Synchronous Buck-Boost Controller
BD8303MUV EVK
（BD8303MUV-EVK-001）

User’s Guide

＜High Voltage Safety Precautions＞

◇ Read all safety precautions before use

Please note that this document covers only the BD8303MUV evaluation board (BD8303MUV-EVK-001) 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

Synchronous Buck-Boost Controller BD8303MUV EVK

BD8303MUV-EVK-001 (7.4V → 12V, 1.5A)

Introduction

This user's guide will provide the steps necessary to operate the BD8303MUV-EVK-001 and evaluate ROHM's BD8303MUV synchronous buck-boost DC/DC controller. Component selection, operating procedures and application data are included.

Description

This EVK uses a synchronous rectifying buck-boost DC / DC controller IC BD8303MUV to output 12V from an input voltage of 4V to 14V. BD8303MUV accepts a power supply input range of 2.7V to 14V. The output voltage can be set from 1.8V to 12V with an external resistor. The operating frequency can be set from 200kHz to 1MHz with an external resistor. The IC implements an efficient buck-boost converter using one inductor and external N-Channel FETs. It has a built-in soft start function for rush current countermeasures at startup, UVLO (Under Voltage Lock Out), TSD (Thermal Shutdown Detection), and SCP (Short Circuit Protection).

Application

General Portable Equipment such as:

- DVC (Digital Video Camera)
- Single-Lens Reflex Cameras
- Portable DVDs player
- Laptop PCs

Operating Limits

Table 1. Operating Limits

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage	4.0	7.4	14	V	
Output Voltage		12		V	RINV1=330kΩ、RINV2=30kΩ
Output Current Range			1.5	A	
Operating Frequency		400		kHz	RT=75kΩ
Maximum Efficiency		92		%	I_{OUT} = 1.5A

No. 63UG045E Rev.002
OCT.2023

EVK

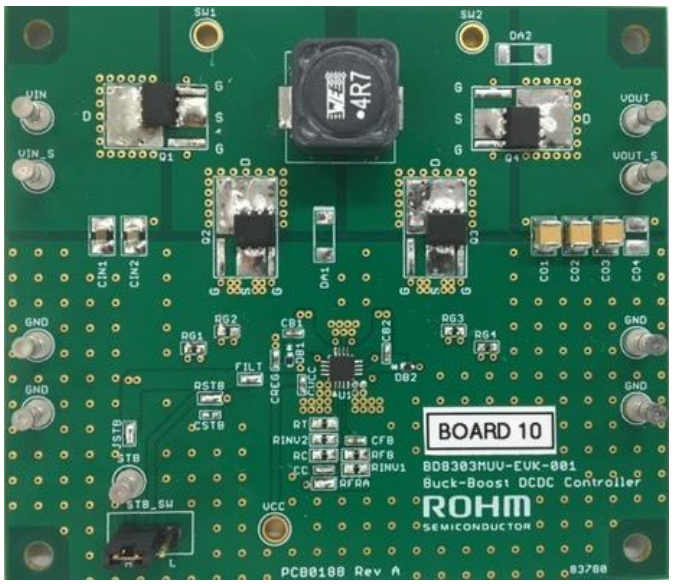

Figure 1. BD8303MUV-EVK-001(Top View)

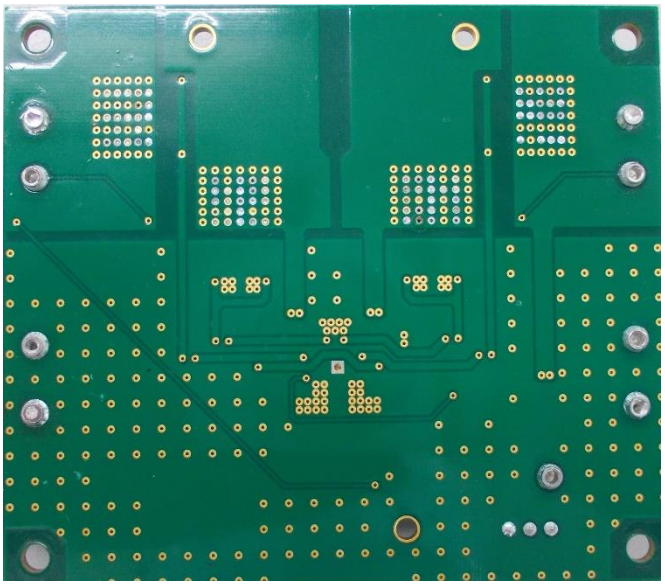

Figure 2. BD8303MUV-EVK-001(Bottom View)

