

RTKA211450DE0010BU

The RTKA211450DE0010BU board evaluates the [RAA211450](#) (HTSSOP version), a DC/DC synchronous step-down regulator with programmable switching frequency.

The RAA211450 supports a wide input voltage range (from 4.5V to 42V) and adjustable output voltage. It delivers up to a continuous 3A output current with a premium load regulation and line regulation performance.

**Features**

- Simple and flexible design
- 4.5V to 42V  $V_{IN}$  range
- Convenient power conversion

**Specifications**

The following are the design specifications for the RTKA211450DE0010BU:

- Input voltage ( $V_{IN}$ ): 4.5V to 42V
- Output voltage ( $V_{OUT}$ ): 3.3V
- Maximum output current: 5A

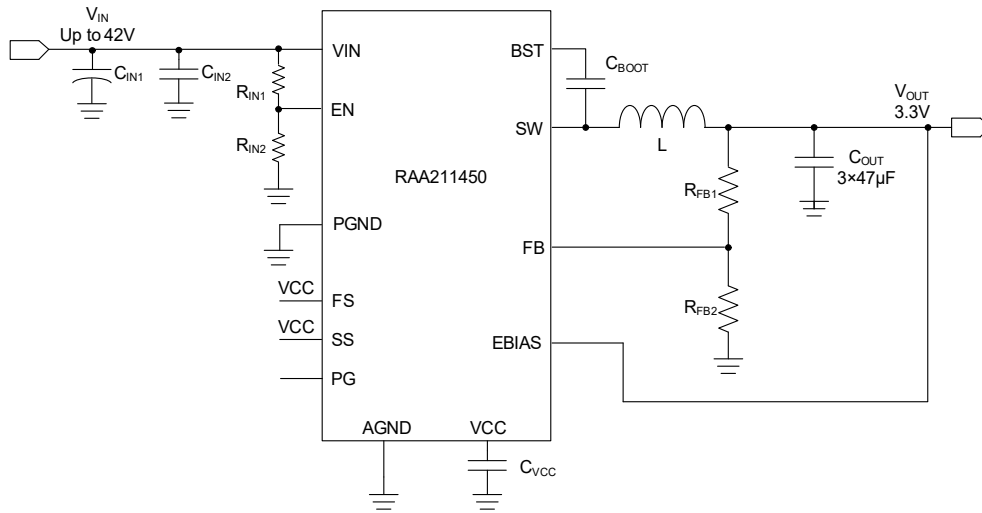


Figure 1. Simplified Circuit

## Contents

|  |           |
|--|-----------|
| <b>1. Functional Description</b> .....     | <b>3</b>  |
| 1.1 Operational Characteristics .....      | 3         |
| 1.2 Setup and Configuration .....          | 3         |
| <b>2. Board Design</b> .....               | <b>4</b>  |
| 2.1 Layout Guidelines .....                | 4         |
| 2.2 Schematic Diagram .....                | 5         |
| 2.3 Bill of Materials .....                | 6         |
| 2.4 Board Layout .....                     | 7         |
| <b>3. Typical Performance Graphs</b> ..... | <b>9</b>  |
| <b>4. Ordering Information</b> .....       | <b>10</b> |
| <b>5. Revision History</b> .....           | <b>10</b> |

# 1. Functional Description

The RAA211450 (HTSSOP version) is an easy-to-use synchronous Buck switching regulator with integrated 90mΩ (high-side) and 45mΩ (low-side) MOSFETs. The RTKA211450DE0010BU board evaluates the operations of RAA211450 (HTSSOP version). The board allows you to evaluate the performance of the part with a different application circuit, and it provides a reference for a board layout.

The manual includes a schematic (Figure 4), PCB layers (Figure 5 to Figure 8), performance data and waveforms taken from the evaluation board (Figure 9 to Figure 16), and a full list of materials (Bill of Materials).

