



# **BD9G500EFJ-EVK-001**

## **User's Guide**

## <High Voltage Safety Precautions>

◇ Read all safety precautions before use

Please note that this document covers only the **BD9G500EFJ-LA** evaluation board (BD9G500EFJ-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.

#### **After Use**

- [8] Be sure to wear insulated gloves when handling is required during operation.
- [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 be 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 Buck Converter

# BD9G500EFJ-LA EVK

## BD9G500EFJ-EVK-001 (48V→5V, 5A)

### Introduction

This user's guide describes the steps required to operate the EVK of BD9G500EFJ-LA. This document includes a description of peripheral components, operating instructions, and reference data.

### Description

BD9G500EFJ-EVK-001 uses BD9G500EFJ-LA to output 5V from a 48V input voltage. The input voltage of the BD9G500EFJ-LA is from 7V to 76V and the output voltage is configurable from 1V to  $0.97 \times V_{IN}$  V with external resistors. The operating frequency is configurable between 100 kHz and 650 kHz with an external resistor connected to RT pin. This is a current mode control DC/DC converter that provides fast transient response performance and simple phase compensation setup. Built-in functions include variable soft start function which prevents inrush current at startup, UVLO (Under Voltage Lock Out), TSD (Thermal Shutdown Detection), OVP (Over Voltage Protection), OCP (Over Current Protection) and OVDIS (Over Voltage Discharge).

### Application

Industrial Equipment  
Power Supply for FA  
Communication Equipment  
Battery Management System (BMS)

### EVK Operating Limits

| Parameter               | Min | Typ | Max  | Units | Conditions     |
|-------------------------|-----|-----|------|-------|----------------|
| Input Voltage           | 7.0 | -   | 48.0 | V     |                |
| Output Voltage          |     | 5.0 |      | V     |                |
| Maximum Output Current  |     |     | 5.0  | A     |                |
| Switching Frequency     |     | 200 |      | kHz   |                |
| Maximum Efficiency      |     | 81  |      | %     | $I_O = 2.5A$   |
| UVLO Threshold Voltage  |     | 6.4 |      | V     | VIN sweep down |
| UVLO Hysteresis Voltage |     | 200 |      | mV    |                |

## EVK Overview



Figure 1. BD9G500EFJ-EVK-001(Top View)

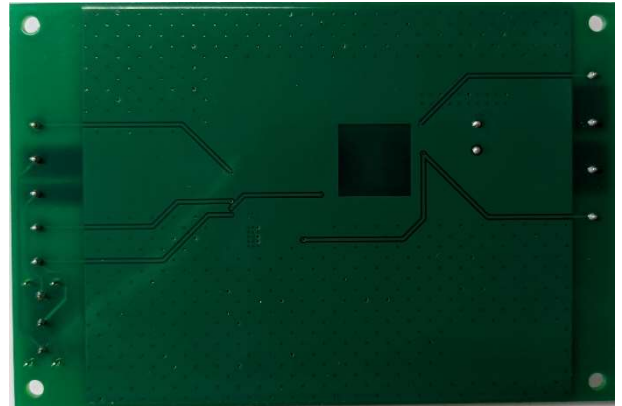


Figure 2. BD9G500EFJ-EVK-001(Bottom View)

