) |
| 2 | R_OCP_M, R_OCP_P | Resistor | 12Ω | 0.1W, 50V, 1% | MCR03EZPFX12R0 | ROHM | 0603(1608) |
| 1 | R_GOUT | Resistor | 10Ω | 0.1W, 50V, 1% | MCR03EZPFX10R0 | ROHM | 0603(1608) |
| 1 | R_RT | Resistor | 120kΩ | 0.1W, 50V, 1% | MCR03EZPFX1203 | ROHM | 0603(1608) |
| 2 | J_EN1, J_VCC | Short | - | - | - | - | 0603(1608) |
| 1 | SW_EN | SWITCH | - | Pin header, 2.54mm x3contacts | 61300311121 | Wurth Electronics | - |
| 1 | | Jumper | - | Jumper, 2.54mm pitch | 60900213421 | Wurth Electronics | - |
| 4 | VIN, VIN_S, VOUT, VOUTS | Test pin | - | - | 1502-2 | Key stone | - |
| 6 | GND | Test pin | - | - | 1502-2 | Key stone | - |
| 8 | EN, MDT, PGDB, SYNC, VCC, VREG, MON, LX | Test pin | - | - | 5002 | Key stone | - |

Note.

Recommended parts are selected from those products and information available at the time this data sheet (Rev.001) was released. If supply conditions change and parts are not available, use similar parts.

## Board Layout

EVK PCB information

| Number of Layers | Material | Board Size | Copper Thickness |
|---|---|---|---|
| 4 | FR-4 High TG | 100mm x 100mm x 1.6mmt | 1oz (35µm) |

Following is the layout of BD9615MUV-EVK-002.

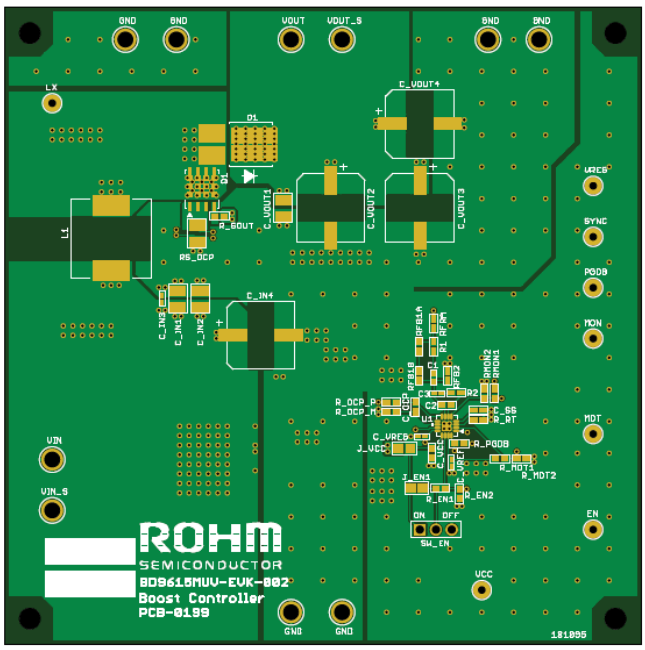


Figure 4. Top PCB image
(Top View)