## 1.1 Operational Characteristics

The board input voltage range is from 4.5V to 42V. The output voltage is set to 3.3V by default and can be changed by  $R_9$  and  $R_{10}$ , as shown in Equation 1:

$$(EQ. 1) \quad R_9 = R_{10} \cdot \frac{V_{OUT} - 0.8}{0.8}$$

Renesas recommends using a 20kΩ resistor for  $R_{10}$  and choose  $R_9$  based on Equation 1.

## 1.2 Setup and Configuration

1. Populate a jumper on JP1(VIN shorted to EN).
2. Connect the power supply to the input terminals VIN(T1) and GND(T2). Connect the load to the output terminals VOUT(T3) and GND(T4). Verify the setup is correctly connected before applying any power or load to the board.
3. Turn on the power supply, and the part should start operating.
4. Verify that the output voltage is 3.3V and the phase node waveforms can be monitored at J1.

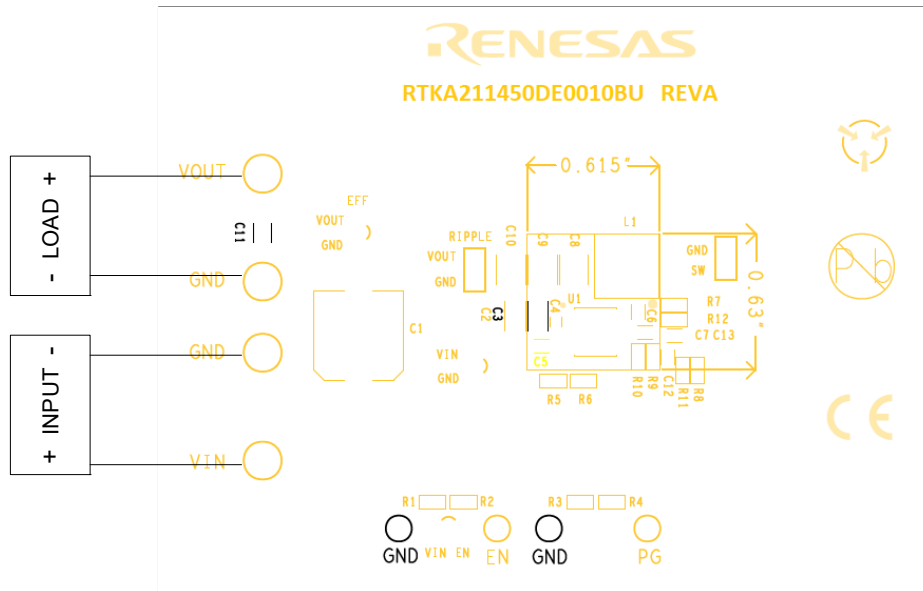


Figure 2. RTKA211450DE0010BU Board Setup

## 2. Board Design

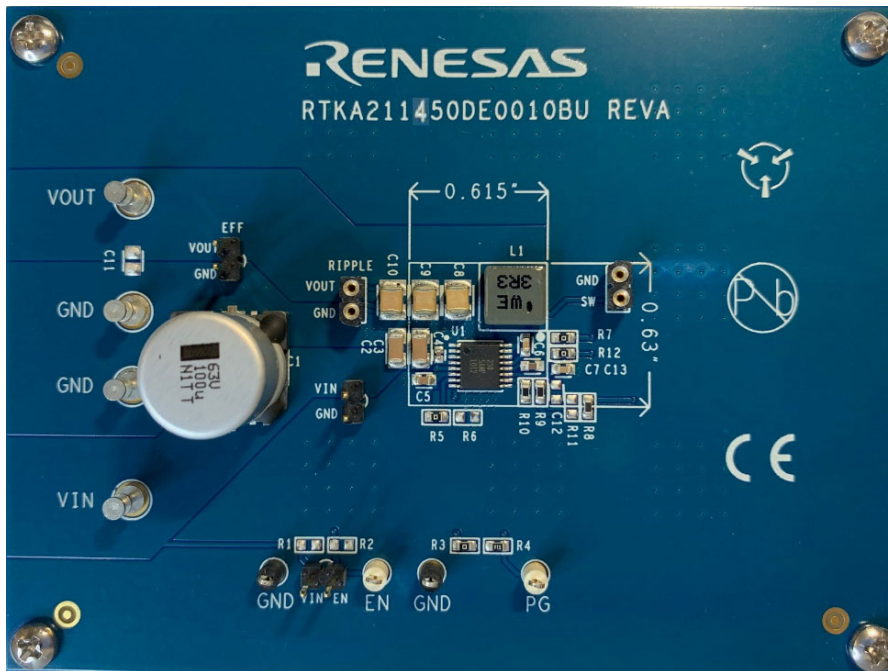


Figure 3. RTKA211450DE0010BU Evaluation Board (Top)

### 2.1 Layout Guidelines

For detailed layout guidelines reference the Layout Guidelines section in the *RAA211450 Datasheet*.



## 2.3 Bill of Materials

| Qty | Ref Des                   | Description   | Manufacturer      | Part Number          |
|-----|---------------------------|---|-------------------|----------------------|
| 3   | C8, C9, C10               | CAP, SMD, 1210, 47 $\mu$ F, 10V, 10%, X7R, ROHS                   | Murata            | GRM32ER71A476KE15L   |
| 1   | C7                        | CAP, SMD, 0603, 1.0 $\mu$ F, 16V, 10%, X7R, ROHS                  | TDK               | C1608X7R1C105K       |
| 1   | C6                        | CAP, SMD, 0603, 0.1 $\mu$ F, 16V, 10%, X7R, ROHS                  | Murata            | GCM188R71C104KA37D   |
| 1   | C5                        | CAP, SMD, 0603, 4.7 $\mu$ F, 10V, 10%, X7S, ROHS                  | Murata            | GRM188C71A475KE11D   |
| 1   | C4                        | CAP, SMD, 0402, 0.1 $\mu$ F, 50V, 10%, X5R, ROHS                  | TDK               | CGA2B3X5R1H104K050BB |
