

## Switching Regulator Series

# Step-Down DC/DC Converter

## BD9A400MUV Evaluation Board

BD9A400MUV-EVK-001

### Description

This evaluation board has been developed for ROHM's synchronous buck DC/DC converter customers evaluating BD9A400MUV. While accepting a power supply of 2.7-5.5V, an output of 1.8V can be produced. The IC has internal 60mΩ high-side N-channel MOSFET and 60mΩ low-side N-channel MOSFET and a synchronization frequency is of 1MHz. A Soft Start circuit prevents in-rush current during startup. An EN pin allows for simple ON/OFF control of the IC to reduce standby current consumption. 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. Include OCP (Over Current Protection) and SCP (Short Circuit Protection).

### Evaluation Board Operating Limits and Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Limit			Unit	Conditions
		MIN	TYP	MAX		
Supply Voltage	V <sub>CC</sub>	2.7	-	5.5	V	
Output Voltage / Current	V <sub>OUT</sub>	-	1.8	-	V	
	I <sub>OUT</sub>	-	-	4	A	

### Evaluation Board

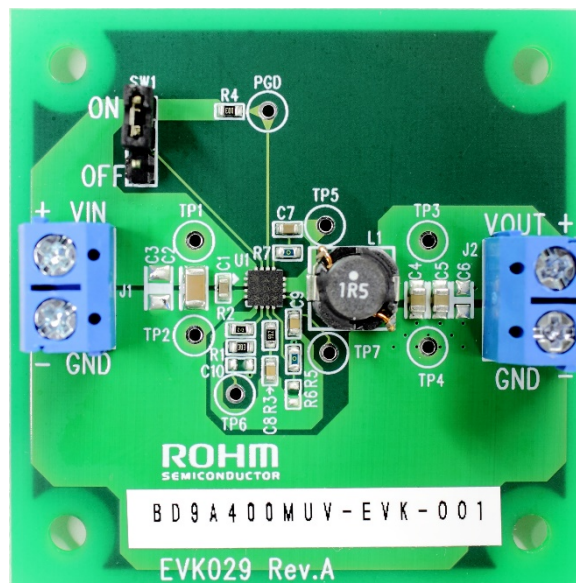


Figure 1. BD9A400MUV-EVK-001 Evaluation Board

## Operation Procedures

### 1. Necessary equipments

- (1) DC power-supply of 2.7V to 5.5V/4A
- (2) Maximum 4A 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 4A 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.