## EVK Schematic

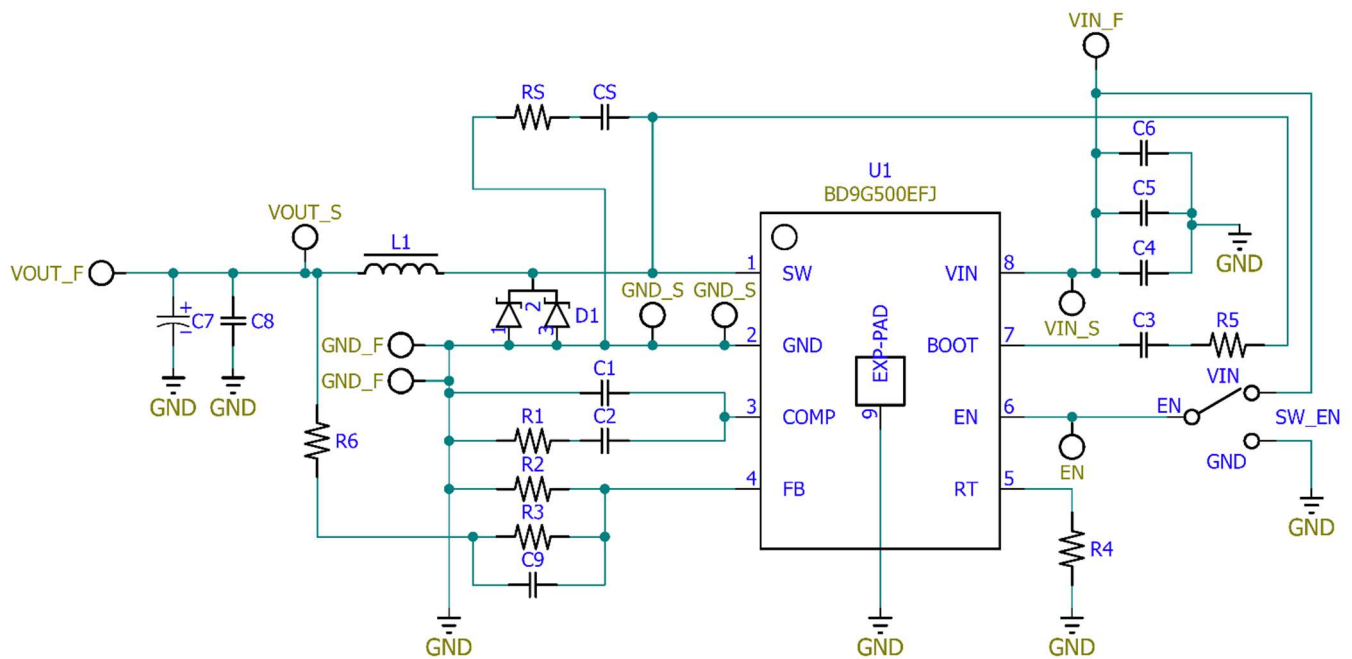


Figure 3. BD9G500EFJ-EVK-001 Schematic

## Operating Procedure

1. Turn off the DC power supply power switch and connect the power supply's GND terminal to the GND\_F pin of the EVK.
2. Connect the positive terminal of the DC power supply to the VIN\_F pin of the EVK.
3. Connect the load across the VOUT\_F pin and the GND\_F pin of the EVK. In the case of an electronic load, turn the load off.
4. Connect the voltmeter's positive terminal to the EVK's VOUT\_S pin and the GND terminal to the EVK's GND\_S pin.
5. Tilt the switch of SW\_EN to the VIN side.
6. Turn on the DC power supply. Make sure that the voltmeter reading is 5V.
7. Turn on the electronic load.

(Caution) This EVK does not support hot plug. Do not perform hot plug test.

## Operating State Settings

Select the status of BD9G500EFJ-LA as shown in Table 1 according to the EN pin voltage.

Table 1. EN Pin Settings

| EN Pin Voltage       | State    |
|----------------------|----------|
| HIGH ( $\geq 2.5$ V) | Enable   |
| LOW ( $\leq 0.4$ V)  | Shutdown |