| 2   | C2, C3                    | CAP, SMD, 1206, 10 $\mu$ F, 50V, 10%, X5R, ROHS                   | TDK               | C3216X5R1H106K       |
| 1   | L1                        | COIL-PWR INDUCTOR, SMD, 6.6mmx6.4mm, 6.8 $\mu$ H, 20%, 6.5A, ROHS | Würth Electronics | 74439344033          |
| 4   | T1, T2, T3, T4            | CONN-DBL TURRET, TH, 0.218x0.078 PCB MNT, TIN/BRASS, ROHS         | Keystone          | 1502-1               |
| 2   | J1, J2                    | CONN-BRD-BRD, 1x2, TH, Socket, 1x64 STRIP, 2.54mm, ST             | Mill-max          | 310-43-164-41-001000 |
| 1   | TP3, TP4                  | CONN-MINI TEST PT, VERTICAL, BLK, ROHS                            | Keystone          | 5001                 |
| 1   | TP1, TP2                  | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS                       | Keystone          | 5002                 |
| 1   | JP1                       | CONN-HEADER, 1x2, RETENTIVE, 2.54mm, 0.230x0.120, ROHS            | BERG/FCI          | 69190-202HLF         |
| 1   | R10                       | RES, SMD, 0603, 20k $\Omega$ , 1/10W, 1%, ROHS                    | Various           | Generic              |
| 1   | R9                        | RES, SMD, 0603, 62k $\Omega$ , 1/10W, 1%, ROHS                    | Panasonic         | ERJ-3EKF6202V        |
| 1   | R8                        | RES, SMD, 0603, 20 $\Omega$ , 1/10W, 1%, ROHS                     | Panasonic         | ERJ-3EKF20R0V        |
| 3   | R3, R5, R7                | RES, SMD, 0603, 0 $\Omega$ , 1/10W, ROHS                          | Various           | Generic              |
| 1   | R4                        | RES, SMD, 0603, 100k $\Omega$ , 1/10W, 1%, ROHS                   | Various           | Generic              |
| 1   | U1                        | IC-5A DC/DC Step Down Regulator, 16P, HTSSOP, ROHS                | Renesas           | RAA211450GSP#HA0     |
| 0   | C1                        | CAP, 12x10, 100 $\mu$ F, 63V, 20%, ALUM.ELEC., ROHS               | Vishay            | MAL214699904E3       |
| 0   | C11, C12, R1, R2, R6, R11 | DO NOT POPULATE   | N/A               | N/A                  |

