Switching Regulator Series

Buck Converter with Integrated FET BD9E104FJ EVK

BD9E104FJ-EVK-001 (12V→5V, 1.0A)

Introduction

This user's guide provide the necessary steps to operate the EVK of ROHM's BD9E104FJ 1channel Buck DC/DC converter. This include the external parts, operating procedures and application data.

Description

This EVK has been developed for ROHM's synchronous buck DC/DC converter customers evaluating BD9E104FJ and outputs 5V from 12V input voltage. The BD9E104FJ accepts a power supply input range of 7V to 26V, and generates output voltage ranging from 1.0V to 0.5 x V_{IN} using external resistors. The operating frequency is fixed at 570 kHz. The SLLM™ (Simple Light Load Mode) control provides good efficiency characteristics in light load conditions, which is ideal for equipment that want to reduce standby power. The current mode control DC/DC converter provides high-speed transient response performance. Additional protection functions include a built-in soft start function to prevent rush current at startup, UVLO (under voltage lock out), TSD (thermal shutdown detection), SCP(short current protection) and OCP (over current protection).

Application

DC/DC power supply for consumer electronics such as home appliances
Secondary power supply and adapter equipment
Communication equipment

Operating Limits

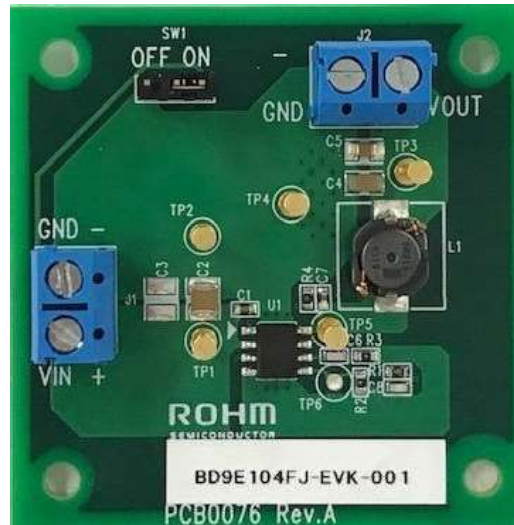| Parameter	Min	Typ	Max	Units	Conditions
Input Voltage	10.0	12.0	18.0	V	
Output Voltage		5.0		V	
Output Current Range			1.0	A	
Operating Frequency		570		kHz	
Maximum Efficiency		92		%	
UVLO Detect Voltage		6.4		V	VCC sweep down
UVLO Hysteresis Width		200		mV	

EVK

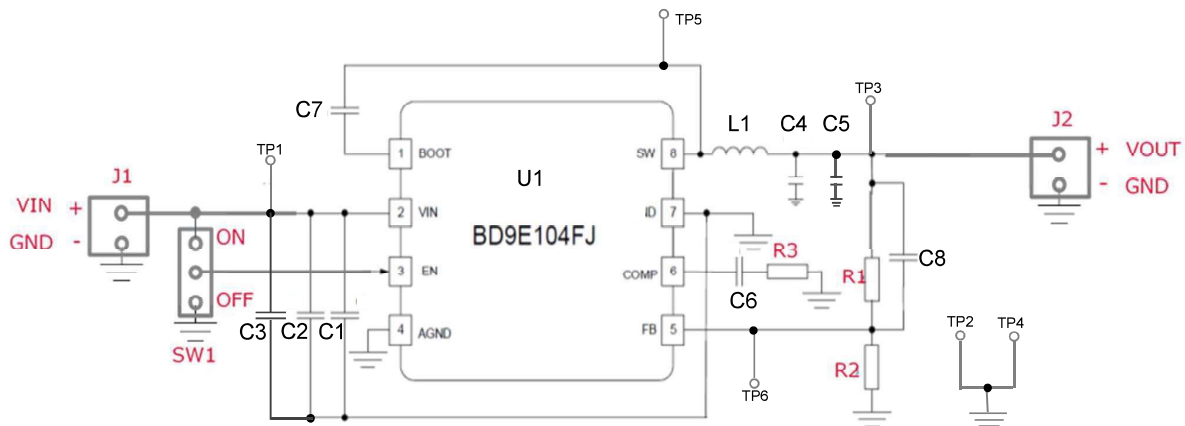Figure 1. BD9E104FJ-EVK-001(Top View)

EVK Schematic

Figure 2. BD9E104FJ-EVK-001 Circuit Diagram

Operating Procedure

1. Turn off the DC power supply and connect the GND terminal of the power supply to the GND terminal (J1) of the EVK.
2. Connect the VCC pin of the DC power supply to the VIN pin (J1) of the EVK.
3. Connect the load to the VOUT and GND terminals of J2 of EVK. When using an electronic load, connect with the load turned off.
4. Connect a voltmeter with the VOUT terminal to the EVK's TP3 and the GND terminal to the EVK's TP4.
5. Connect the jumper of SW1 to ON side.
6. Turn on the DC power supply. Make sure the voltmeter shows 5V.
7. Turn on the electronic load.

