Switching regulator series

Single Synchronous Buck DC/DC Converter BD9DA00MF Evaluation Board

BD9DA00MF-EVK-001 (12V Input, 1.2V, 800kHz setting)

Introduction

This user's guide will provide the necessary steps to operate the Evaluation Board of ROHM's BD9DA00MF Buck DC/DC converters. This includes the external parts, operating procedures and application data.

Description

This Evaluation Board was developed for ROHM's Single Synchronous Buck DC/DC Converter BD9DA00MF. BD9DA00MF is a synchronous buck DC/DC converter with built-in low on-resistance power MOSFETs. It can provide current up to 12 A. It features fast transient response due to constant on-time control system. The Light Load Mode (LLM mode) control improves efficiency in light-load conditions. It is ideal for reducing standby power consumption of equipment. Power Good function makes it possible for system to control sequence.

Application

Step-down Power Supply for SoC, FPGA, Microprocessor

Servers

Recommended Operating Conditions

Table 1. Recommended Operating Conditions

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage	4.0	-	16.0	V	
Output Voltage (Note 1)	0.6	-	5.5	V	
Output Current (Note 2)	-	-	12	A	
Switching Frequency	-	800	-	kHz	Set RMODE4 = 240 kΩ. 600 kHz, 800 kHz, 1 MHz are selectable by setting resistor to MODE PIN.
On Time	-	125	-	ns	VIN = 12 V, 800 kHz, Forced CCM mode
Maximum Efficiency	-	89.9	-	%	VIN = 12 V, VOUT = 1.2 V, IOUT = 5A, 800 kHz, Forced CCM, Ta = 25 °C

(Note 1) At low duty cycles, the frequency is lowered accordingly. Additionally, at high duty cycles, the output voltage may be limited by the VIN voltage.

(Note 2) Tj must be lower than 125 °C under the actual operating environment.