## 2.4 Board Layout

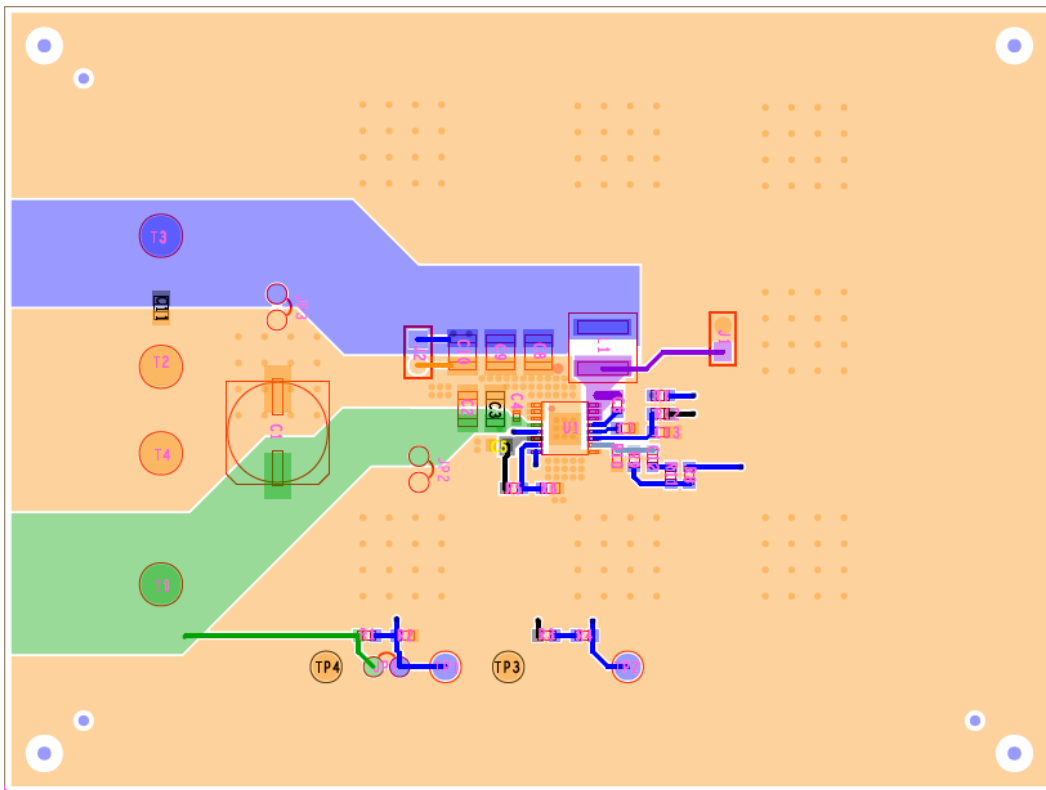


Figure 5. Top Layer

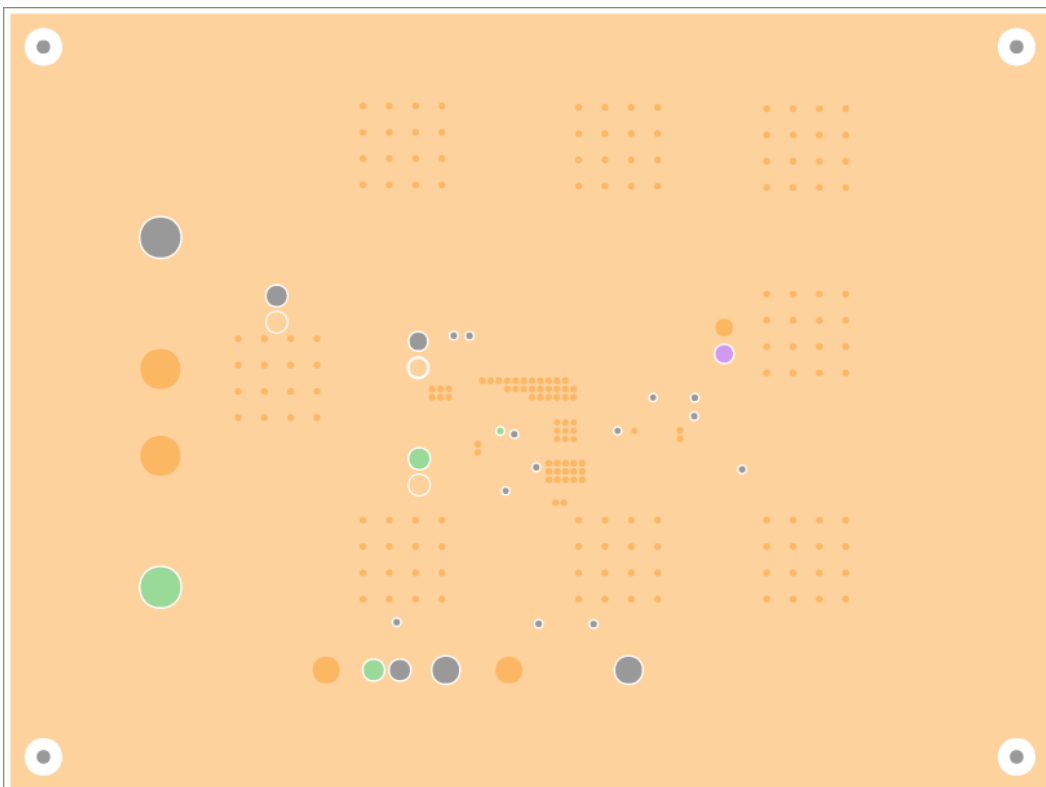


