Switching Regulator Series

Step-Down DC/DC Converter BD9C301FJ Evaluation Board

BD9C301FJ-EVK-001

BD9C301FJ-EVK-001 Evaluation board delivers an output 3.3 volts from an input 4.5 to 18 volts using BD9C301FJ, a synchronous rectification step-down DC/DC converter integrated circuit, with output current rating of maximum 3A. The output voltage can be set by changing the external parts of circuit and the loop-response characteristics also can be adjusted by the phase compensation circuit.

Performance specification

These are representative values, and it is not a guaranteed against the characteristics.

V_{IN} = 12V, V_{OUT} = 3.3V, Unless otherwise specified.

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage Range	4.5 (NOTE1)		18	V	
Output Voltage		3.3		V	R1=7.5kΩ, R2=2.4kΩ
Output Voltage Setting Range	V_{IN}×0.125 (NOTE2)		V_{IN}×0.7	V	
Output Current Range	0		3.0	A	
Loop Band Width		39.8		kHz	
Phase Margin		56.2		degrees	
Input Ripple Voltage		120		mVpp	I_O = 3.0A
Output Ripple Voltage		50		mVpp	I_O = 3.0A
Output Rising Time		1		ms	
Operating Frequency		500		kHz	
Maximum Efficiency		91.4		%	I_O = 1.2A

(NOTE1) When the output voltage is 3.3V, it is 4.72V by limiting ratio of the maximum duty.

(NOTE2) However, (V_{IN}×0.125) ≥ 0.8V

Operation Procedures

1. Necessary equipment

(1) DC power-supply of 4.7V to 18V/3A

(2) Maximum 3A load

(3) DC voltmeter

2. Connecting the equipment

(1) DC power-supply presets to 12V and then the power output turns off.

(2) The maximum 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 3.3V.

(11) The load is enabled.

(12) Check at DC voltmeter 1 whether the voltage-drop (loss) is not caused by the wire’s resistance.

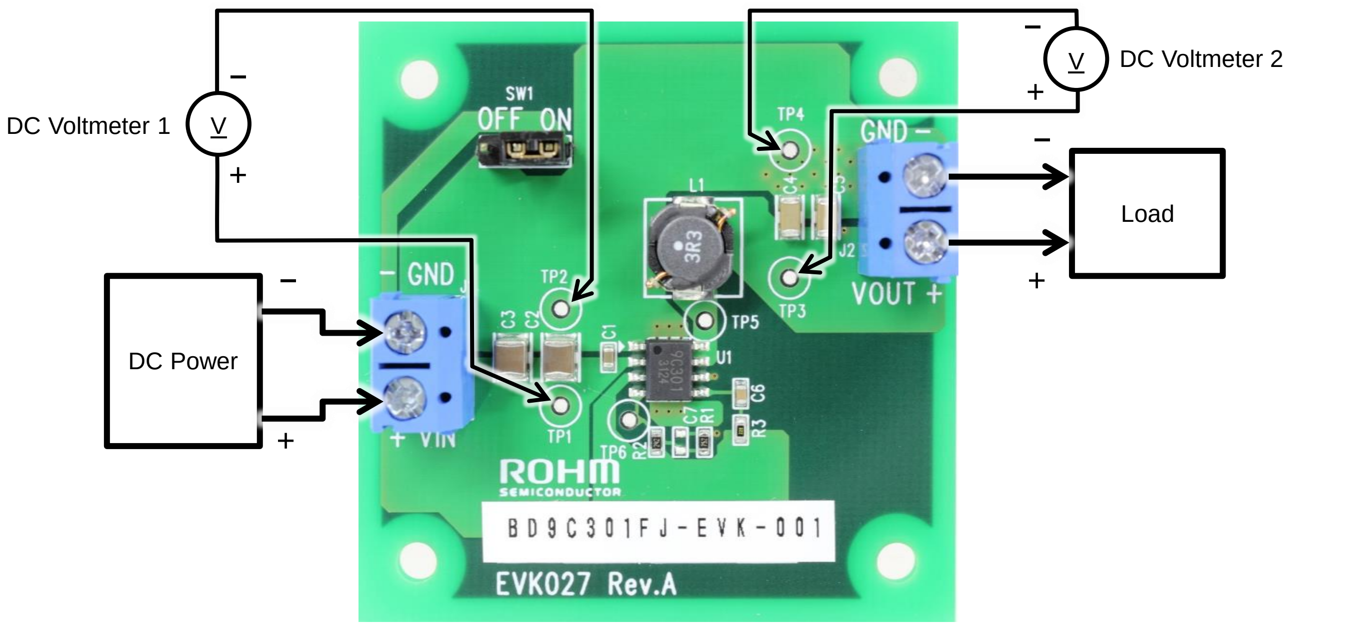

Figure 1. Connection Diagram

Enable-Pin

To minimize current consumption during standby-mode and normal operation, Enable-mode can be switched by controlling EN pin (6pin) 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 switched 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 0.8V, and normal-mode operation when it is over 2.0V.