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Evaluation Board

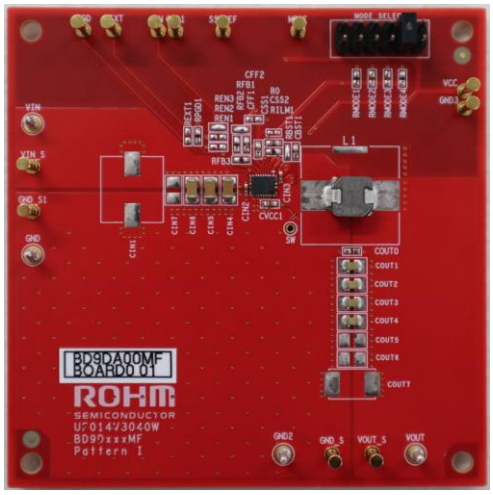


Figure 1. Evaluation Board Top View

Evaluation Board Schematic

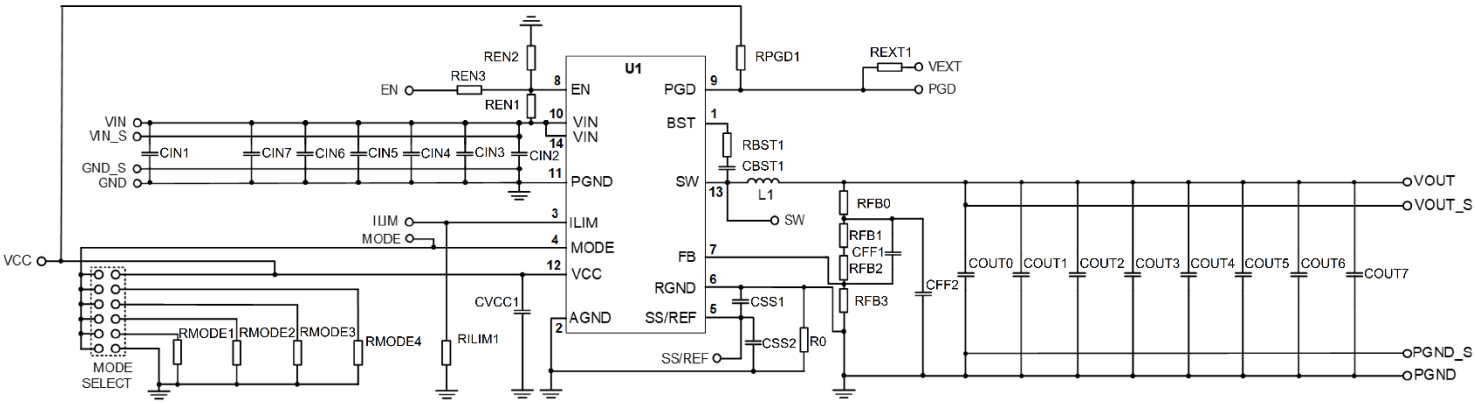


Figure 2. Circuit Diagram

Operating Procedure

1. Turn off EN and connect the GND terminal of the power supply to the GND terminal of Evaluation Board.
2. Connect power supply to the VIN terminal of the Evaluation Board.
3. Connect the load to the Evaluation Board's VOUT and GND terminals. When using an electronic load, connect with the load turned off.
4. Connect a voltmeter to the Evaluation Board's VOUT_S and PGND_S terminals.
5. Turn on the Power supply of VIN. Turn on the switch of EN terminal.
6. Make sure that the voltmeter is set to measure voltage.
7. Turn on the electronic load.

(Caution) This Evaluation Board does not support hot plug. Do not perform hot plug test.

(Note) DCDC starts when the EN pin is 1.22 V (TYP) or higher. Please keep the applied voltage to EN pin within 7 V.

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Pin Configuration

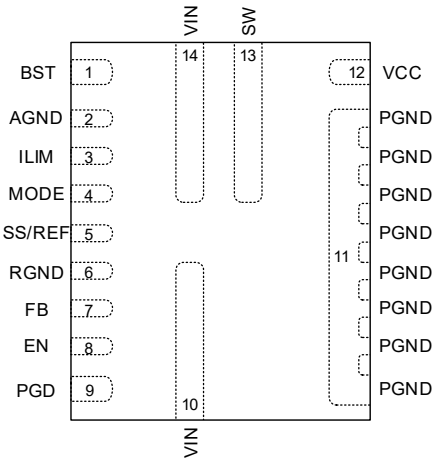


Figure 3. Pin Configuration

Parts list

Table 2. Parts list

No	Package	Parameters	Part Name (Series)	Type	Manufacturer
U1	-	-	BD9DA00MF	IC	ROHM
L1 (Note 1)	-	0.33 µH	SPM6550CT-R33L	Inductor	TDK
CIN1	-	-	-	-	-
CIN2 (Note 2)	1005	1 µF	GRM155C81E105KE11	Ceramic Capacitor	Murata
CIN3 (Note 2)	1005	1 µF	GRM155C81E105KE11	Ceramic Capacitor	Murata
CIN4	3216	10 µF	GRM31CR71E106KA12	Ceramic Capacitor	Murata
CIN5	3216	10 µF	GRM31CR71E106KA12	Ceramic Capacitor	Murata
CIN6	3216	10 µF	GRM31CR71E106KA12	Ceramic Capacitor	Murata
CIN7	-	-	-	-	-
COUT0	-	-	-	-	-
COUT1 (Note 1)	2012	47 µF	GRM21BR60J476ME01	Ceramic Capacitor	Murata
COUT2 (Note 1)	2012	47 µF	GRM21BR60J476ME01	Ceramic Capacitor	Murata
COUT3 (Note 1)	2012	47 µF	GRM21BR60J476ME01	Ceramic Capacitor	Murata
COUT4 (Note 1)	2012	47 µF	GRM21BR60J476ME01	Ceramic Capacitor	Murata
COUT5	-	-	-	-	-
COUT6	-	-	-	-	-
COUT7	-	-	-	-	-
CFF1 (Note 1, 3)	1005	2200 pF	GRM155R71H222KA01	Ceramic Capacitor	Murata
CFF2	-	-	-	-	-
CBST1	1005	0.1 µF	GRM155R71E104KE14	Ceramic Capacitor	Murata
CSS1	1005	0.022 µF	GRM155R71E223KA61	Ceramic Capacitor	Murata
CSS2	1005	0.022 µF	GRM155R71E223KA61	Ceramic Capacitor	Murata
CVCC1	1005	1 µF	GRM155C81E105KE11	Ceramic Capacitor	Murata
R0	-	-	-	-	-
RFB0 (Note 4)	-	Short	-	-	-
RFB1 (Note 1)	-	Short	-	-	-
RFB2 (Note 1)	1005	1.5 kΩ	MCR01S series	Chip Resistor	ROHM
RFB3 (Note 1)	1005	1.5 kΩ	MCR01S series	Chip Resistor	ROHM
RBST1	-	Short	-	-	-
REN1	-	-	-	-	-
REN2	-	-	-	-	-
REN3	-	Short	-	-	-
REXT1	-	-	-	-	-
RILIM1	1005	5.1 kΩ	MCR01S series	Chip Resistor	ROHM

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RPGD1	1005	10 kΩ	MCR01S series	Chip Resistor	ROHM
RMODE1 (Note 5)	1005	30 kΩ	MCR01S series	Chip Resistor	ROHM
RMODE2 (Note 5)	-	-	-	-	-
RMODE3 (Note 5)	-	-	-	-	-
RMODE4 (Note 5)	1005	240 kΩ	MCR01S series	Chip Resistor	ROHM
MODE SELECT (Note 5)	-	Jumper Select RMODE1	HDR2X6	SOCKET	-

(Note 1) For setting of L1, COUT1 to 7, RFB1, 2, 3, and CFF1, please refer to Table 4.