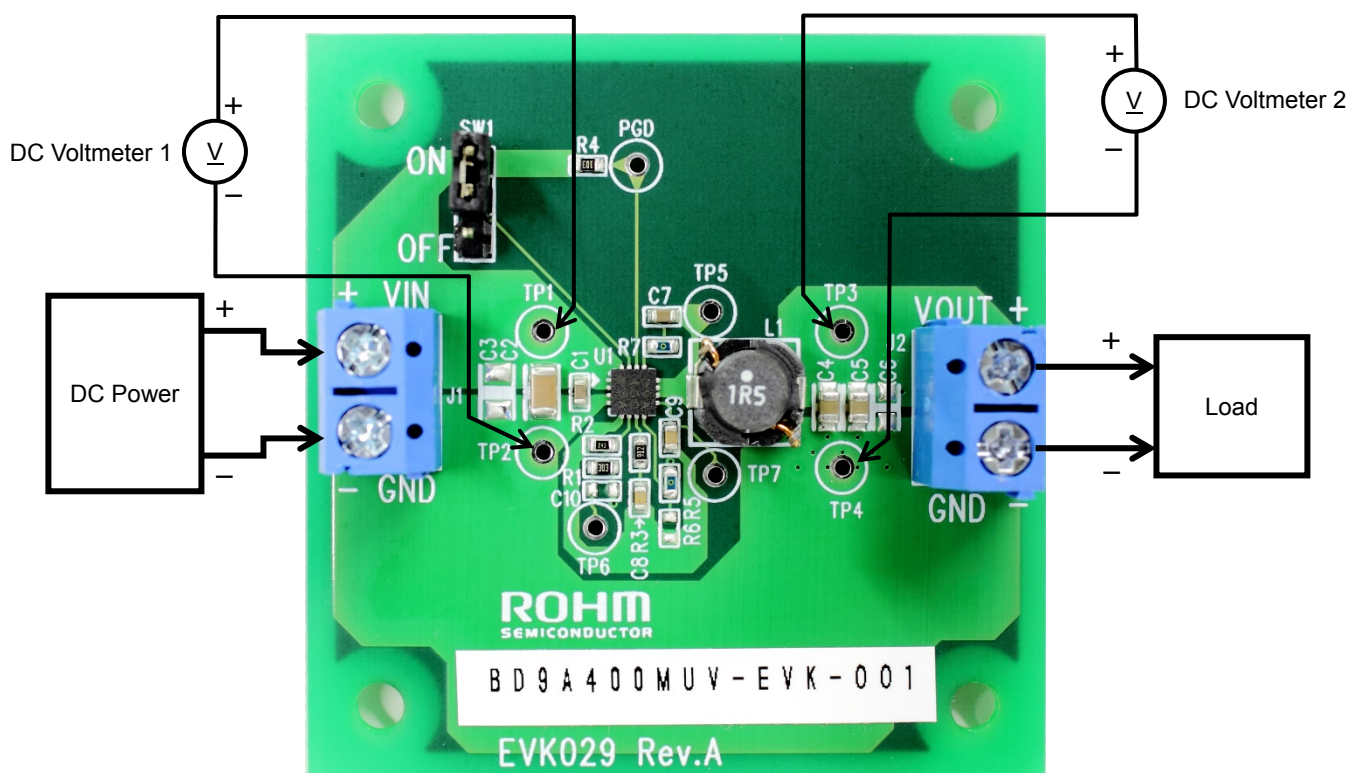


Figure 2. Connection Diagram

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

### Circuit Diagram

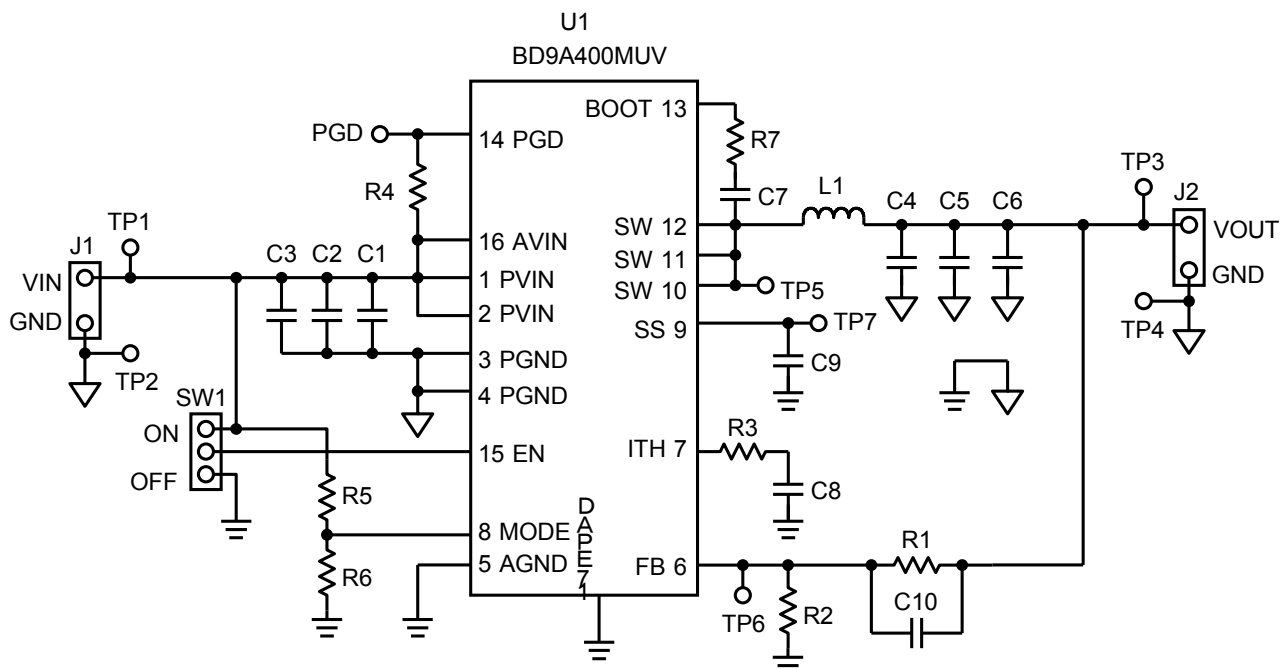
$$V_{IN} = 2.7V \sim 5.5V, V_{OUT} = 1.8V$$