Circuit Diagram

V_{IN} = 4.72V to 18V, V_{OUT} = 3.3V

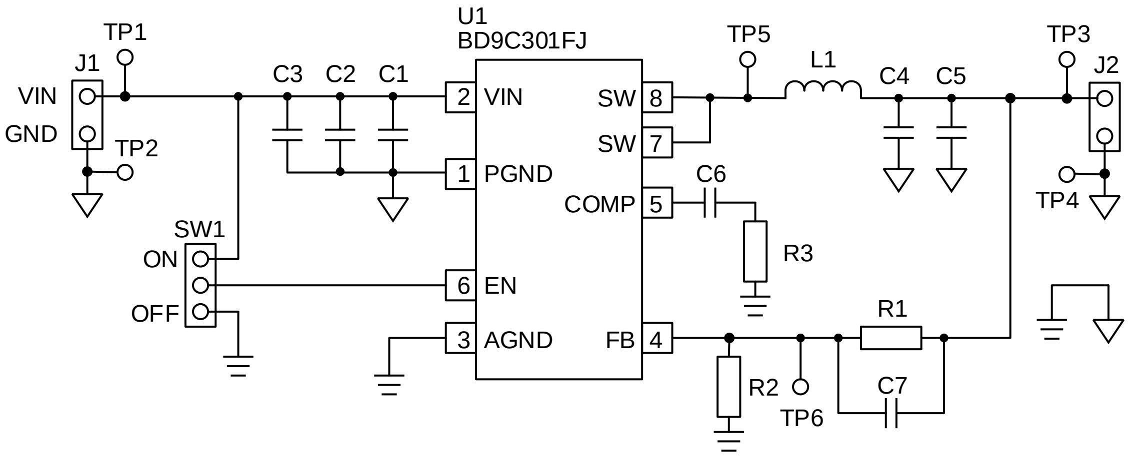

Figure 2. BD9C301FJ-EVK-001 Circuit Diagram

Bill of Materials

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
1	C1	Ceramic Capacitor	0.1µF	50V, B, ±20%	GRM188B31H104MA92	MURATA	1608
2	C2, C3	Ceramic Capacitor	10µF	35V, B, ±10%	GRM32EB3YA106KA12	MURATA	3225
2	C4, C5	Ceramic Capacitor	22µF	10V, B, ±10%	GRM31CB31A226KE19	MURATA	3216
1	C6	Ceramic Capacitor	4700pF	25V, B, ±10%	GRM188B11E472KA01	MURATA	1608
0	C7	Ceramic Capacitor	-	Not installed	-	-	3216
1	L1	Inductor	3.3µH	±30%, DCR=21.3mΩmax, 5.0A	CLF7045T-3R3N	TDK	7269
1	R1	Resistor	7.5kΩ	1/10W, 50V, 1%	MCR03EZPFX7501	ROHM	1608
1	R2	Resistor	2.4kΩ	1/10W, 50V, 1%	MCR03EZPFX2401	ROHM	1608
1	R3	Resistor	8.2kΩ	1/10W, 50V, 1%	MCR03EZPFX8201	ROHM	1608
1	SW1	Pin header	-	2.54mm × 3 contacts	PH-1x03SG	USECONN	-
					61300311121	Wurth Electronics Inc.	-
1	U1	IC	-	Buck DC/DC Converter	BD9C301FJ	ROHM	SOP-J8
2	J1, J2	Terminal Block	-	2 contacts, 15A, 14 to 22AWG	TB111-2-2-U-1-1	Alphaplus Connectors & Cables	-
					OSTTC022162	On Shore Technology Inc	-
1	-	Jumper	-	Jumper pin for SW1	MJ254-6BK	USECONN	-
					969102-0000-DA	3M	-

