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 | *note 1 |
| 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 |

Note.

(*note 1) Although the IC operating range is up to 14V, this EVK is equipped with a 10V operating Zener diode D1 in front of the VCC pin to protect the IC. Therefore, please operate with an input voltage of 9V or less.



No. 63UG045E Rev.003
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## EVK

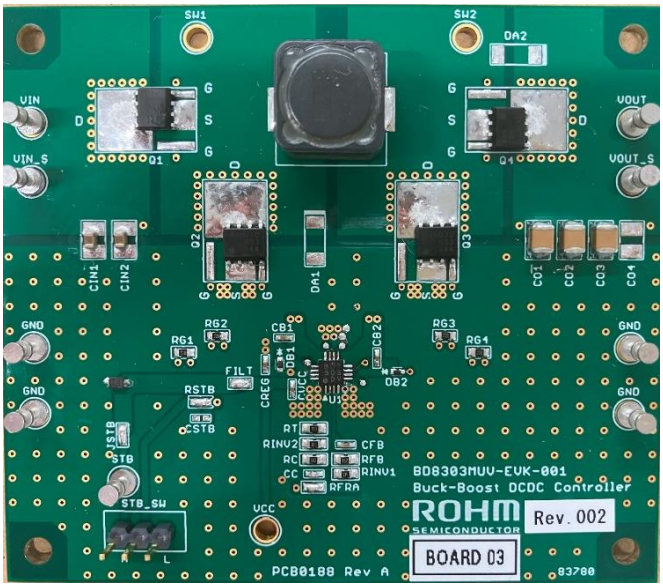


Figure 1. BD8303MUV-EVK-001(Top View)

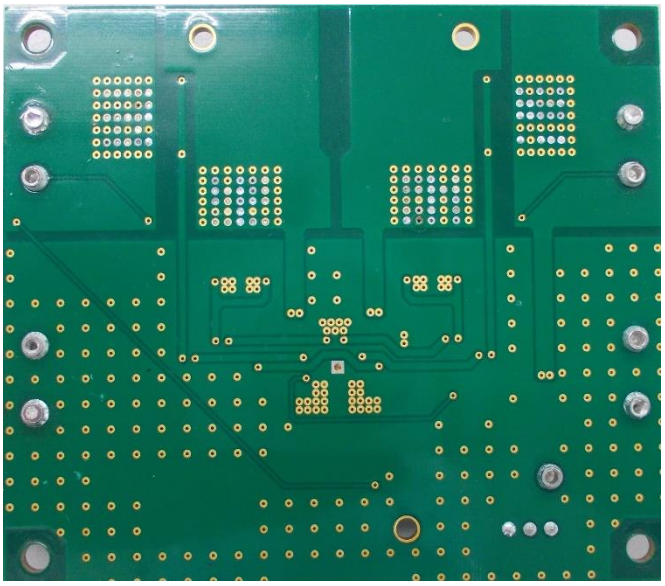

Figure 2. BD8303MUV-EVK-001(Bottom View)