Figure 3. BD9A400MUV-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%	MCR03ERPFP3002	ROHM	1608
1	R2	Resistor	24kΩ	1/10W, 50V, ±1%	MCR03ERPFP2402	ROHM	1608
1	R3	Resistor	9.1kΩ	1/10W, 50V, ±1%	MCR03ERPFP9101	ROHM	1608
1	R4	Resistor	10kΩ	1/10W, 50V, ±1%	MCR03ERPFP1002	ROHM	1608
2	R5, R7	Resistor	0Ω	Jumper	MCR03ERPJ000	ROHM	1608
0	R6	Resistor	-	Not installed	-	-	1608
1	SW1	Pin header	-	2.54mm × 3 contacts	PH-1x03SG	USECONN	-
1	U1	IC	-	Buck DC/DC Converter	BD9A400MUV	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	-



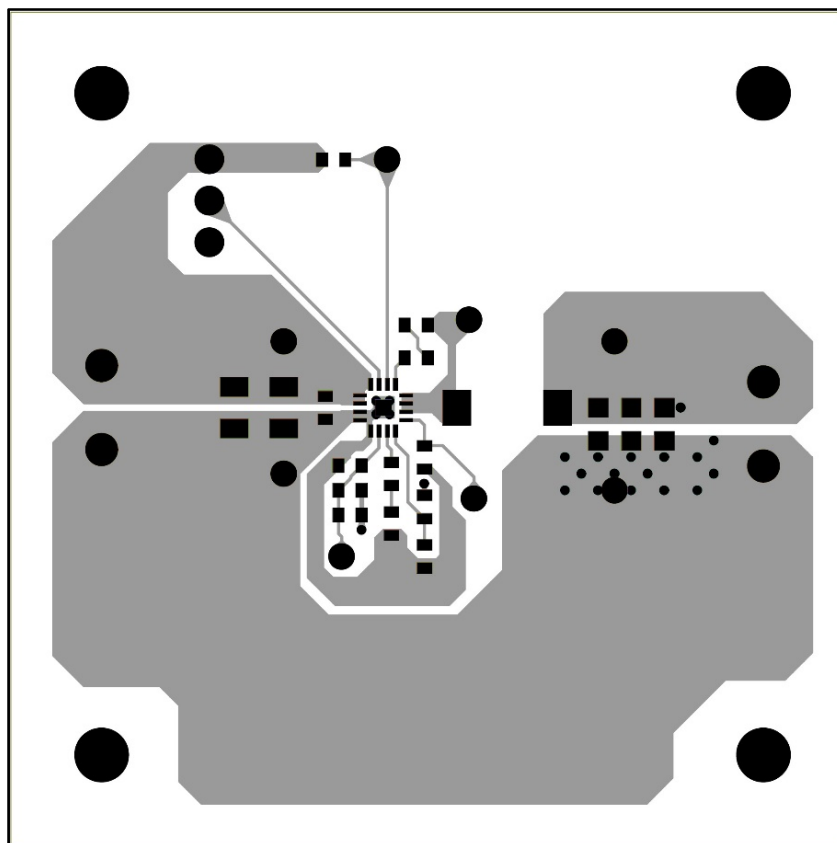


Figure 6. Top Side Layout (Top view)