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

Operation State Settings

Below is a table of BD9E104FJ condition selectable using SW1.

Table 1. SW1 Settings

SW1 state	BD9E104FJ Condition
ON (short to VIN)	Enable
OFF (short to GND)	Shutdown

Parts list

Table 2. Parts list

Count	Parts No.	Type	Value	Description	Manufacturer Part Number	Manufacturer	Size[Unit: mm(inch)]
IC							
1	U1	DCDC	-	Buck Converter	BD9E104FJ	ROHM	4.90 x 6.00
Inductor							
1	L1	Inductor	6.8µH	±30%, DCR=22mΩtyp, 4.1A	CLF7045NIT-6R8N	TDK	7.4 x 7.0
Capacitor							
2	C1,C7	MLCC	0.1µF	50V, X5R	GRM155 Series	MURATA	1005(0402)
1	C2	MLCC	10µF	50V, X5R	GRM32 Series	MURATA	3225(1210)
-	C3	-	-	No mounted	-	-	-
1	C4	MLCC	10µF	16V, X5R	GRM31 Series	MURATA	3216(1206)
1	C5	MLCC	22µF	10V, X5R	GRM21 Series	MURATA	2012(0805)
1	C6	MLCC	390pF	50V, ±10%	GRM188 Series	MURATA	1608(0603)
1	C8	MLCC	12pF	16V, ±10%	C0G(NP0) Series	AVX	1608(0603)
Resistor							
1	R1	Resistor	430kΩ	1/10W, ±1%	MCR03 Series	ROHM	1608(0603)
2	R2,R3	Resistor	82kΩ	1/10W, ±1%	KTR03 Series	ROHM	1608(0603)
Switching Terminal							
1	SW1	Pin header	-	2.54mm × 3 contacts	61300311121	Wurth Electronics	-
1	SW1	Jumper	-	Jumper pin for SW1	60900213421	Wurth Electronics	-
Connecter							
2	J1,J2	Terminal Block	-	2 contacts, 15A, 5mm	691102710002	Wurth Electronics	-
Contact pin							
5	TP1-5	Test Pin	-	10A, 1mm hole	ST-2-2	Sunhayato	-

Board Layout

EVK PCB information

Number of Layers	Material	Board Size	Copper Thickness
4	FR-4	50mm x 50mm x 1.6mmt	1oz (35μm)

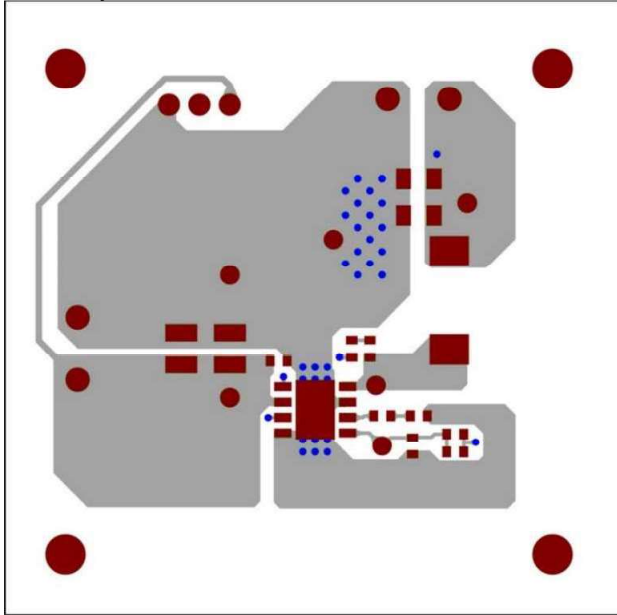The layout of BD9E104FJ-EVK-001 is shown below.