(Note 2) In order to reduce the influence of high frequency noise, connect 1 µF ceramic capacitors to CIN2 and CIN3 as close as possible to the VIN pin and the PGND pin.

(Note 3) CFF1 is an option used to adjust the frequency response. If you are using a value other than those listed in Table 2 and 4, please confirm with the actual application.

(Note 4) RFB0 is an option used for feedback's frequency response measurement. By inserting a resistor at RFB0, it is possible to measure the frequency response (phase margin) using an FRA. However, the resistor must not be used in actual application, so please short this resistor pattern.

(Note 5) For setting of RMODE 1 to 4, and MODE SELECT, please refer to Table 3. The MODE pin is used to set the switching frequency and operation mode. It cannot be changed during operation.

(Note 6) If the recommended parts on table 2 are not available anymore due to end of production, different parts will be used on the test board because the end of production parts are deprecated.

Table 3. Mode PIN Setting

MODE SELECT	MODE PIN condition	Switching Frequency	Control mode
-	VCC	600 kHz	LLM
RMODE4	240 kΩ to GND	800 kHz	LLM
-	120 kΩ to GND	1 MHz	LLM
-	GND	600 kHz	Forced CCM Mode
RMODE1	30 kΩ to GND	800 kHz	Forced CCM Mode
-	62 kΩ to GND	1 MHz	Forced CCM Mode

Table 4. Recommended component constants and minimum effective output capacitance for each setting

VIN [V]	VOUT [V]	Switching Frequency [kHz]	IOUTMAX [A]	L1_TYP [µH]	RUP(Note) [kΩ]	RDOWN(Note) [kΩ]	CFF1_TYP [pF]	COUTMIN_EFF(Note) [µF]
5	1.2	600	12	0.47	1.5	1.5	2200	170
5	3.3	600	10	0.47	6.8	1.5	68	170
12	1.2	600	12	0.47	1.5	1.5	2200	170
12	3.3	600	12	1	6.8	1.5	270	170
12	5	600	12	1.4	11	1.5	150	110
5	1.2	800	12	0.33	1.5	1.5	2200	135
5	3.3	800	8	0.33	6.8	1.5	100	135
12	1.2	800	12	0.33	1.5	1.5	2200	135
12	3.3	800	12	0.68	6.8	1.5	270	135
12	5	800	12	1	11	1.5	150	85
5	1.2	1000	12	0.25	1.5	1.5	2200	135
5	3.3	1000	6	0.33	6.8	1.5	180	135
12	1.2	1000	12	0.33	1.5	1.5	2200	135
12	3.3	1000	12	0.68	6.8	1.5	270	135
12	5	1000	12	0.68	11	1.5	150	85

(Note) RUP = RFB1 + RFB2, RDOWN = RFB3, COUTMIN_EFF is the Minimum effective capacitance of the total output capacitors. The output voltage, VOUT, can be calculated as below:

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$$VOUT = \frac{RUP+RDOWN}{RDOWN} \times 0.6 \text{ [V]}$$

$$0.6 \leq VOUT \leq 5.5 \text{ [V]}$$

However, RDOWN should be set within the following formula:

$$RDOWN \leq 10 \text{ [k}\Omega\text{]}$$

VOUT should be used to satisfy the conditions of the following equation:

600 kHz : $VOUT \leq (VIN \times 0.86) - 0.095 \times IOUT$ [V]

800 kHz : $VOUT \leq (VIN \times 0.82) - 0.095 \times IOUT$ [V]

1 MHz : $VOUT \leq (VIN \times 0.78) - 0.095 \times IOUT$ [V]

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Board Layout

Evaluation Board PCB information

Number of Layers	Material	Board Size	Copper Thickness
4	FR4	80mm x 80mm x 1.6mm	2oz (70μm) / 2oz (70μm) / 2oz (70μm) / 2oz(70μm)

The layout of BD9DA00MF series is shown below.