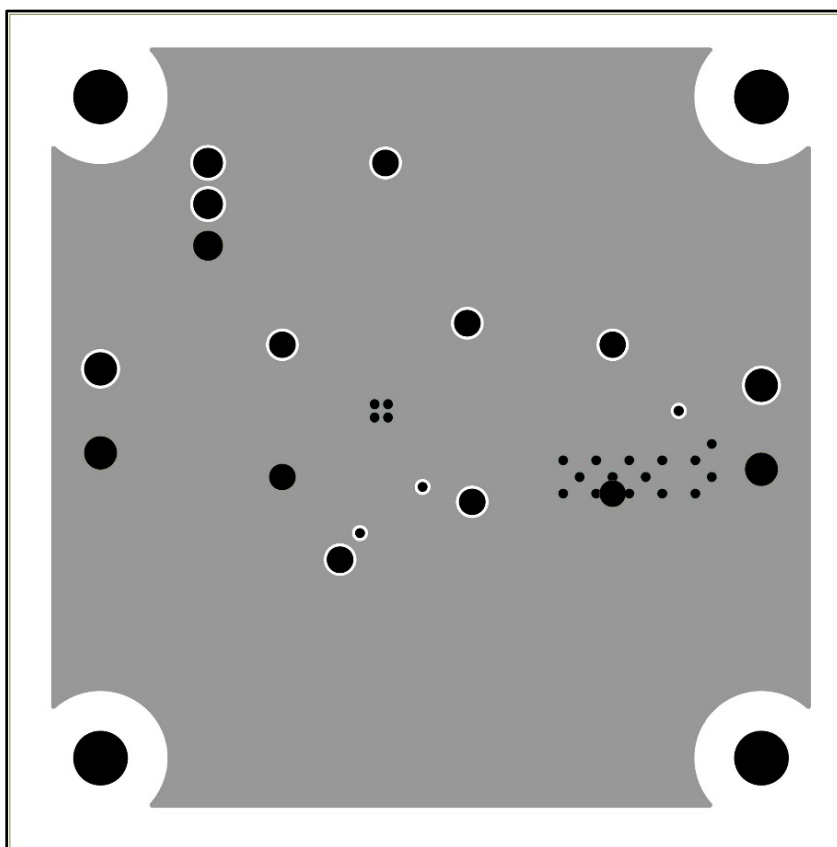


Figure 7. L2 Layout (Top view)

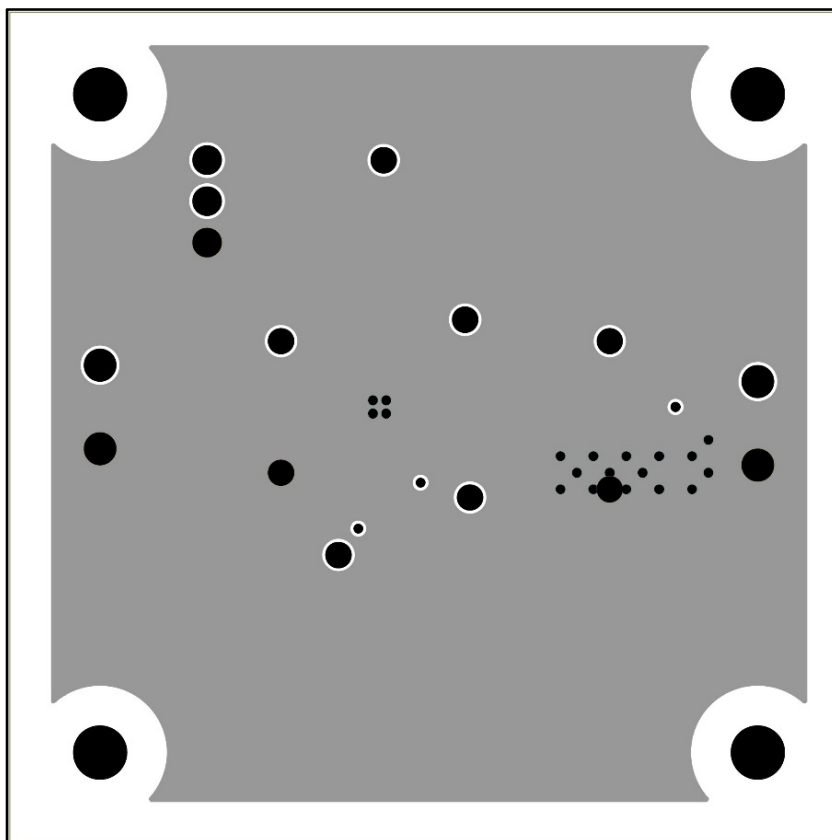


Figure 8. L3 Layout (Top view)