EVK Schematic

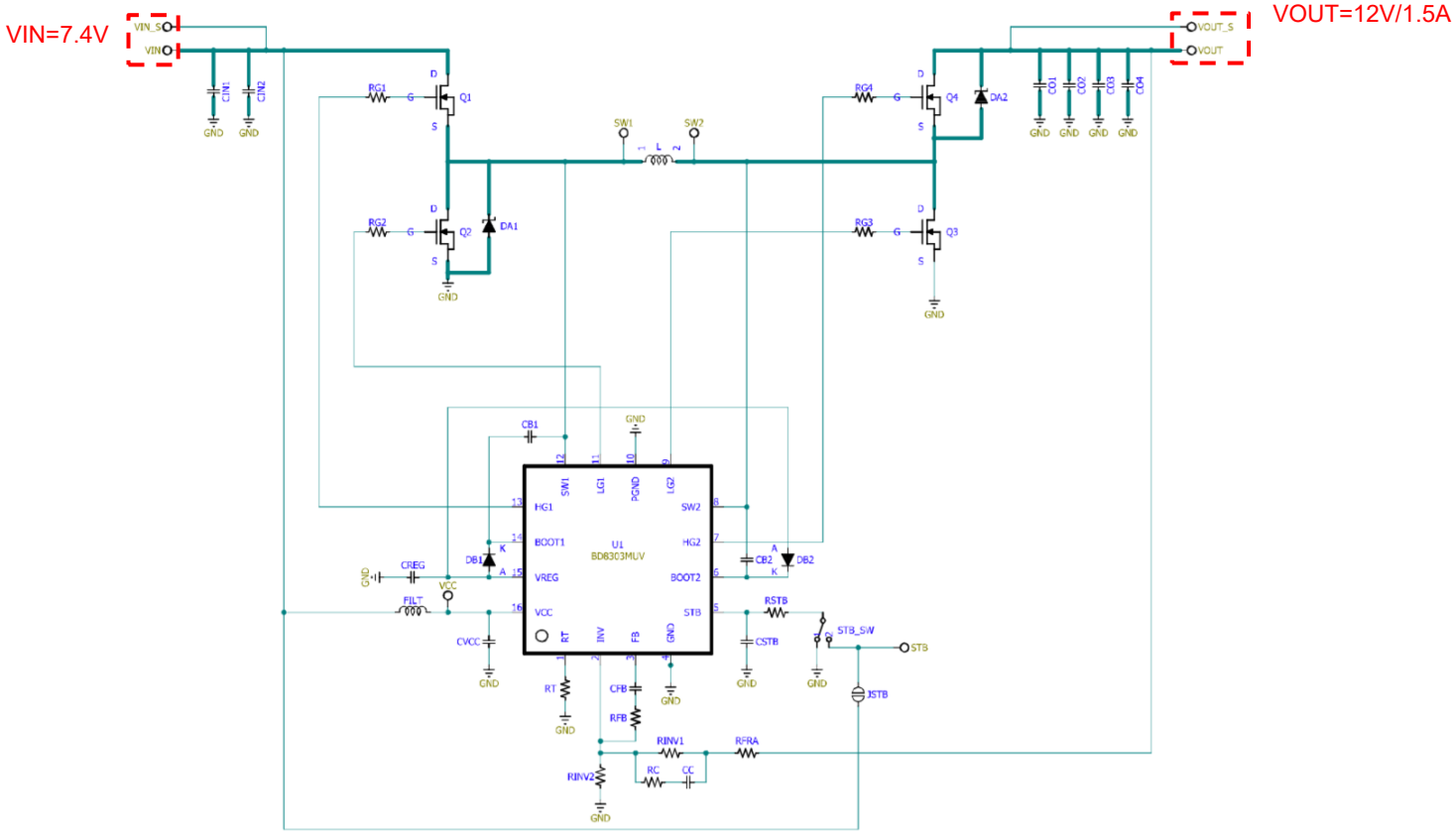

Figure 3. BD8303MUV-EVK-001 Schematic

Operating Procedure

Below is the procedure to operate the EVK.

