Switching Regulator Series

Step-Down DC/DC Converter BD9A301MUV-LB Evaluation Board

BD9A301MUV-EVK-001

BD9A301MUV-EVK-001 Evaluation board delivers an output 1.8 volts from an input 2.7 to 5.5 volts using BD9A301MUV-LB, 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 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} = 5.0V, V_{OUT} = 1.8V, Unless otherwise specified.

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage Range	2.7		5.5	V	
Output Voltage		1.8		V	R1=30kΩ, R2=24kΩ
Output Voltage Setting Range	0.8		V_{IN}×0.7	V	
Output Current Range	0		3.0	A	
Loop Band Width		89.1		kHz	
Phase Margin		54.1		degrees	
Input Ripple Voltage		140		mVpp	I_O = 3.0A
Output Ripple Voltage		40		mVpp	I_O = 3.0A
Output Rising Time		5		ms	
Operating Frequency		1.0		MHz	
Maximum Efficiency		91.8		%	I_O = 0.7A

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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 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 1.8V.
   (11) The load is enabled.
   (12) Check at DC voltmeter 1 whether the voltage-drop (loss) is not caused by the wire's resistance.

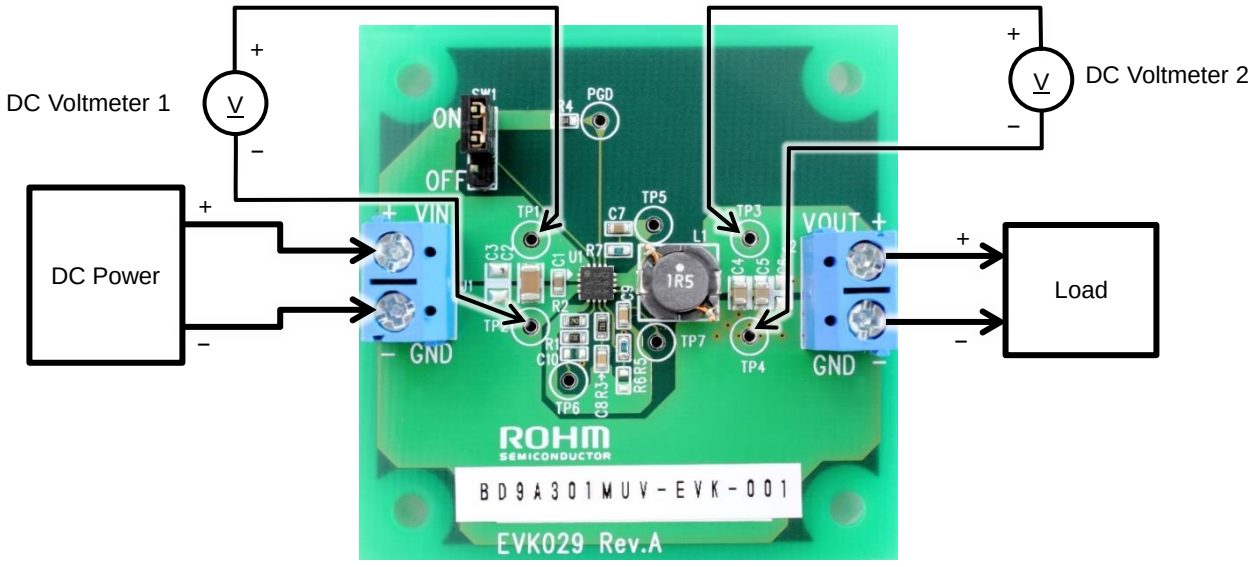

Figure 1. Connection Diagram

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 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 0.5V, and normal-mode operation when it is over 2.0V.

