

## Secondary Buck DC/DC Converter

# Single Synchronous Buck DC/DC Converter For Automotive

## BD9S209NUX-C Evaluation Board

BD9S209NUX-TSB-001 (5.0V Input, 1.2V Output, 2A)

### Introduction

This user's guide will provide the necessary steps to operate the Evaluation Board of ROHM's BD9S209NUX-C Buck DC/DC converter. 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 BD9S209NUX-C. It is a synchronous buck DC/DC converter with built-in low On Resistance power MOSFETs. BD9S209NUX-C accepts a power supply input range of 2.7 V to 5.5 V and generates a maximum output current of 2 A. Small inductor is applicable due to high switching frequency of 2.2 MHz. It is a current mode control DC/DC Converter and features high-speed transient response. It has a built-in phase compensation circuit. Applications can be created with a few external components.

### Application

- Automotive Equipment
- Other Electronic Equipment

### Recommended Operating Conditions

Table 1. Recommended Operating Conditions

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage	2.7	-	5.5	V	
Output Voltage (Note1)	0.8	-	V <sub>IN</sub>	V	
Output Current Range	-	-	2.0	A	
Switching Frequency	-	2.2	-	MHz	
Maximum Efficiency (V <sub>o</sub> = 1.2 V)	-	87.32	-	%	V <sub>IN</sub> = 3.3 V, I <sub>o</sub> = 0.4A, T <sub>a</sub> = 25 °C

(Note 1) Although the minimum output voltage is configurable up to 0.8 V, it may be limited by the SW min ON pulse width. SW Minimum ON Time that BD9S209NUX-C can output stably in the entire load range is 80 ns. Use the value to calculate the input

and output conditions that satisfy the equation of  $80 \text{ [ns]} \leq \frac{V_{OUT}}{V_{IN} \times f_{SW}}$

