Switching Regulator Series

Step-Down DC/DC Converter BD9E102FJ Evaluation Board

BD9E102FJ-EVK-001

Description

BD9E102FJ-EVK-001 Evaluation board delivers an output 5.0 volts from an input 7.2 to 26 volts using BD9E102FJ, a synchronous rectification step-down DC/DC converter integrated circuit, with output current rating of maximum 1A. 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 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} = 24V, V_{OUT} = 5.0V, Unless otherwise specified.

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage Range	7.0 (NOTE1)		26	V	
Output Voltage		5.0		V	R4=430kΩ, R5=82kΩ
Output Voltage Setting Range	V_{IN}×0.143 (NOTE2)		V_{IN}×0.7	V	
Output Current Range	0		1.0	A	
Loop Band Width		22.4		kHz	
Phase Margin		73.2		degrees	
Input Ripple Voltage		70		mVpp	I_O = 1.0A
Output Ripple Voltage		20		mVpp	I_O = 1.0A
Output Rising Time		3		ms	
Operating Frequency		570		kHz	
Maximum Efficiency		89.6		%	I_O = 0.7A

(NOTE1) When the output voltage is 5.0V, it is 7.2V by limiting ratio of the maximum duty.

(NOTE2) However, (V_{IN}×0.143) ≥ 1.0V

Operation Procedures

1. Necessary equipments
   (1) DC power-supply of 7.0V to 26V/1A
   (2) Maximum 1A load
   (3) DC voltmeter

2. Connecting the equipments
   (1) DC power-supply presets to 24V and then the power output turns off.
   (2) The max. load should be set at 1A 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 TP6 and negative-terminal to TP7 for output-voltage measurement.
   (8) DC power-supply output is turned ON.
   (9) The load is enabled.
   (10) IC is enable (EN) by shorting Jumper-pin of SW1 between intermediate-terminal and ON-side terminal.
   (11) Check DC voltmeter 2 displays 5.0V.
   (12) Check at DC voltmeter 1 whether the voltage-drop (loss) is not caused by the wire's resistance.

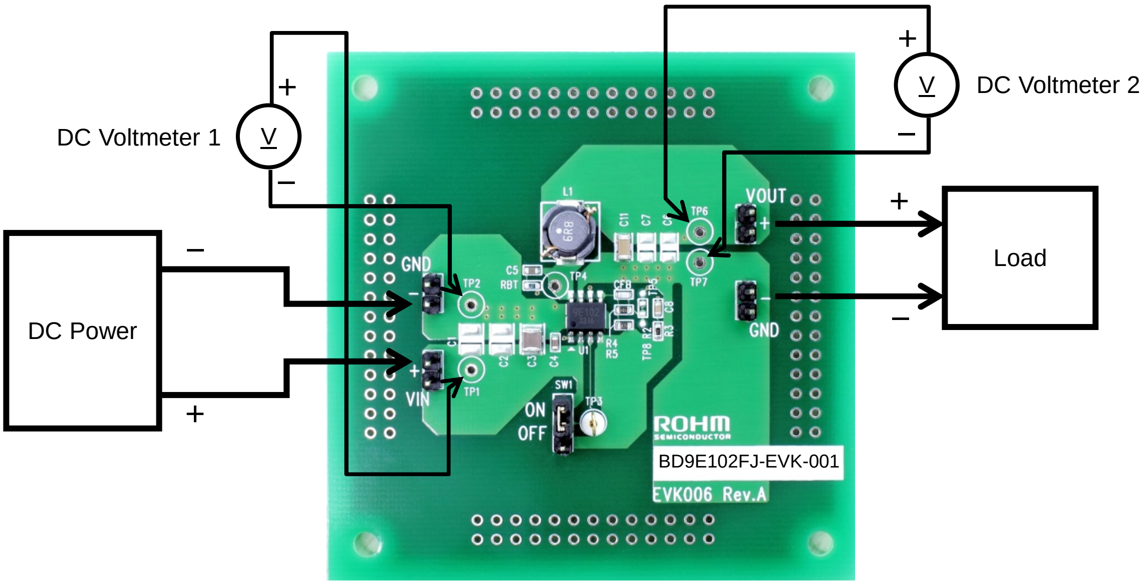

Figure 1. Connection Diagram

Enable-Pin

To minimize current consumption during standby-mode and normal operation, Enable-mode can be switched by controlling EN pin(3rd pin) 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 TP3 and GND-terminal. Standby-mode is enabled when the voltage of TP3 is under 0.8V, and normal-mode operation when it is over 2.0V.

