RTKA808013DE0000BU

The RTKA808013DE0000BU evaluation board is a 3A synchronous buck regulator with an input range of 2.7V to 5.5V. The board evaluates the performance of the RAA808013 high-efficiency low BOM count Sync Buck Regulator with 3A output current.

The RTKA808013DE0000BU is offered in a 6-lead TSOT23 package with 1.1mm maximum height. The converter occupies 1.516cm^2 area.

Specifications

This board is optimized for the following operating conditions:

- Input voltage: 2.7V ~ 5.5V_{DC}
- Output voltage: 1.2V_{DC}
- Output current: 3A max
- Output power: 3.6W
- Efficiency: 91% at 0.6A, 87% at 1.5A, 83% at 2.4A
- High switching frequency: 1.5MHz
- Load regulation: ±0.5% at 25°C
- Operating temperature: -40°C to 85°C
- Board dimension: 76.2mm×63.5mm

Features

- 2.7V to 5.5V operating input range
- Continuous output current up to 3A
- 77mΩ and 42mΩ internal power MOSFET switches
- Output adjustable from 0.6V
- 100% duty cycle in dropout
- High switching frequency (1.5MHz)
- Fixed soft-start time
- Cycle-by-cycle overcurrent protection
- OCP and SCP with Hiccup mode
- Input undervoltage lockout (UVLO)
- Over-temperature protection
- EN for power sequencing

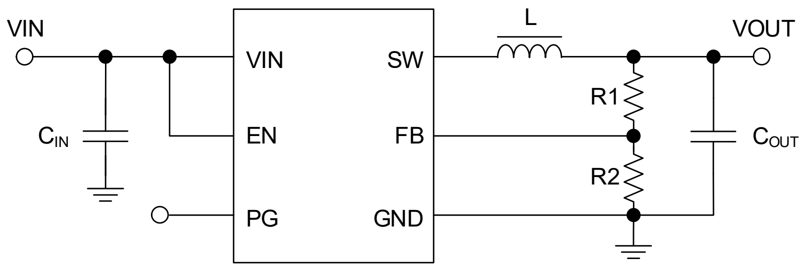

Figure 1. Block Diagram

Contents

1. Functional Description

1.1 Recommended Equipment

The following materials are recommended to perform testing:

- 0V to 6V power supply with at least 15A source current capability
- Electronic loads capable of sinking current up to 15A
- Digital multimeters (DMMs)
- 100MHz quad-trace oscilloscope
- Signal generator

1.2 Quick Start Guide

1. Ensure that the circuit is correctly connected to the supply and loads before applying any power.
2. Connect the bias supply to VIN, the plus terminal to VIN+ and the negative return to VIN-.
3. Turn on the power supply (Recommend V_{INMAX} = <5.5V).
4. Verify the output voltage is 1.2V for V_{OUT}.

1.3 Evaluating the Other Output Voltage

The RTKA808013DE0000BU output is preset to 1.2V; however, output voltages can be adjusted from 0.6V to 3.3V. The output voltage programming resistor, R_1, depends on the required output voltage of the regulator and the value of the feedback resistor R_2, as shown in Equation 1.

(EQ. 1)
$$R_2 = \frac{R_1 \times 0.6V}{V_{OUT} - 0.6V}$$

Table 1 shows the component selection that should be used for the respective V_{OUTs}.

Table 1. External Component Selection

V_{OUT} (V)	L (µH)	C_{OUT} (µF)	R_1 (kΩ)	R_2 (kΩ)
0.6	1	22×2	0	51
	2.2	22		
1.0	1	22×2	34	51
	2.2	22		
1.2	1	22	51	51
	2.2	10		
1.8	1	22	102	51
	2.2	10		
2.5	1	22	162	51
	2.2	10		
3.3	1	22	229	51
	2.2	10		