## Evaluation Board

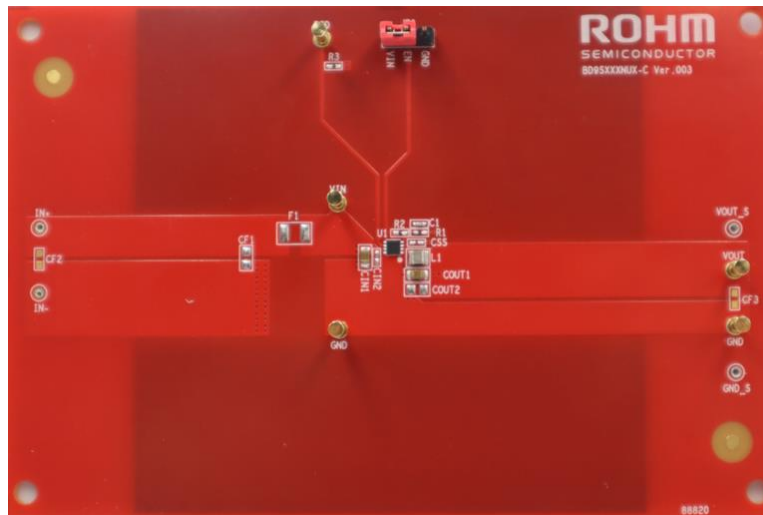


Figure 1. Evaluation Board Top View

## Evaluation Board Schematic

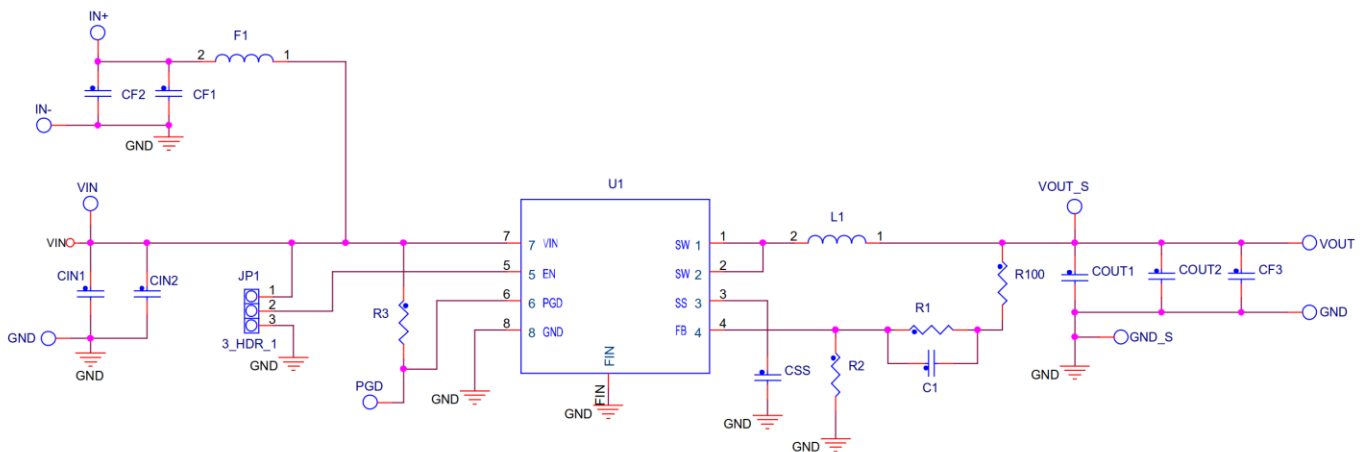


Figure 2. Circuit Diagram

## 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 and GND 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) If EN = High (EN short to VIN) before Power ON, the turn ON and turn OFF is controlled by VIN only.

## Pin Configuration

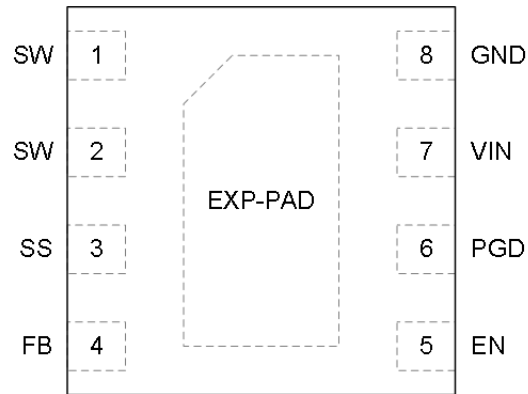


Figure 3. Pin Configuration

## Parts list

Table 2. Parts List (VOUT=1.0V, VIN=5.0V, 3.3V)

No	Package	Parameters	Part Name (Series)	Type	Manufacturer
L1	2520	0.68 $\mu$ H	DFE252012PD-R68M	Inductor	Murata
COUT1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
CIN1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
R100	-	SHORT	-	-	-
R1 (Note1)	0603	7.5 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R2 (Note1)	0603	30 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R3	0603	100 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
CSS	-	-	-	-	-
C1	1005	100 pF, C0G, 50 V	GCM1555C1H101JA16	Ceramic Capacitor	Murata
COUT2	-	-	-	-	-
CIN2	-	-	-	-	-
CF1	-	-	-	-	-
CF2	-	-	-	-	-
F1	-	-	-	-	-
CF3	-	-	-	-	-

Table 3. Parts List (VOUT=1.2V, VIN=5.0V, 3.3V)

No	Package	Parameters	Part Name (Series)	Type	Manufacturer
L1	2520	0.68 $\mu$ H	DFE252012PD-R68M	Inductor	Murata
COUT1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
CIN1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
R100	-	SHORT	-	-	-
R1 (Note1)	0603	10 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R2 (Note1)	0603	20 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R3	0603	100 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
CSS	-	-	-	-	-
C1	1005	100 pF, C0G, 50 V	GCM1555C1H101JA16	Ceramic Capacitor	Murata
COUT2	-	-	-	-	-
CIN2	-	-	-	-	-
CF1	-	-	-	-	-
CF2	-	-	-	-	-
F1	-	-	-	-	-
CF3	-	-	-	-	-

Table 4. Parts List (VOUT=1.5V, VIN=5.0V, 3.3V)

No	Package	Parameters	Part Name (Series)	Type	Manufacturer
L1	2520	0.68 $\mu$ H	DFE252012PD-R68M	Inductor	Murata
COUT1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
CIN1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
R100	-	SHORT	-	-	-
R1 (Note1)	0603	16 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R2 (Note1)	0603	18 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R3	0603	100 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
CSS	-	-	-	-	-
C1	1005	100 pF, C0G, 50 V	GCM1555C1H101JA16	Ceramic Capacitor	Murata
COUT2	-	-	-	-	-
CIN2	-	-	-	-	-
CF1	-	-	-	-	-
CF2	-	-	-	-	-
F1	-	-	-	-	-
CF3	-	-	-	-	-