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Circuit Diagram

V_{IN} = 2.7V to 5.5V, V_{OUT} = 1.8V

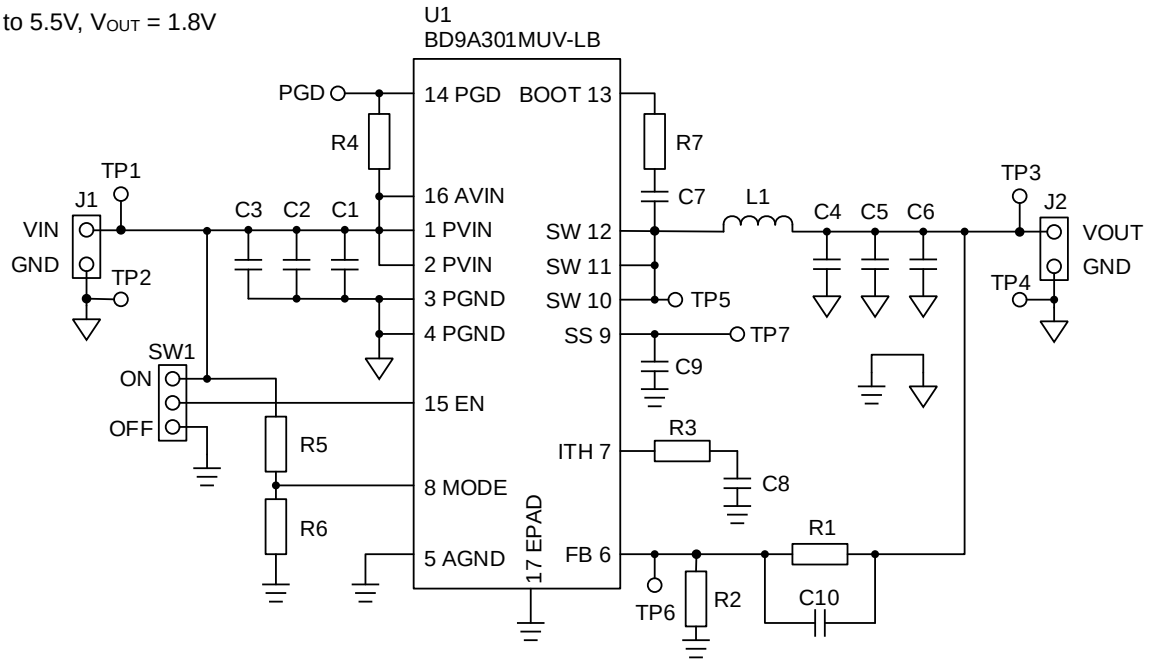

Figure 2. BD9A301MUV-EVK-001 Circuit Diagram

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%	GRM31CB31C106KA88L	MURATA	3216
0	C3	Ceramic Capacitor	-	Not installed	-	-	3216
2	C4, C5	Ceramic Capacitor	22µF	6.3V, B, ±20%	GRM21BB30J226ME38L	MURATA	2012
0	C6	Ceramic Capacitor	-	Not installed	-	-	2012
1	C8	Ceramic Capacitor	3300pF	50V, B, ±10%	GRM188B11H332KA01D	MURATA	1608
1	C9	Ceramic Capacitor	0.01µF	50V, B, ±10%	GRM188B11H103KA01D	MURATA	1608
0	C10	Ceramic Capacitor	-	Not installed	-	-	1608
1	L1	Inductor	1.5µH	±30%, DCR=14.3mΩmax, 7.3A	CLF7045T-1R5N	TDK	7269
1	R1	Resistor	30kΩ	1/10W, 50V, ±1%	MCR03EZPFX3002	ROHM	1608
1	R2	Resistor	24kΩ	1/10W, 50V, ±1%	MCR03EZPFX2402	ROHM	1608
1	R3	Resistor	9.1kΩ	1/10W, 50V, ±1%	MCR03EZPFX9101	ROHM	1608
1	R4	Resistor	10kΩ	1/10W, 50V, ±1%	MCR03EZPFX1002	ROHM	1608
2	R5, R7	Resistor	0Ω	Jumper	MCR03EZPJ000	ROHM	1608
0	R6	Resistor	-	Not installed	-	-	1608
1	SW1	Pin header	-	2.54mm × 3 contacts	PH-1x03SG	USECONN	-
					61300311121	Wurth Electronics Inc.	-
1	U1	IC	-	Buck DC/DC Converter	BD9A301MUV-LB	ROHM	VQFN016V3030
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	-

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Layout

PCB size：50mm×50mm×1.6mm

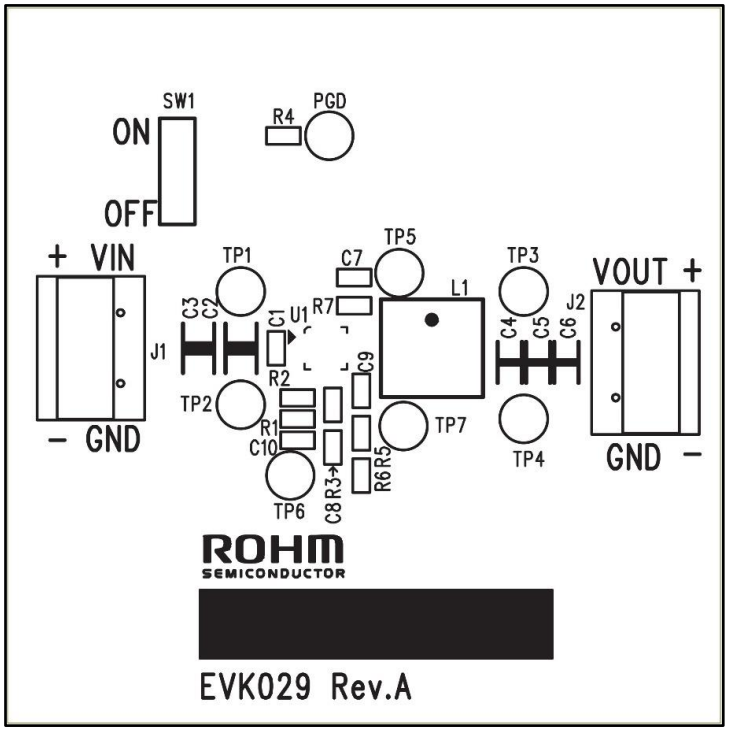

Figure 3. Top Silk Screen (Top view)