## EVK Schematic

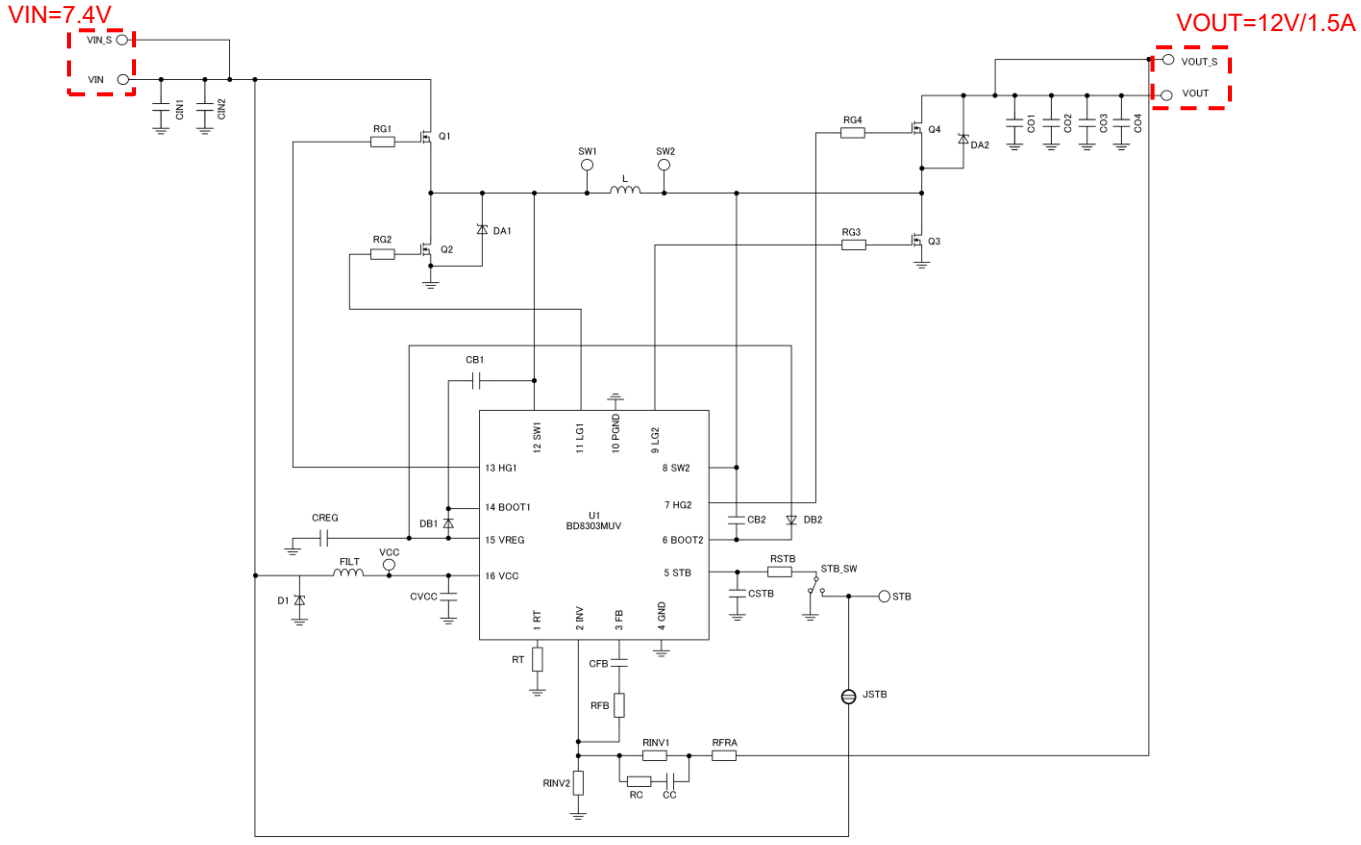


Figure 3. BD8303MUV-EVK-001 Schematic

## 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 | D1 (*note 4) | Diode | 10V | 500mW | TFZV10B | ROHM | 0.55 x 0.079 (1.4 x 2.0) |
| 1 | L | Inductor | 4.7µH | 8.5A, -40%-+20% | 74477004 | WURTH | 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.

(*note 2) 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.

(*note3) 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.

(*note 4) D1 TFZV10B has been added from EVK Rev.003.