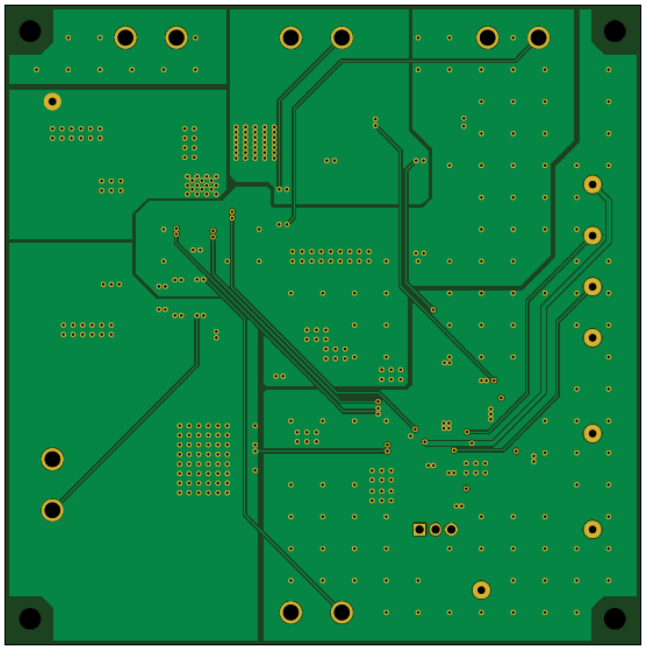

Figure 5. Bottom PCB image
(Top View)

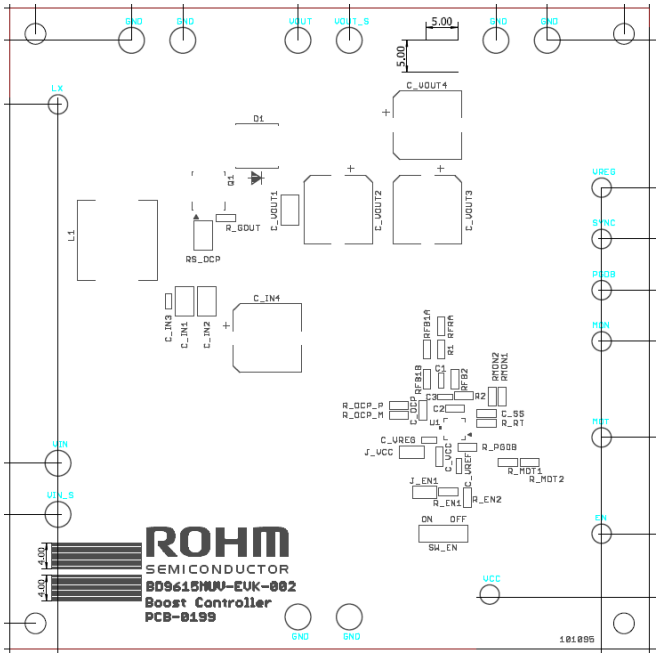


Figure 6. Top Layer Silkscreen layout
(Top View)

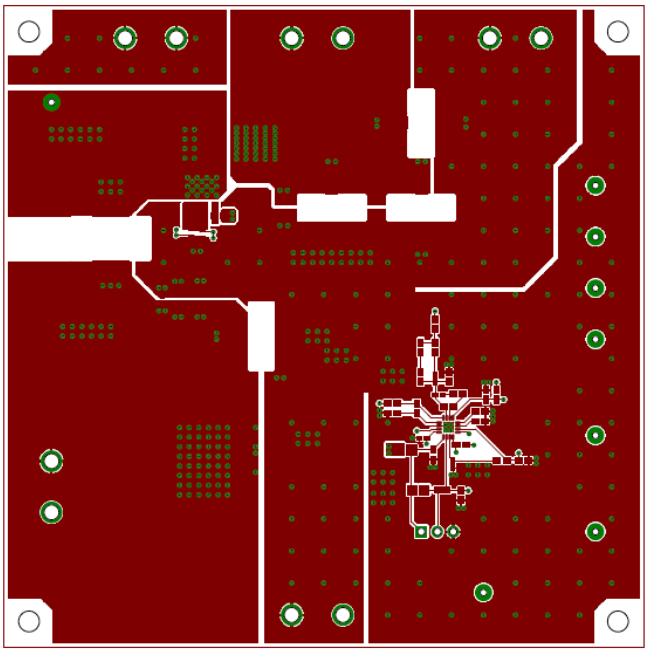

Figure 7. Top Layer layout
(Top View)