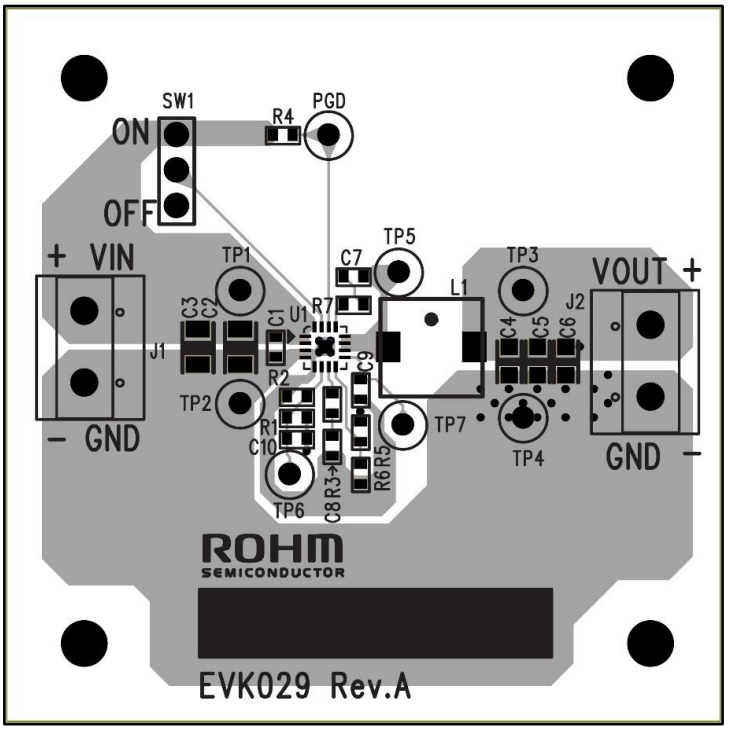

Figure 4. Top Silk Screen and Layout (Top view)

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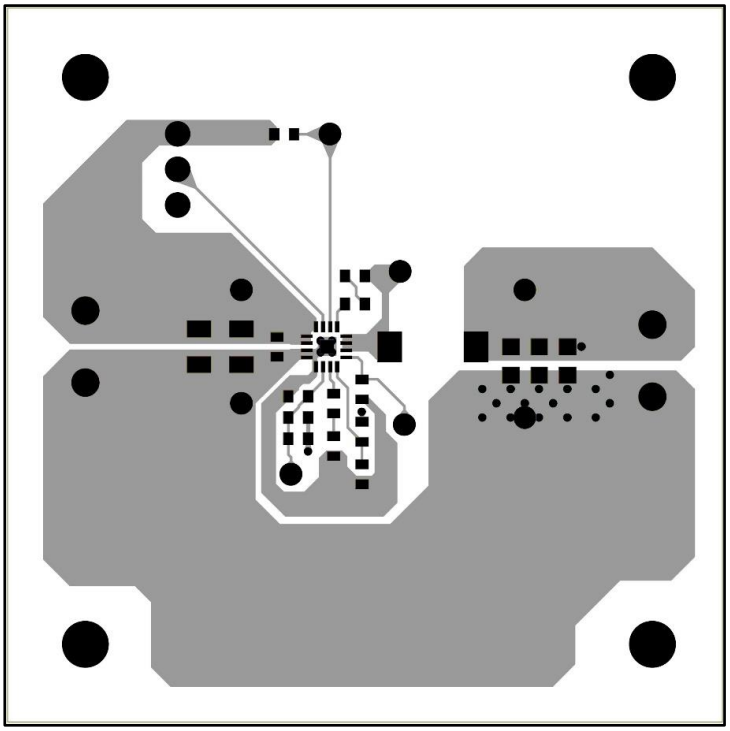

Figure 5. Top Side Layout (Top view)

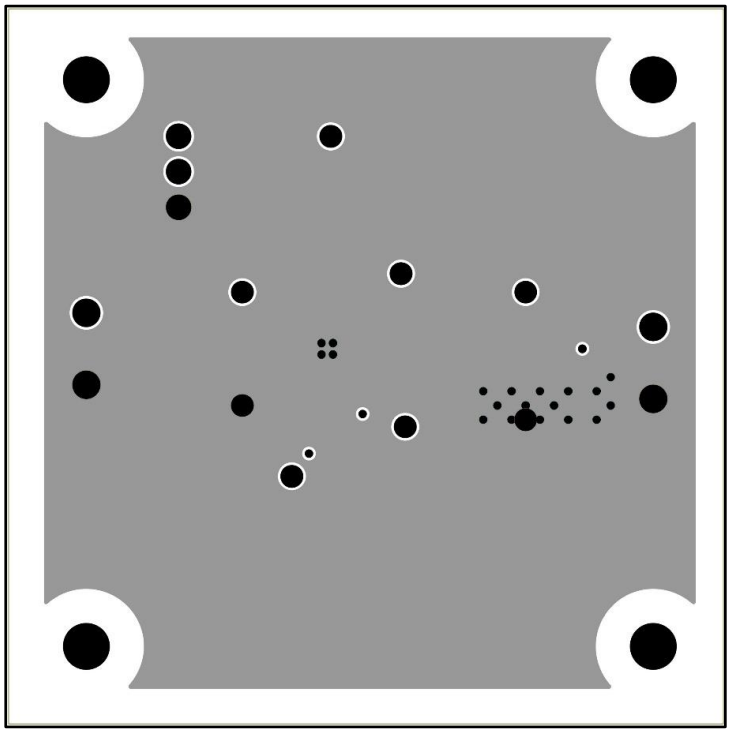

Figure 6. L2 Layout (Top view)