2. Board Design

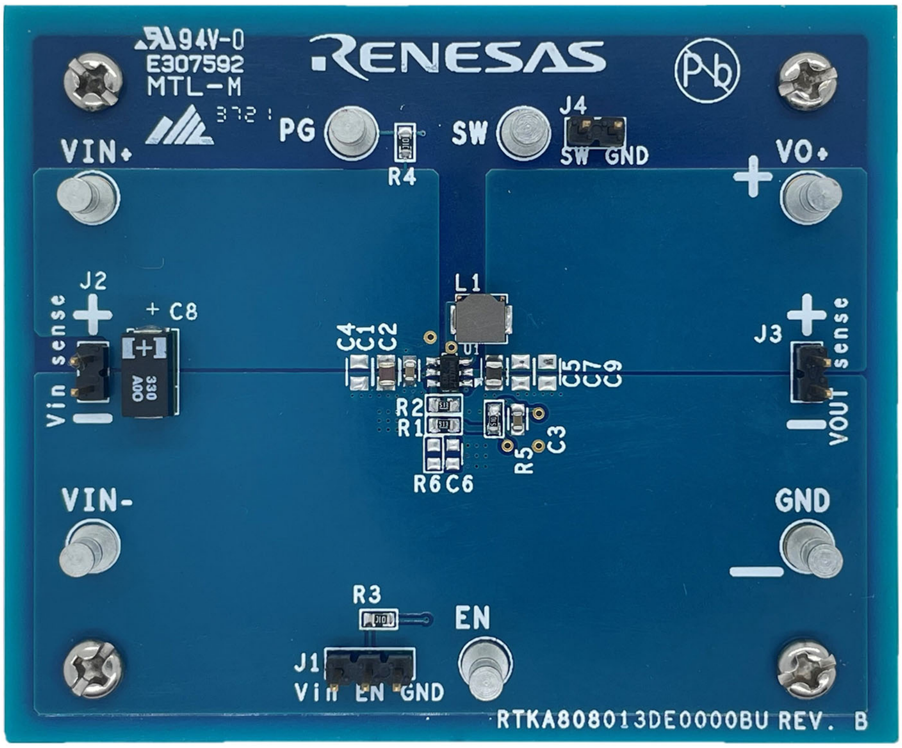

Figure 2. RTKA808013DE0000BU Evaluation Board (Top)

2.1 Layout Guidelines

The following are PCB guidelines to consider when laying out the board.

- Place the input ceramic capacitors between VIN and GND pins. Put them as close to the pins as possible.
- A 0.1µF decoupling input ceramic capacitor is recommended. Place it as close to the VIN pin as possible.
- Keep the switching node (SW) plane away from the feedback network. Place the resistor divider close to the IC.

2.2 Schematic Diagrams

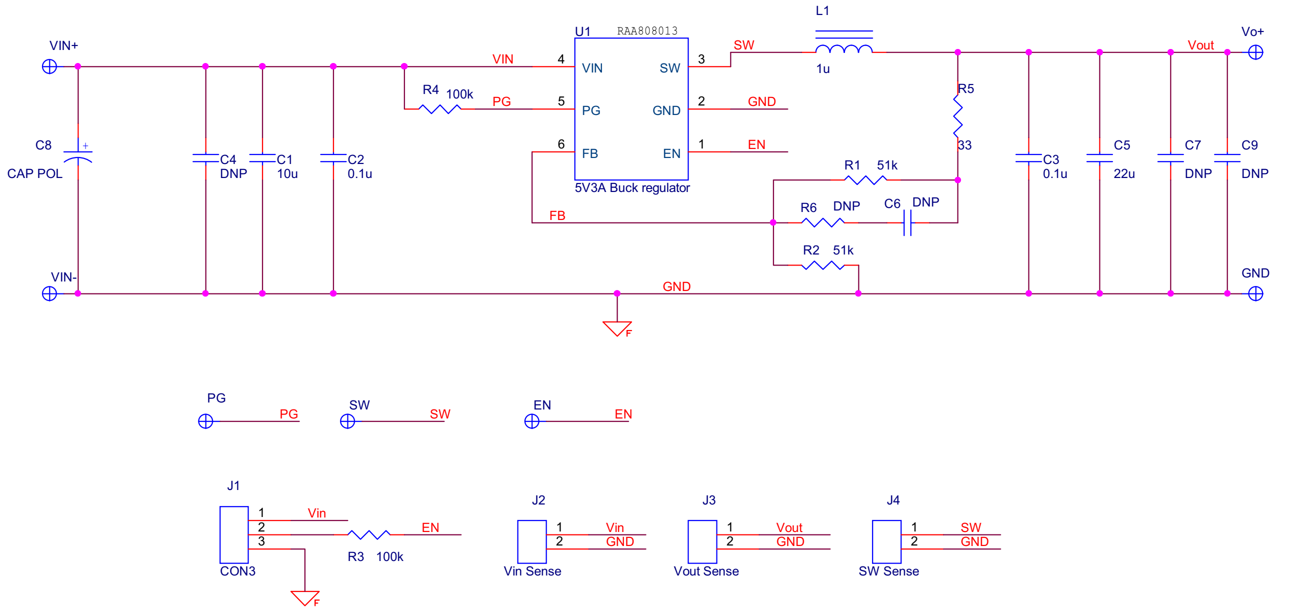

Figure 3. Schematic

2.3 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1	U1	IC 3A Buck Regulator TSOT23-6, ROHS	Renesas	RAA808013GP3#JA0
2	C1	CAP, SMD, 0805, 10µF, 10V, 10%, X7R, ROHS	TDK Corporation	C2012X7R1A106K125AC
2	C2, C3	CAP, SMD, 0603, 0.1µF, 100V, 10%, X7R, ROHS	Murata Electronics	GRM188R72A104KA35J
2	C5	CAP, SMD, 0805, 22µF, 10V, 10%, X7R, ROHS	Murata Electronics	GRM21BZ71A226ME15L
		CAP, SMD, 0805, 22µF, 10V, 20%, X7S, ROHS	TDK Corporation	C2012X7S1A226M125AC
1	R1	RES, SMD, 0603, 51k, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-0751KL
1	R2	RES, SMD, 0603, 51k, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-0751KL
2	R3, R4	RES SMD 100kΩ 1% 1/10W 0603	Yageo	RT0603FRD07100KL
1	R5	RES SMD 33Ω 1% 1/10W 0603	Yageo	RC0603FR-0733RL
7	EN, GND, PG, SW, VIN, VO-, VO+	TERM TURRET SINGLE L = 7.14MM TIN, ROHS	Keystone	1514-2
1	J1	CONN-HEADER, 1×3, BREAKAWY 1×36, 2.54mm, ROHS	BERG/FCI	68000-236HLF
3	J2, J3, J4	CONN-HEADER, 1×2, BREAKAWY 1×36, 2.54mm, ROHS	BERG/FCI	69190-202HLF