1. Turn off the power supply and connect power supply's GND terminal to the GND terminal of the EVK.
2. Connect the power supply's positive terminal to the VIN terminal of the EVK.
3. Check if the electronic load is turned off and connect the electronic load to the VOUT terminal and the GND terminal of the EVK.
4. Connect the voltmeter to the VOUT_S terminal and the GND terminal of the EVK.
5. Check if the shunt jumper of STB_SW is at position H.
6. Turn on the power supply and check if the measured value of the voltmeter is 12V.
7. Turn on the electronic load.

Notes:

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

Operation State Settings

Table 2 is BD8303MUV condition using STB_SW.

Table 2. STB_SW Settings

STB_SW state	BD8303MUV Condition
ON (short to VIN)	Enable
OFF (short to GND)	Shutdown

BOM

Below is a table with the bill of materials.

Table 3. Bill of Materials

Count	Parts No.	Type	Value	Description	Part Number	Manufacturer	Configuration Inch(mm)
1	U1	IC	-	Buck-boost DC/DC Controller	BD8303MUV	ROHM	1111(3030)
2	CIN1, CIN2	Ceramic Capacitor	10µF	25V, B, ±10%	GRM21BB31E106MA73	MURATA	0805(2012)
3	CO1, CO2, CO3	Ceramic Capacitor	47µF	16V, B, ±20%	GRM32EB31C476ME15	MURATA	1210(3225)
1	CVCC	Ceramic Capacitor	0.1µF	50V, X7R, ±10%	GRM155R71H104KE14	MURATA	0402(1005)
1	CREG	Ceramic Capacitor	1µF	16V, B, ±10%	GRM155B31C105KA12	MURATA	0402(1005)
1	CFB	Ceramic Capacitor	0.022µF	50V, B, ±10%	GRM155B11E223KA61	MURATA	0402(1005)
1	CC	Ceramic Capacitor	68pF	50V, C0G, ±5%	885012005060	Wurth elektronik	0402(1005)
0	CSTB, CO4	Ceramic Capacitor	No mount	N/A	N/A	N/A	-
2	CB1, CB2	Ceramic Capacitor	0.1µF	50V, X7R, ±10%	GRM155R71H104KE14	MURATA	0402(1005)
1	RT	Resistor	75kΩ	50V, 0.1W, ±0.5%	MCR03EZPD7502	ROHM	0603(1608)
1	RFB	Resistor	7.5kΩ	50V, 0.1W, ±0.5%	MCR03EZPD7501	ROHM	0603(1608)
1	RINV1	Resistor	330kΩ	50V, 0.1W, ±0.5%	MCR03EZPD3303	ROHM	0603(1608)
1	RINV2	Resistor	30kΩ	50V, 0.1W, ±0.5%	MCR03EZPD3002	ROHM	0603(1608)
1	RC	Resistor	5.1kΩ	50V, 0.1W, ±0.5%	MCR03EZPD5101	ROHM	0603(1608)
4	RG1, RG2, RG3, RG4	Resistor	22Ω	50V, 0.1W, ±0.5%	MCR03EZPD22R0	ROHM	0603(1608)
0	RSTB, RFRA	Resistor	-	SHORT	N/A	N/A	-
4	Q1, Q2, Q3, Q4	FET	30V, 7A	Nch, VGS=4.5V, RDS(on)=25mΩ 5.8nC, SOP-8	RXH070N03	ROHM	2024(5060)
2	DB1, DB2	Diode	30V, 0.1A	VF(max)=0.35V, @IF=0.01A	RB521CM-30	ROHM	0403(1006)
0	DA1, DA2	Diode	No mount	N/A	N/A	N/A	-
1	L	Inductor	4.7µH	8.5A, -40%-+20%	74477004	Wurth elektronik	0.47 x 0.47 (12 x 12)
0	FILT	Inductor	-	SHORT	N/A	N/A	-
0	STB_SW	-	-	SWITCH	-	-	-
0	JSTB	-	-	SHORT	N/A	N/A	-

Note.