Layout

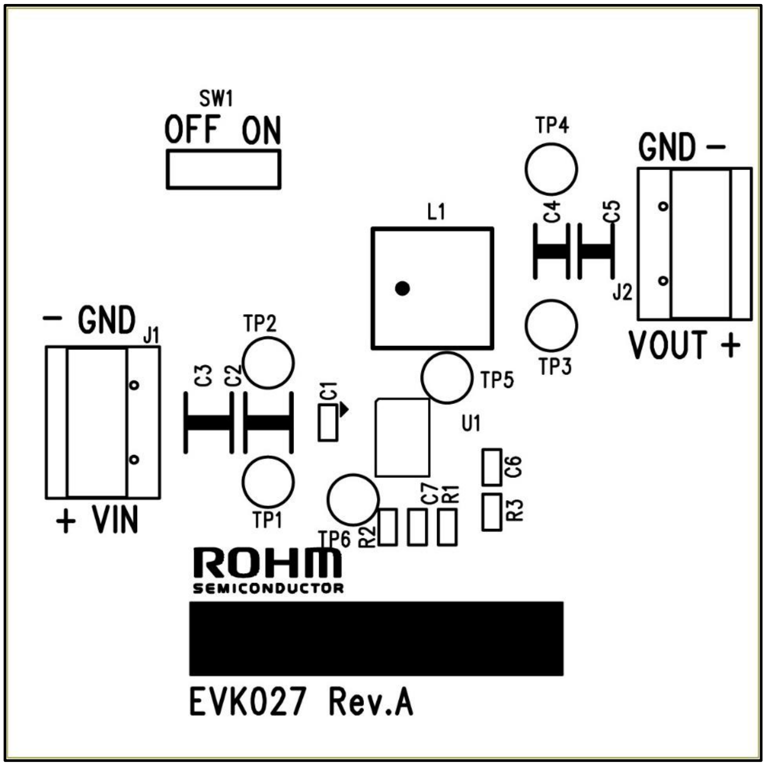

Figure 3. Top Silk Screen (Top view)

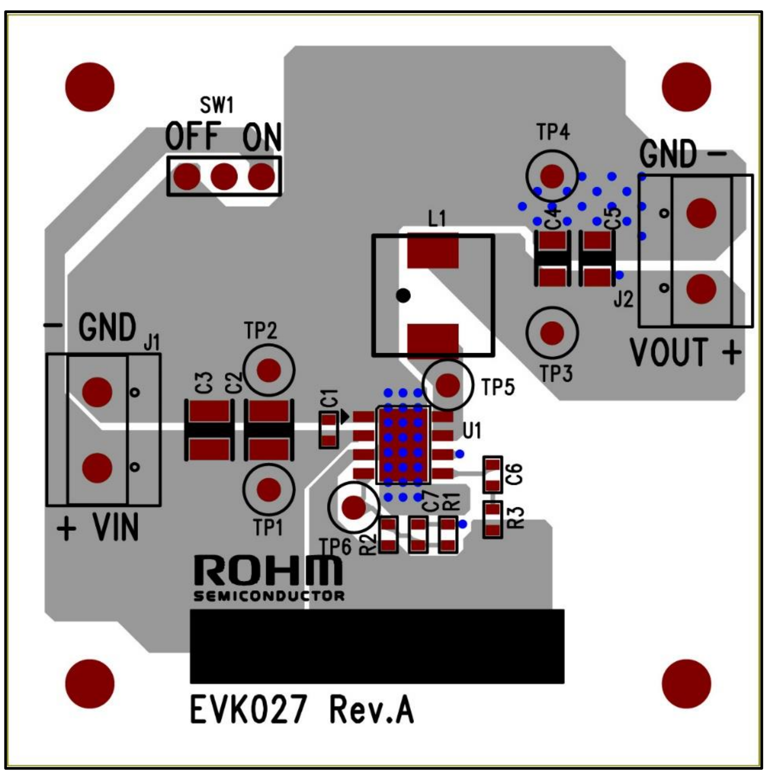

Figure 4. Top Silk Screen and Layout (Top view)

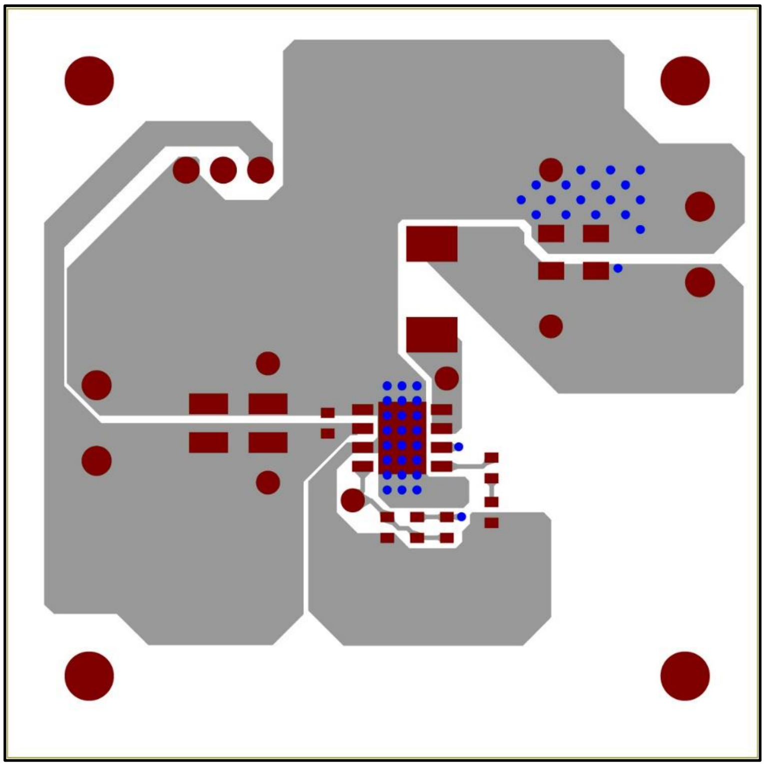

Figure 5. Top Side Layout (Top view)