Cricuit Diagram

V_{IN} = 7.2V to 26V, V_{OUT} = 5.0V

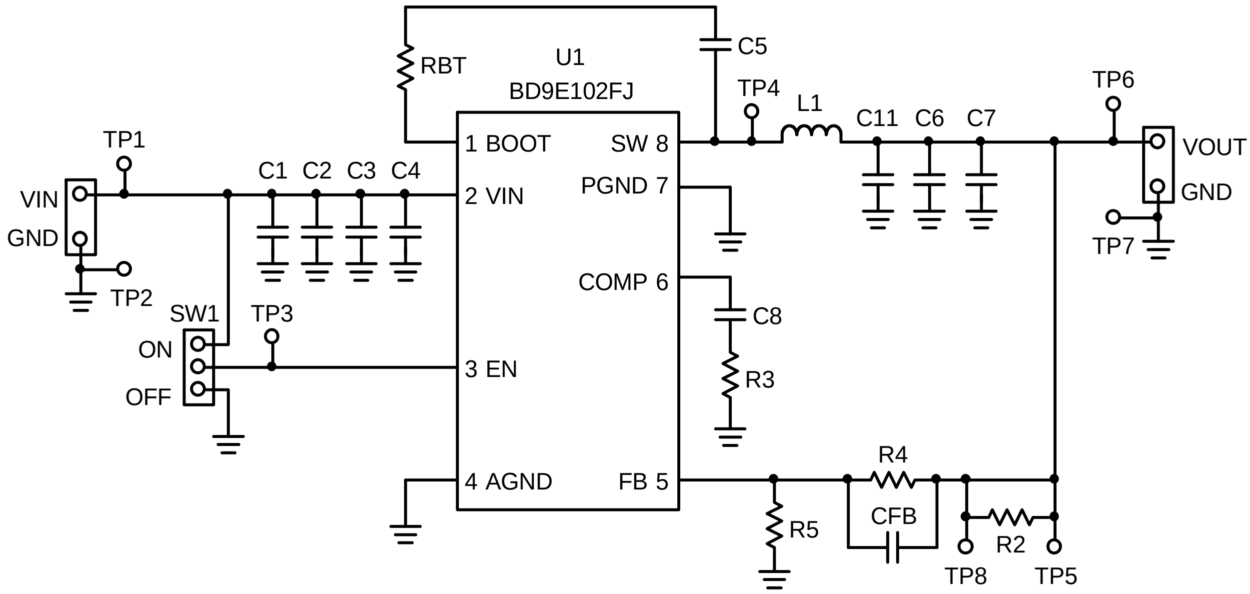

Figure 2. BD9E102FJ-EVK-001 Circuit Diagram

Bill of Materials

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
0	C1, C2	Ceramic Capacitor	-	Not installed	-	-	3225
1	C3	Ceramic Capacitor	10µF	35V, B, ±10%	GRM32EB3YA106KA12	MURATA	3225
2	C4, C5	Ceramic Capacitor	0.1µF	50V, B, ±20%	GRM188B31H104MA92	MURATA	1608
0	C6, C7	Ceramic Capacitor	-	Not installed	-	-	3216
1	C8	Ceramic Capacitor	2200pF	25V, B, ±20%	GRM188B11E222MA01	MURATA	1608
1	C11	Ceramic Capacitor	22µF	10V, B, ±20%	GRM31CB31A226ME19	MURATA	3216
1	CFB	Ceramic Capacitor	33pF	50V, CH, ±5%	GRM1882C1H330JA01	MURATA	1608
1	L1	Inductor	6.8µH	±30%, DCR=35.1mΩmax, 3.3A	CLF7045T-6R8N	TDK	7269
0	R2	Resistor	-	Not installed	-	-	1608
1	R3	Resistor	24kΩ	1/10W, 50V, 1%	MCR03ERPF2402	ROHM	1608
1	R4	Resistor	430kΩ	1/10W, 50V, 1%	MCR03ERPF4303	ROHM	1608
1	R5	Resistor	82kΩ	1/10W, 50V, 1%	MCR03ERPF8202	ROHM	1608
1	RBT	Resistor	0Ω	Jumper	MCR03ERPJ000	ROHM	1608
1	SW1	Pin header	-	2.54mm × 3 contacts	PH-1x03SG	USECONN	-
1	TP3	Terminal	-	Terminal	LC-22-G-WHITE	MAC8	-
1	U1	IC	-	Buck DC/DC Converter	BD9E102FJ	ROHM	SOP-J8
4	VIN, GND, VOUT, GND	Pin header	-	2.54mm × 2 contacts	PH-1x02SG	USECONN	-
1	-	Jumper	-	Jumper pin for SW1	MJ254-6BK	USECONN	-