If the overshoot voltage exceeds the maximum rating of 15V for SW1 and SW2, adjust the gate resistance value. Be careful not to overlap the high side and low side gate voltages.

As an alternative, add a resistor and capacitor snubber circuit between the SW1 terminal and GND, and between the SW2 terminal and GND.

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	80mm x 70mm x 1.6mmt	1oz (35µm)

Followings are the layout of BD8303MUV-EVK-001

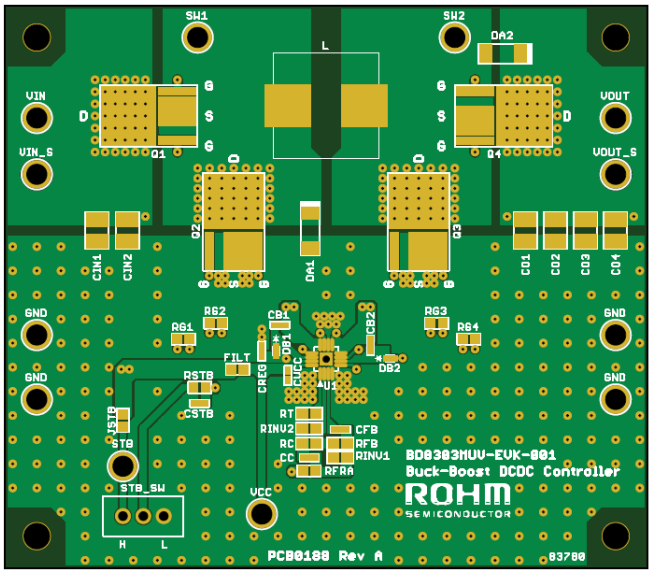

Figure 4. Top PCB image
(Top View)

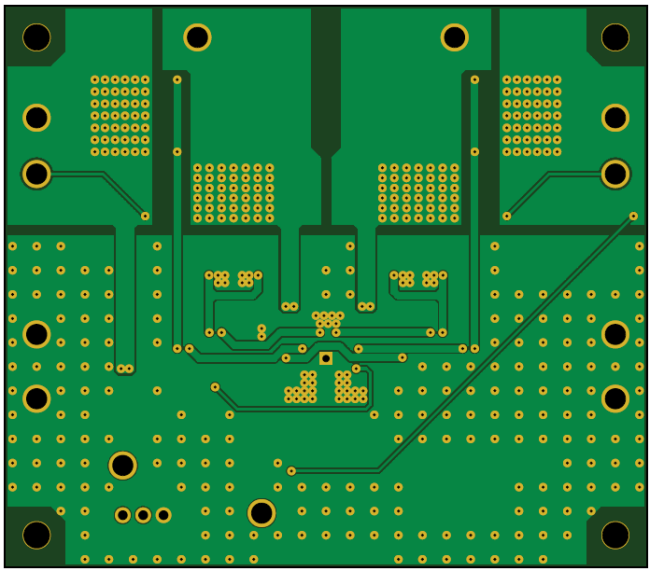

Figure 5. Bottom PCB image
(Top View)

