User's Guide

Switching Regulator Series

Step-Down DC/DC Converter BD9B300MUV Evaluation Board

BD9B300MUV-EVK-001

Description

BD9B300MUV-EVK-001 Evaluation board delivers an output 1.2 volts from an input 2.7 to 5.5 volts using BD9B300MUV, a synchronous rectification step-down DC/DC converter integrated circuit, with output current rating of maximum 3A. It offers high efficiency in all load ranges by equipping the efficiency improvement function in light-load. The output voltage can be set by changing the external parts of circuit. An EN pin allows for simple ON/OFF control of the IC to reduce standby current consumption. A adjustable soft start circuit prevents in-rush current during startup along. A MODE pin allows the user to select fixed frequency PWM mode or enables the Deep-SLLM control and the mode is automatically switched between the Deep-SLLM control and fixed frequency PWM mode. A synchronization frequency is of 1MHz (FREQ pin is connected to V_{IN}) or 2MHz (FREQ pin is connected to ground).

Performance specification (These are representative values, and it is not a guaranteed against the characteristics.)

V_{IN} = 5.0V, V_{OUT} = 1.2V, Unless otherwise specified.

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage Range	2.7		5.5	V	
Output Voltage		1.2		V	R1=75kΩ, R2=150kΩ
Output Voltage Setting Range	0.8		V_{IN}×0.8	V	
Output Current Range	0		3.0	A	
Input Ripple Voltage		90		mVpp	I_O = 3.0A
Output Ripple Voltage		25		mVpp	I_O = 3.0A
Output Rising Time		7		ms	
Operating Frequency		1.0		MHz	
Maximum Efficiency		89.8		%	I_O = 0.8A

Operation Procedures

1. Necessary equipments
   (1) DC power-supply of 2.7V to 5.5V/3A
   (2) Maximum 3A load
   (3) DC voltmeter

2. Connecting the equipments
   (1) DC power-supply presets to 5.0V and then the power output turns off.
   (2) The max. load should be set at 3A and over it will be disabled.
   (3) Check Jumper pin of SW1 is short, between intermediate-terminal and OFF-side terminal.
   (4) Connect positive-terminal of power-supply to VIN+terminal and negative-terminal to GND-terminal with a pair of wires.
   (5) Connect load's positive-terminal to VOUT+terminal and negative-terminal to GND-terminal with a pair of wires.
   (6) Connect positive-terminal of DC voltmeter 1 to TP1 and negative-terminal to TP2 for input-voltage measurement.
   (7) Connect positive-terminal of DC voltmeter 2 to TP3 and negative-terminal to TP4 for output-voltage measurement.
   (8) DC power-supply output is turned ON.
   (9) IC is enable (EN) by shorting Jumper-pin of SW1 between intermediate-terminal and ON-side terminal.
   (10) Check DC voltmeter 2 displays 1.2V.
   (11) The load is enabled.
   (12) Check at DC voltmeter 1 whether the voltage-drop (loss) is not caused by the wire's resistance.