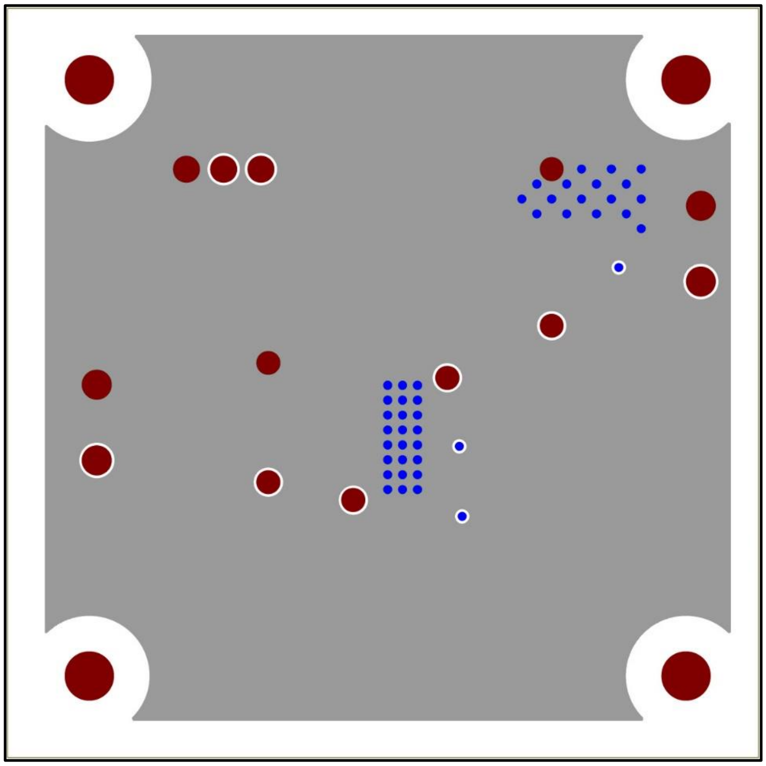

Figure 6. L2 Layout (Top view)

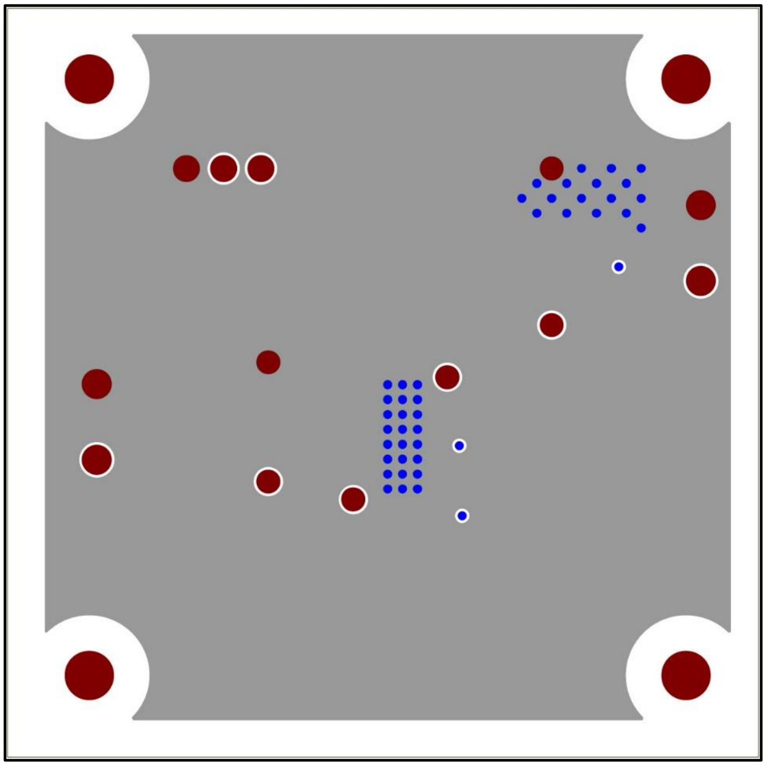

Figure 7. L3 Layout (Top view)