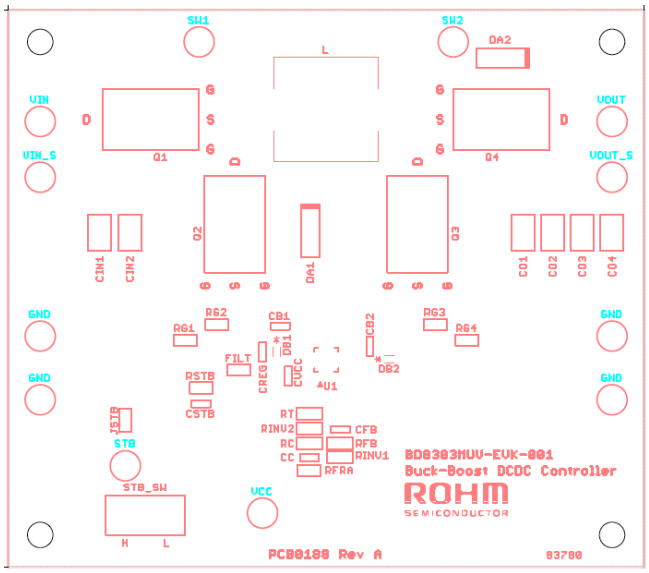

Figure 6. Top Layer Silkscreen layout
(Top View)

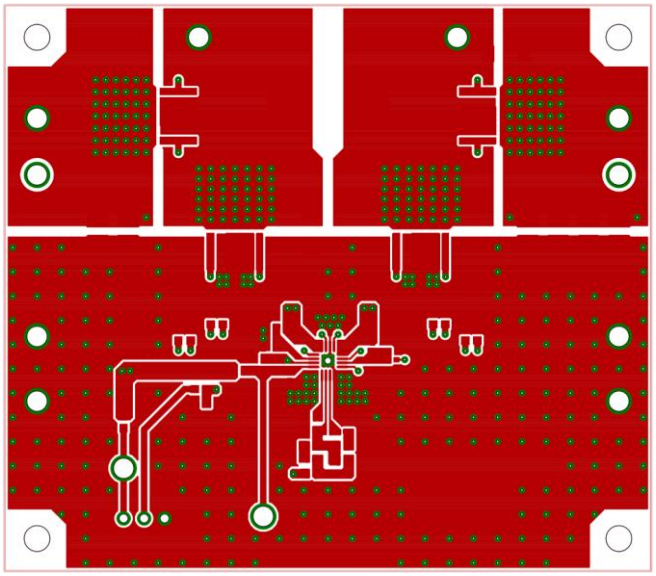

Figure 7. Top Layer layout
(Top View)

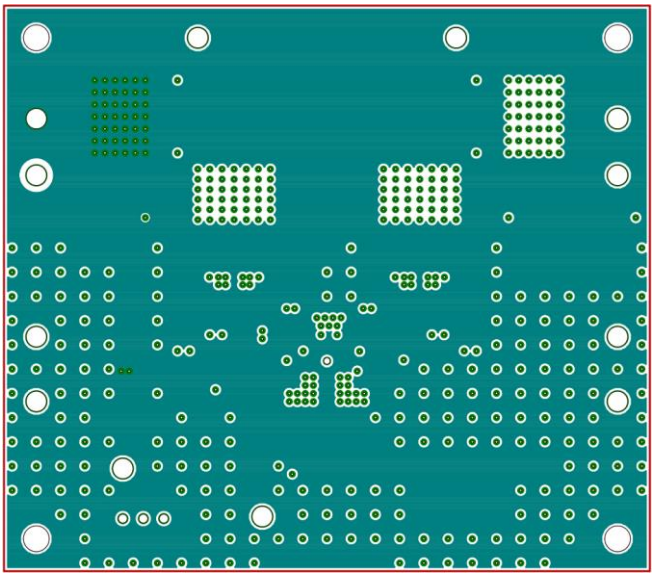

Figure 8. Middle1 Layer (VIN) layout
(Top View)