Layout

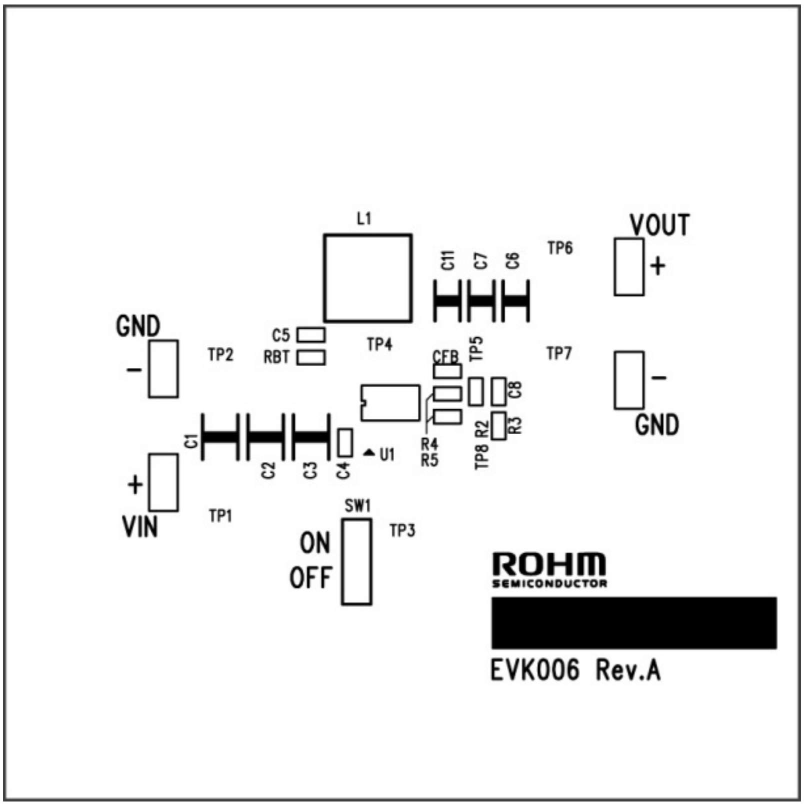

Figure 3. Top Silk Screen (Top view)

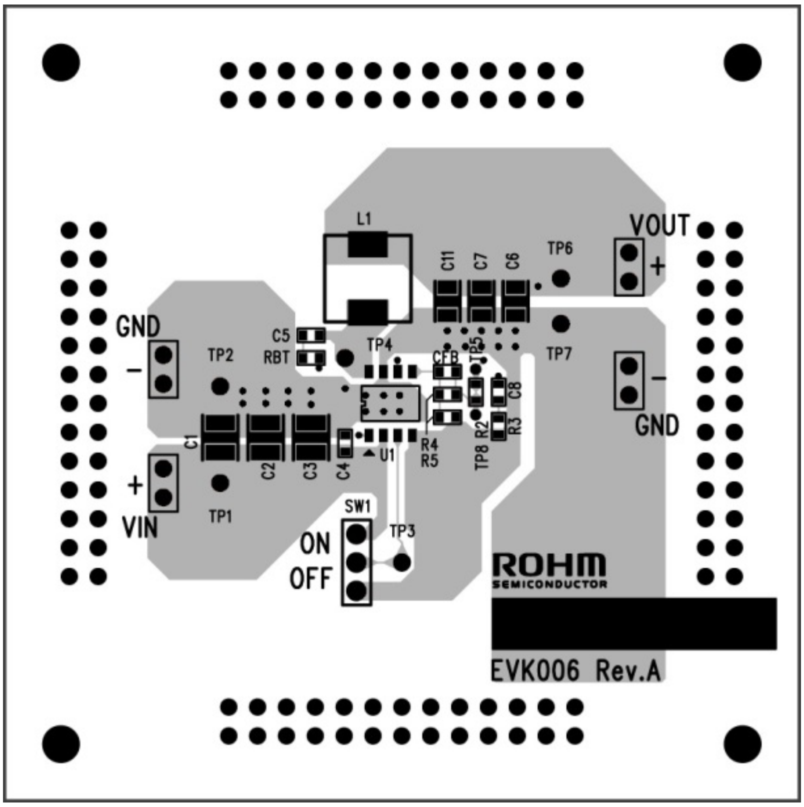

Figure 4. Top Silk Screen and Layout (Top view)