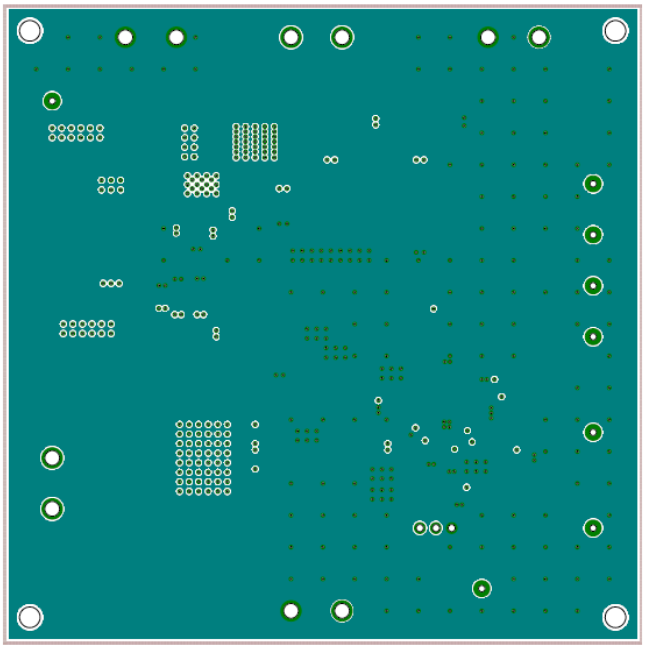

Figure 8. Middle1 Layer (GND) layout
(Top View)

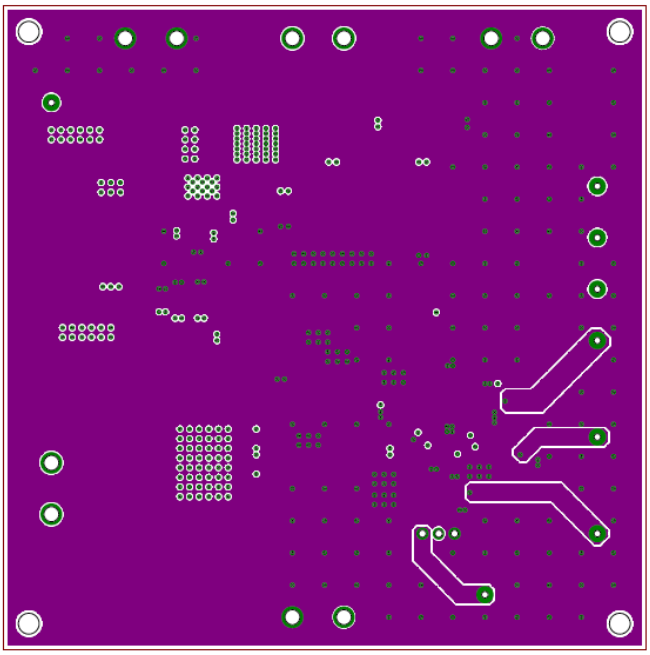

Figure 9. Middle2 Layer (GND) Layout
(Top View)

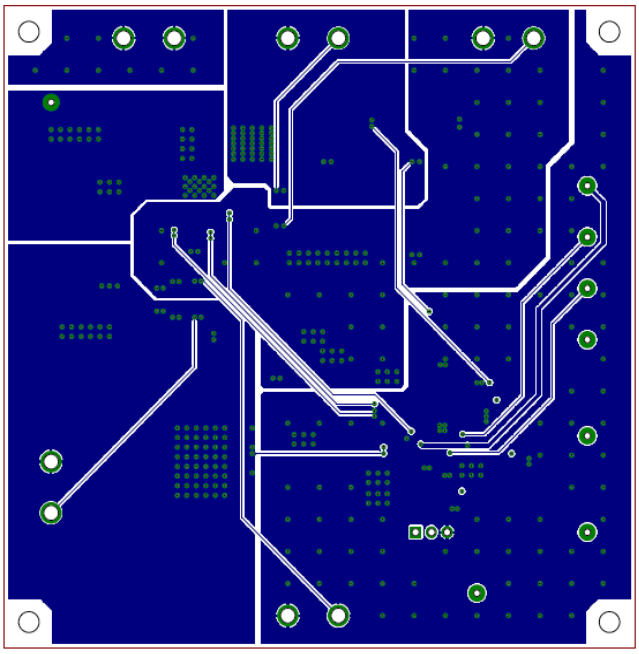

Figure 10. Bottom Layer layout
(Top View)