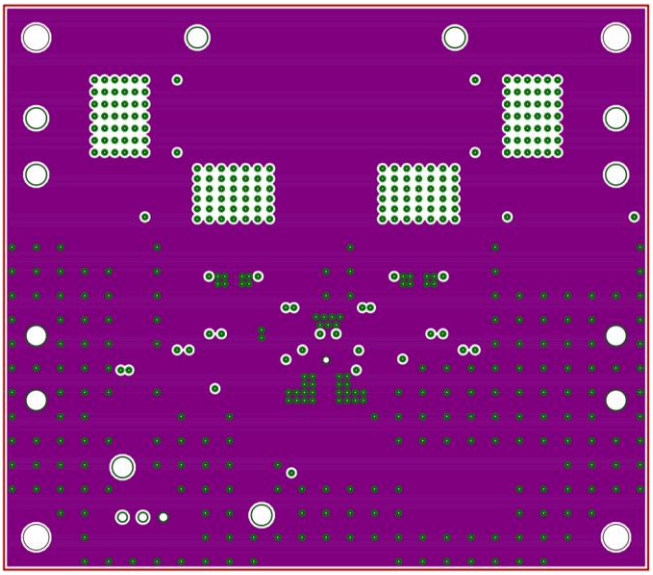

Figure 9. Middle2 Layer (GND) layout
(Top View)

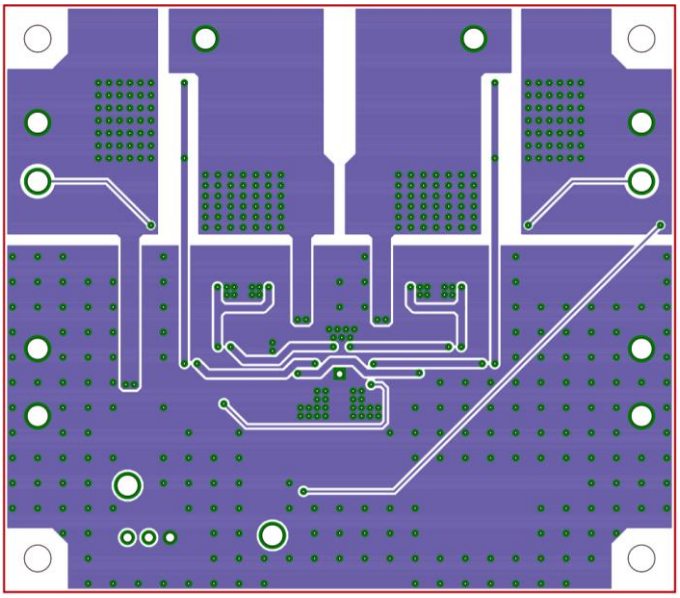

Figure 10. Bottom Layer layout
(Top View)