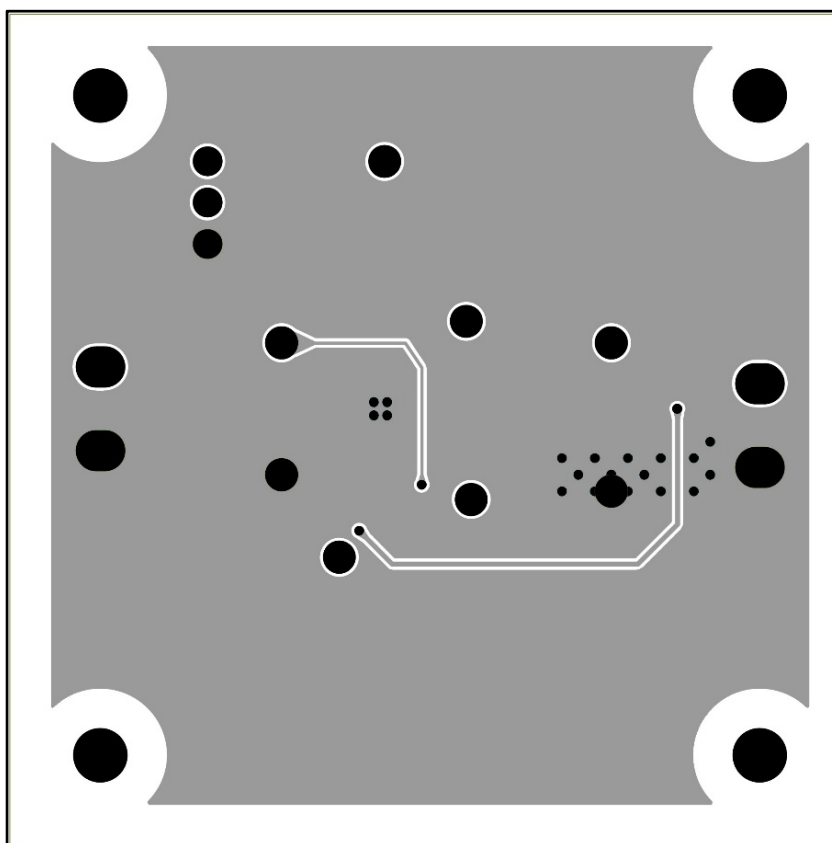


Figure 9. Bottom Side Layout (Top view)