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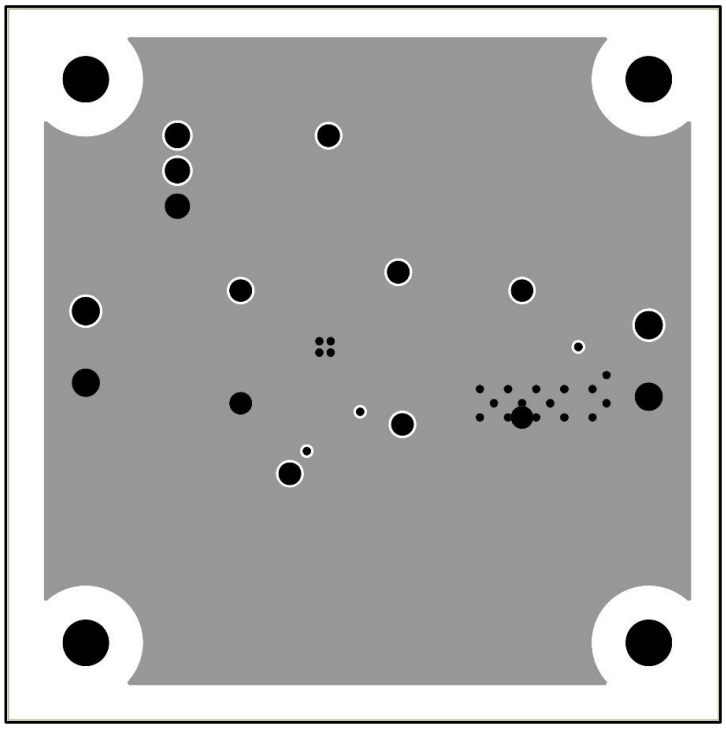

Figure 7. L3 Layout (Top view)

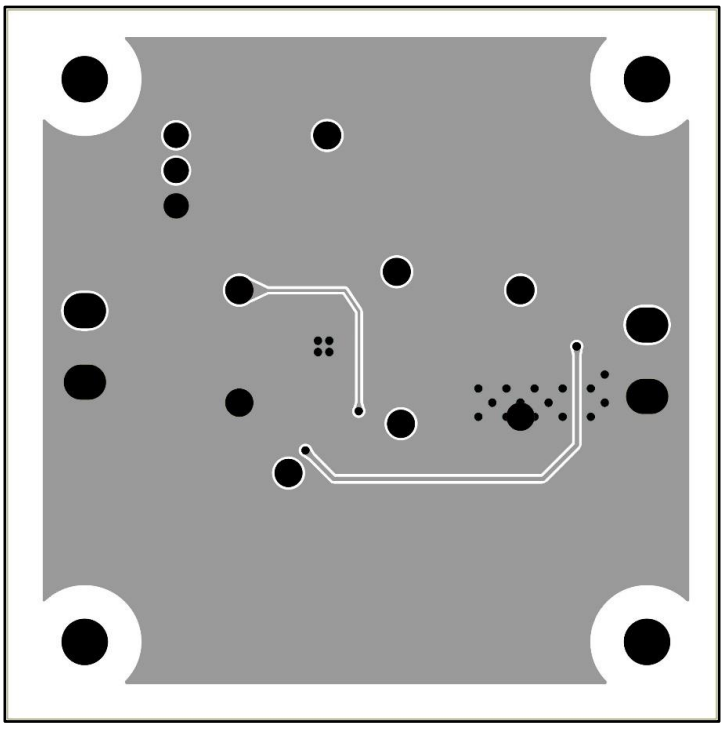

Figure 8. Bottom Side Layout (Top view)