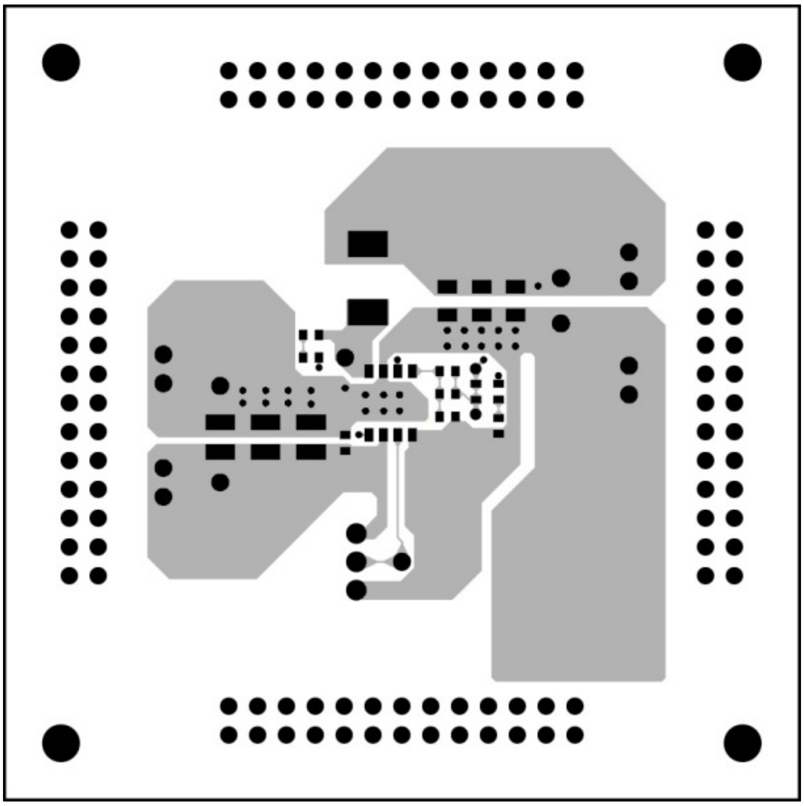

Figure 5. Top Side Layout (Top view)

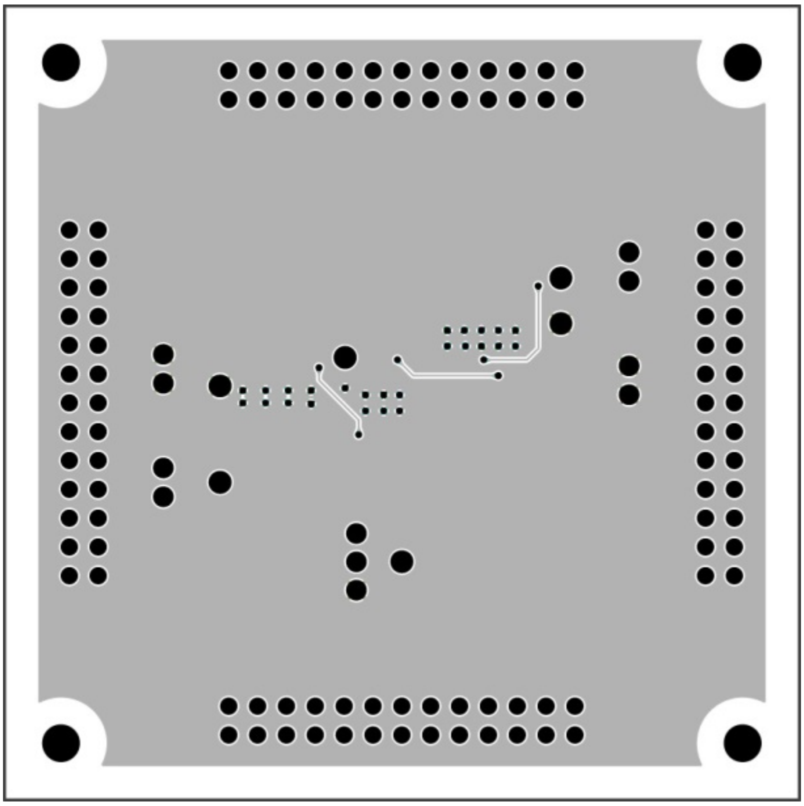

Figure 6. Bottom Side Layout (Top view)