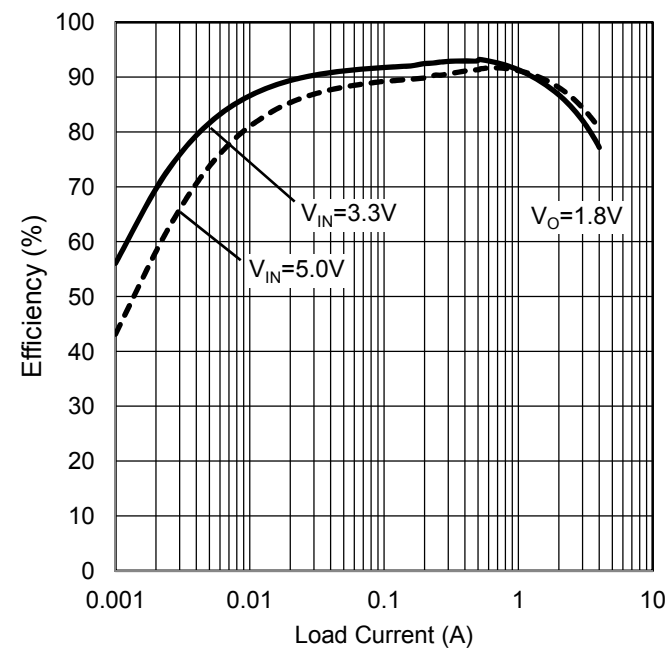


Figure 10. Efficiency vs Load Current

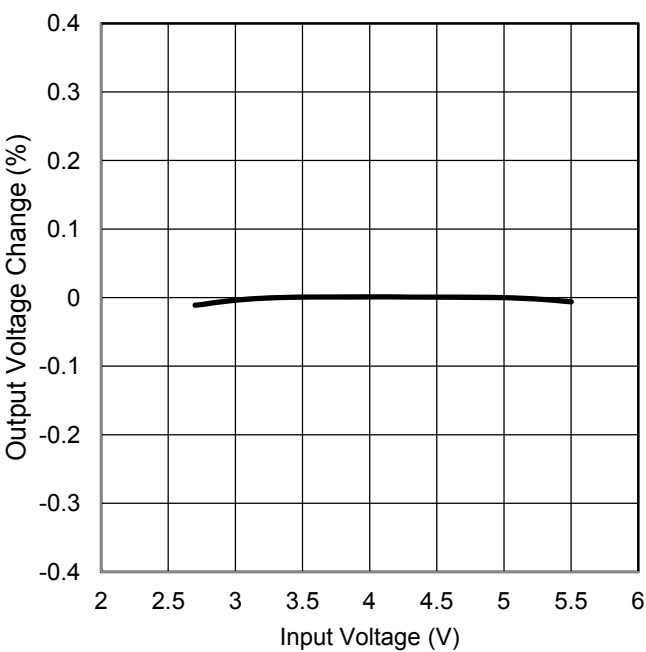


Figure 11. Line Regulation

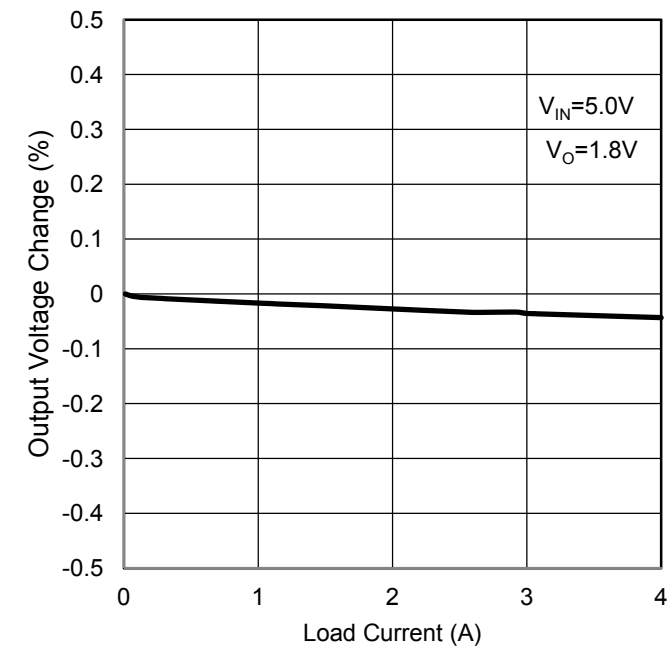


Figure 12. Load Regulation

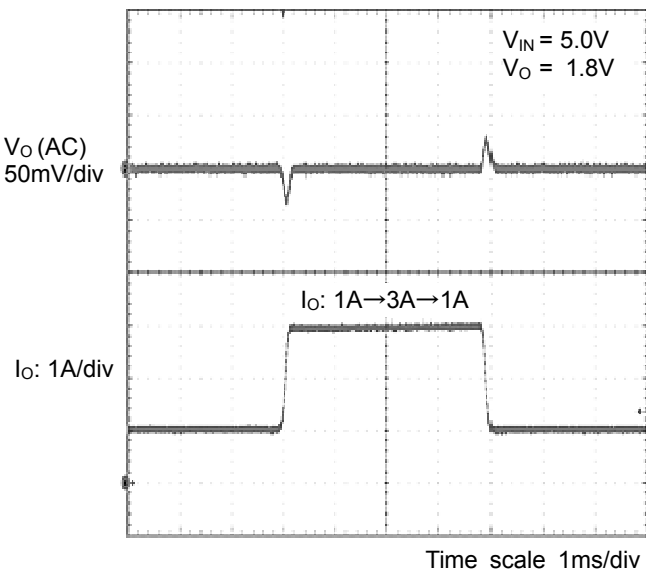


Figure 13. Load Transient Characteristics

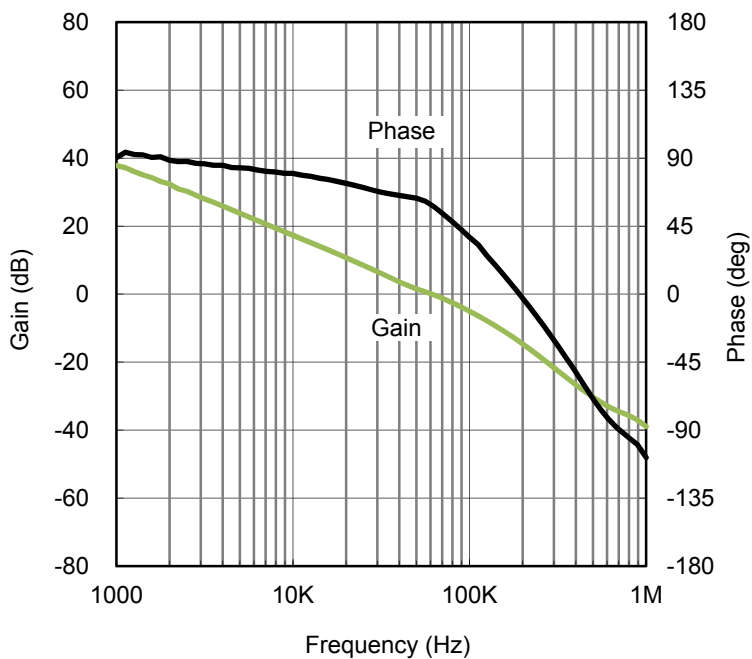


Figure 14. Loop Response  $V_{IN} = 5.0V$ ,  $V_O = 1.8V$ ,  $I_O = 1.0A$