Table 5. Parts List (VOUT=1.8V, VIN=5.0V, 3.3V)

No	Package	Parameters	Part Name (Series)	Type	Manufacturer
L1	2520	1.0 $\mu$ H	TFM252012ALMA1R0M	Inductor	TDK
COUT1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
CIN1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
R100	-	SHORT	-	-	-
R1 (Note1)	0603	30 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R2 (Note1)	0603	24 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R3	0603	100 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
CSS	-	-	-	-	-
C1	1005	100 pF, C0G, 50 V	GCM1555C1H101JA16	Ceramic Capacitor	Murata
COUT2	-	-	-	-	-
CIN2	-	-	-	-	-
CF1	-	-	-	-	-
CF2	-	-	-	-	-
F1	-	-	-	-	-
CF3	-	-	-	-	-

Table 6. Parts List (VOUT=3.3V, VIN=5.0V)

No	Package	Parameters	Part Name (Series)	Type	Manufacturer
L1	2520	1.0 $\mu$ H	TFM252012ALMA1R0M	Inductor	TDK
COUT1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
CIN1	2012	10 $\mu$ F, X7R, 10 V	GCM21BR71A106KE21	Ceramic Capacitor	Murata
R100	-	SHORT	-	-	-
R1 (Note1)	0603	75 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R2 (Note1)	0603	24 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
R3	0603	100 k $\Omega$ , 1 %, 1/20 W	MCR006 series	Chip Resistor	ROHM
CSS	-	-	-	-	-
C1	1005	100 pF, C0G, 50 V	GCM1555C1H101JA16	Ceramic Capacitor	Murata
COUT2	-	-	-	-	-
CIN2	-	-	-	-	-
CF1	-	-	-	-	-
CF2	-	-	-	-	-
F1	-	-	-	-	-
CF3	-	-	-	-	-

(Note 1)  $V_{OUT} = \frac{R1+R2}{R2} \times 0.8$  [V]

(Note 2) CSS, COUT2, CIN2, CF1, CF2, F1, CF3 patterns are only optional. They can be utilized for adjusting the characteristics constants.

(Note 3) If the recommended parts on tables 2, 3, 4, 5 and 6 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.

## Board Layout

Evaluation Board PCB information

Number of Layers	Material	Board Size	Copper Thickness
4	FR4 High TG	114.3mm x 76.2mm x 1.6mm	2oz(70μm) / 1oz (35μm) / 1oz (35μm) / 2oz(70μm)

The layout of BD9SXXXNUX-C series board is shown below.