Figure 3. Top Layer Layout
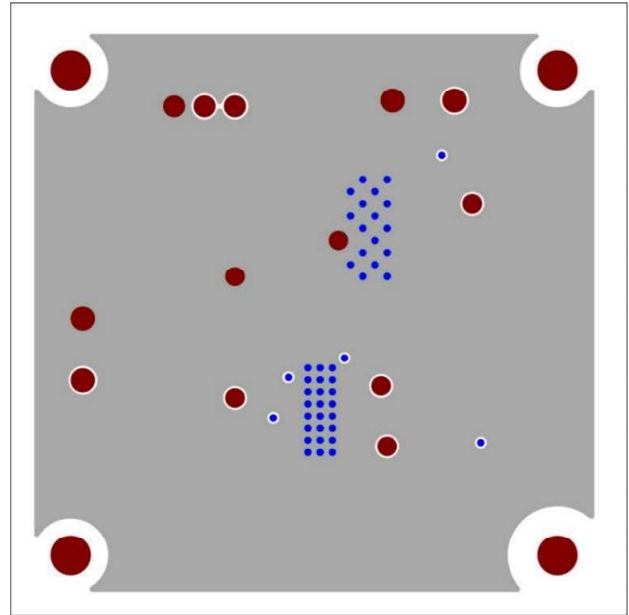(Top View)
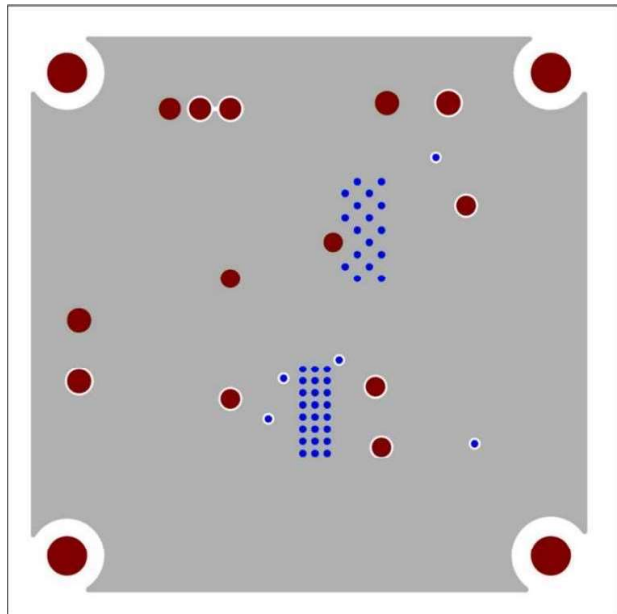

Figure 4. Middle1 Layer Layout
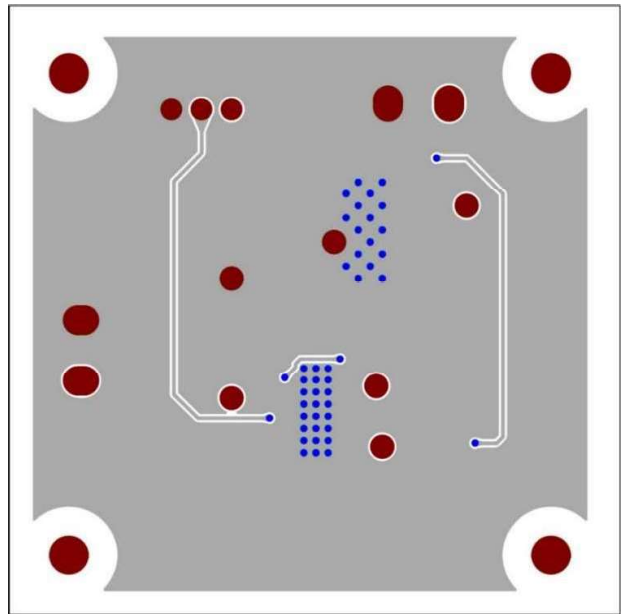(Top View)

Figure 5. Middle2 Layer Layout
(Top view)

Figure 6. Bottom Layer Layout
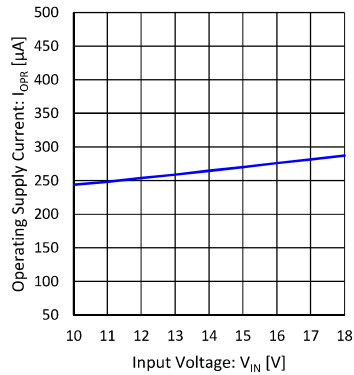(Top view)

Reference application data

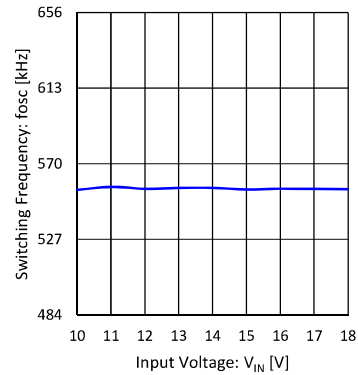Figure 7. Operating quiescent current vs Input Voltage
(VOUT=5V, IOUT=0A)