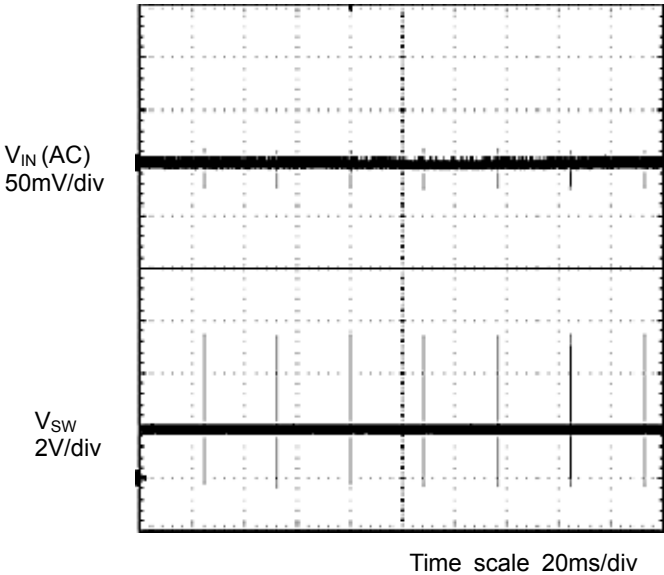


Figure 15. Input Voltage Ripple Wave  
 $V_{IN} = 5.0V$ ,  $V_O = 1.8V$ ,  $I_O = 0A$

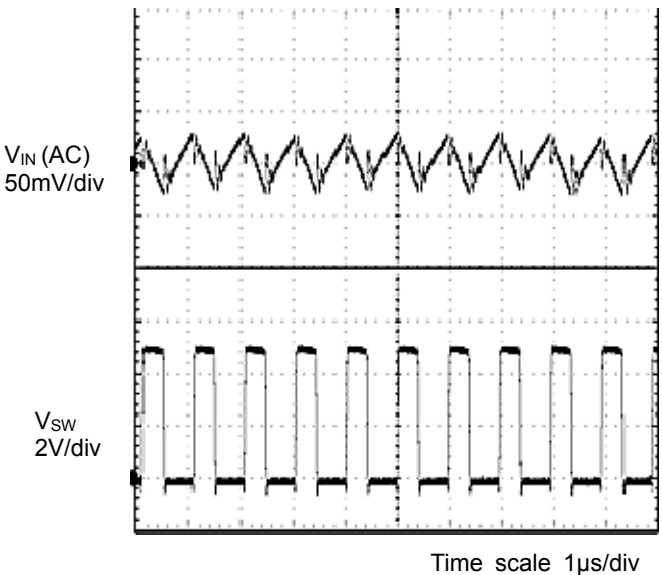


Figure 16. Input Voltage Ripple Wave  
 $V_{IN} = 5.0V$ ,  $V_O = 1.8V$ ,  $I_O = 4A$



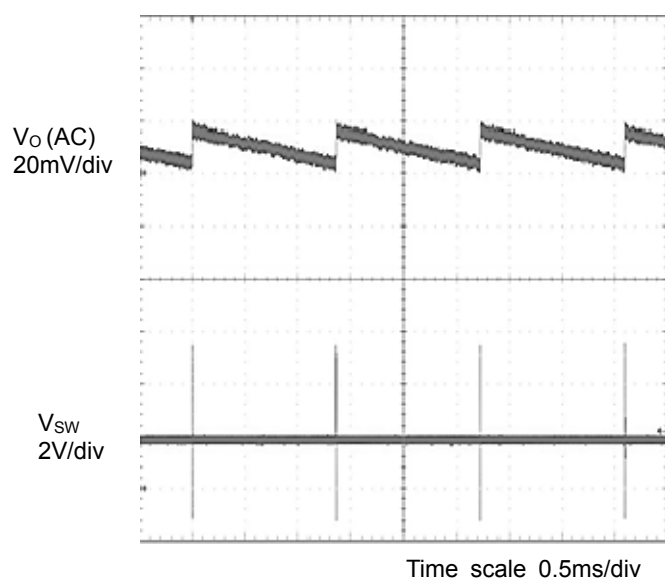


Figure 17. Output Voltage Ripple Wave  
 $V_{IN} = 5.0V$ ,  $V_O = 1.8V$ ,  $I_O = 0A$