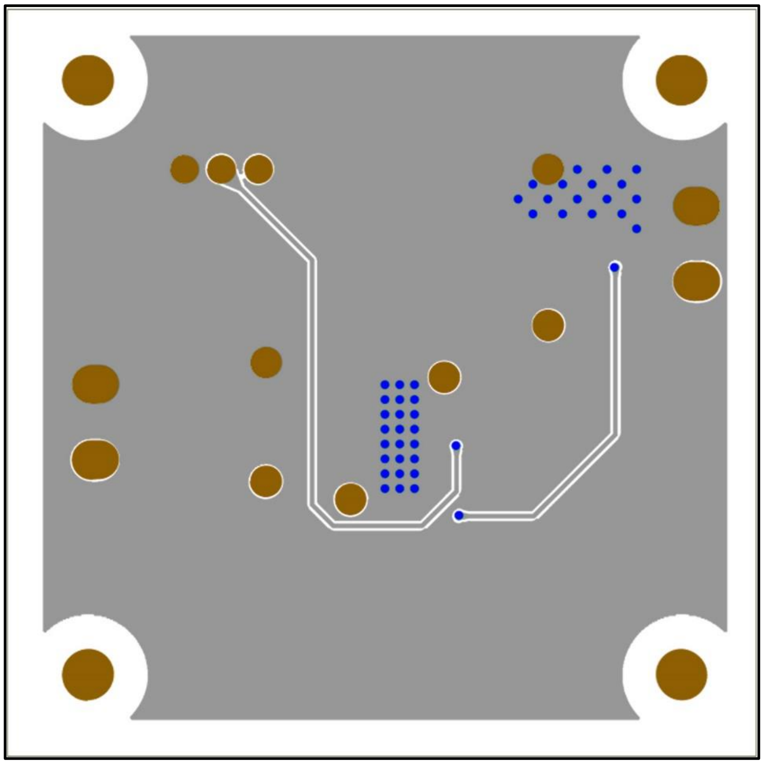

Figure 8. Bottom Side Layout (Top view)