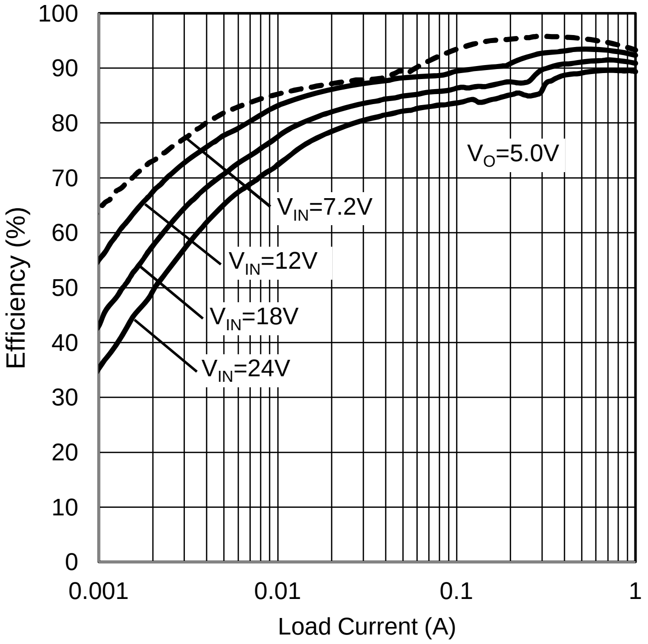

Figure 7. Efficiency vs Load Current

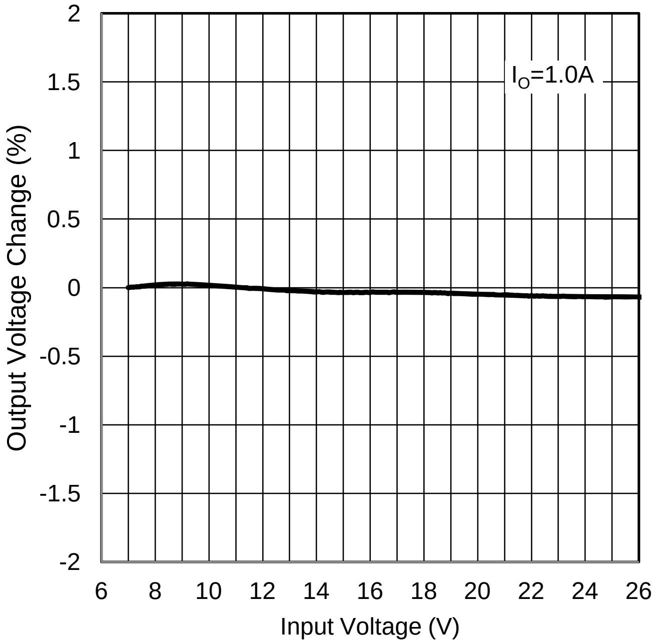

Figure 8. Line Regulation

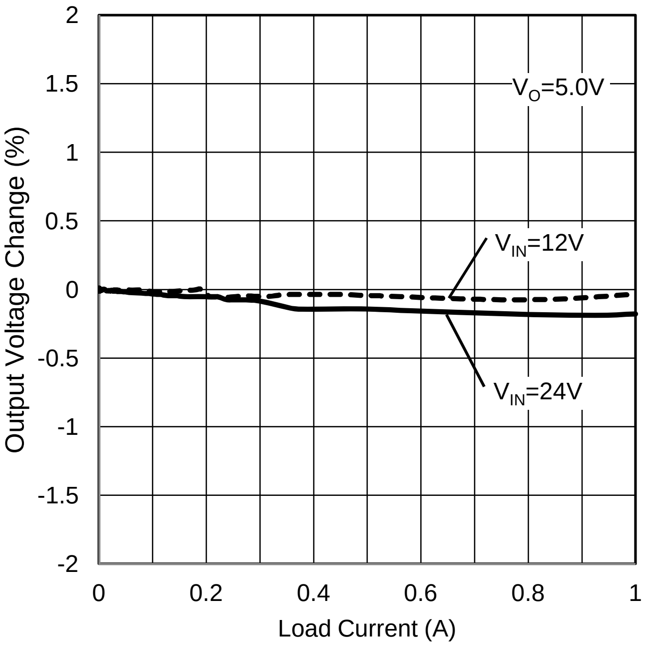

Figure 9. Load Regulation

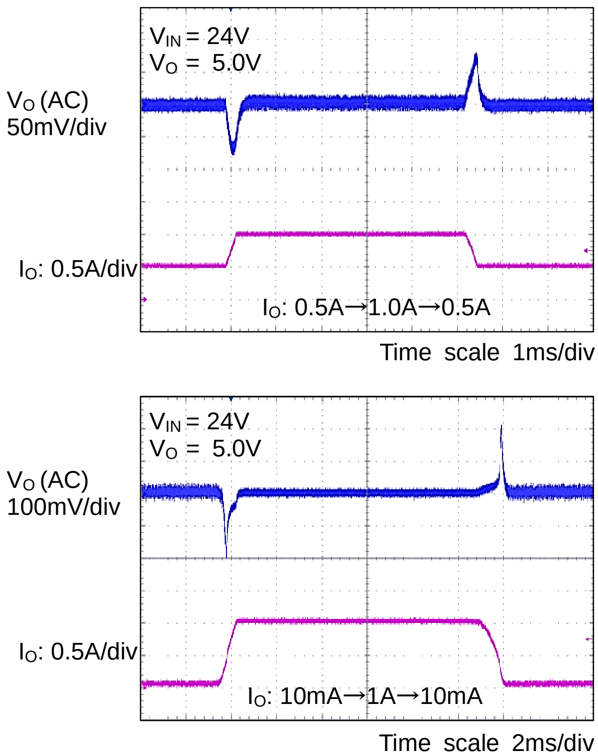

Figure 10. Load Transient Characteristics

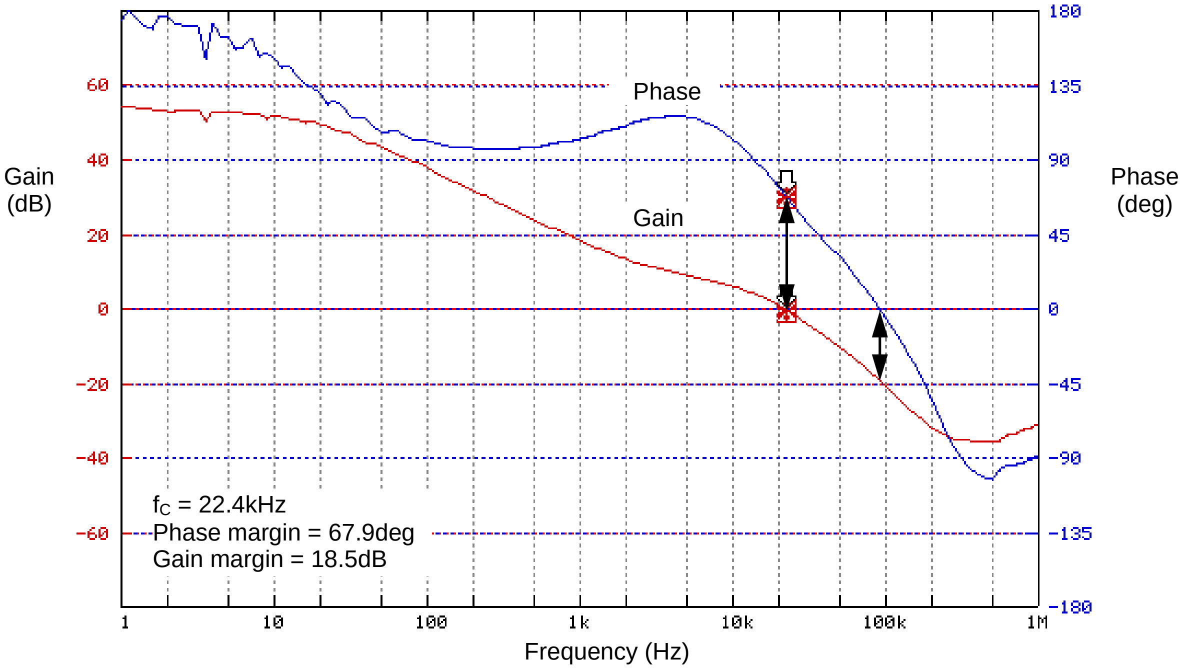

Figure 11. Loop Response V_{IN} = 12V, V_O = 5.0V

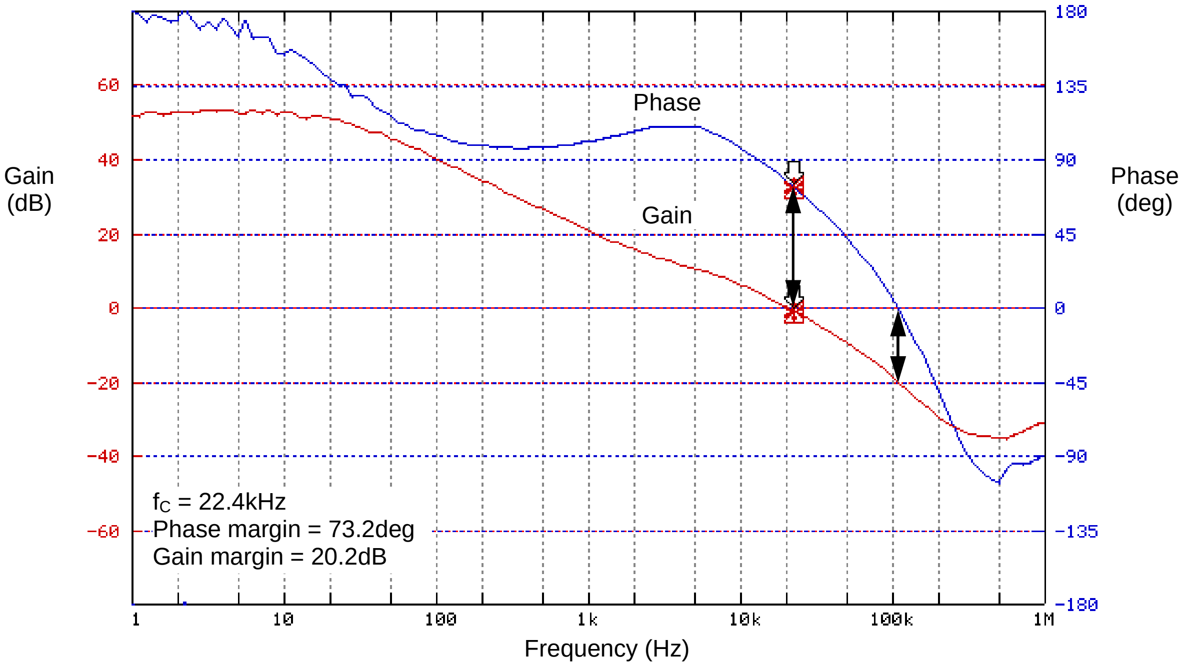