## Reference Application Data

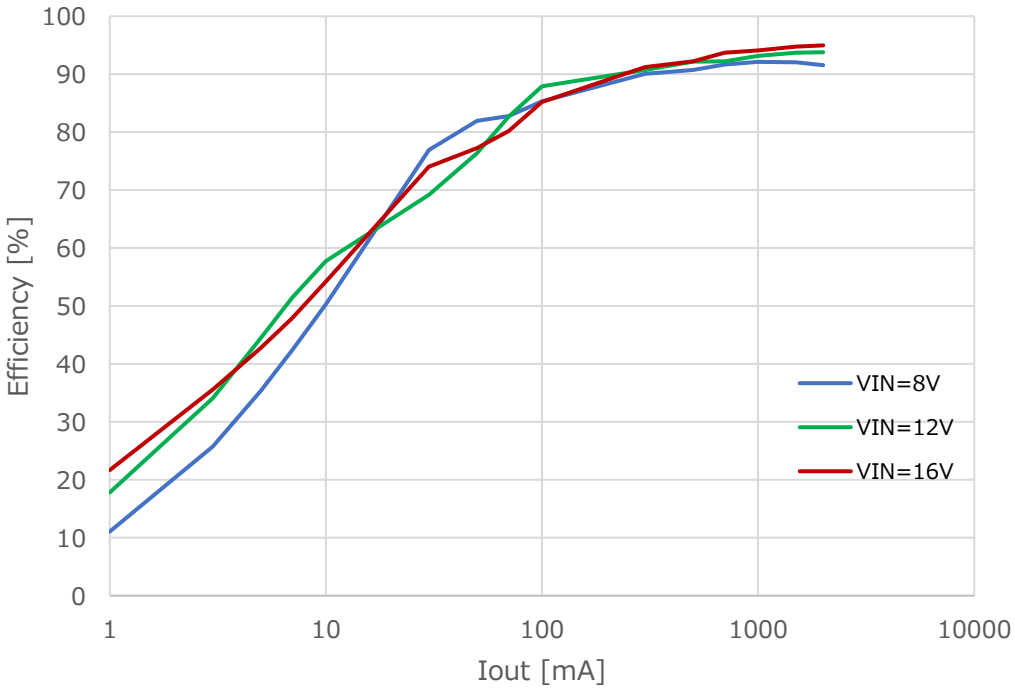


Figure 11. Efficiency vs Load Current (VOUT=24V)