## Parts List

Table 2. Parts List

| Count | Parts No.                                               | Type                            | Value    | Description             | Manufacturer Part Number | Manufacturer | Configuration mm (inch) |
|-------|---------------------------------------------------------|---------------------------------|----------|-------------------------|--------------------------|--------------|-------------------------|
| 1     | U1                                                      | IC                              | -        | Single BUCK Converter   | BD9G500EFJ-LA            | ROHM         | 4.9 mm x 6.0 mm         |
| 1     | L1                                                      | Inductor                        | 33μH     | 5.5A, ±20%              | 7443551331               | WE           | 13 mm x 13 mm           |
| 1     | D1                                                      | Schottky Barrier Diode          | -        | $V_R=100V$<br>$I_O=10A$ | RB088BM100               | ROHM         | 6.6 mm x 10 mm          |
| 0     | C1                                                      | Ceramic Capacitor               | No mount | N/A                     | N/A                      | N/A          | 1005 (0402)             |
| 1     | C2                                                      | Ceramic Capacitor               | 6800pF   | 50V, C0G, ±5%           | GRM1555C1H682JE01        | Murata       | 1005 (0402)             |
| 1     | C3                                                      | Ceramic Capacitor               | 1μF      | 10V, X5R, ±20%          | GRM153R61A105ME95        | Murata       | 1005 (0402)             |
| 1     | C4                                                      | Ceramic Capacitor               | 10μF     | 100V, X7S, ±10%         | GRM32EC72A106KE05        | Murata       | 3225 (1210)             |
| 1     | C5                                                      | Ceramic Capacitor               | 10μF     | 100V, X7S, ±10%         | GRM32EC72A106KE05        | Murata       | 3225 (1210)             |
| 1     | C6                                                      | Ceramic Capacitor               | 1μF      | 100V, X7S, ±10%         | GRM21BC72A105KE01        | Murata       | 2012 (0805)             |
| 1     | C7                                                      | Aluminum Electrolytic Capacitor | 220μF    | 50V, ±20%               | UBT1H221MPD8             | Nichicon     | Φ10 mm                  |
| 1     | C8                                                      | Ceramic Capacitor               | 47μF     | 10V, X6S, ±10%          | GRM32EC81A476KE19        | Murata       | 3225 (1210)             |
| 0     | C9                                                      | Ceramic Capacitor               | No mount | N/A                     | N/A                      | N/A          | 1005 (0402)             |
| 0     | CS                                                      | Ceramic Capacitor               | No mount | N/A                     | N/A                      | N/A          | 1005 (0402)             |
| 1     | R1                                                      | Resistor                        | 62kΩ     | 50V, ±1%, 1/16W         | MCR01MZPF6202            | ROHM         | 1005 (0402)             |
| 1     | R2                                                      | Resistor                        | 0.75kΩ   | 50V, ±1%, 1/16W         | MCR01MZPF7500            | ROHM         | 1005 (0402)             |
| 1     | R3                                                      | Resistor                        | 3kΩ      | 50V, ±1%, 1/16W         | MCR01MZPF3001            | ROHM         | 1005 (0402)             |
| 1     | R4                                                      | Resistor                        | 47kΩ     | 50V, ±1%, 1/16W         | MCR01MZPF4702            | ROHM         | 1005 (0402)             |
| 1     | R5                                                      | Resistor                        | 0Ω       | Jumper                  | MCR01MZPJ000             | ROHM         | 1005 (0402)             |
| 1     | R6                                                      | Resistor                        | 0Ω       | Jumper                  | MCR01MZPJ000             | ROHM         | 1005 (0402)             |
| 0     | RS                                                      | Resistor                        | No mount | N/A                     | N/A                      | N/A          | 1005 (0402)             |
| 1     | SW_EN                                                   | Miniature Toggle Switch         | -        | -                       | BT1E-2M4-Z               | NIDEC COPAL  | 7.6 mm x 12.7 mm        |
| 9     | VIN_F, VIN_S,<br>VOUT_F, VOUT_S,<br>GND_F, GND_S,<br>EN | Test Pin                        | -        | -                       | ST-2-2                   | MAC8         | Φ2.5 mm                 |

EVK PCB Layout

EVK PCB Information

| Number of Layers | Material | Board Size                | Copper Thickness                                           |
|------------------|----------|---------------------------|------------------------------------------------------------|
| 4                | FR-4     | 114.3mm x 76.2mm x 1.6mmt | 2oz (70μm) *Top, Bottom Layer<br>1oz (35μm) *Middle Layers |



Figure 4. Top Layer Layout  
(Top View)

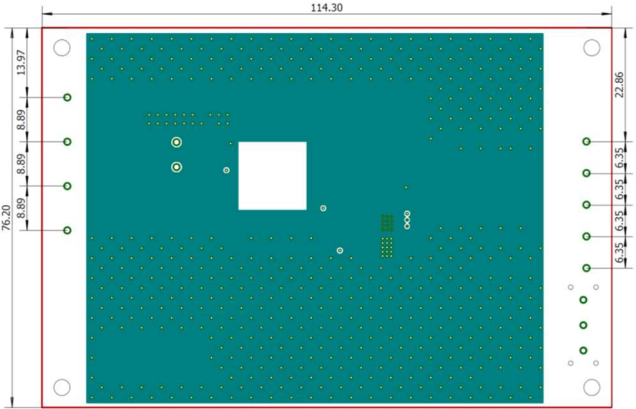


Figure 5. Middle1 Layer Layout  
(Top View)