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1	L1	FIXED IND 1µH 7.2A 12 MΩ SMD, ROHS	Wurth Elektronik	74438356010
		FIXED IND 1µH 5.6A 25.5MΩ SMD, ROHS	TDK Corporation	SPM4020T-1R0M-LR
		FIXED IND 1µH 11.7A 7.6MΩ SMD, ROHS	Sunlord Electronics	WTX0420T1R0MTR01
1	C8	330µF Molded Tantalum Polymer Capacitor 10V (7343 Metric) 35mΩ at 100kHz	Panasonic	10THB330M

2.4 Board Layout

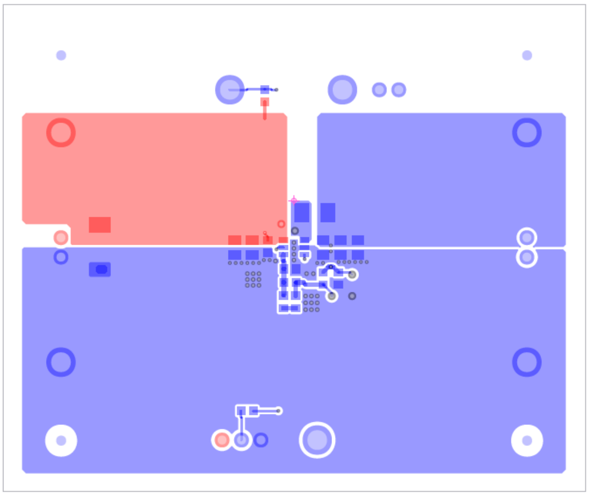

Figure 4. Top Layer

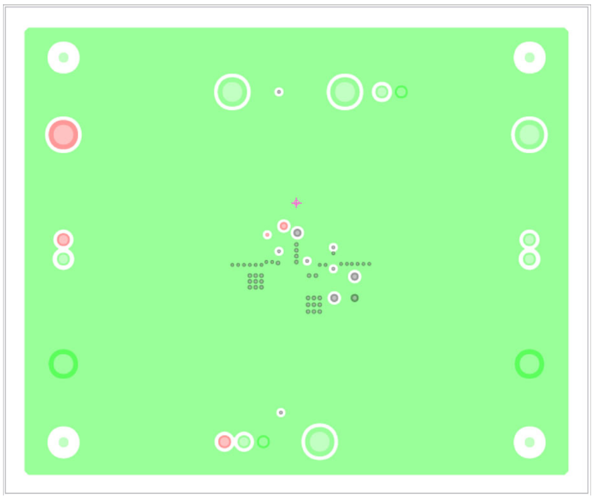

Figure 5. Internal Layer 1

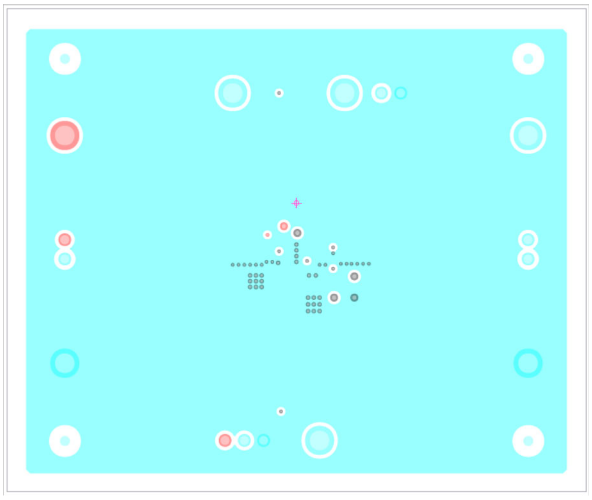

Figure 6. Internal Layer 2

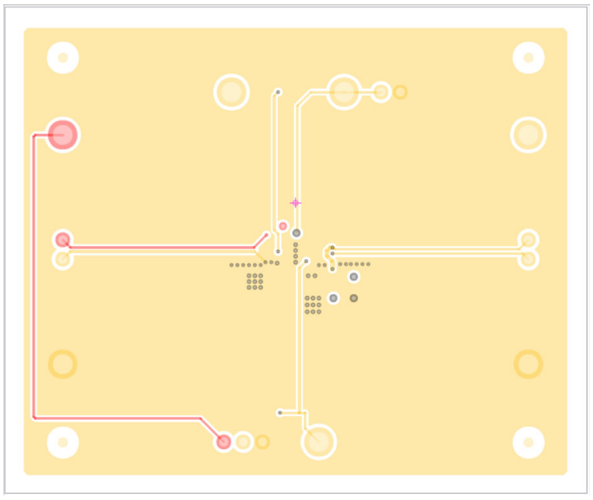

Figure 7. Bottom Layer

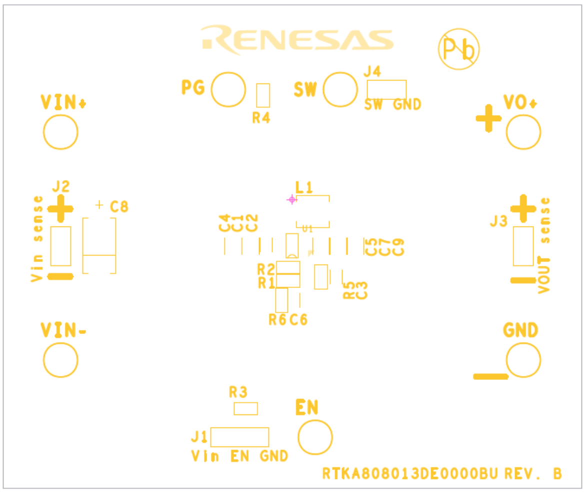

Figure 8. Silkscreen - Top Layer