Figure 12. Loop Response V_{IN} = 24V, V_O = 5.0V

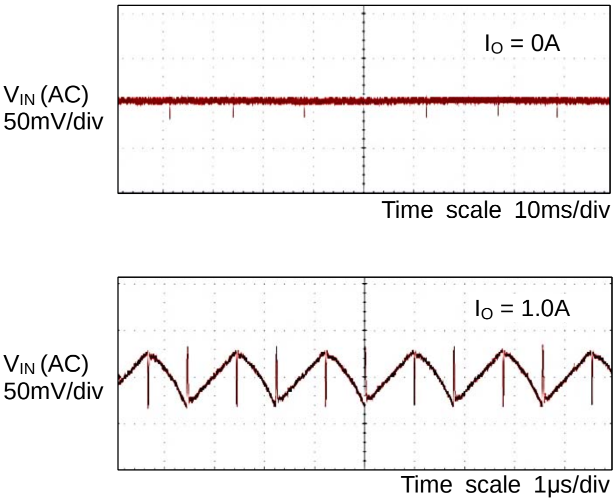

Figure 13. Input Voltage Ripple Wave
V_{IN} = 12V, V_O = 5.0V

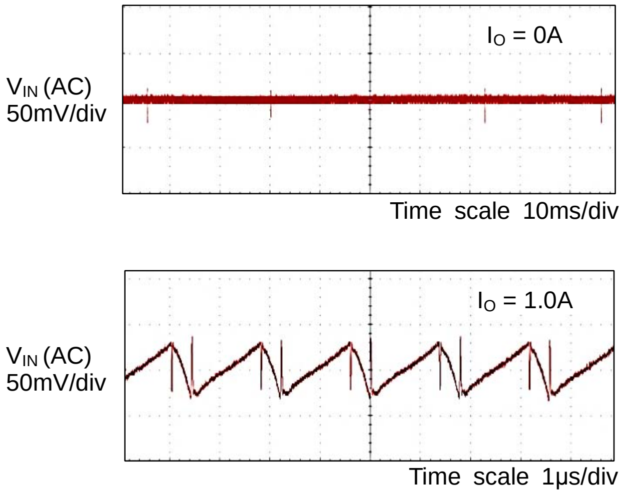

Figure 14. Input Voltage Ripple Wave
V_{IN} = 24V, V_O = 5.0V

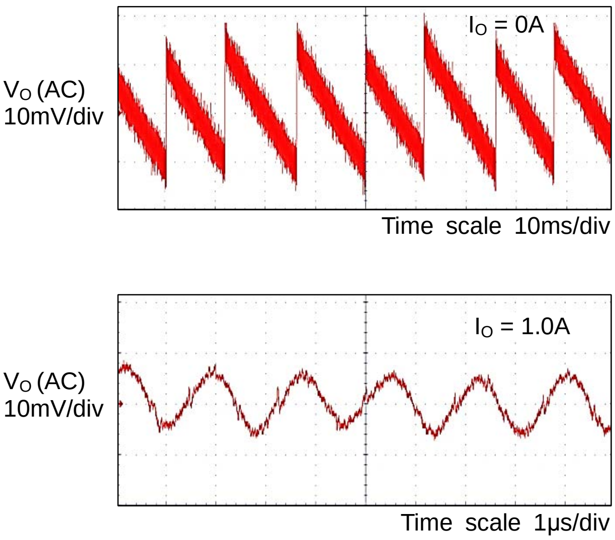

Figure 15. Output Voltage Ripple Wave
V_{IN} = 12V, V_O = 5.0V

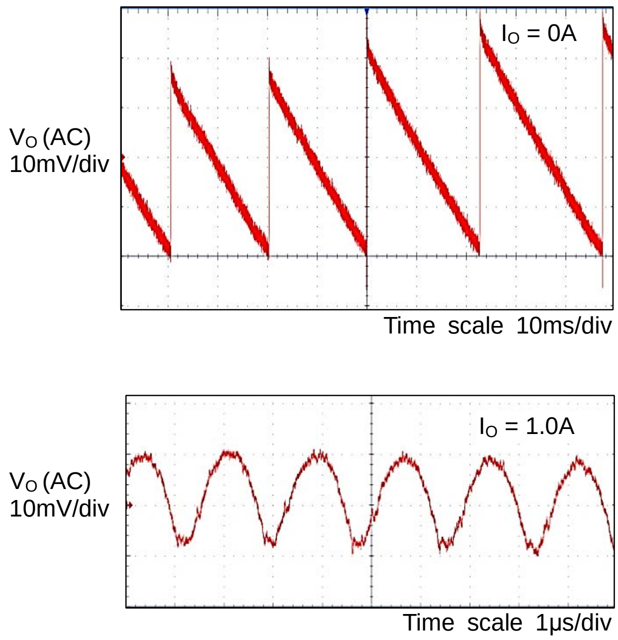

Figure 16. Output Voltage Ripple Wave
V_{IN} = 24V, V_O = 5.0V