Reference Application Data

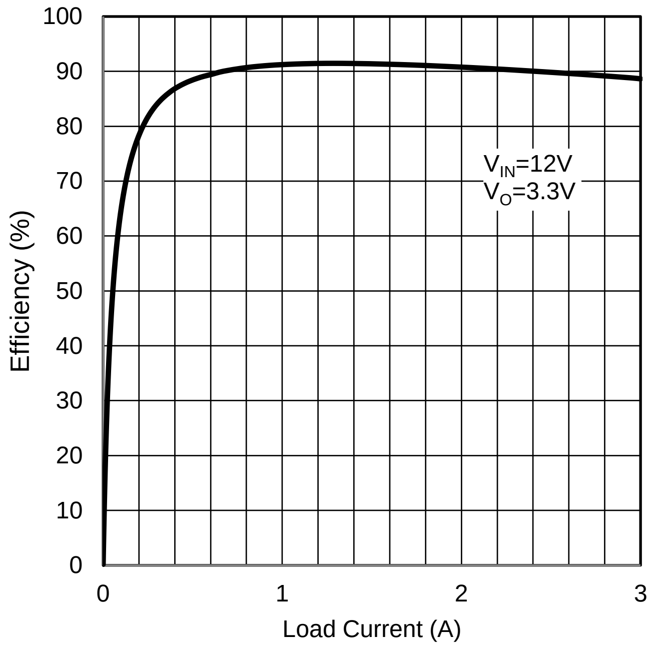

Figure 9. Efficiency vs Load Current

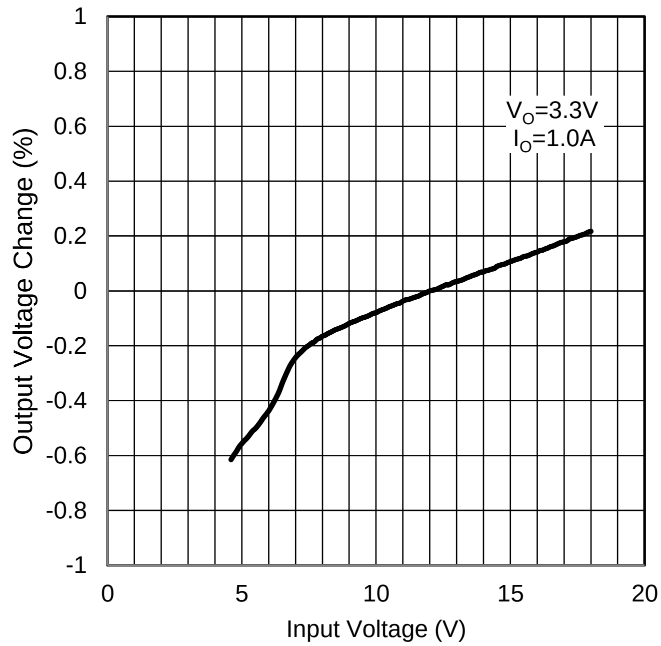

Figure 10. Line Regulation

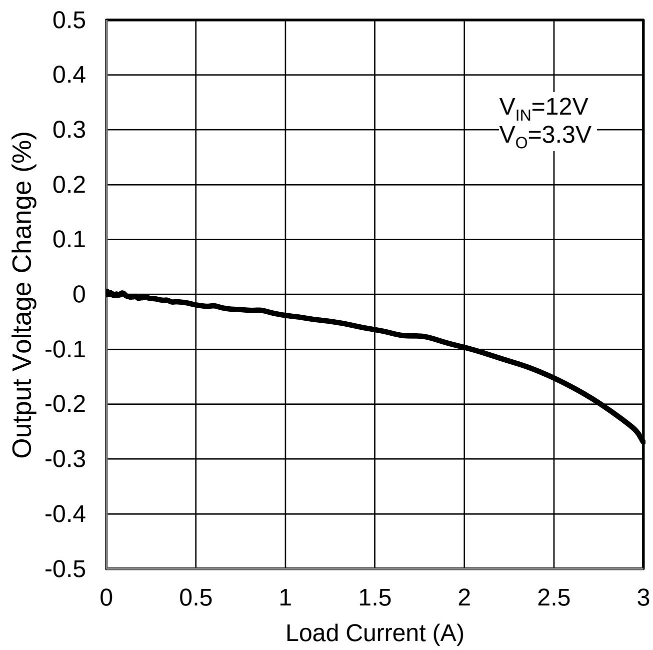

Figure 11. Load Regulation

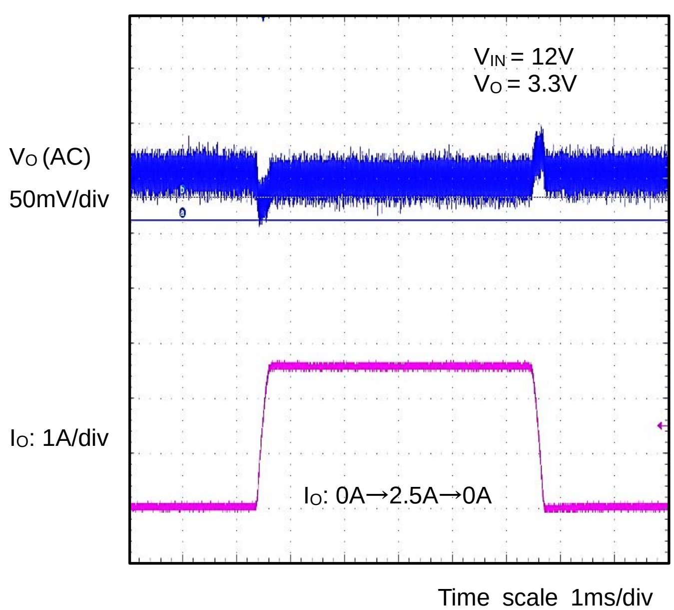

Figure 12. Load Transient Characteristics

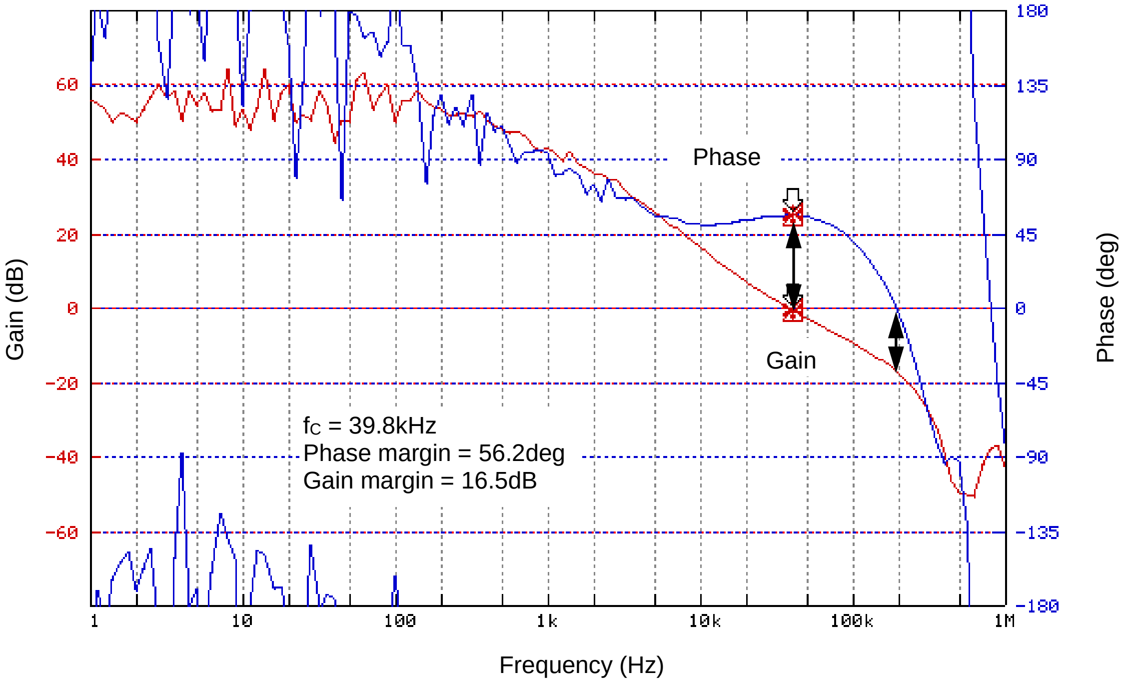

Figure 13. Loop Response V_{IN} = 12V, V_O = 3.3V, I_O = 0A