Reference Application Data

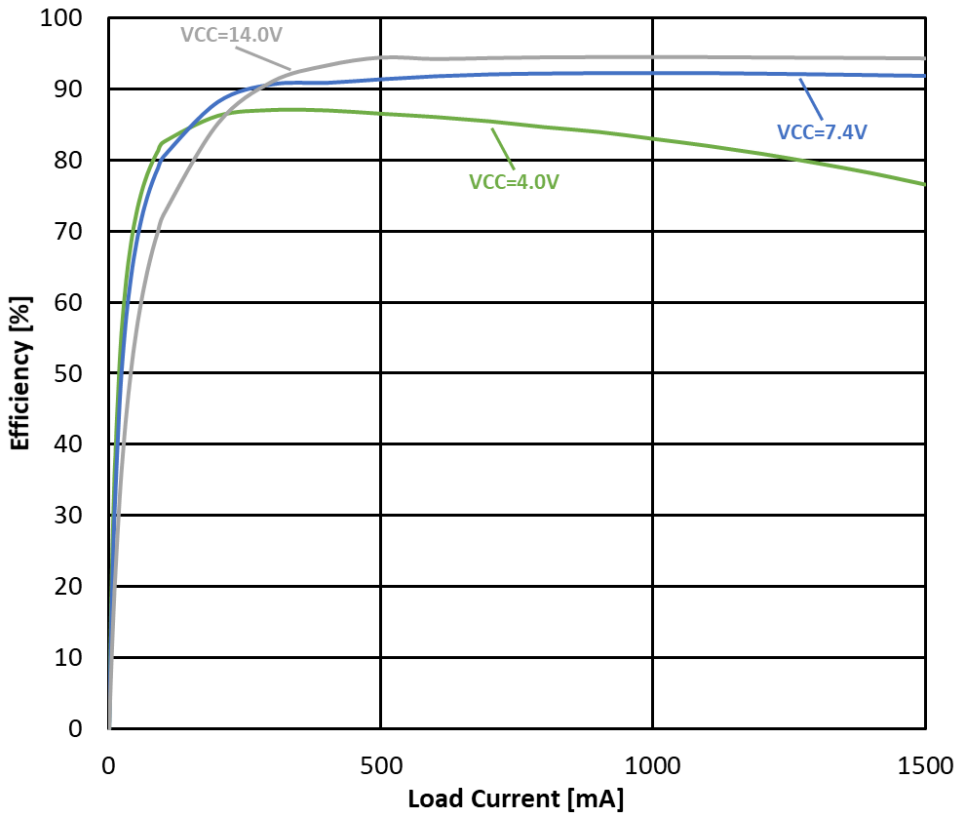

Figure 11. Efficiency vs Load Current (VCC=4V to 14V, VOUT=12V)

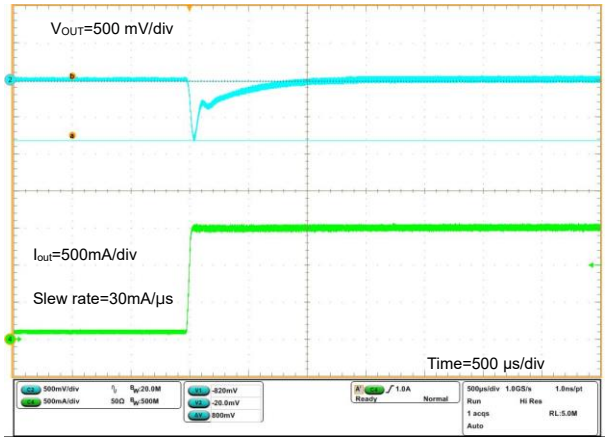

Figure 12. Transient Load Response
(VCC=7.4V, I_{out}=0.1A→1.5A)

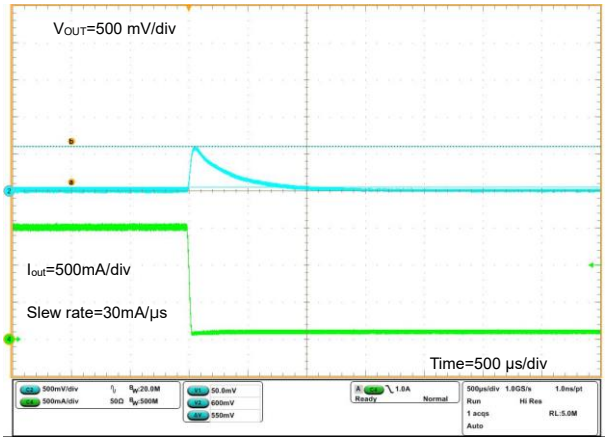

Figure 13. Transient Load Response
(VCC=7.4V, I_{out}=1.5A→0.1A)

Reference Application Data - continued

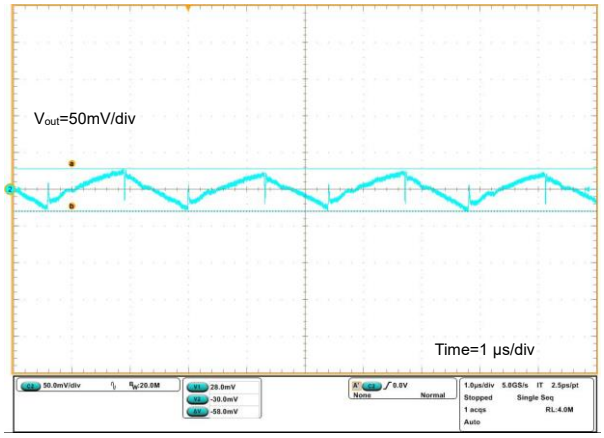

Figure 14. Output Ripple Voltage
(VCC=7.4V, I_{out}=1.5A)