## 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

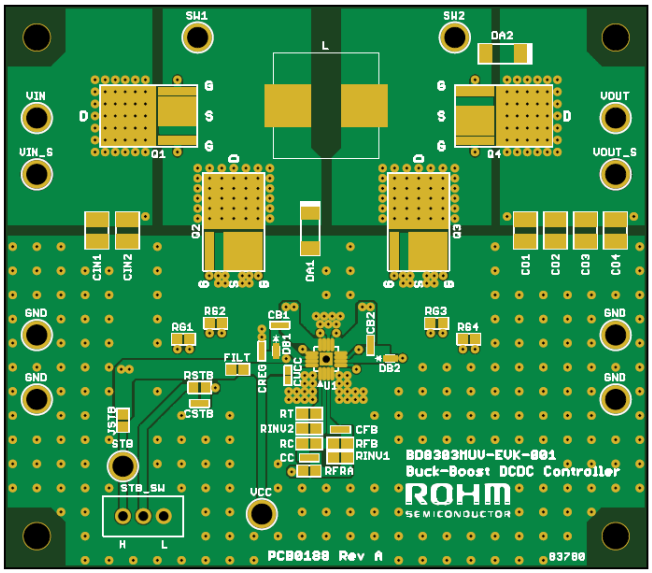


Figure 4. Top PCB image
(Top View)

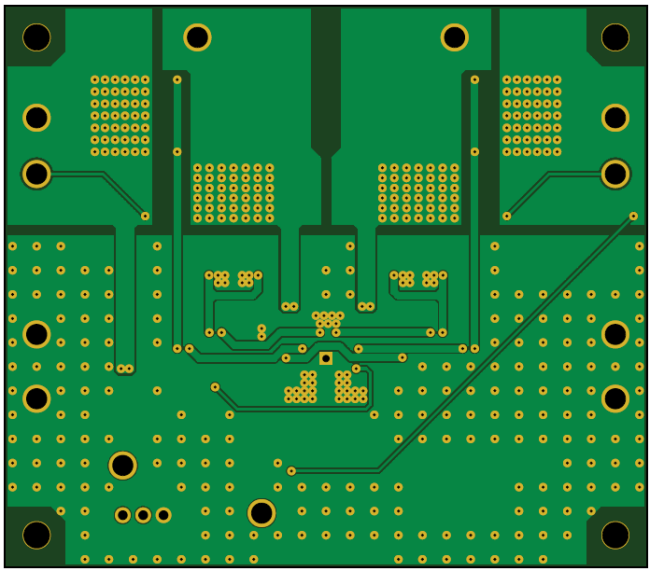

Figure 5. Bottom PCB image
(Top View)

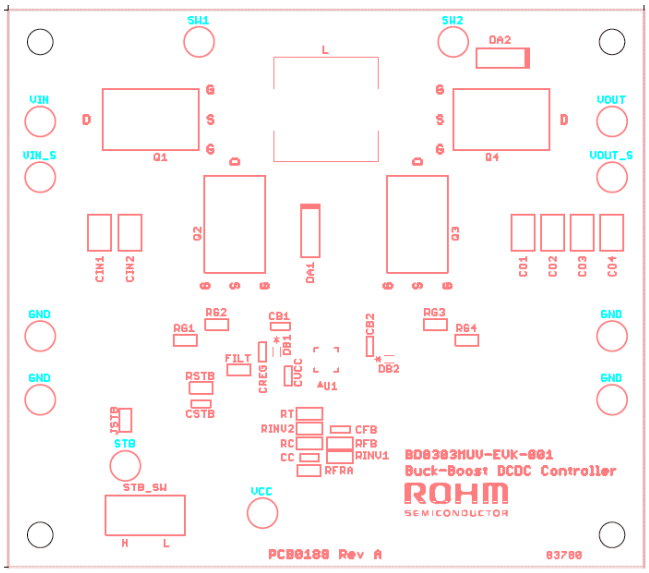


Figure 6. Top Layer Silkscreen layout
(Top View)