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Reference Application Data

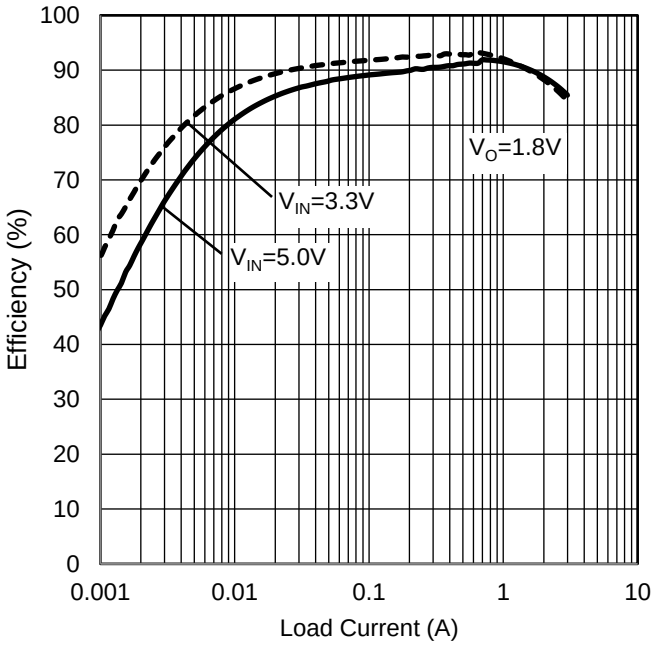

Figure 9. Efficiency vs Load Current

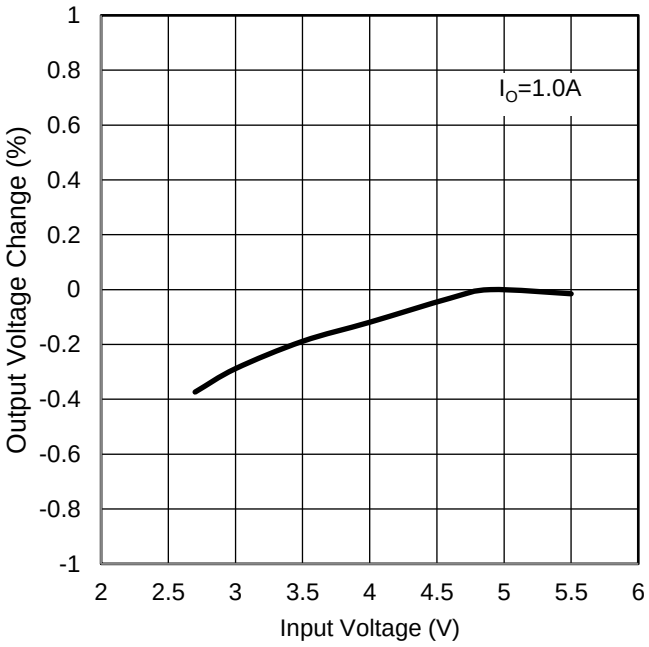

Figure 10. Line Regulation

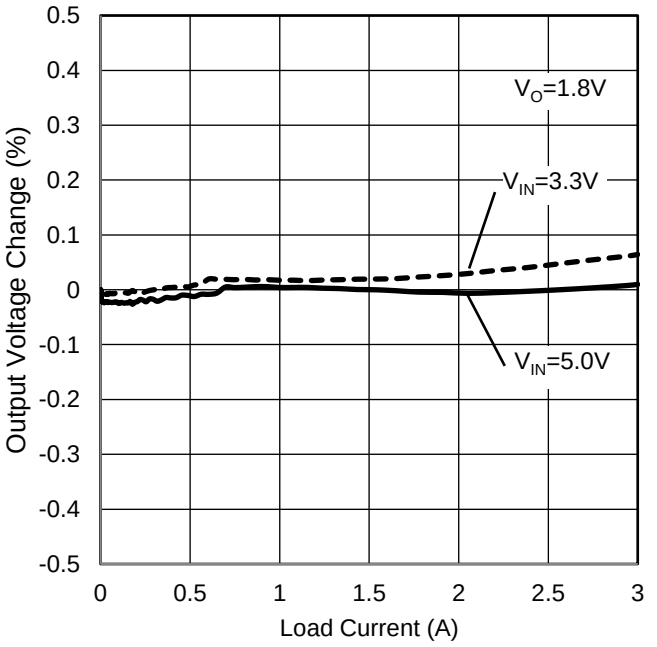

Figure 11. Load Regulation

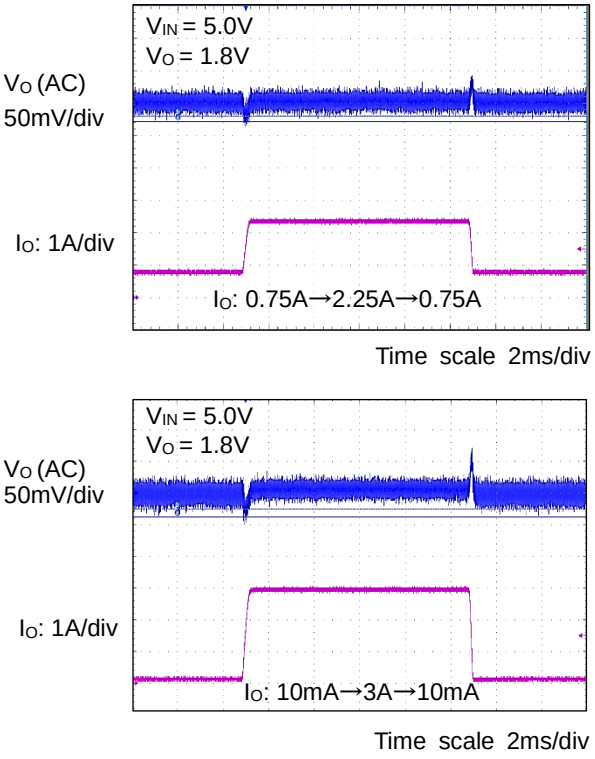

Figure 12. Load Transient Characteristics