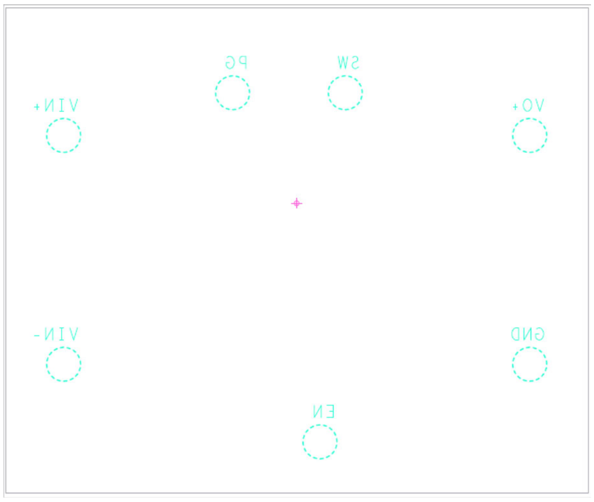

Figure 9. Silkscreen - Bottom Layer

3. Typical Performance Graphs

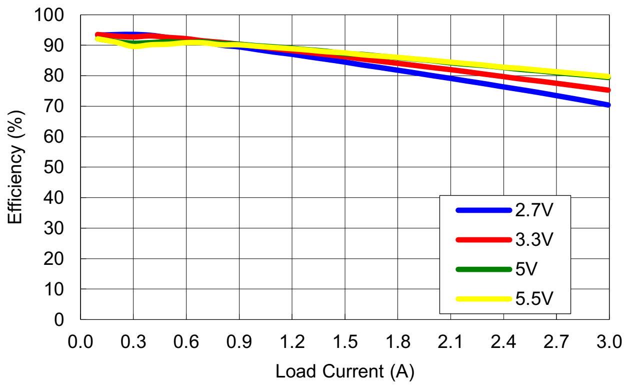

Figure 10. Efficiency vs Load, V_{OUT} = 1.2V, 25°C

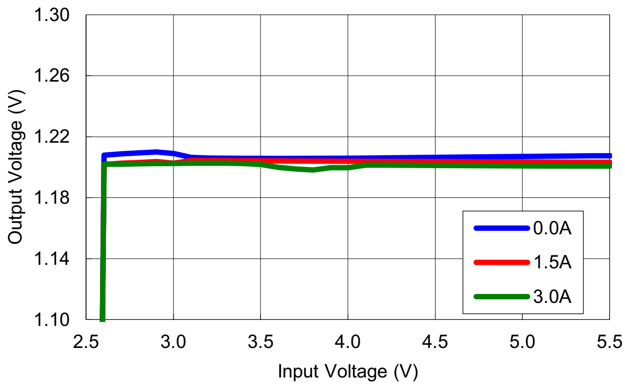

Figure 11. Line Regulation, V_{OUT} = 1.2V, 25°C

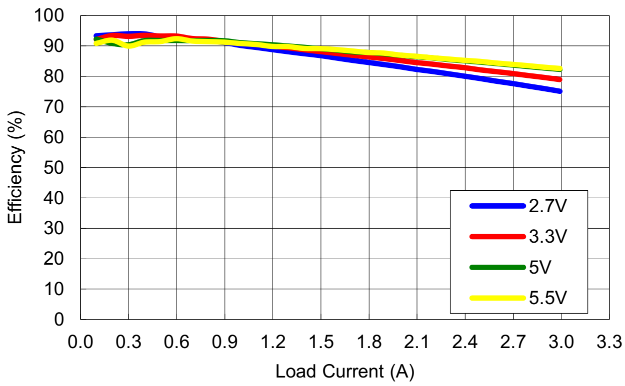

Figure 12. Efficiency vs Load, V_{OUT} = 1.2V, -40°C

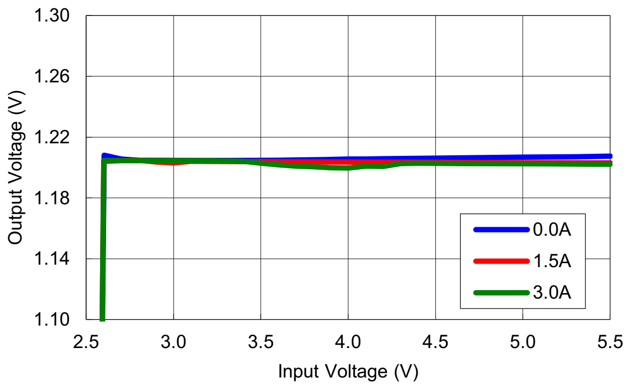

Figure 13. Line Regulation, V_{OUT} = 1.2V, -40°C

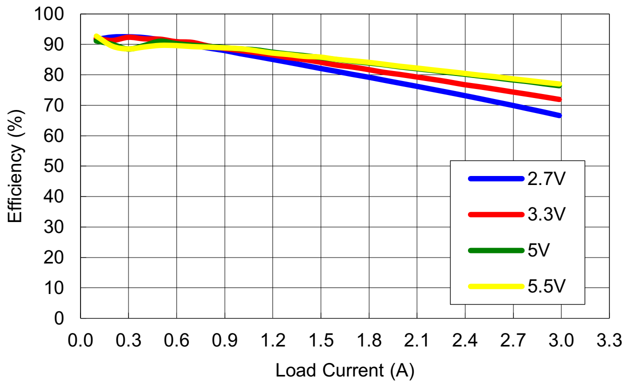

Figure 14. Efficiency vs Load, V_{OUT} = 1.2V, 85°C

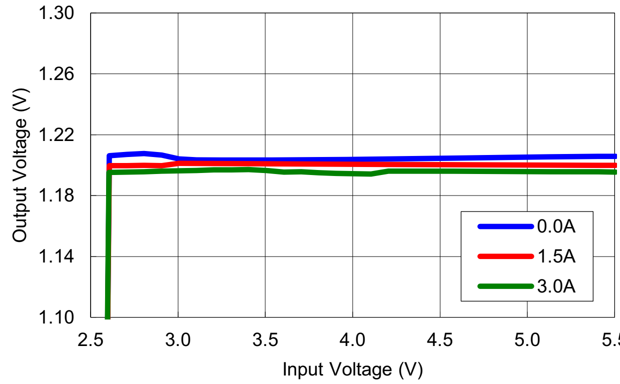

Figure 15. Line Regulation, V_{OUT} = 1.2V, 85°C

V_{IN} = 5V, V_{OUT} = 1.2V, T_A = +25°C.