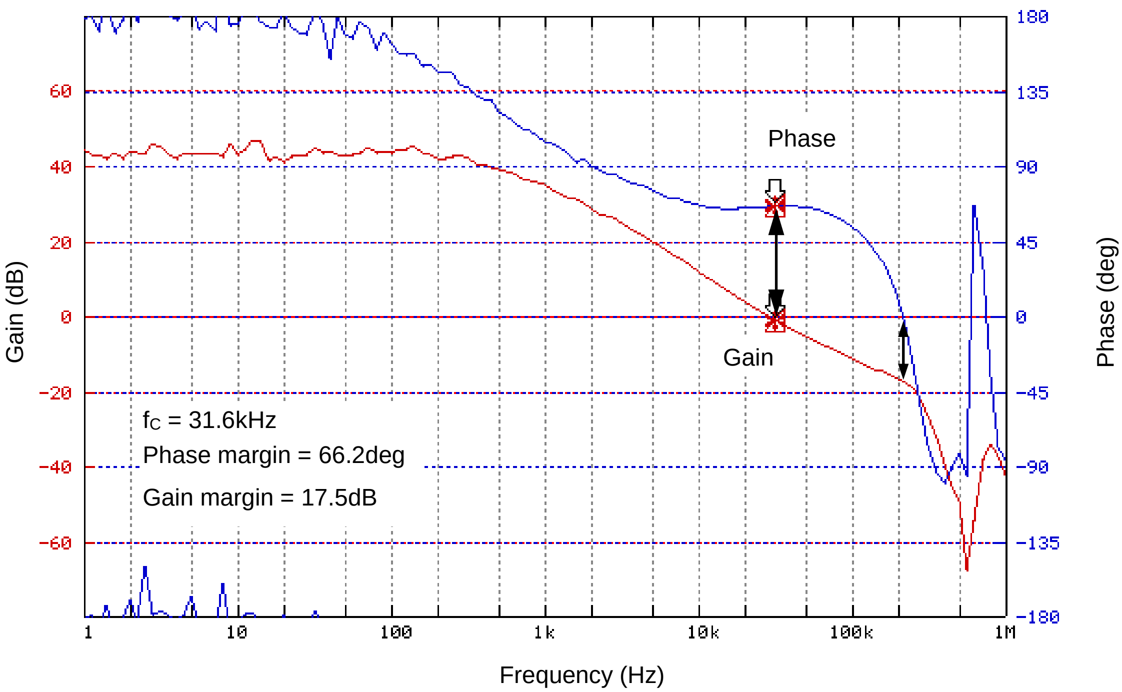

Figure 14. Loop Response V_{IN} = 12V, V_O = 3.3V, I_O = 3A

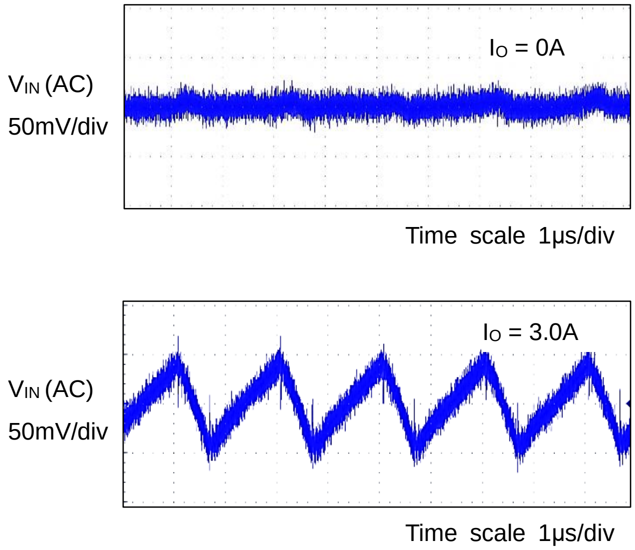

Figure 15. Input Voltage Ripple Wave
V_{IN} = 12V, V_O = 3.3V

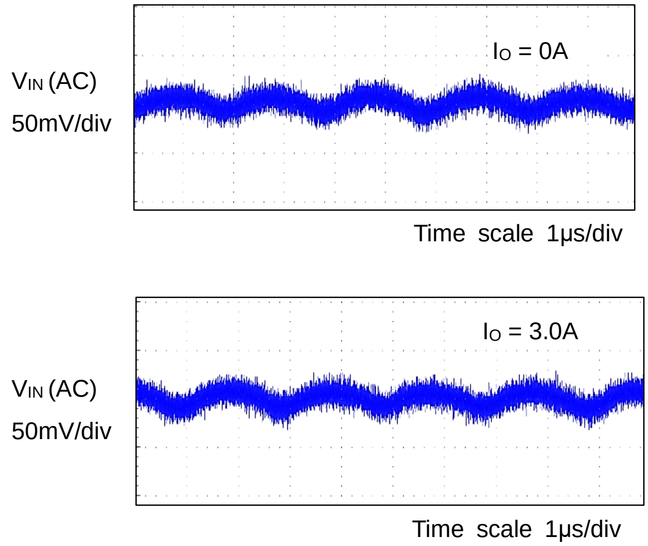

Figure 16. Output Voltage Ripple Wave
V_{IN} = 12V, V_O = 3.3V

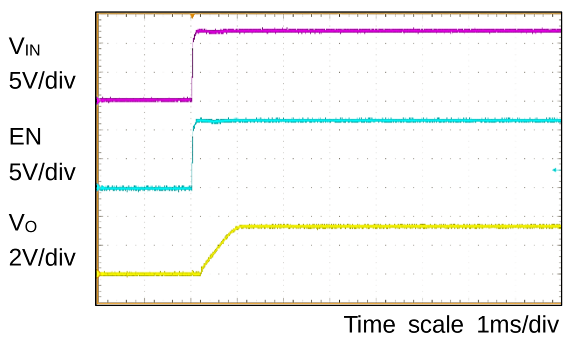

Figure 17. Start-up EN = V_{IN}