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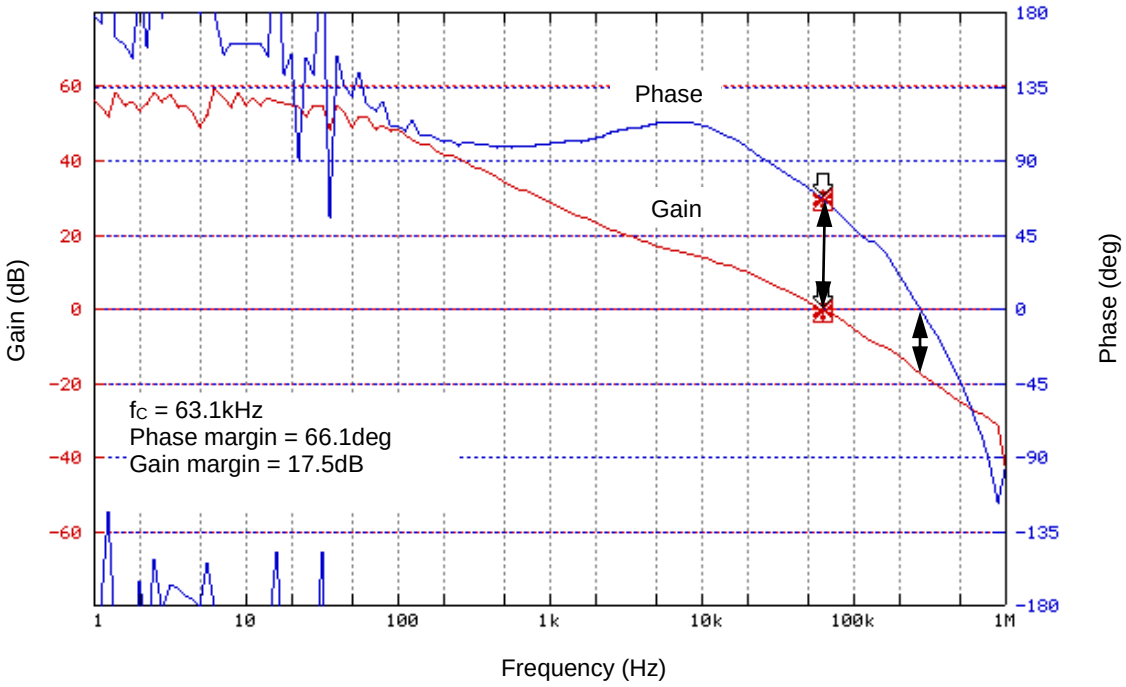

Figure 13. Loop Response V_{IN} = 3.3V, V_O = 1.8V, I_O = 1.0A

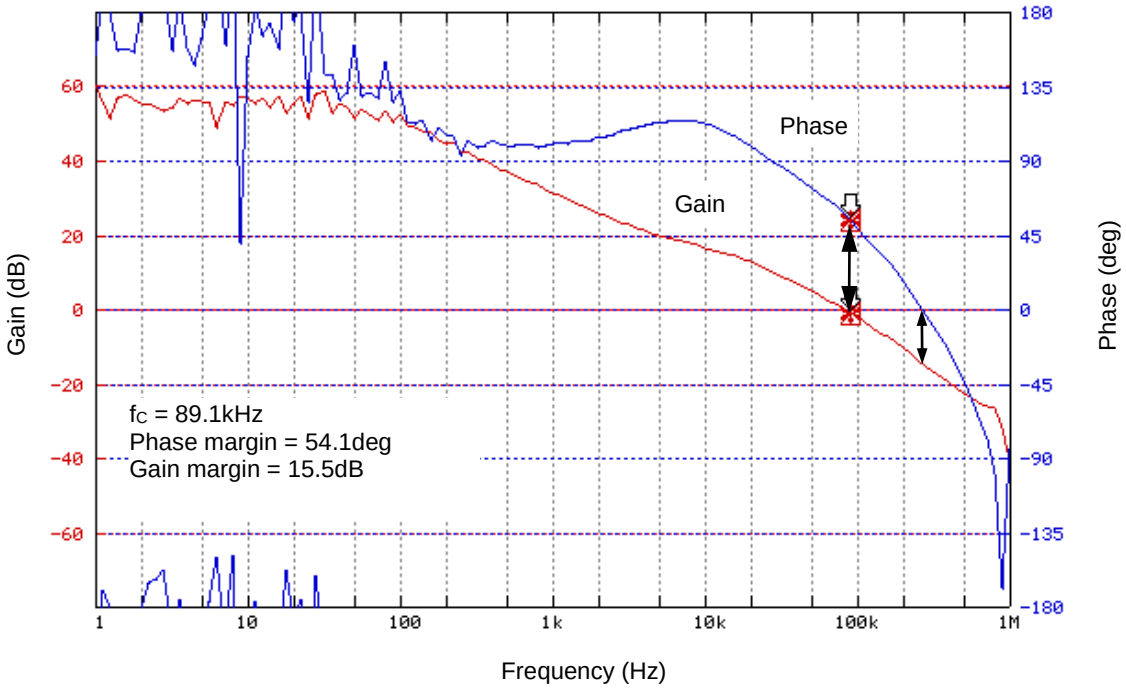

Figure 14. Loop Response V_{IN} = 5.0V, V_O = 1.8V, I_O = 1.0A

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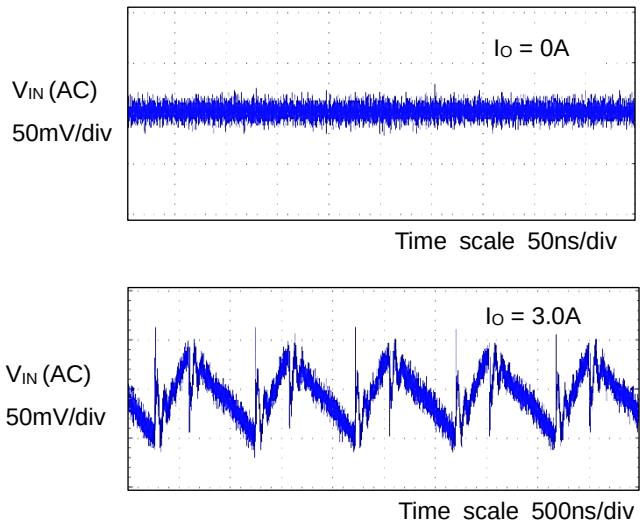