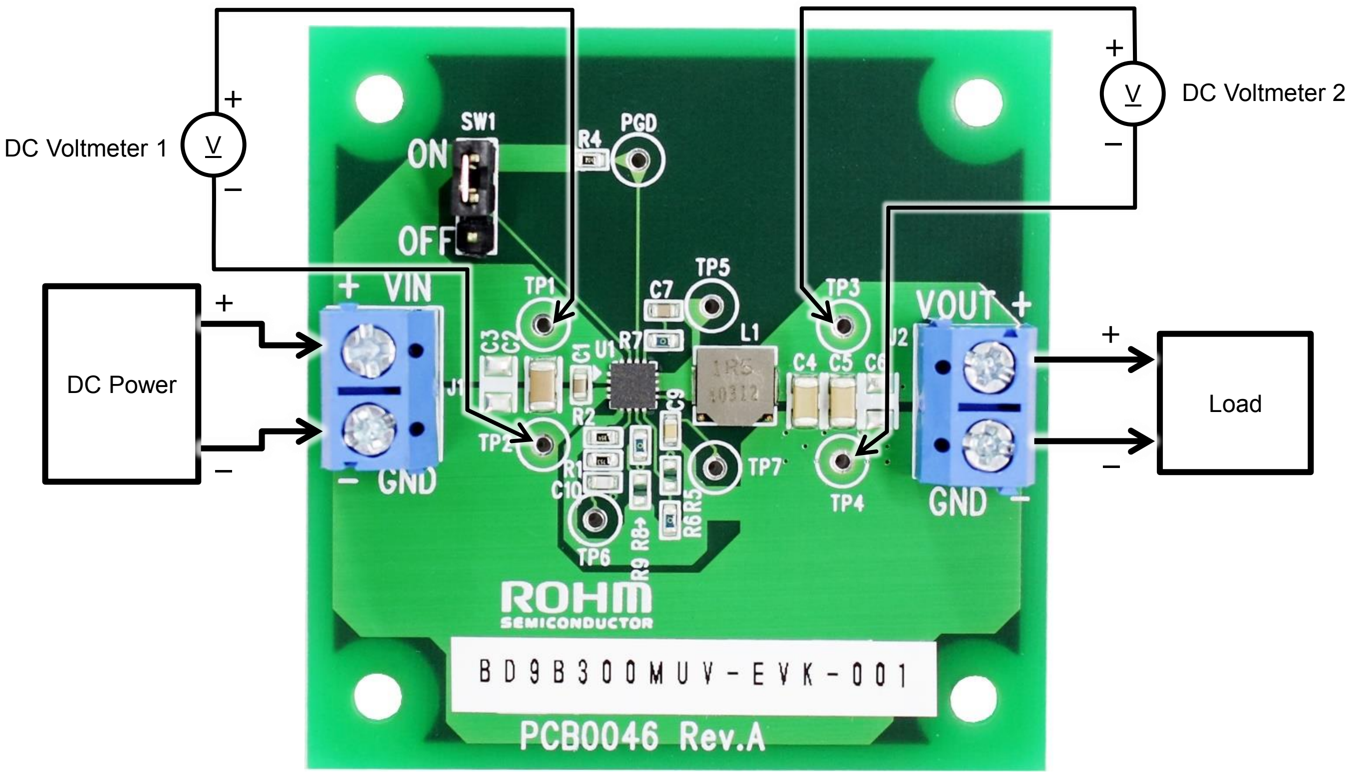


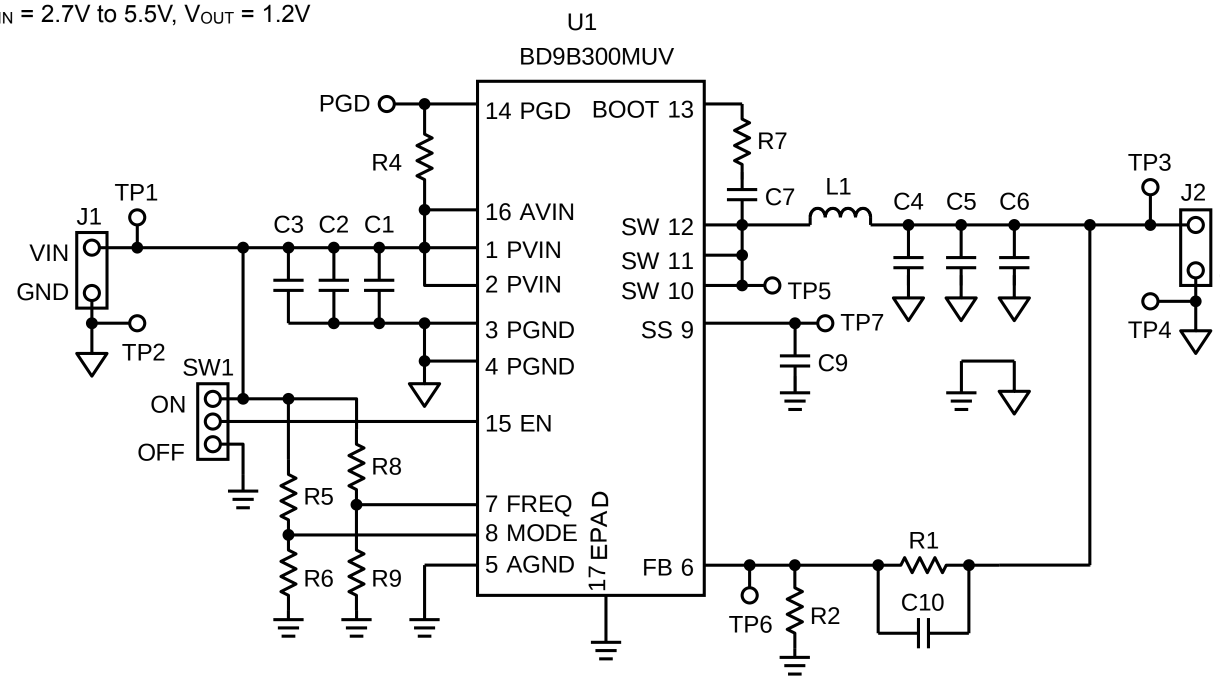
Figure 1. Connection Diagram

Enable-Pin

To minimize current consumption during standby-mode and normal operation, Enable-mode can be switched by controlling EN pin(15pin) of the IC. Standby-mode is enabled by shorting Jumper-pin of SW1 between intermediate-terminal and OFF-side terminal and normal-mode operation by shorting between intermediate-terminal and ON-side terminal.
It also can be swithed between standby-mode and normal-mode operation by removing Jumper-pin and controlling the voltage between EN and GND-terminal. Standby-mode is enabled when the voltage of EN is under 0.3V, and normal-mode operation when it is over 2.0V.

Cricuit Diagram

V_{IN} = 2.7V to 5.5V, V_{OUT} = 1.2V



Reference Designator		Description
R8	R9	
0Ω	-	Set switching frequency is 1MHz
-	0Ω	Set switching frequency is 2MHz

Reference Designator		Description
R5	R6	
0Ω	-	Set operation mode is fixed frequency PWM mode
-	0Ω	Set operation mode is automatically switched between the Deep-SLLM control and fixed frequency PWM mode