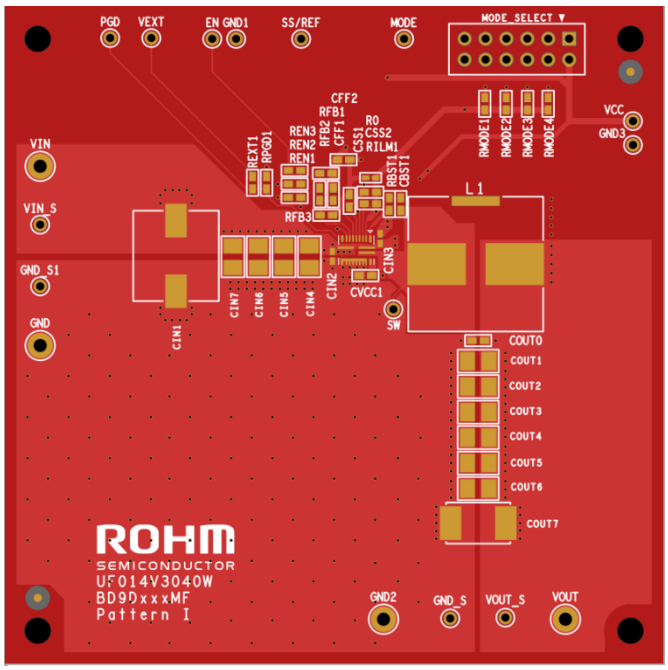


Figure 4. Top PCB Image

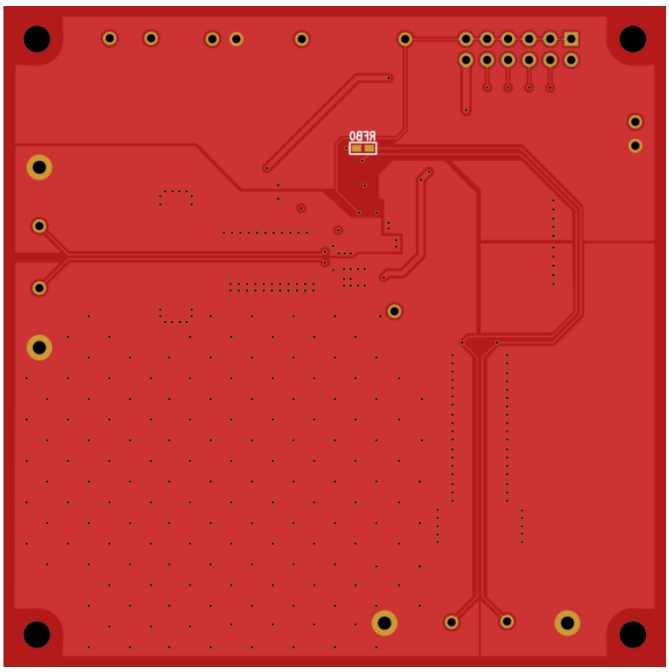


Figure 5. Bottom PCB Image (Top View)