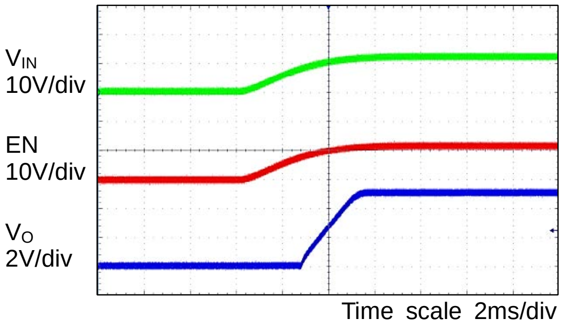

Figure 17. Start-up EN = V_{IN}
V_{IN} = 12V, V_O = 5.0V, I_O = 0A

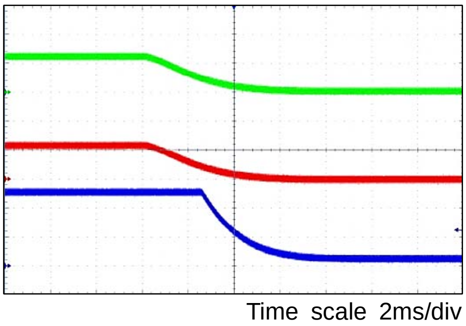

Figure 18. Power-down EN = V_{IN}
V_{IN} = 12V, V_O = 5.0V, I_O = 0A

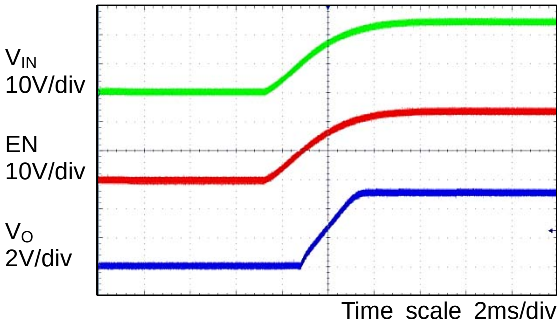

Figure 19. Start-up EN = V_{IN}
V_{IN} = 24V, V_O = 5.0V, I_O = 0A

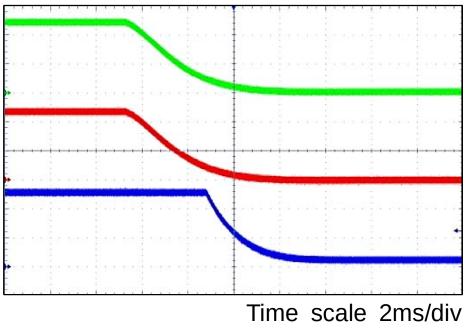

Figure 20. Power-down EN = V_{IN}
V_{IN} = 24V, V_O = 5.0V, I_O = 0A