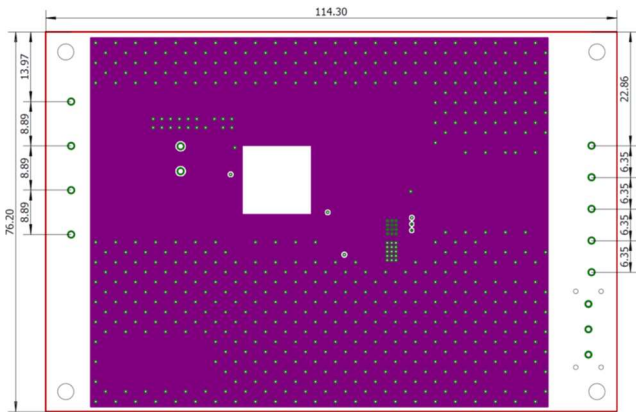


Figure 6. Middle2 Layer Layout  
(Top View)

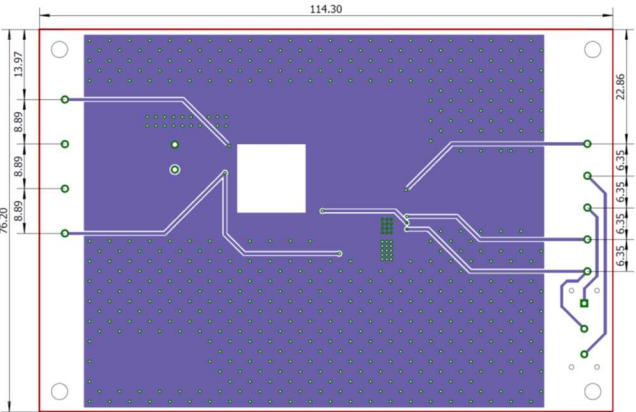


Figure 7. Bottom Layer Layout  
(Top View)

## Reference Application Curves

$T_a = 25^\circ\text{C}$ ,  $V_{IN} = 48\text{V}$ ,  $EN = V_{IN}$ , unless otherwise specified

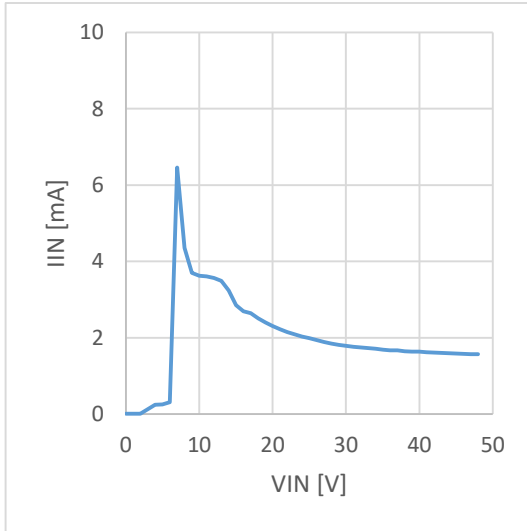


Figure 8. Current Consumption vs VIN  
( $I_o = 0\text{mA}$ )

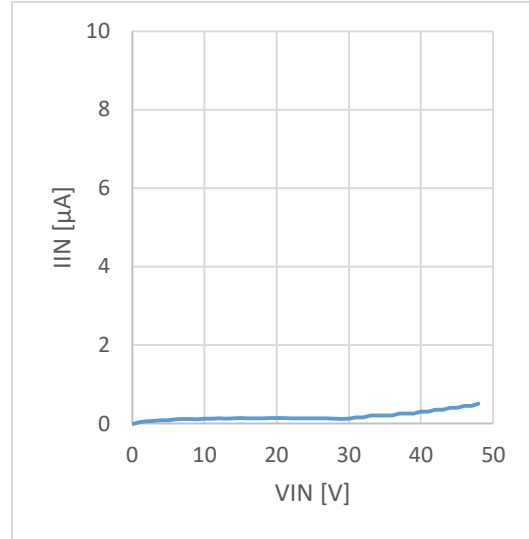


Figure 9. Shutdown Current vs VIN  
( $EN = \text{GND}$ )