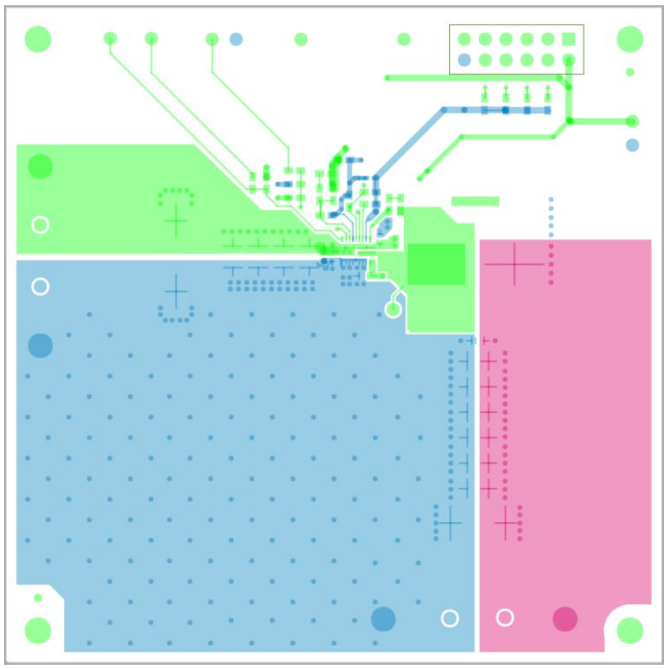


Figure 6. Top Layer Layout

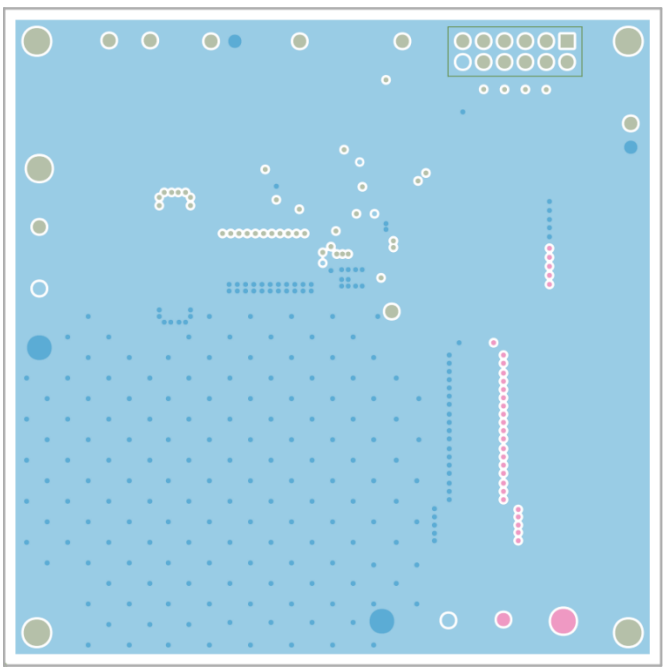


Figure 7. Middle1 Layer Layout

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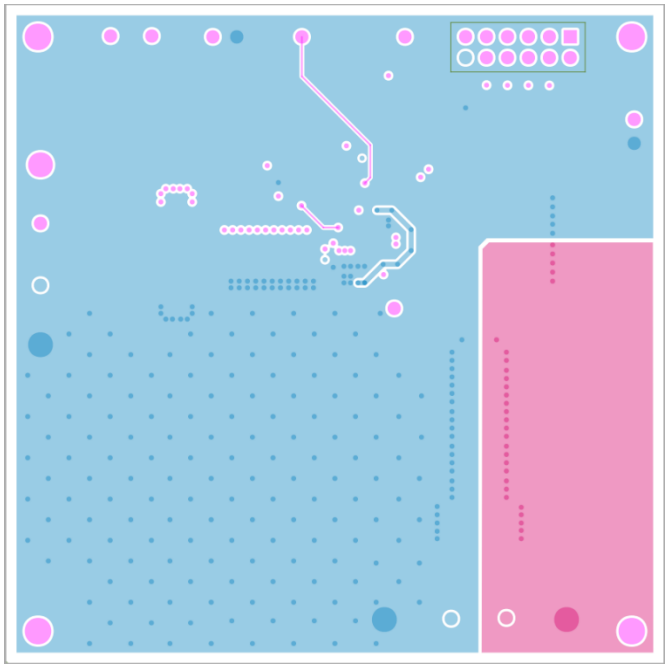


Figure 8. Middle2 Layer Layout

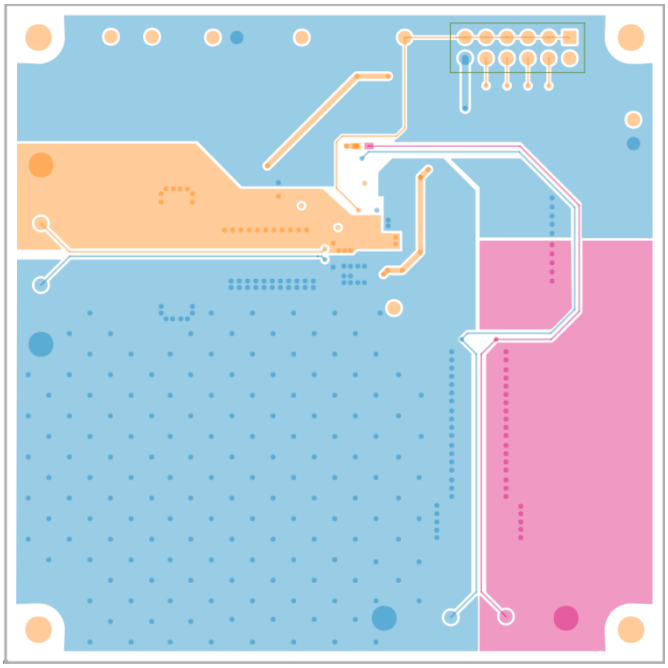


Figure 9. Bottom Layer Layout

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Revision History

Date	Revision	Changes
12.Dec.2025	Rev. 001	Initial release

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