V_{IN} = 12V, V_O = 3.3V, I_O = 0A

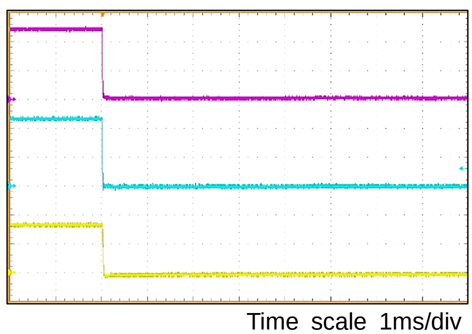

Figure 18. Power-down EN = V_{IN}
V_{IN} = 12V, V_O = 3.3V, I_O = 0A

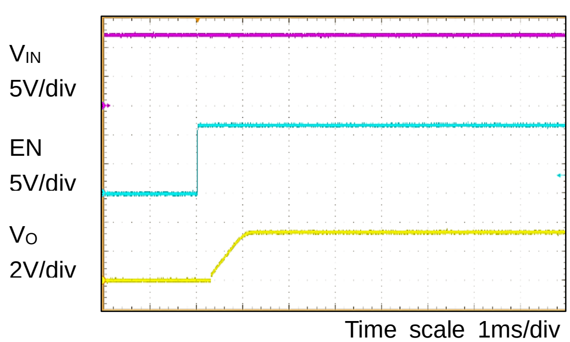

Figure 19. Start-up by EN
V_{IN} = 12V, V_O = 3.3V, I_O = 0A

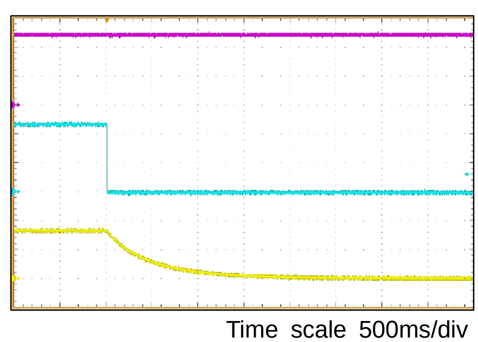

Figure 20. Power-down by EN
V_{IN} = 12V, V_O = 3.3V, I_O = 0A

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