Figure 2. BD9B300MUV-EVK-001 Circuit Diagram

Bill of Materials

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
2	C1, C7	Ceramic Capacitor	0.1µF	50V, B, ±10%	GRM188B31H104KA92D	MURATA	1608
1	C2	Ceramic Capacitor	10µF	16V, B, ±10%	GRM31CB31C106KA88	MURATA	3216
0	C3	Ceramic Capacitor	-	Not installed	-	-	3216
2	C4, C5	Ceramic Capacitor	22µF	6.3V, B, ±20%	GRM31CB30J226ME18	MURATA	3216
0	C6	Ceramic Capacitor	-	Not installed	-	-	3216
1	C9	Ceramic Capacitor	0.01µF	50V, B, ±10%	GRM188B11H103KA01D	MURATA	1608
1	C10	Ceramic Capacitor	120pF	50V, C0G, ±5%	GRM1885C1H121JA01	MURATA	1608
1	L1	Inductor	1.5µH	±20%, DCR=33.4mΩmax, 7.8A	SPM5020T-1R5M	TDK	5451
1	R1	Resistor	75kΩ	1/10W, 50V, ±1%	MCR03EZPF7502	ROHM	1608
1	R2	Resistor	150kΩ	1/10W, 50V, ±1%	MCR03EZPF1503	ROHM	1608
1	R4	Resistor	100kΩ	1/10W, 50V, ±5%	MCR03EZPJ104	ROHM	1608
0	R5, R9	Resistor	-	Not installed	-	-	1608
3	R6, R7, R8	Resistor	0Ω	Jumper	MCR03ERPJ000	ROHM	1608
1	SW1	Pin header	-	2.54mm × 3 contacts	PH-1x03SG	USECONN	-
1	U1	IC	-	Buck DC/DC Converter	BD9B300MUV	ROHM	VQFN016V3030
2	J1, J2	Terminal Block	-	2 contacts, 15A, 14 to 22AWG	TB111-2-2-U-1-1	Alphaplus Connectors & Cables	-
1	-	Jumper	-	Jumper pin for SW1	MJ254-6BK	USECONN	-

Layout

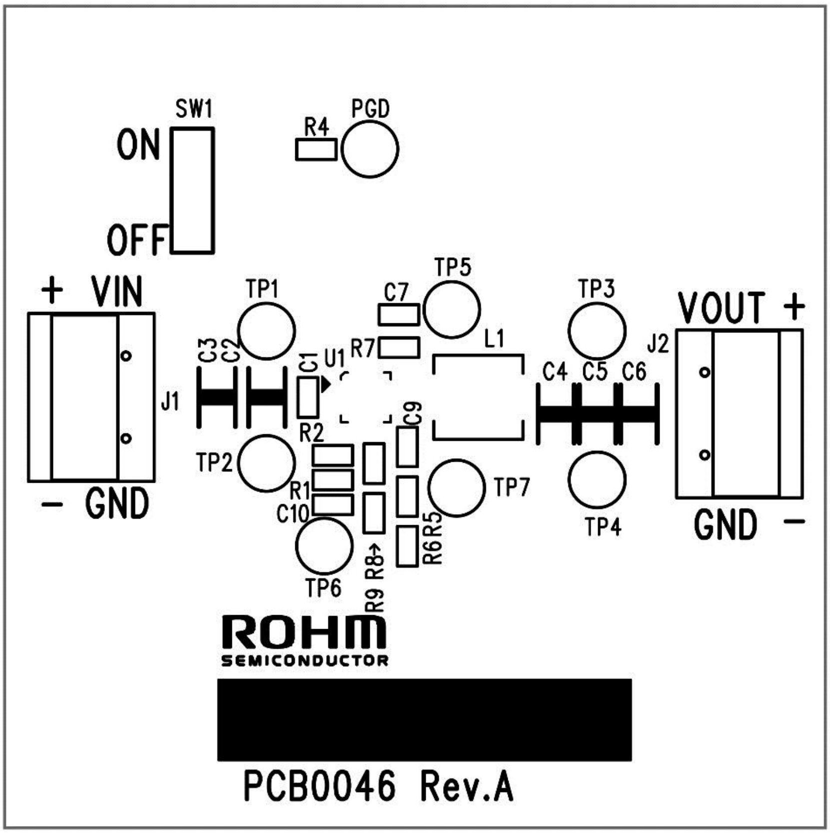


Figure 3. Top Silk Screen (Top view)