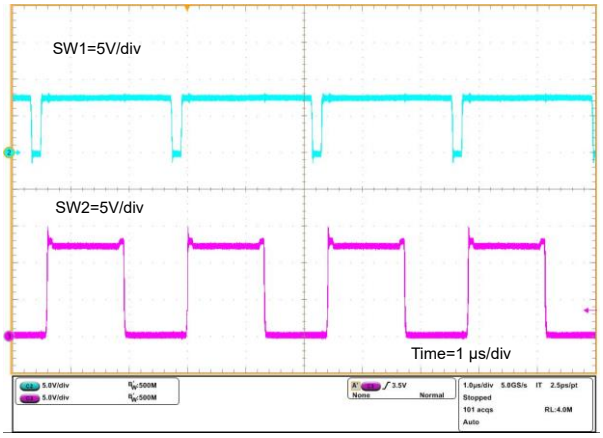

Figure 15. Output Ripple Voltage
(VCC=7.4V, I_{out}=1.5A)

Revision History

Date	Revision Number	Description
22. Feb. 2021	001	Initial release
18. Oct. 2023	002	p.2 Changed to a photo with RG1, RG2, RG3, and RG4 added in Figure.1. p.4 CC 68pF of Table.3 is change from GRM1552C1H680JA01 to 885012005060. p.4 RFB of Table.3 is change from MCR03ECPD7501 to MCR03EZPD7501. p.4 Add comment. " Recommended parts are selected from those products and information available at the time this user's guide (Rev.001) was released. If supply conditions change and parts are not available, use similar parts." p.5 Copper Thickness changed from 2oz to 1oz.

Notice

1) The information contained in this document is intended to introduce ROHM Group (hereafter referred to asROHM) products. When using ROHM products, please verify the latest specifications or datasheets before use.

2) ROHM products are designed and manufactured for use in general electronic equipment and applications (such as Audio Visual equipment, Office Automation equipment, telecommunication equipment, home appliances, amusement devices, etc.) or specified in the datasheets. Therefore, please contact the ROHM sales representative before using ROHM products in equipment or devices requiring extremely high reliability and whose failure or malfunction may cause danger or injury to human life or body or other serious damage (such as medical equipment, transportation, traffic, aircraft, spacecraft, nuclear power controllers, fuel control, automotive equipment including car accessories, etc. hereafter referred to as Specific Applications). Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses, or losses incurred by you or third parties arising from the use of ROHM Products for Specific Applications.

3) Electronic components, including semiconductors, can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against physical injury, and damage to any property, which a failure or malfunction of products may cause.

4) The information contained in this document, including application circuit examples and their constants, is intended to explain the standard operation and usage of ROHM products, and is not intended to guarantee, either explicitly or implicitly, the operation of the product in the actual equipment it will be used. As a result, you are solely responsible for it, and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses, or losses incurred by you or third parties arising from the use of such information.

5) When exporting ROHM products or technologies described in this document to other countries, you must abide by the procedures and provisions stipulated in all applicable export laws and regulations, such as the Foreign Exchange and Foreign Trade Act and the US Export Administration Regulations, and follow the necessary procedures in accordance with these provisions.

6) The technical information and data described in this document, including typical application circuits, are examples only and are not intended to guarantee to be free from infringement of third parties intellectual property or other rights. ROHM does not grant any license, express or implied, to implement, use, or exploit any intellectual property or other rights owned or controlled by ROHM or any third parties with respect to the information contained herein.

7) No part of this document may be reprinted or reproduced in any form by any means without the prior written consent of ROHM.

8) All information contained in this document is current as of the date of publication and subject to change without notice. Before purchasing or using ROHM products, please confirm the latest information with the ROHM sales representative.

9) ROHM does not warrant that the information contained herein is error-free. ROHM shall not be in any way responsible or liable for any damages, expenses, or losses incurred by you or third parties resulting from errors contained in this document.

ROHM SEMICONDUCTOR

Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available, please contact us.

ROHM Customer Support System

https://www.rohm.com/contactus