Figure 6. Second Layer

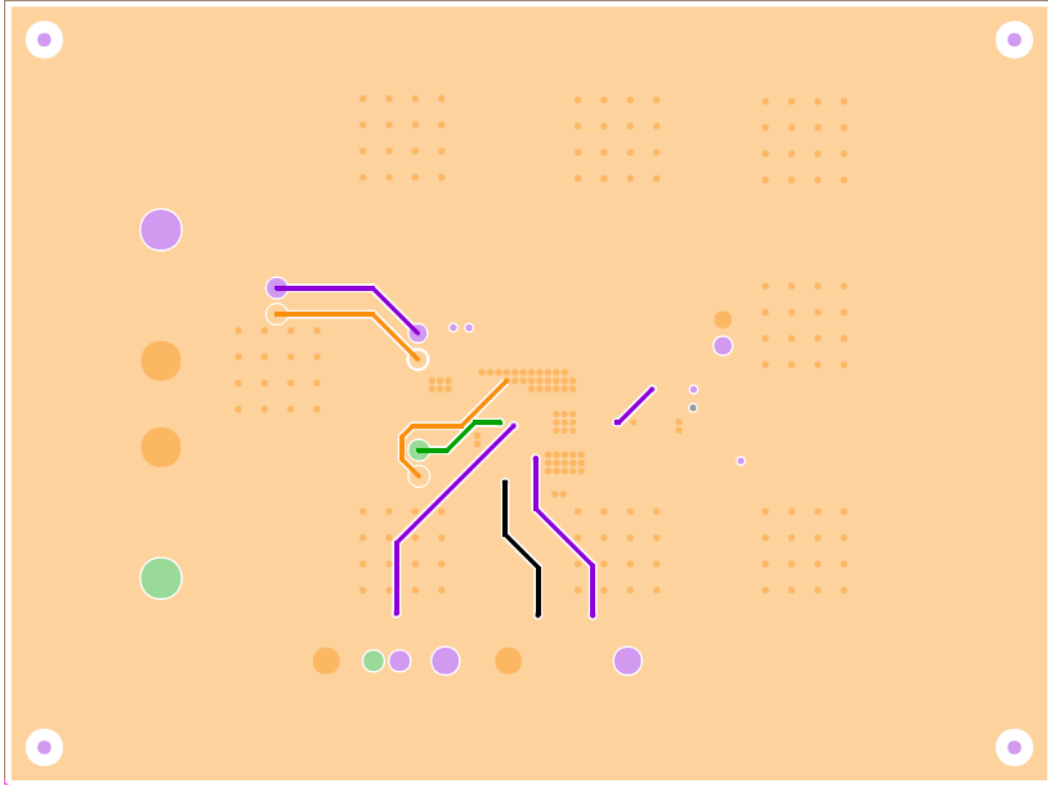


Figure 7. Third Layer

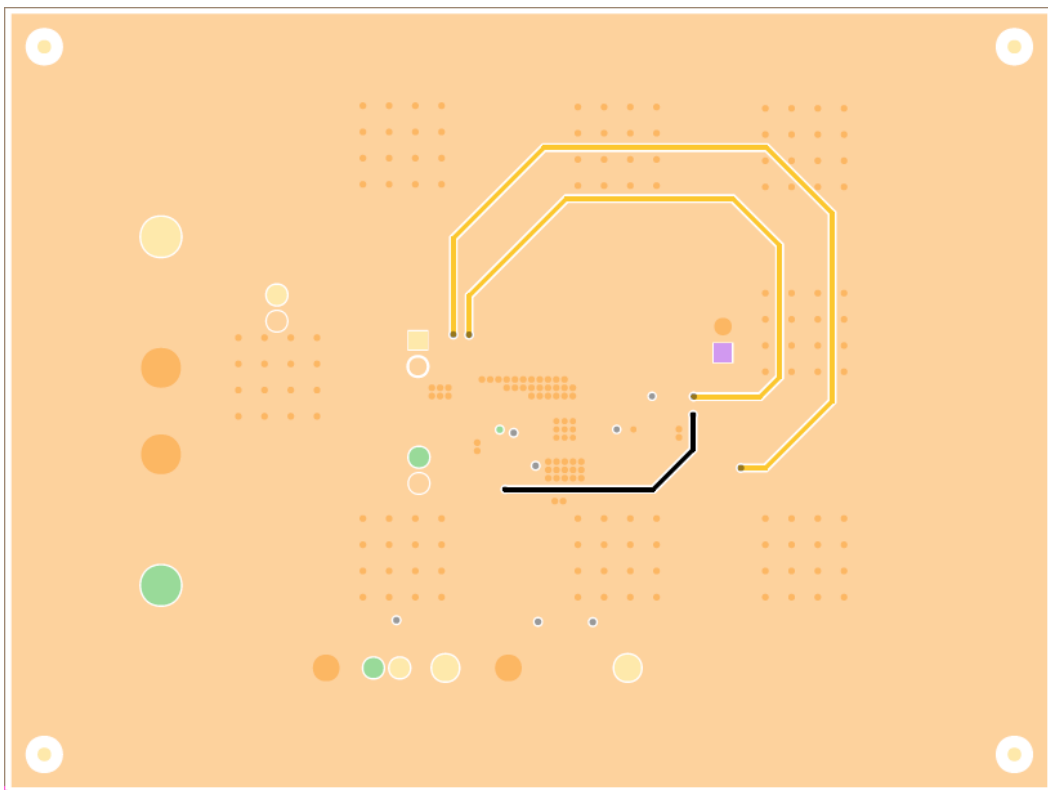


Figure 8. Bottom Layer



### 3. Typical Performance Graphs

$V_{IN} = 24V$ ,  $V_{OUT} = 3.3V$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted.