Figure 15. Input Voltage Ripple Wave
V_{IN} = 3.3V, V_O = 1.8V

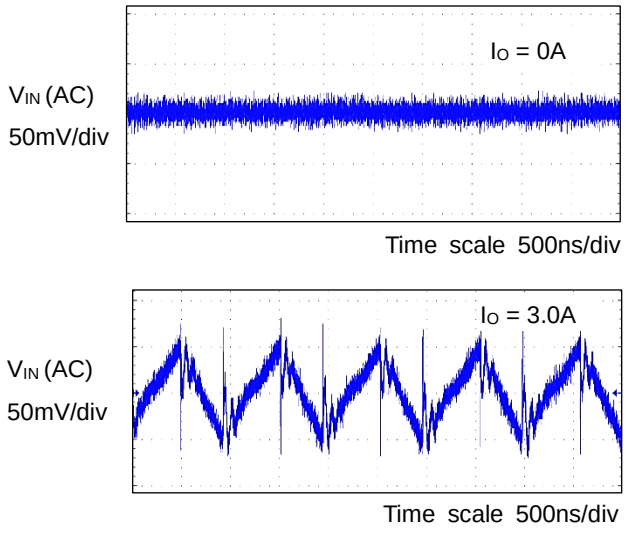

Figure 16. Input Voltage Ripple Wave
V_{IN} = 5.0V, V_O = 1.8V

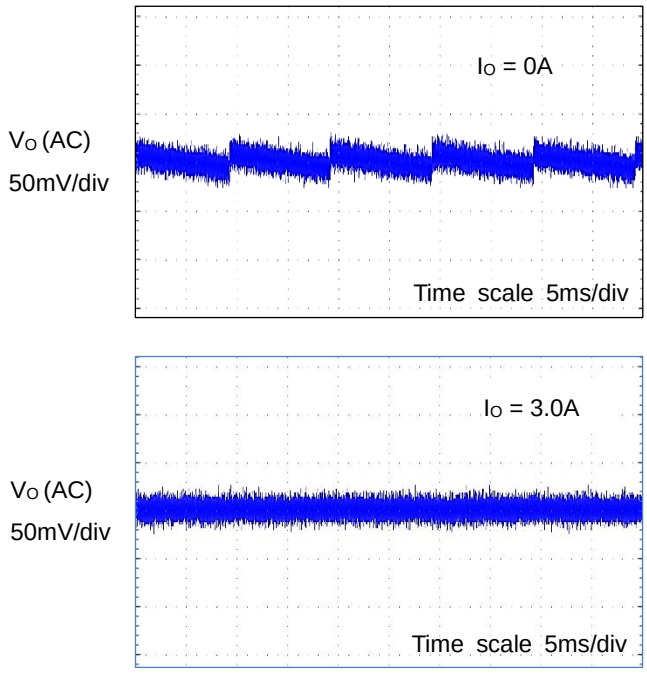

Figure 17. Output Voltage Ripple Wave
V_{IN} = 3.3V, V_O = 1.8V

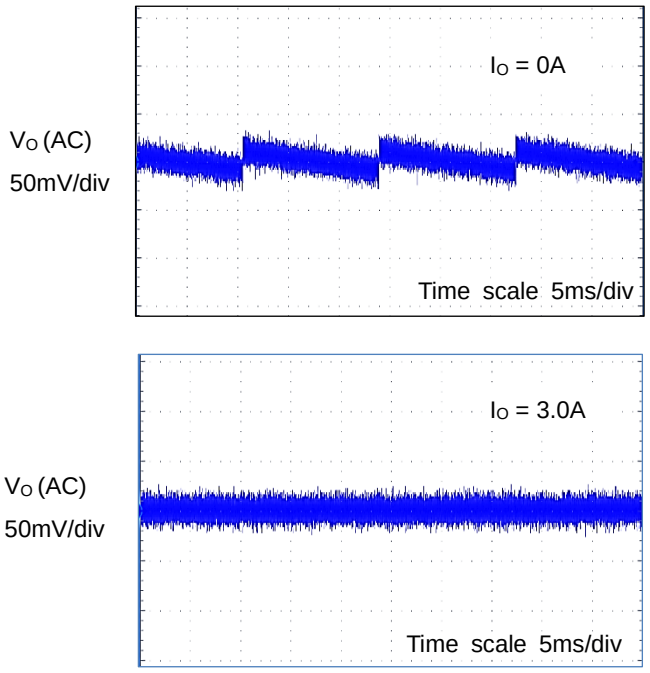

Figure 18. Output Voltage Ripple Wave
V_{IN} = 5.0V, V_O = 1.8V

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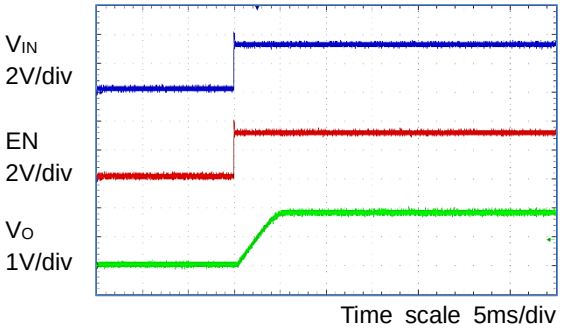