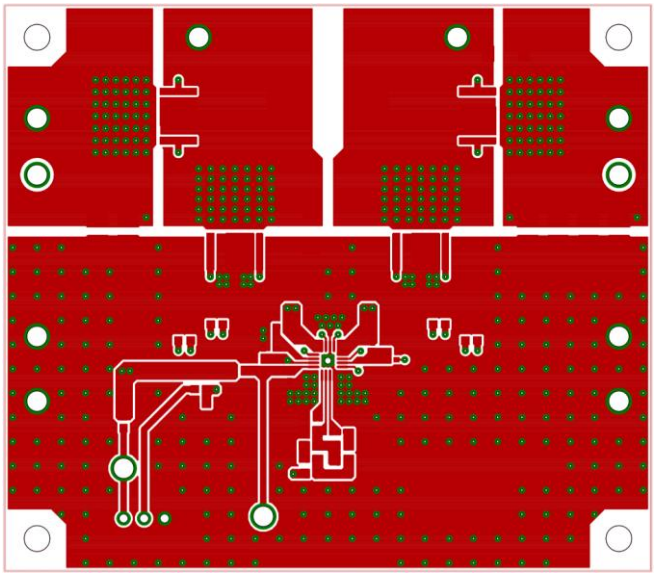

Figure 7. Top Layer layout
(Top View)

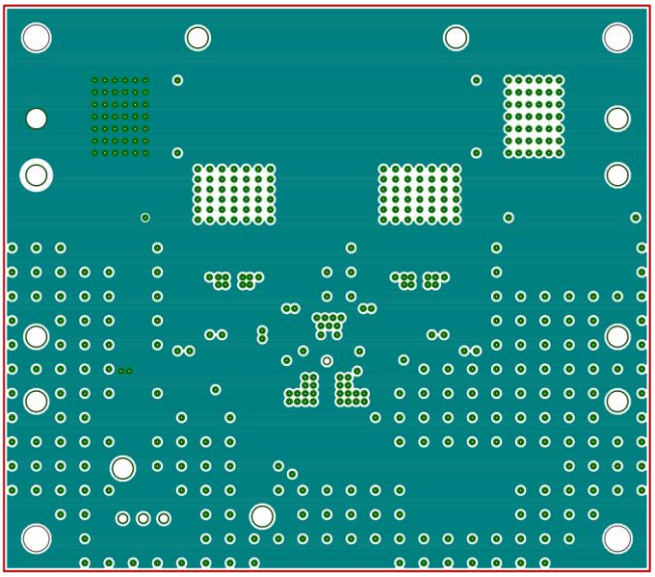

Figure 8. Middle1 Layer (VIN) layout
(Top View)

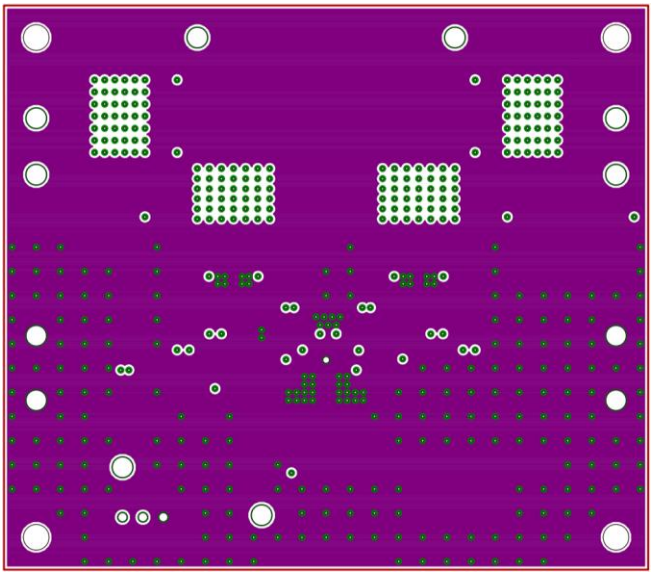

Figure 9. Middle2 Layer (GND) layout
(Top View)