Figure 8. Switching frequency vs Input Voltage
(VOUT=5V, IOUT=1A)

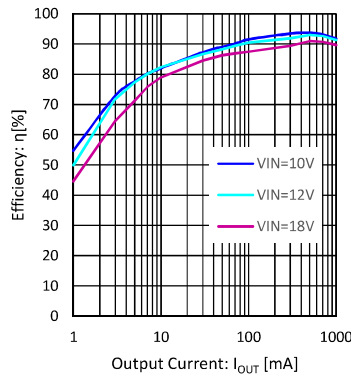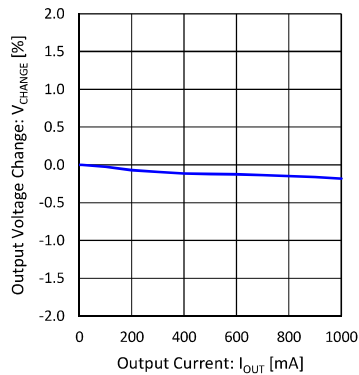Figure 9. Efficiency vs Output current(VOUT=5V)

Figure 10. VOUT Load regulation
(VIN=12V, VOUT=5V)
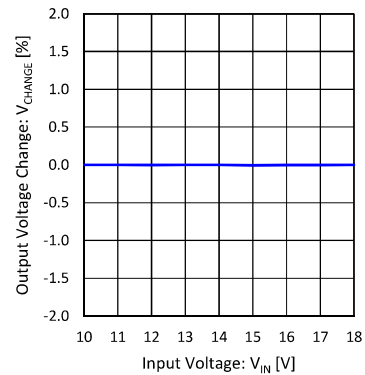

Figure 11. VOUT Line regulation
(VOUT=5V, IOUT=1A)

Reference application data - continued
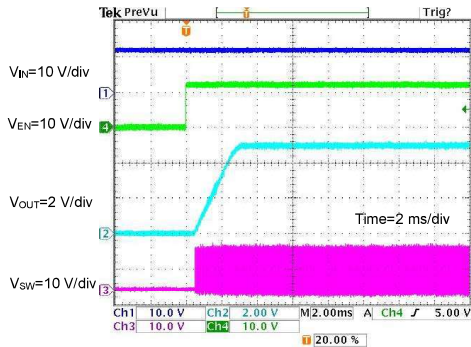

Figure 12. Rise-up waveform
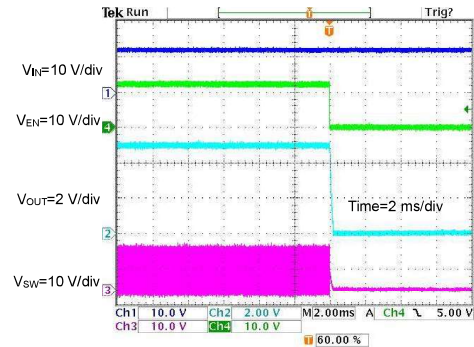($V_{EN}=0V \rightarrow 5V$, $I_{OUT}=1A$)

Figure 13. Shut-down waveform
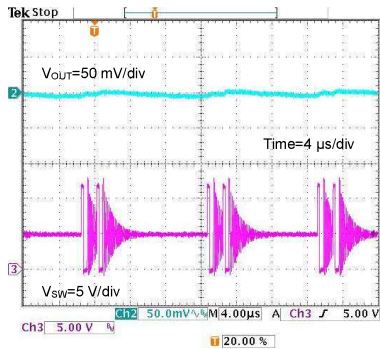($V_{EN}=5V \rightarrow 0V$, $I_{OUT}=1A$)

Figure 14. SW waveform
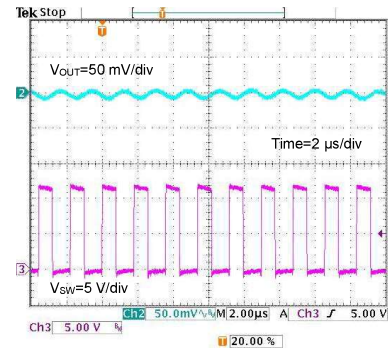($V_{IN}=12V$, $V_{OUT}=5V$, $I_{OUT}=10mA$)

Figure 15. SW waveform
($V_{IN}=12V$, $V_{OUT}=5V$, $I_{OUT}=1A$)

Revision History

Date	Revision Number	Description
17. Sep. 2020	001	Initial release

Notes

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