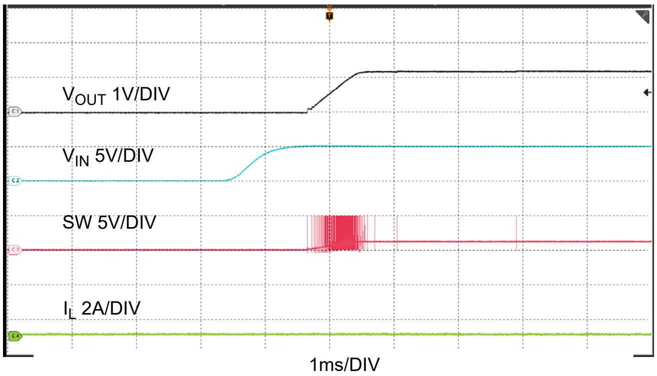

Figure 16. Startup at 0A

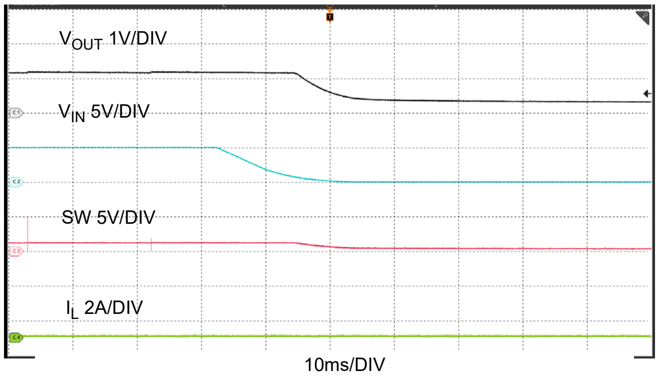

Figure 17. Shutdown at 0A

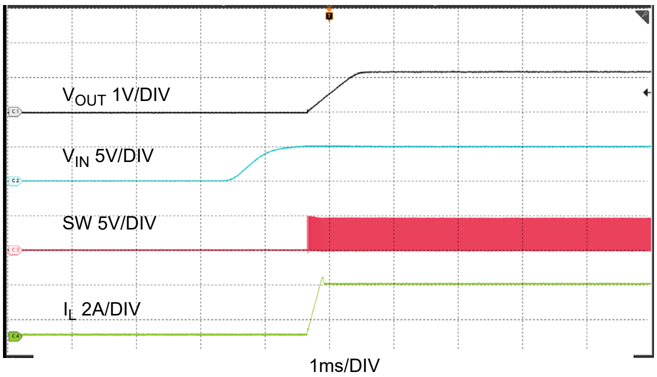

Figure 18. Startup at 3A

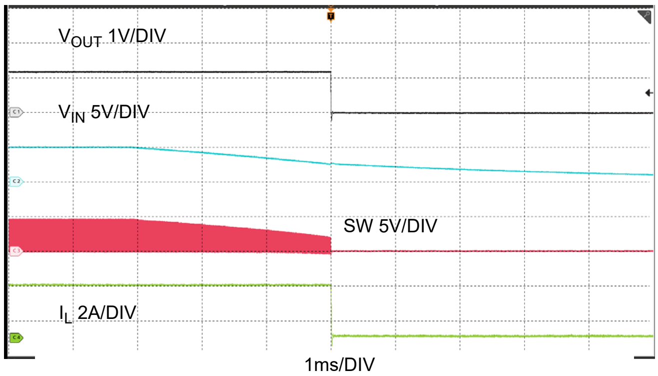

Figure 19. Shutdown at 3A

V_{IN} = 5V, V_{OUT} = 1.2V, T_A = +25°C. (Cont.)