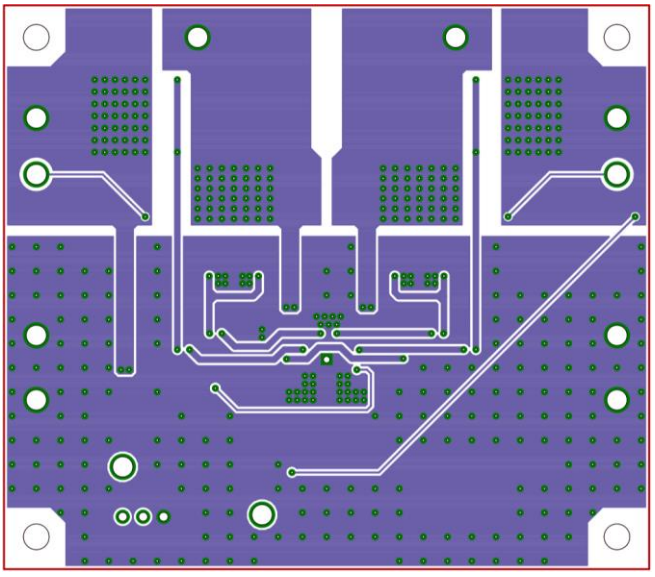

Figure 10. Bottom Layer layout
(Top View)

## Reference Application Data

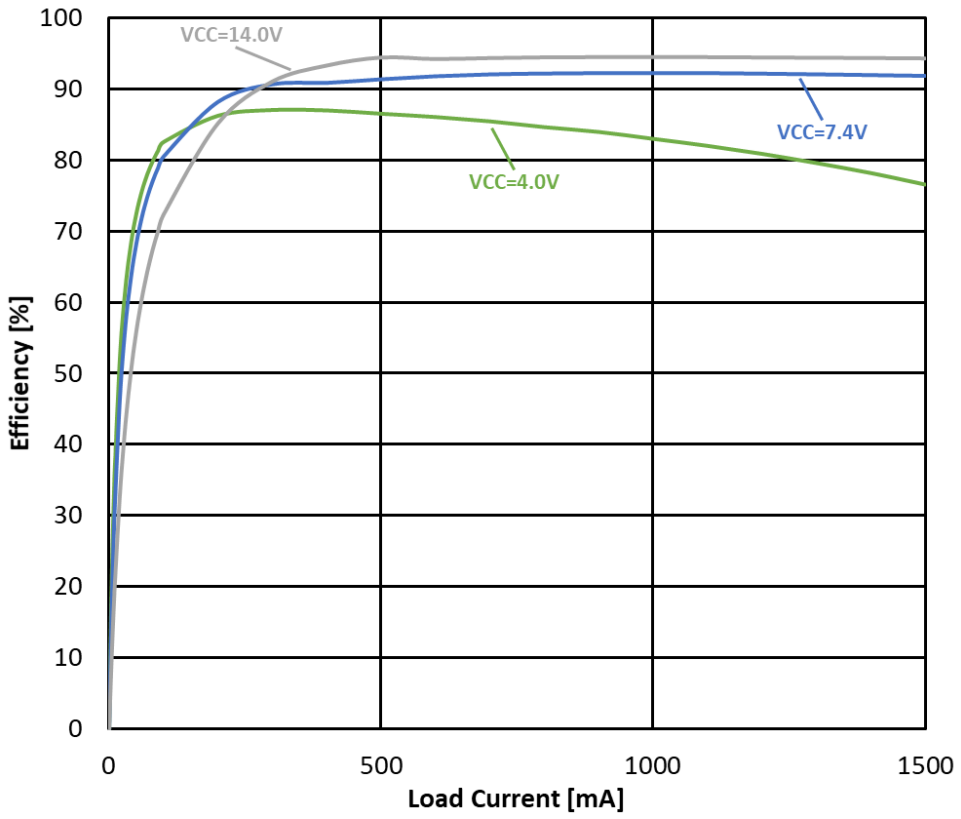


Figure 11. Efficiency vs Load Current (VCC=4V to 14V, VOUT=12V)