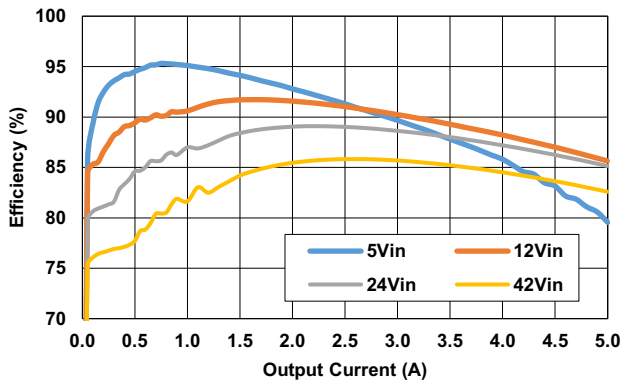


Figure 9. Efficiency vs Load

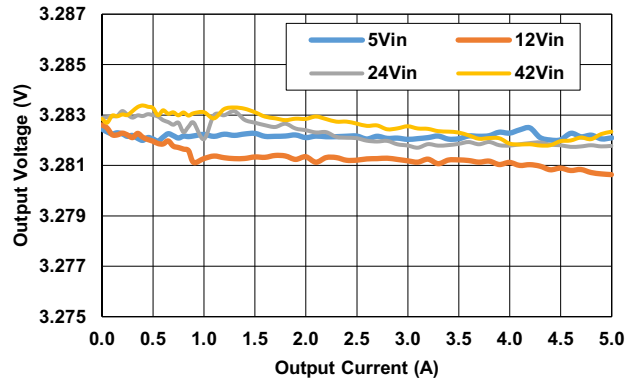


Figure 10. Load Regulation

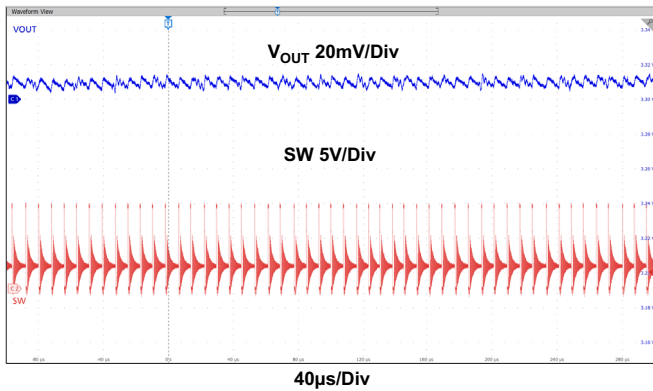


Figure 11. Output Ripple at No Load

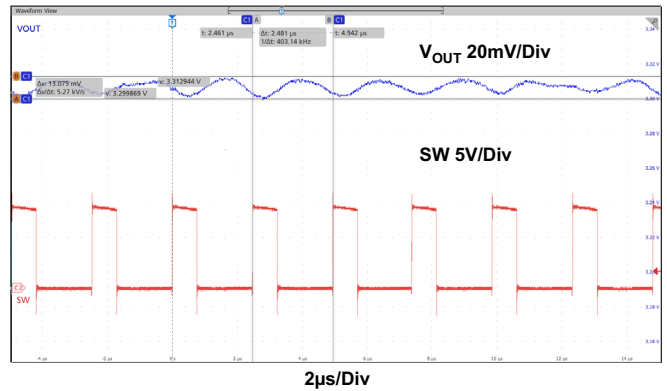


Figure 12. Output Ripple at Full Load

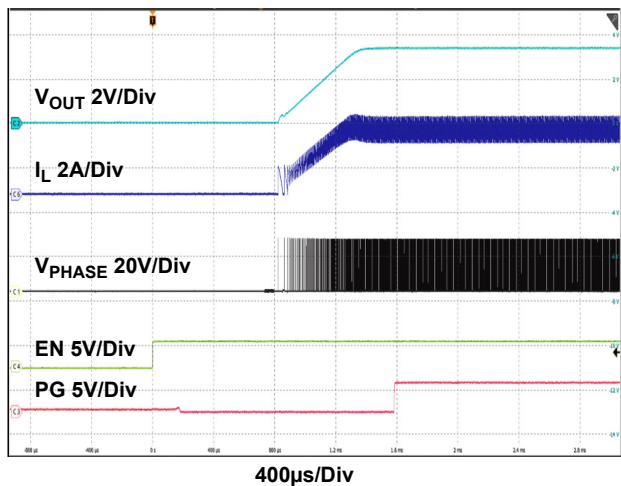


Figure 13. Enable On at Full Load with Internal SS

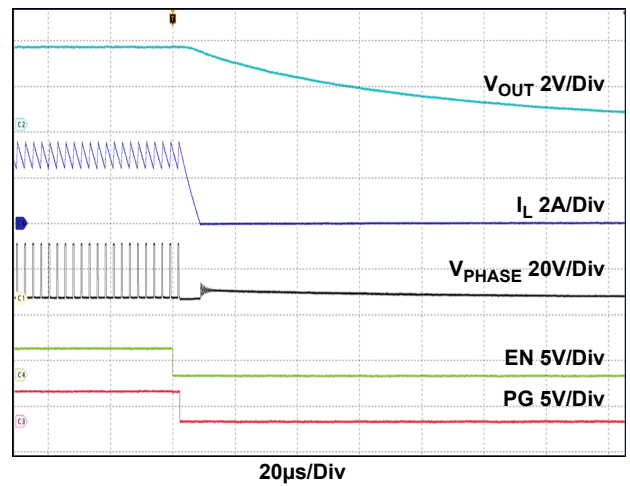


Figure 14. Enable Off at Full Load with Internal SS

$V_{IN} = 24V$ ,  $V_{OUT} = 3.3V$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted. (Cont.)