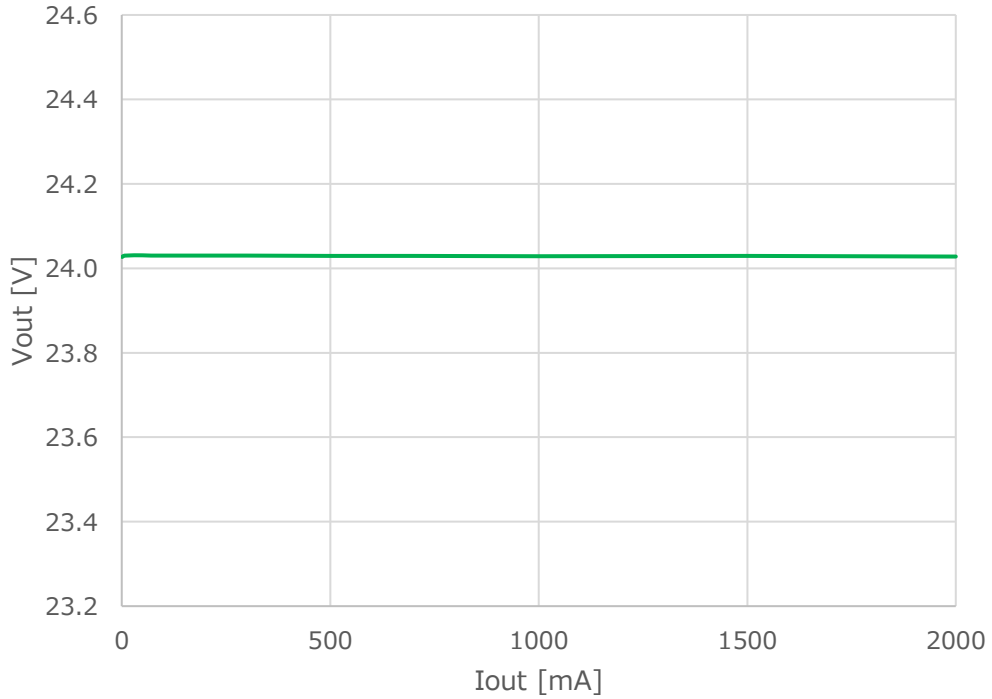


Figure 12. Load Regulation (VIN=12V, VOUT=24V)

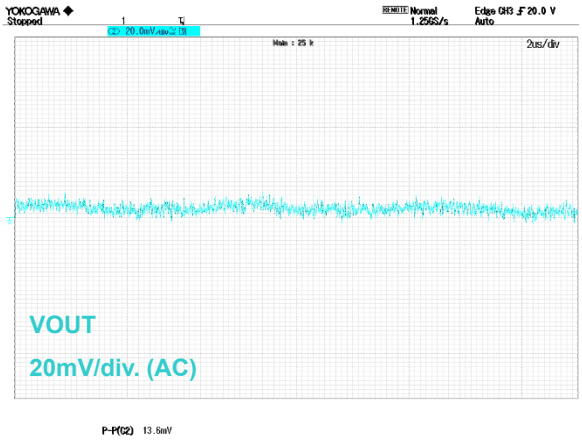


Figure 13. Output Ripple Voltage
(VIN=12V, IOUT=0A)

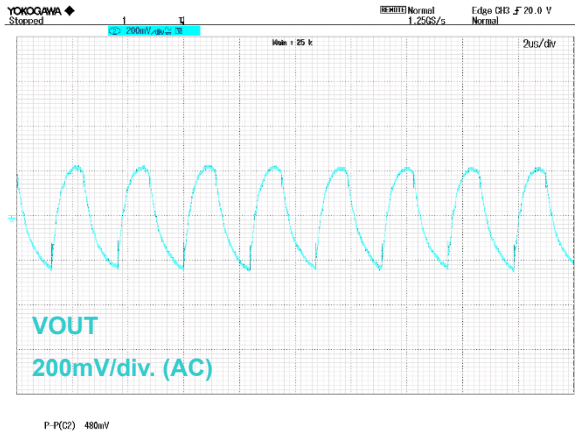


Figure 14. Output Ripple Voltage
(VIN=12V, IOUT=2A)

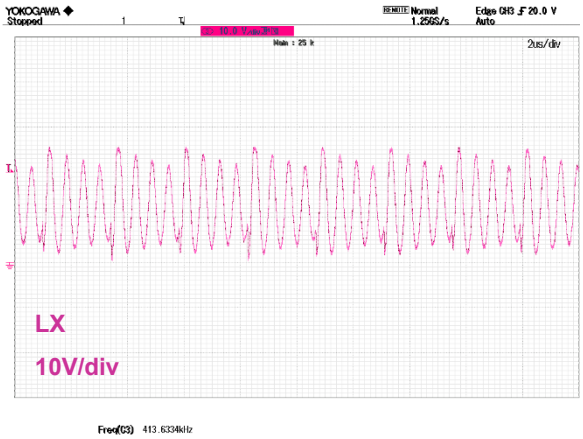


Figure 15. Switching Waveform
(VIN=12V, IOUT=0A)