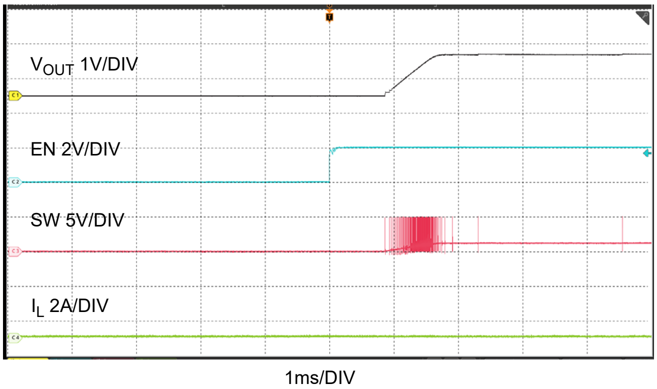

Figure 20. EN on at 0A

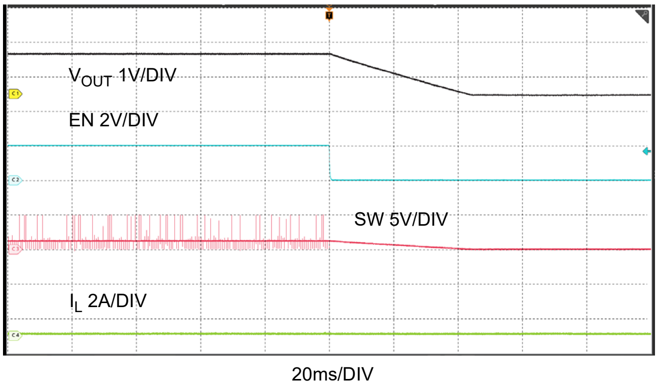

Figure 21. EN off at 0A

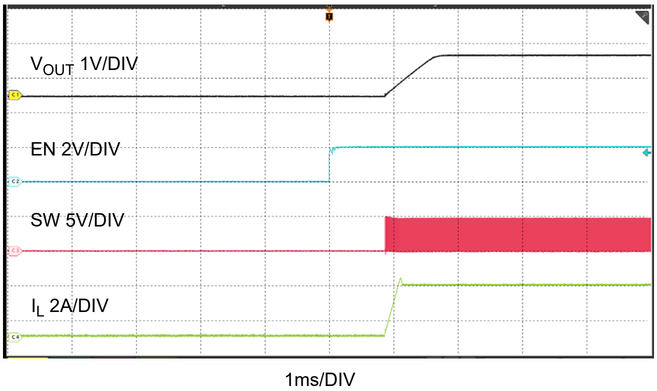

Figure 22. EN on at 3A

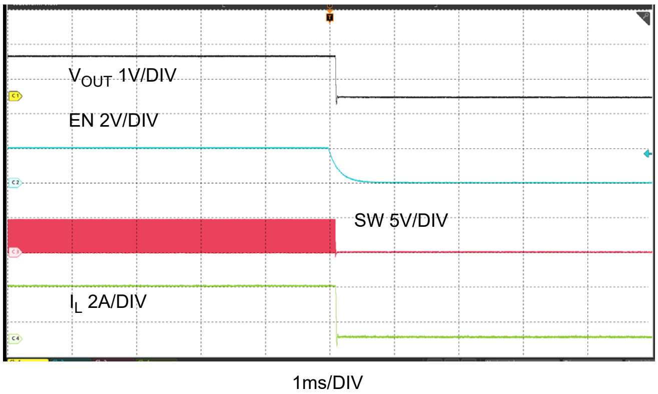

Figure 23. EN off at 3A

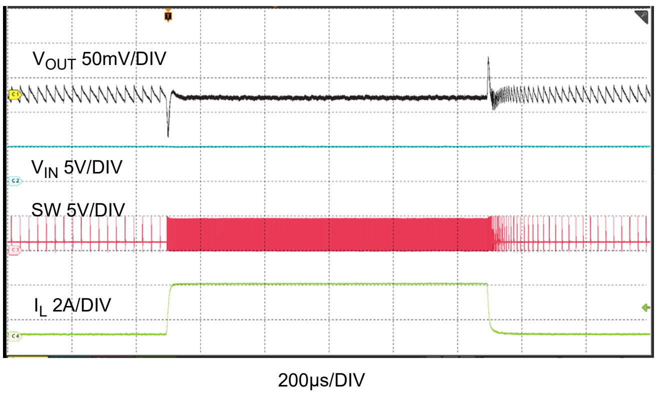

Figure 24. Load Transition, 0A->3A

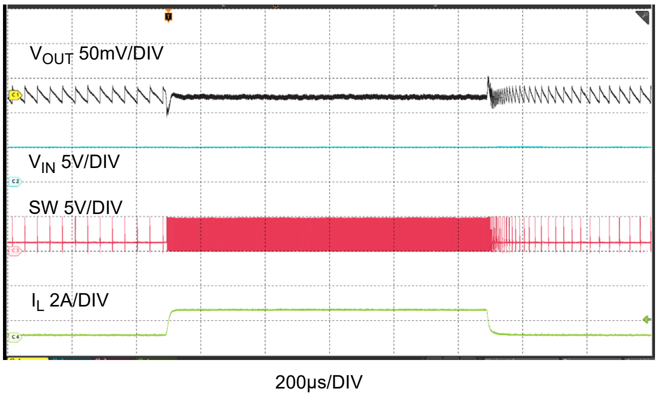

Figure 25. Load Transition, 0A->1.5A

V_{IN} = 5V, V_{OUT} = 1.2V, T_A = +25°C. (Cont.)