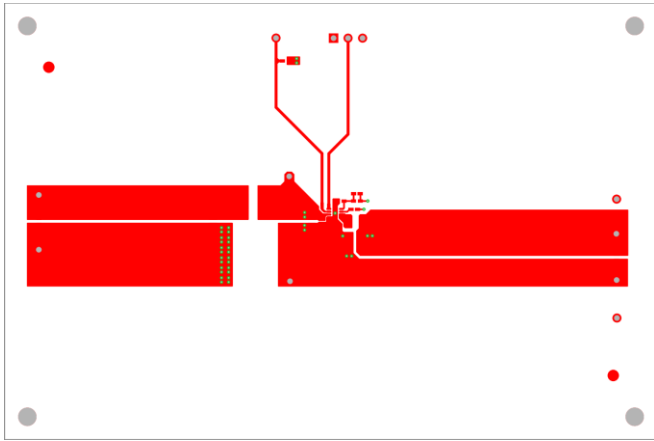


Figure 4. Top Layer Layout

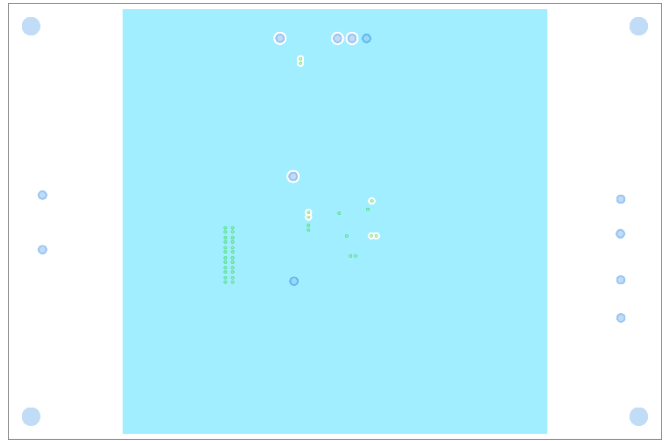


Figure 5. Middle1 Layer Layout

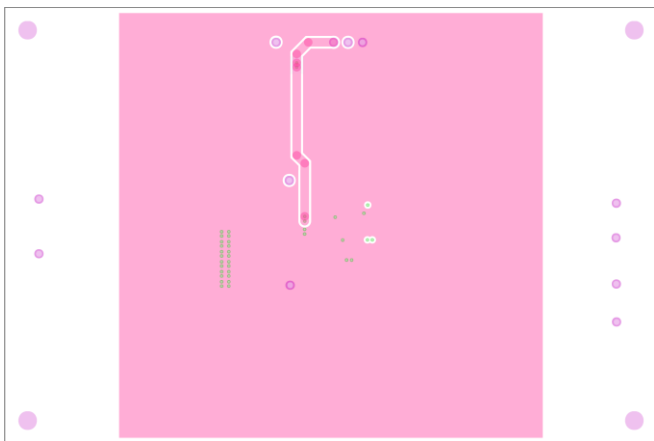


Figure 6. Middle2 Layer Layout

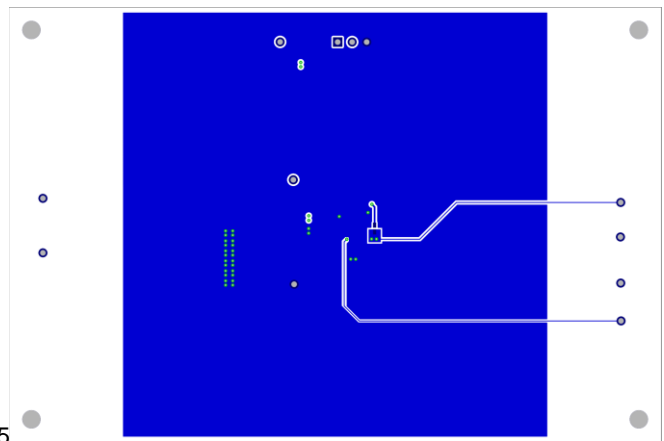


Figure 7. Bottom Layer Layout

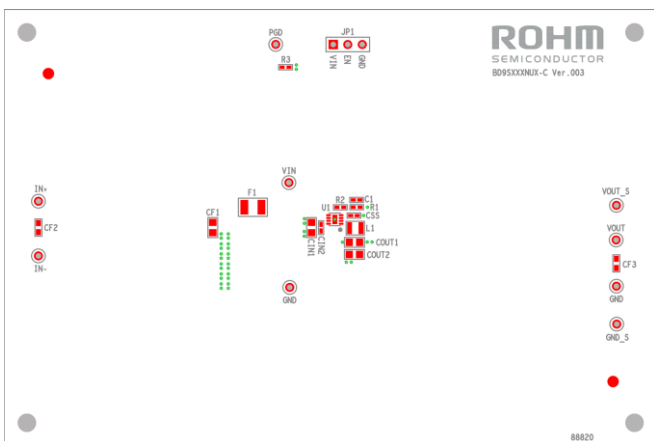


Figure 8. Top Parts Placement

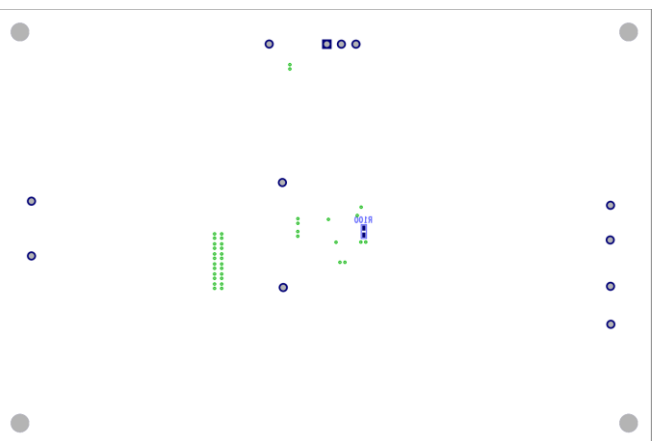


Figure 9. Bottom Parts Placement

**Revision History**

Date	Revision Number	Description
16.Apr.2024	001	New Release

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