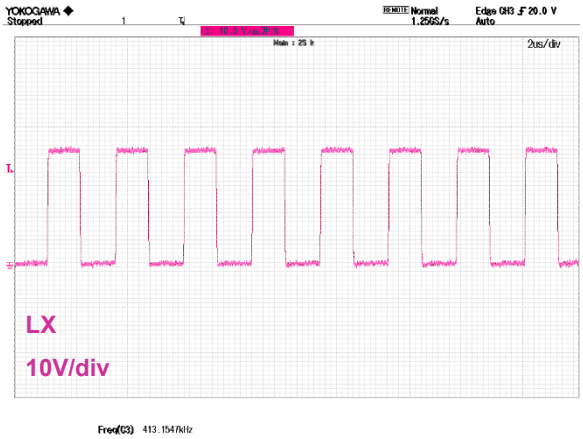


Figure 16. Switching Waveform
(VIN=12V, IOUT=2A)

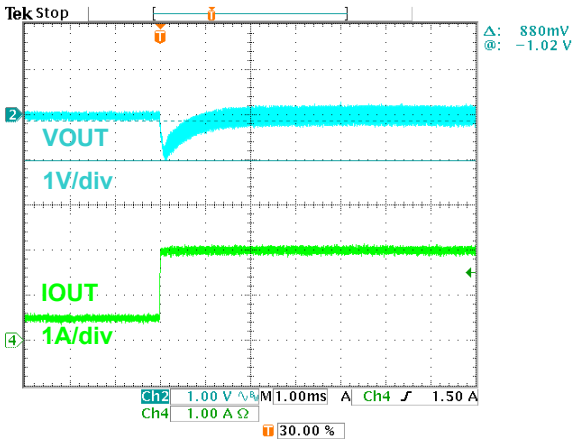


Figure 17. Transient Load Response
(VIN=12V, IOUT=0.5A→2A, Slew Rate=0.1A/μs)

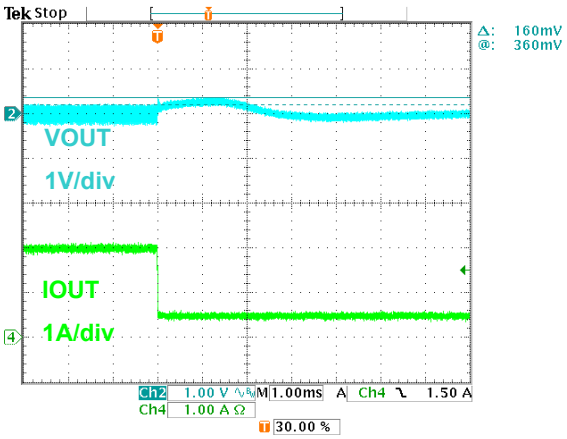


Figure 18. Transient Load Response
(VIN=12V, IOUT=2A→0.5A, Slew Rate=0.1A/μs)

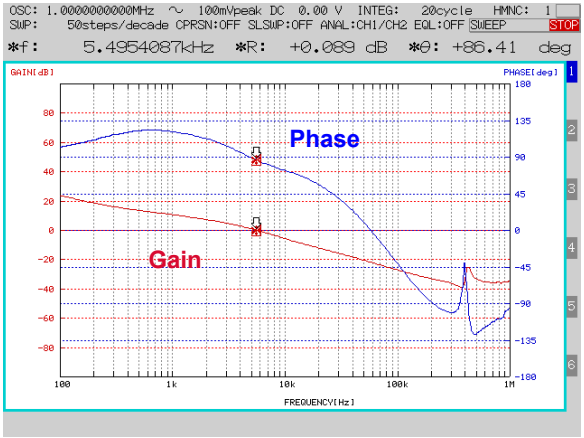


Figure 19. Frequency Response
(VIN=12V, IOUT=2A)