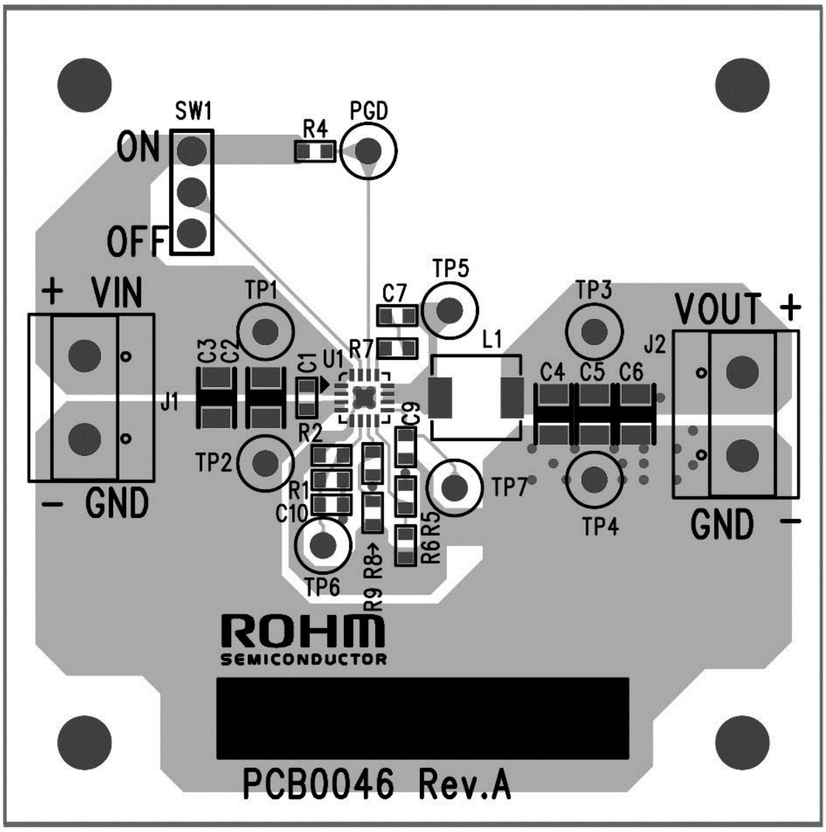


Figure 4. Top Silk Screen and Layout (Top view)

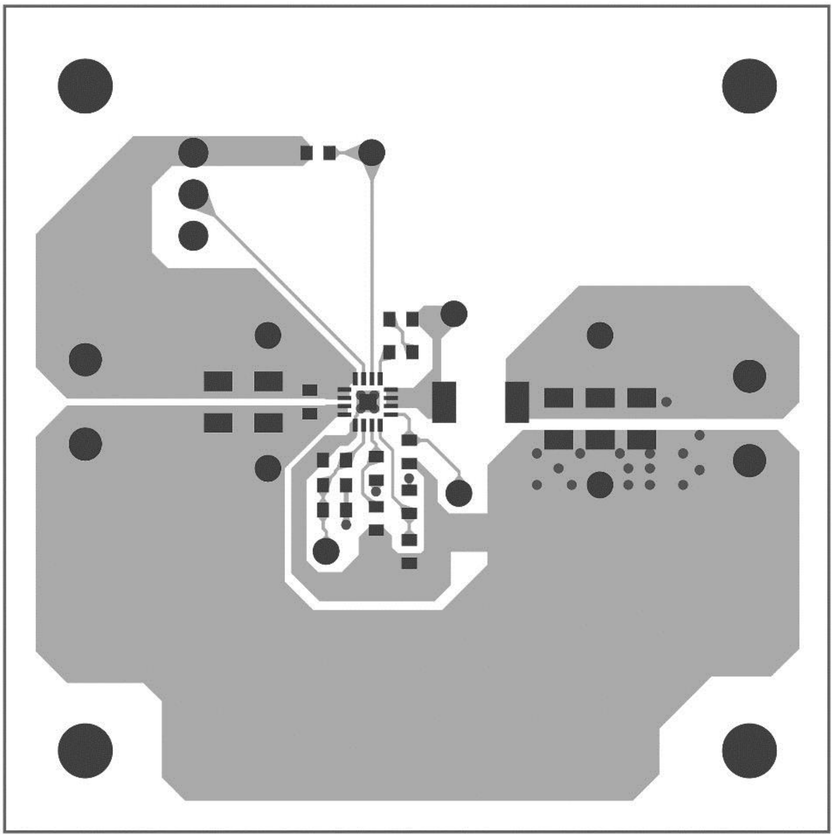


Figure 5. Top Side Layout (Top view)

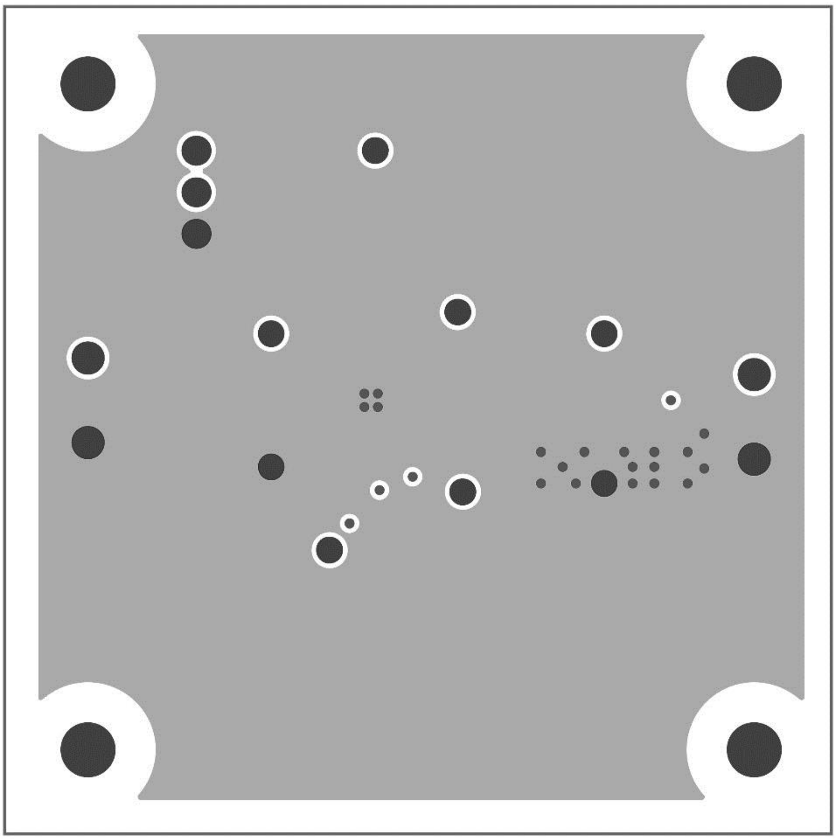


Figure 6. L2 Layout (Top view)