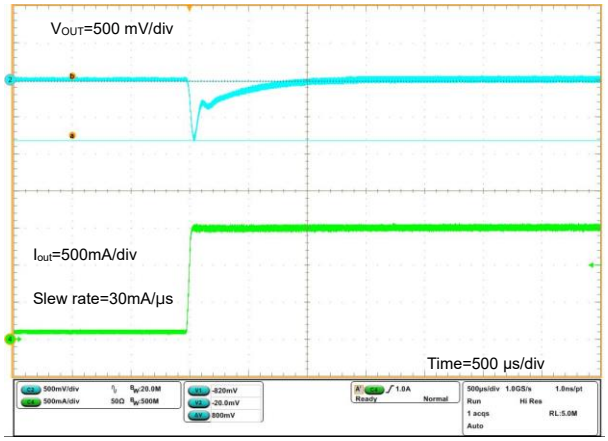


Figure 12. Transient Load Response
(VCC=7.4V, $I_{out}$=0.1A→1.5A)

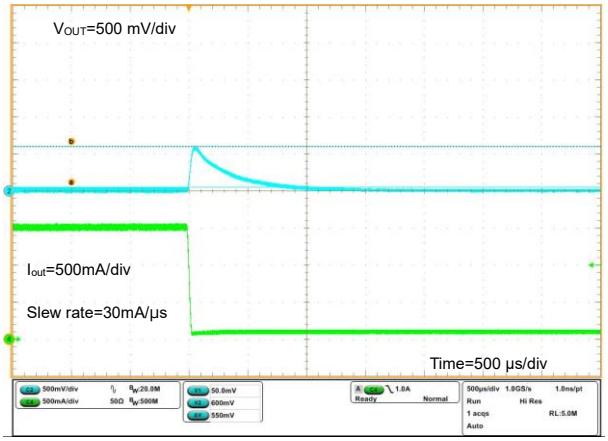


Figure 13. Transient Load Response
(VCC=7.4V, $I_{out}$=1.5A→0.1A)

## Reference Application Data - continued

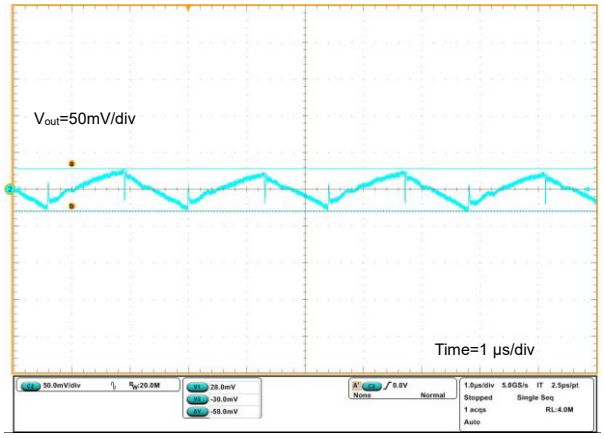


Figure 14. Output Ripple Voltage
(VCC=7.4V, $I_{out}$=1.5A)

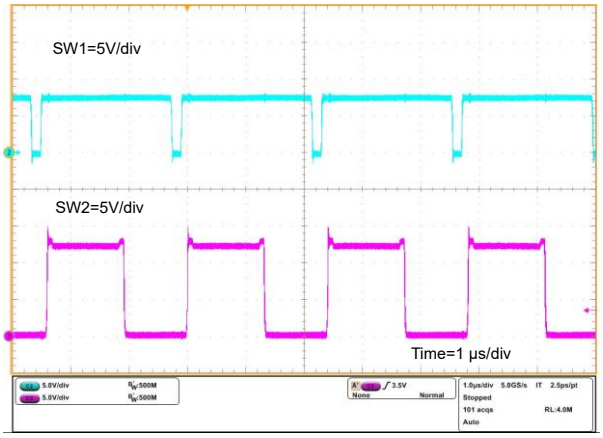


Figure 15. Output Ripple Voltage
(VCC=7.4V, $I_{out}$=1.5A)

## 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.<br>p.4 CC 68pF of Table.3 is change from GRM1552C1H680JA01 to 885012005060.<br>p.4 RFB of Table.3 is change from MCR03ECPD7501 to MCR03EZPD7501.<br>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."<br>p.5 Copper Thickness changed from 2oz to 1oz. |
| 13. May. 2024 | 003 | Added D1 TFZV10B to the circuit diagram and parts list. |

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