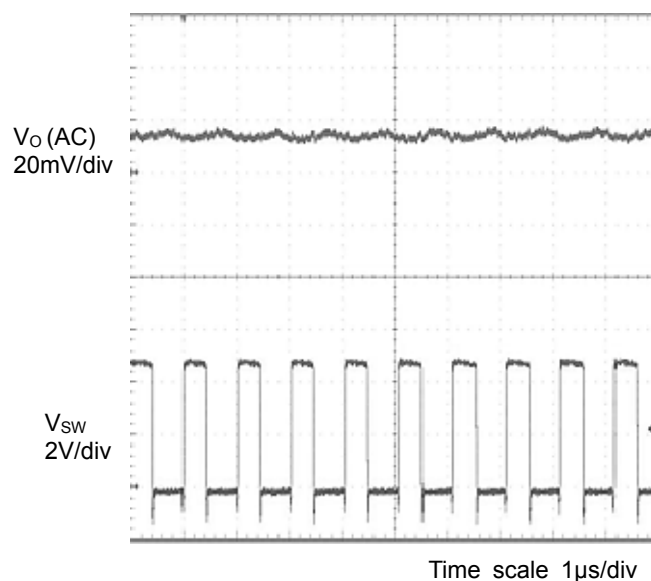


Figure 18. Output Voltage Ripple Wave  
 $V_{IN} = 5.0V$ ,  $V_O = 1.8V$ ,  $I_O = 4A$

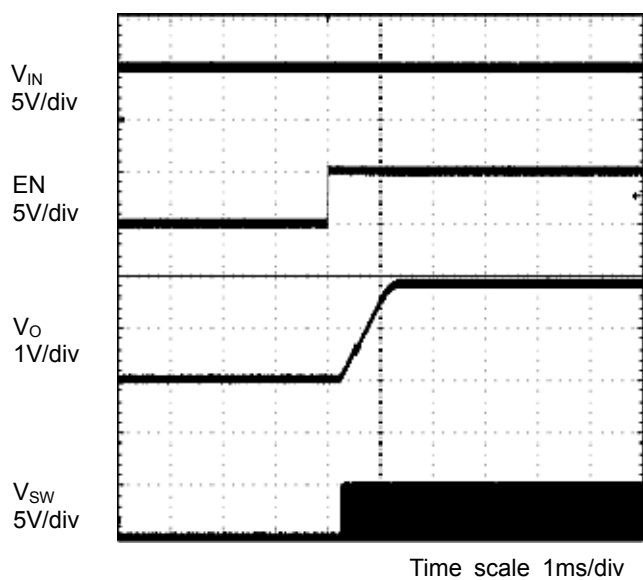


Figure 19. Start-up by EN  
 $V_{IN} = 5.0V$ ,  $V_O = 1.8V$

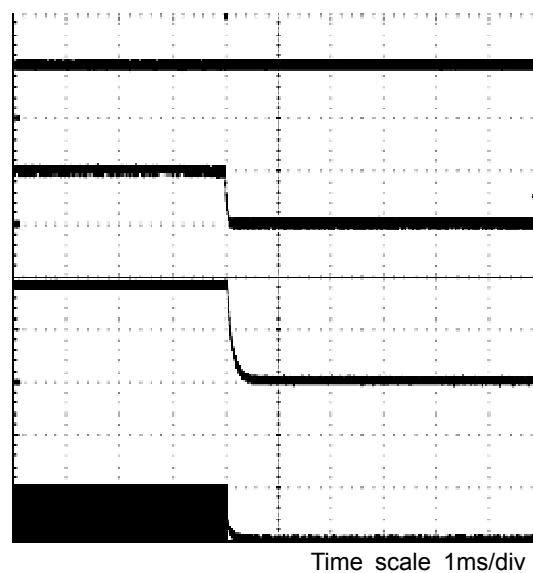


Figure 20. Power-down by EN  
 $V_{IN} = 5.0V$ ,  $V_O = 1.8V$

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