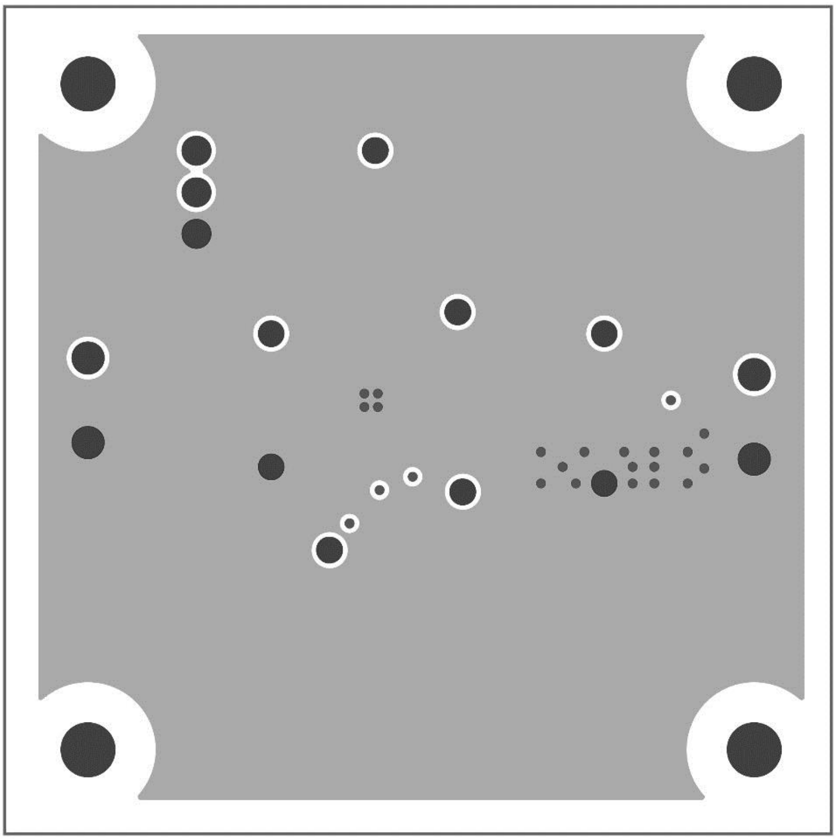


Figure 7. L3 Layout (Top view)

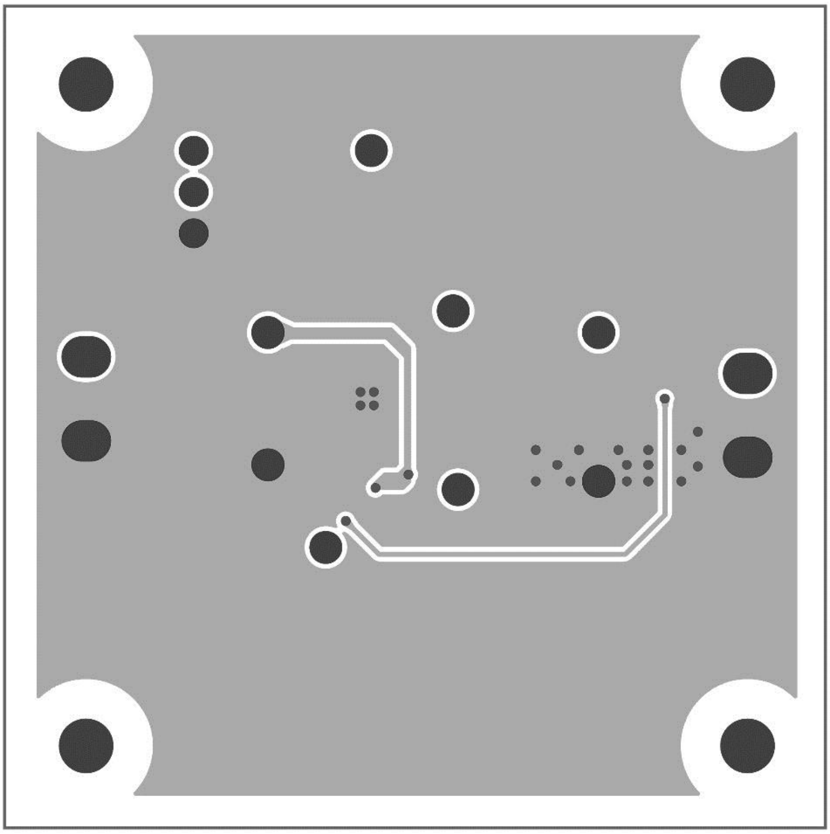


Figure 8. Bottom Side Layout (Top view)