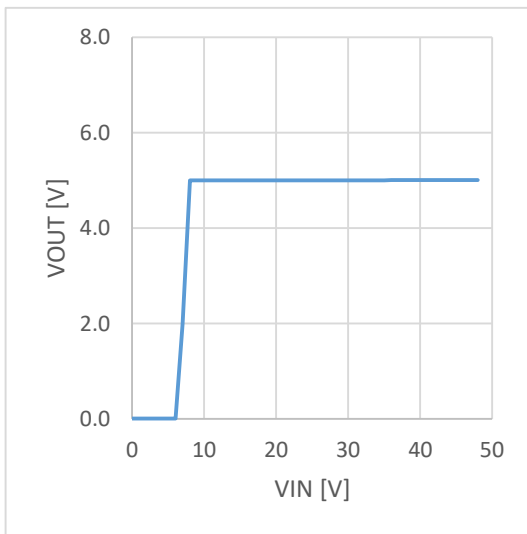


Figure 10. Line Regulation  
( $I_o = 0\text{mA}$ )

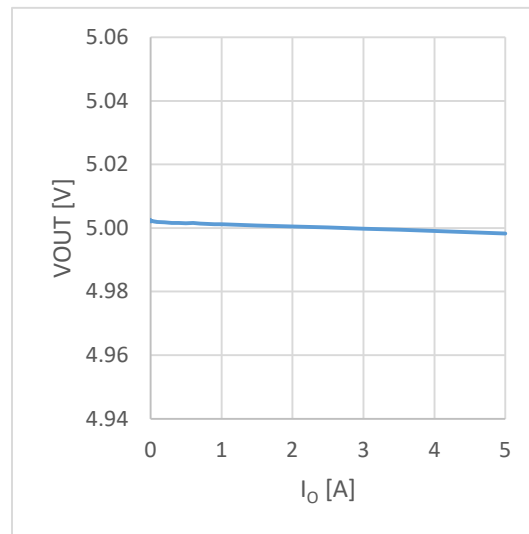


Figure 11. Load Regulation

# Reference Application Curves – Cont'd

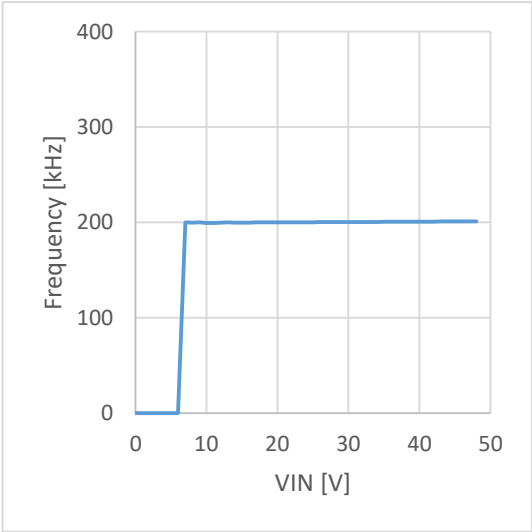


Figure 12. Switching Frequency vs VIN  
( $I_O = 1A$ )