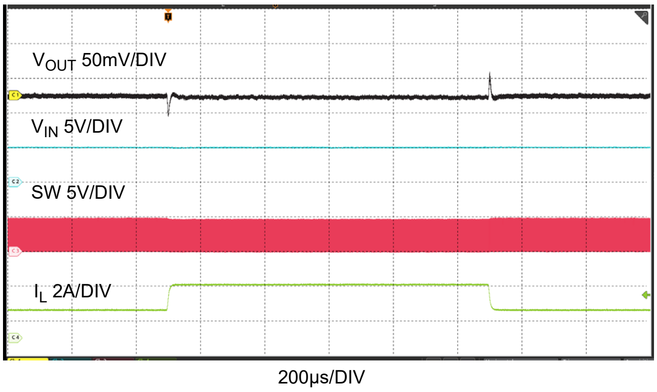

Figure 26. Load Transition, 1.5A->3A

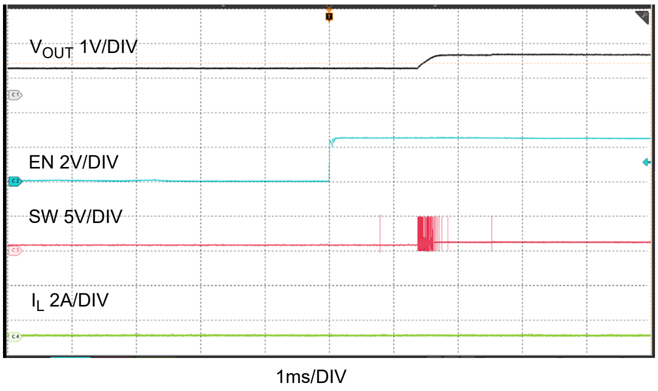

Figure 27. Pre-bias on, no load

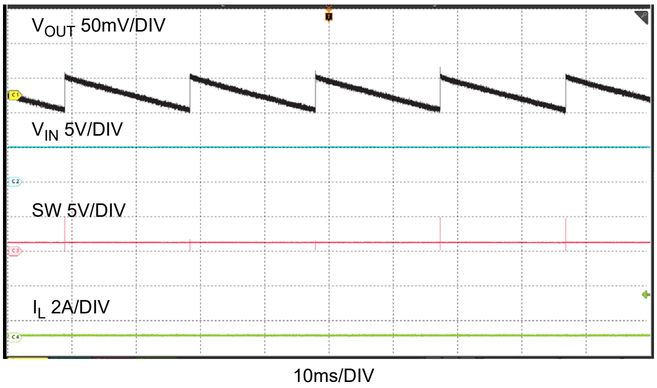

Figure 28. Steady State at 0A

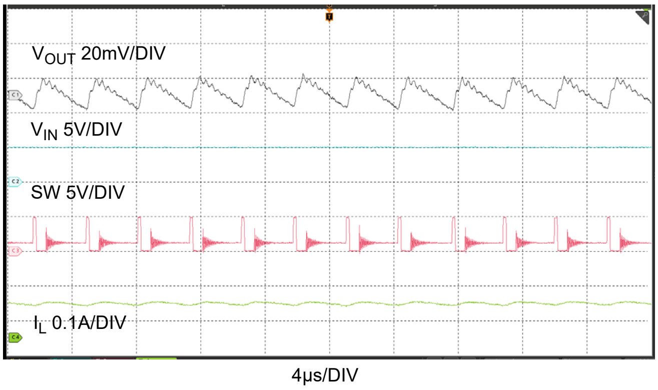

Figure 29. Steady State at 0.1A

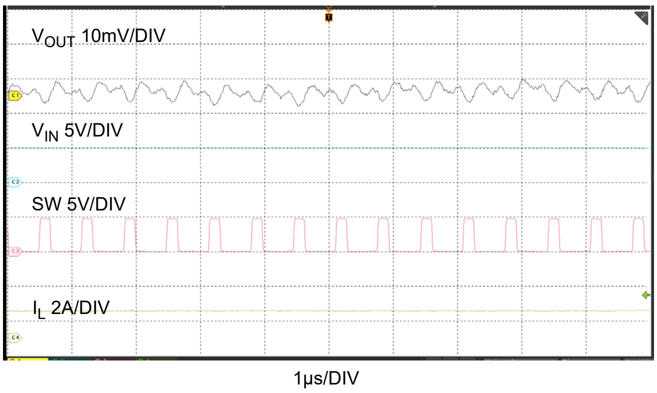

Figure 30. Steady State at 1.5A

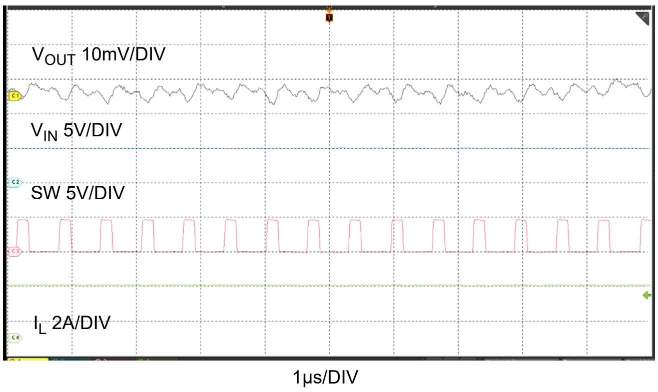

Figure 31. Steady State at 3A