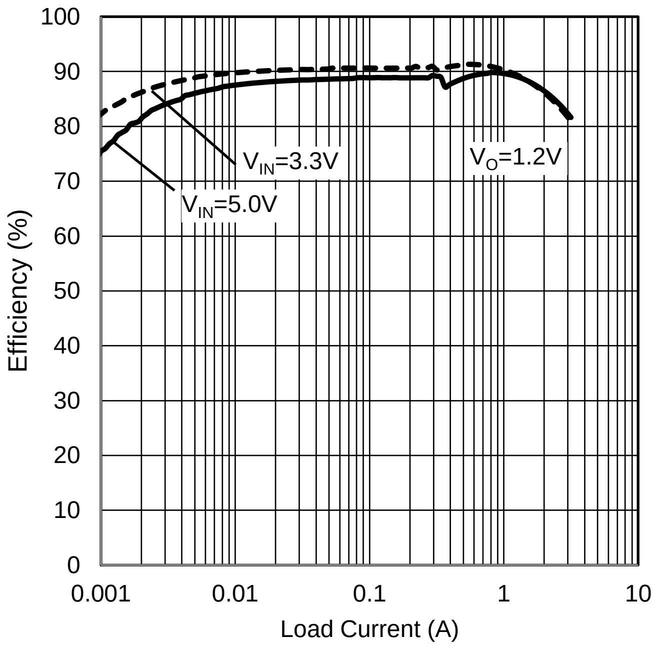


Figure 9. Efficiency vs Load Current

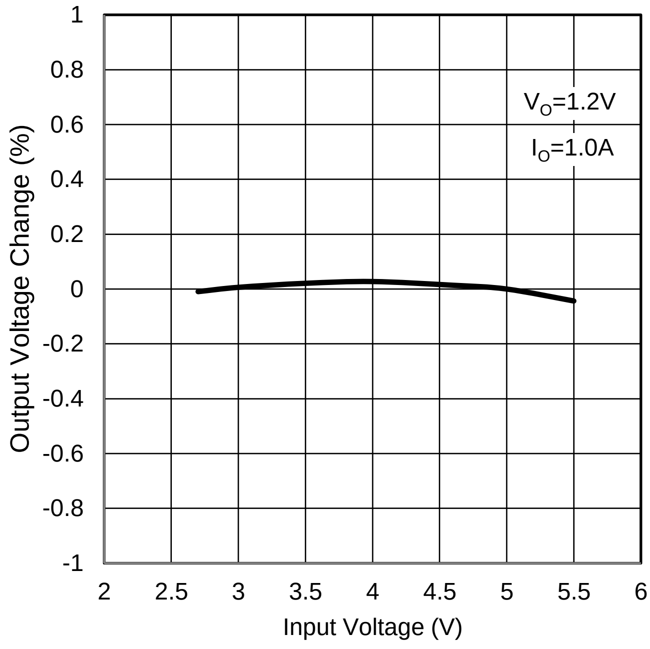


Figure 10. Line Regulation

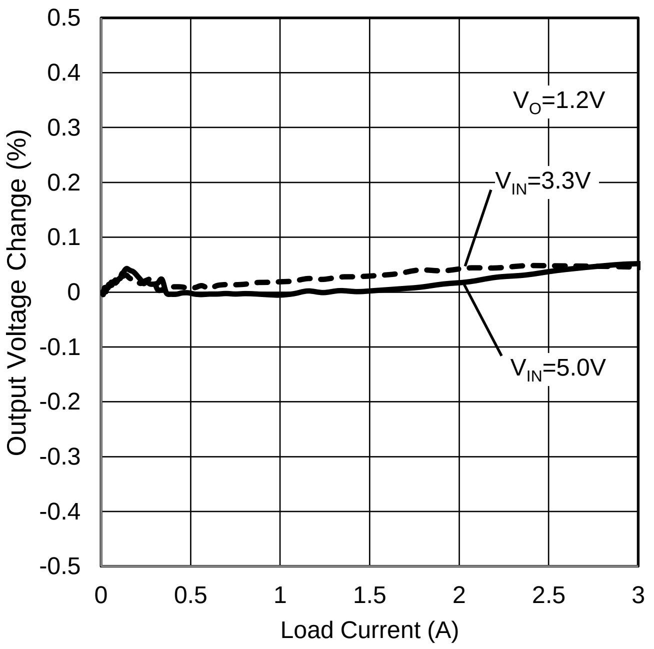


Figure 11. Load Regulation

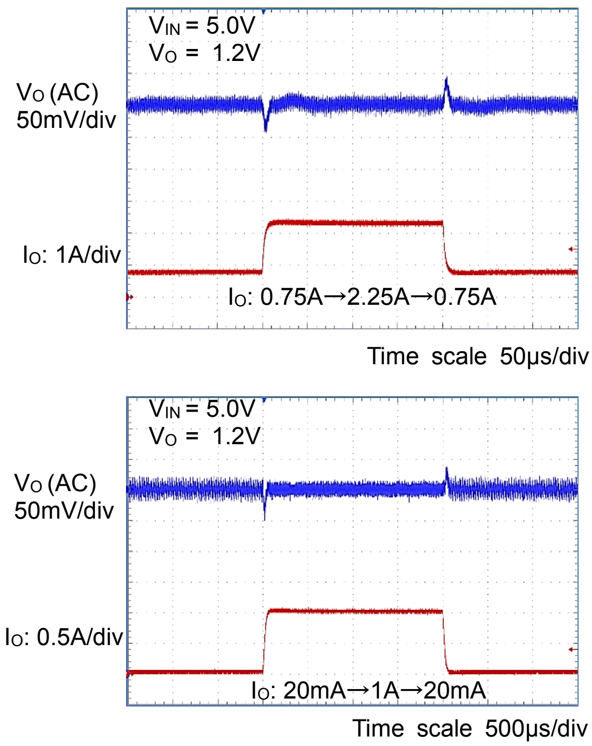


Figure 12. Load Transient Characteristics

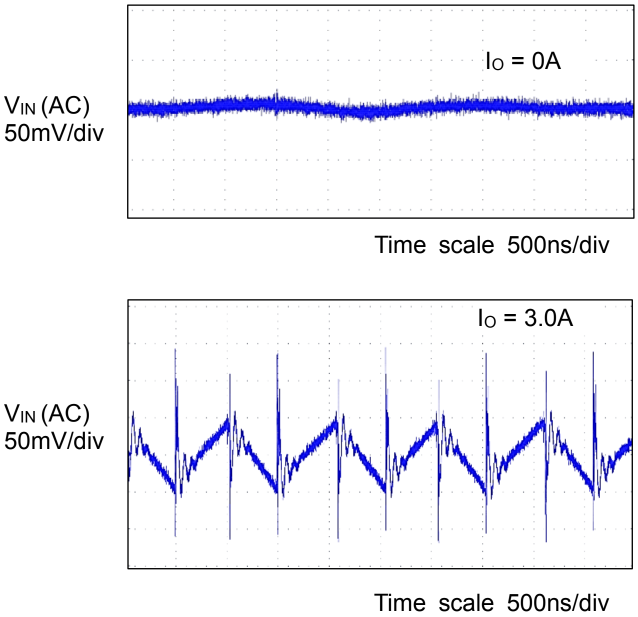


Figure 13. Input Voltage Ripple Wave
V_{IN} = 3.3V, V_O = 1.2V

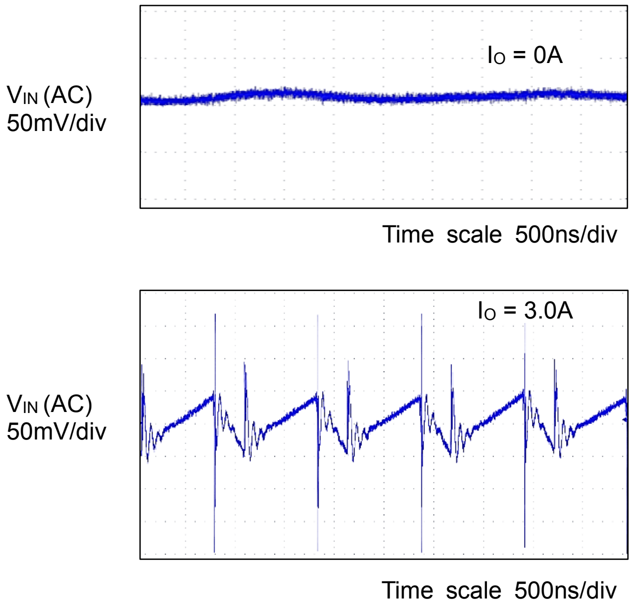


Figure 14. Input Voltage Ripple Wave
V_{IN} = 5.0V, V_O = 1.2V

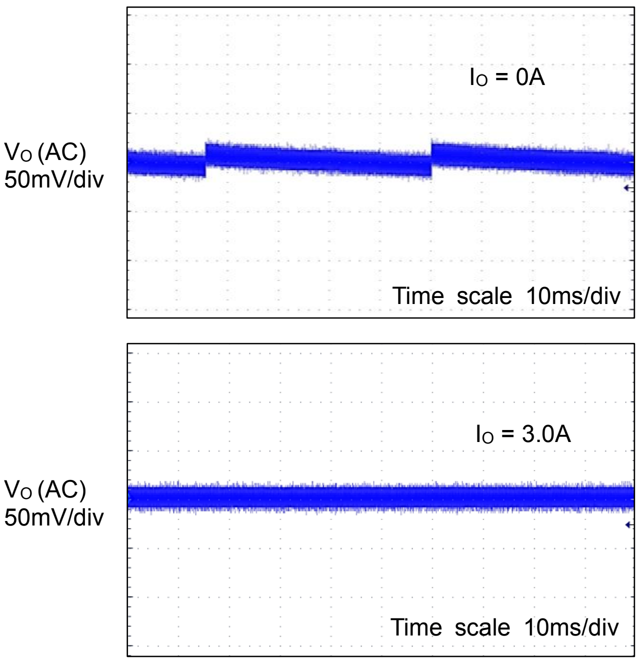