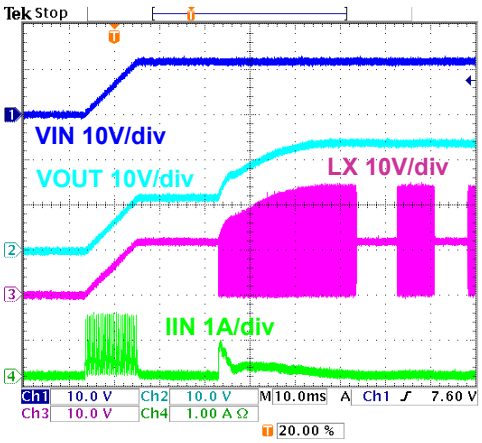


Figure 20. Start-up Waveform
(VIN=0V→12V, IOUT=0A, Slew Rate=1V/ms)

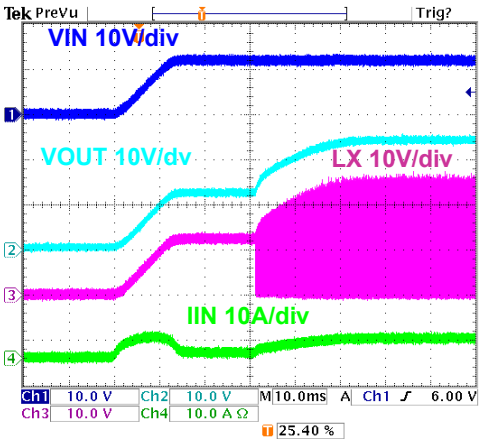


Figure 21. Start-up Waveform
(VIN=0V→12V, IOUT=2A, Slew Rate=1V/ms)

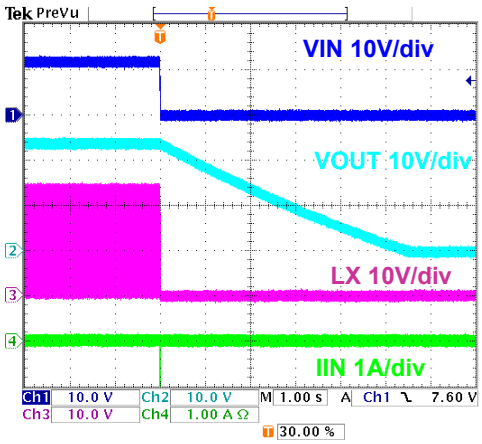


Figure 22. Shutdown Waveform
(VIN=12V→0V, IOUT=0A, Slew Rate=1V/ms)

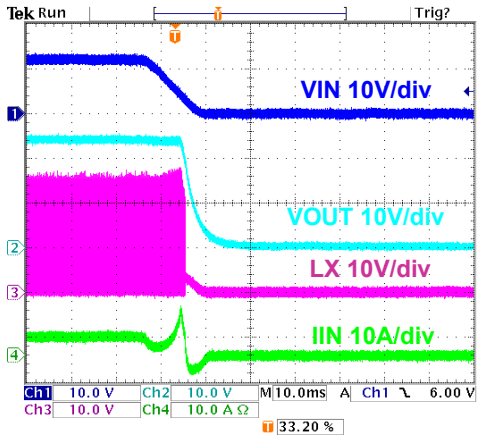


Figure 23. Shutdown Waveform
(VIN=12V→0V, IOUT=2A, Slew Rate=1V/ms)

## Revision History

| Date | Revision Number | Description |
|---|---|---|
| 26. Nov. 2023 | 001 | Initial release |

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