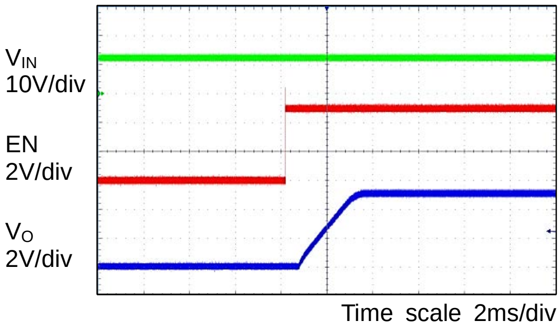

Figure 21. Start-up by EN
V_{IN} = 12V, V_O = 5.0V, I_O = 0A

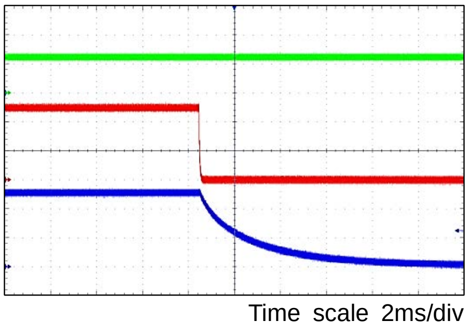

Figure 22. Power-down by EN
V_{IN} = 12V, V_O = 5.0V, I_O = 0A

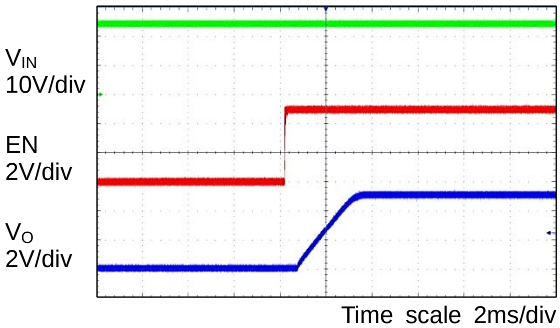

Figure 23. Start-up by EN
V_{IN} = 24V, V_O = 5.0V, I_O = 0A

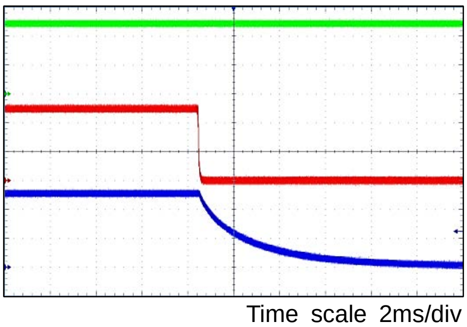

Figure 24. Power-down by EN
V_{IN} = 24V, V_O = 5.0V, I_O = 0A

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