Figure 19. Start-up EN = V_{IN}
V_{IN} = 3.3V, V_O = 1.8V, I_O = 0A

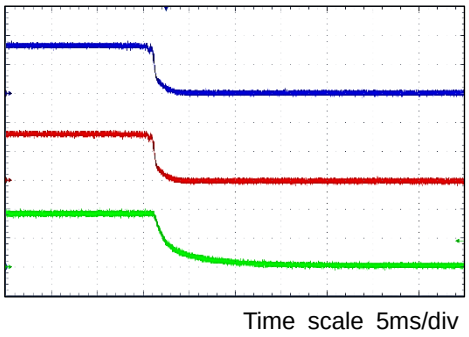

Figure 20. Power-down EN = V_{IN}
V_{IN} = 3.3V, V_O = 1.8V, I_O = 0A

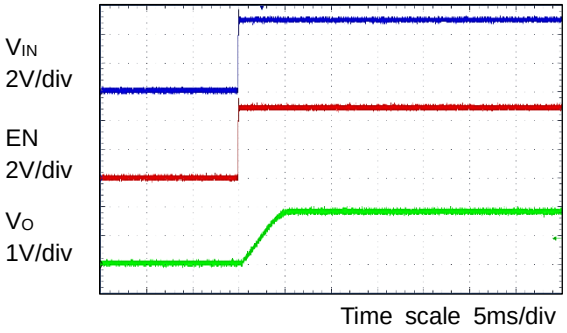

Figure 21. Start-up EN = V_{IN}
V_{IN} = 5.0V, V_O = 1.8V, I_O = 0A

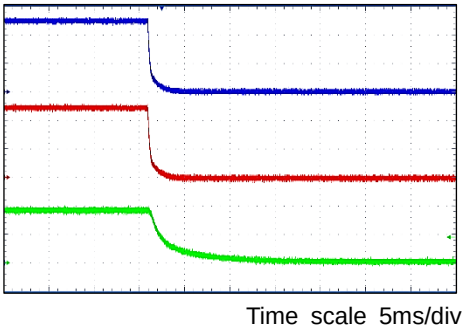

Figure 22. Power-down EN = V_{IN}
V_{IN} = 5.0V, V_O = 1.8V, I_O = 0A

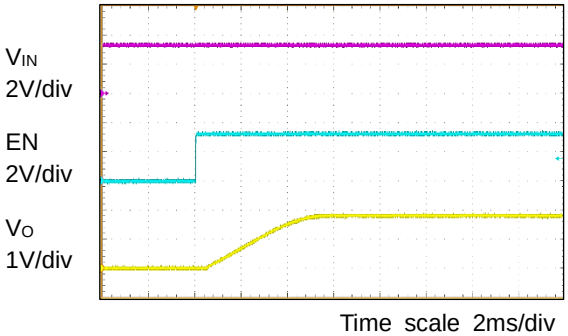

Figure 23. Start-up by EN
V_{IN} = 3.3V, V_O = 1.8V, I_O = 0A

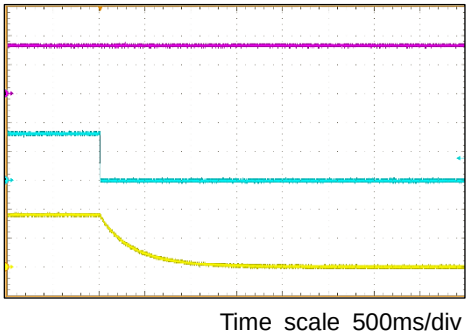

Figure 24. Power-down by EN
V_{IN} = 3.3V, V_O = 1.8V, I_O = 0A

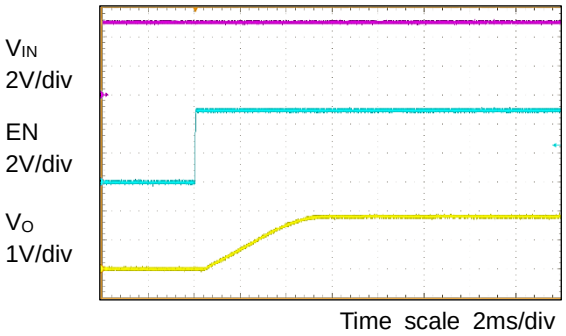

Figure 25. Start-up by EN
V_{IN} = 5.0V, V_O = 1.8V, I_O = 0A

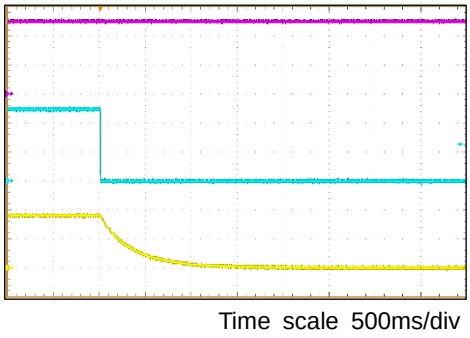

Figure 26. Power-down by EN
V_{IN} = 5.0V, V_O = 1.8V, I_O = 0A

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BD9A301MUV-EVK-001

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