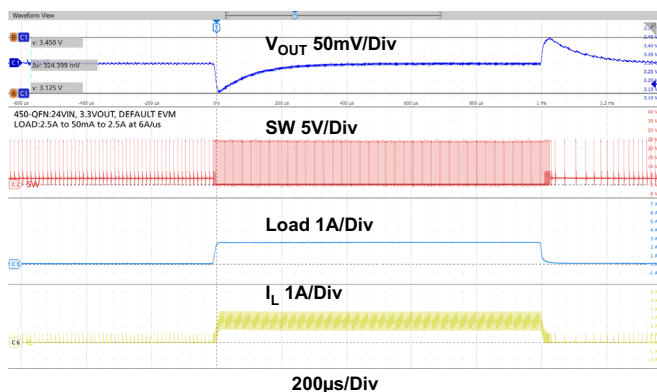


Figure 15. Load Ramp from 50mA to 2.5A

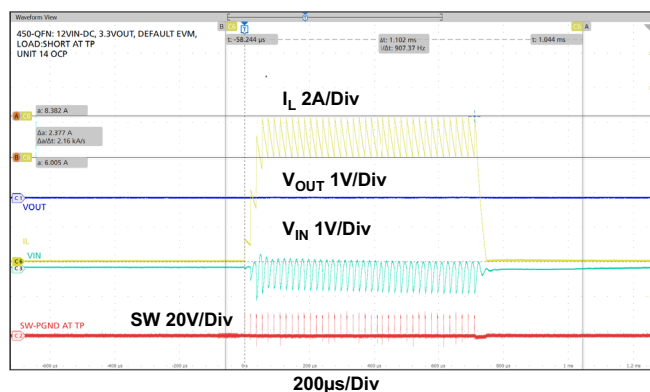


Figure 16. OCP by Short  $V_{OUT}$

## 4. Ordering Information

| Part Number        | Description                                 |
|--------------------|---|
| RTKA211450DE0010BU | RAA211450 Evaluation Board - HTSSOP Version |

## 5. Revision History

| Revision | Date        | Description       |
|----------|-------------|-------------------|
| 1.01     | Oct 7, 2022 | Updated Figure 1. |
| 1.00     | May 5, 2022 | Initial release   |

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