Figure 15. Output Voltage Ripple Wave
V_{IN} = 3.3V, V_O = 1.2V

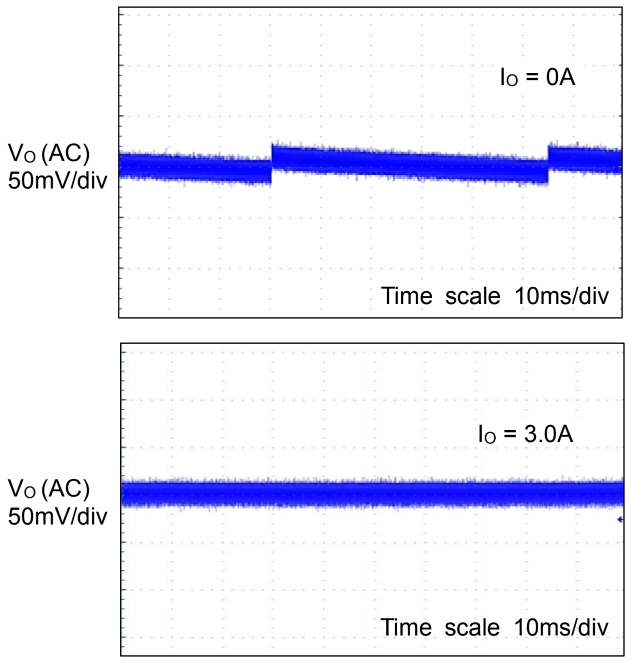
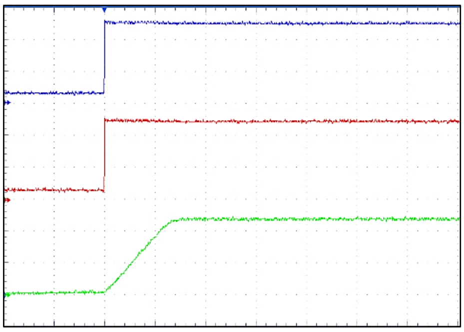


Figure 16. Output Voltage Ripple Wave
V_{IN} = 5.0V, V_O = 1.2V

V_{IN}
2V/div

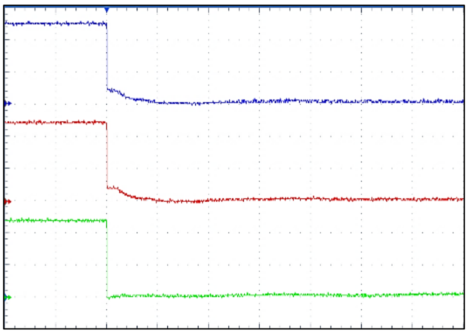
EN
2V/div

V_O
0.5V/div



Time scale 5ms/div

Figure 17. Start-up EN = V_{IN}
V_{IN} = 5.0V, V_O = 1.2V, R_L = 1.2Ω



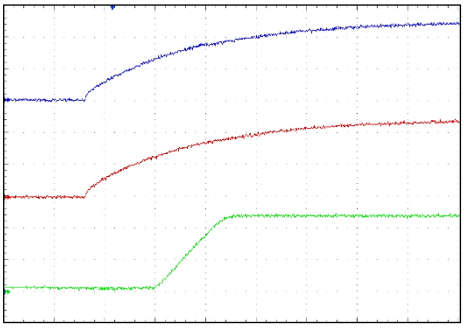
Time scale 5ms/div

Figure 18. Power-down EN = V_{IN}
V_{IN} = 5.0V, V_O = 1.2V, R_L = 1.2Ω

V_{IN}
2V/div

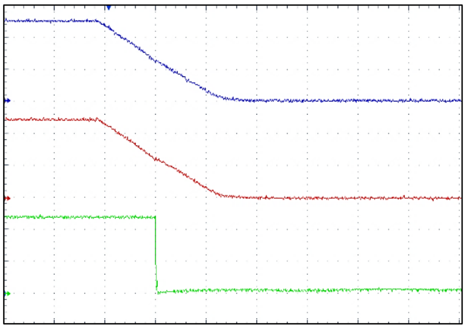