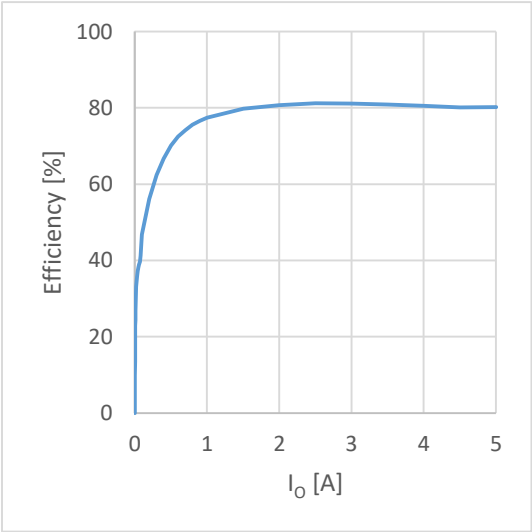


Figure 13. Efficiency vs Load Current

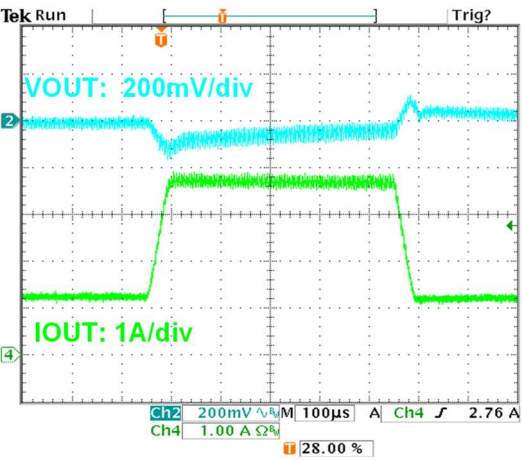


Figure 14. Load Response

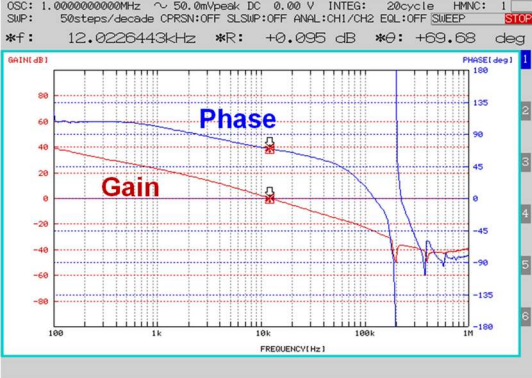


Figure 15. Frequency Response  
( $I_O = 5A$ )

## Reference Application Curves – Cont'd

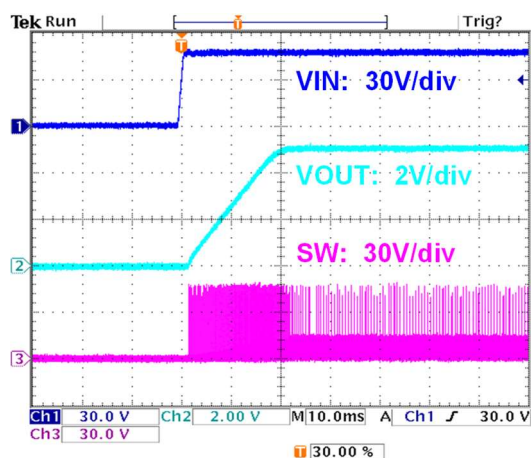


Figure 16. Start Up Waveform  
( $I_O = 0A$ )

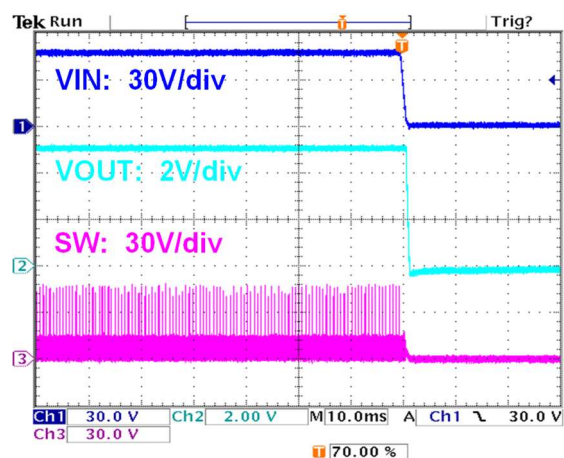


Figure 17. Shutdown Waveform  
( $I_O = 0A$ )

## Revision History

| Date       | Revision Number | Description     |
|------------|-----------------|-----------------|
| 2021. 3. 3 | 001             | Initial release |

## Notes

- 1) The information contained herein is subject to change without notice.
- 2) Before you use our Products, please contact our sales representative and verify the latest specifications :
- 3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.  
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