V_{IN} = 5V, V_{OUT} = 1.2V, T_A = +25°C. (Cont.)

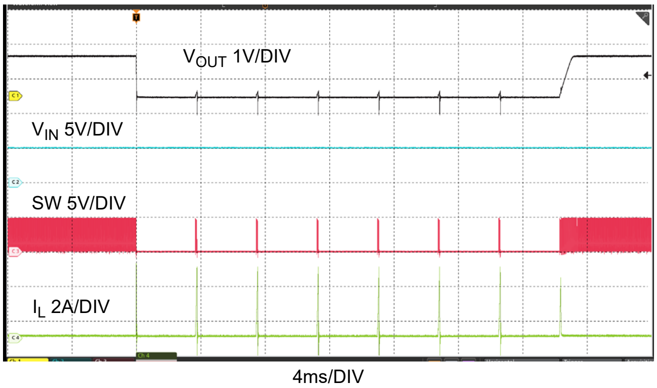

Figure 32. Hiccup with Output Short, No Load

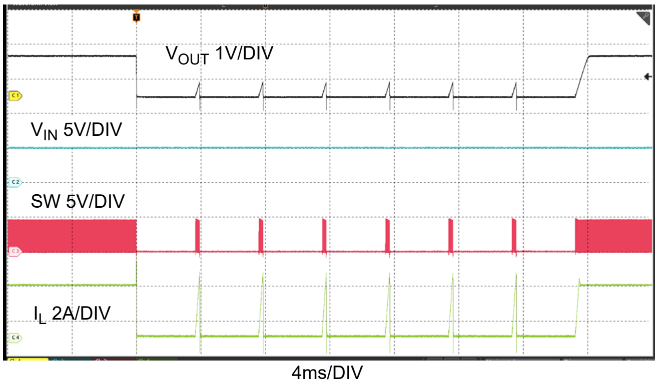

Figure 33. Hiccup with Output Short, Full Load

4. Ordering Information

Part Number	Description
RTKA808013DE0000BU	2.7V~5.5V Synchronous Buck Converter Evaluation Board

5. Revision History

Revision	Date	Description
1.00	Aug 19, 2022	Initial release

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