EN
2V/div

V_O
0.5V/div



Time scale 5ms/div

Figure 19. Start-up EN = V_{IN}
V_{IN} = 5.0V, V_O = 1.2V, R_L = 1.2Ω



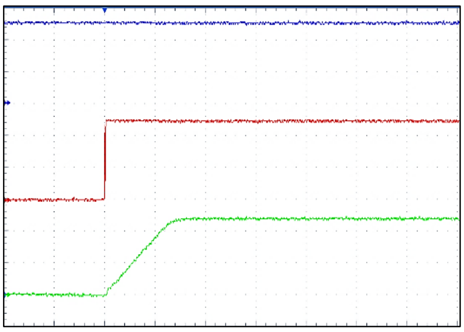
Time scale 5ms/div

Figure 20. Power-down EN = V_{IN}
V_{IN} = 5.0V, V_O = 1.2V, R_L = 1.2Ω

V_{IN}
2V/div

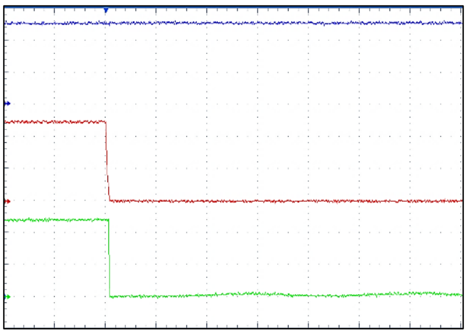
EN
2V/div

V_O
0.5V/div



Time scale 5ms/div

Figure 21. Start-up by EN
V_{IN} = 5.0V, V_O = 1.2V, R_L = 1.2Ω



Time scale 5ms/div

Figure 22. Power-down by EN
V_{IN} = 5.0V, V_O = 1.2V, R_L = 1.2Ω

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