Switching Regulator Series

Buck Converter with Integrated FET BD9E302EFJ EVK

BD9E302EFJ-EVK-001 (12V→5V, 3A)

Introduction

This user's guide will provide the necessary steps to operate the EVK of ROHM's BDE302EFJ 1channel Buck DC/DC converter. This include the external parts, operating procedures and application data.

Description

BD9E302EFJ-EVK-001 Evaluation board delivers an output 5 volts from an input 7.2 to 28 volts using BD9E302EFJ, a synchronous rectification step-down DC/DC converter integrated circuit, with output current rating of maximum 3A. It adopts a SLLM™ (Simple Light Load Mode) control system which can operate low power consumption in light load condition. It has a soft start function to prevent rush current at startup, UVLO (under voltage lock out), TSD (thermal shutdown detection), OCP (over current protection) and OVP (over voltage protection) protection functions.

Application

Consumer applications such as home appliance

Secondary power supply and Adapter equipment

Telecommunication devices

Operating Limits

These are representative values, and it is not a guaranteed against the characteristics.

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage Range	7.2		28.0	V	
Output Voltage		5.0		V	R1=430kΩ, R2=82kΩ
Output Current Range			3.0	A	
Operating Frequency		550		kHz	
Maximum Efficiency		91		%	V_{IN}=12V, I_{OUT}=1A

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EVK

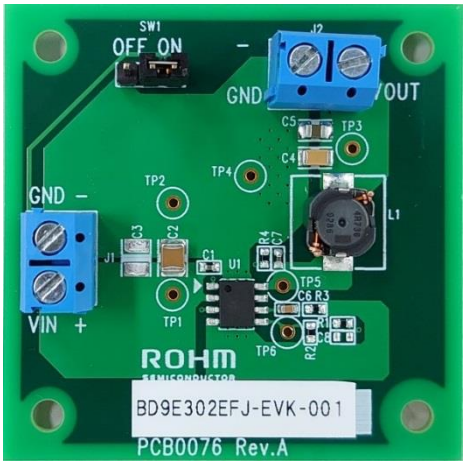

Figure 1. BD9E302EFJ-EVK-001
(Top View)

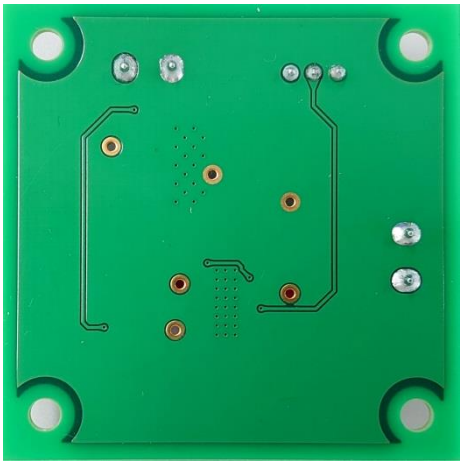

Figure 2. BD9E302EFJ-EVK-001
(Bottom View)

EVK Schematic

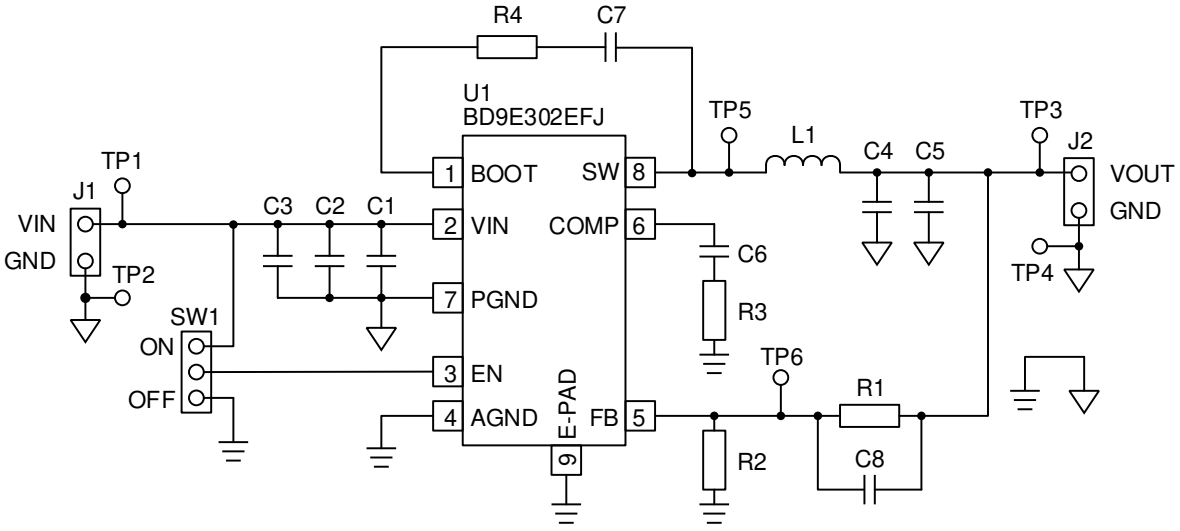

Figure 3. BD9E302EFJ-EVK-001 Circuit Diagram

Operation Procedure

Below is the procedure to operate the EVK.

1. Turn off the power supply and connect power supply's GND pin to the GND pin of the terminal block J1.
2. Connect the power supply's VCC pin to the VIN pin of the terminal block J1.
3. Check if the shunt jumper of SW1 is at position ON (intermediate-terminal connect to H-side terminal, the EN pin of IC is pulled high)
4. Check if the electronic load is turned off and connect the electronic load to the VOUT pin and the GND pin of the terminal block J2.
5. Connect the voltmeter to the VOUT pin and the GND pin of the terminal block J2.
6. Turn on the power supply and check if the measured value of the voltmeter is 5V.
7. Turn on the electronic load.

Notes:

The board does not support hot plugging protection. Do not perform hot plugging on this board.

Enable-Pin

To minimize current consumption during standby-mode and normal operation, Enable-mode can be switched by controlling EN pin (3pin) 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 0.8V, and normal-mode operation when it is over 2.5V.

Bill of Materials

Table 1. Bill of Materials

Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
C1, C7	Ceramic Capacitor	0.1µF	50V, X5R, ±10%	GRM155R61H104KE14	MURATA	1005
C2	Ceramic Capacitor	10µF	100V, X7S, ±10%	GRM32EC72A106KE05	MURATA	3225
C3	Ceramic Capacitor	-	Not installed	-	-	-
C4, C5	Ceramic Capacitor	22µF	25V, X5R, ±20%	TMK212BBJ226MG-TT	TAIYO YUDEN	2012
C6	Ceramic Capacitor	6800pF	50V	-	-	1608
C8	Ceramic Capacitor	-	Not installed	-	-	-
L1	Inductor	4.7µH	±30%, DCR=23mΩmax, 4.1A	CLF7045NIT-4R7	TDK	7470
R1	Resistor	430kΩ	1/16W, ±1%	-	-	1005
R2	Resistor	82kΩ	1/16W, ±1%	-	-	1005
R3	Resistor	10kΩ	1/16W, ±1%	-	-	1005
R4	Resistor	0Ω	Jumper	-	-	1005
SW1	Pin header	-	2.54mm × 3 contacts	61300311121	Wurth Elektronik	-
U1	IC	-	Buck DC/DC Converter	BD9E302EFJ	ROHM	HTSOP-J8
J1, J2	Terminal Block	-	2 contacts, 15A, 14 to 22AWG	691102710002	Wurth Elektronik	-
-	Jumper	-	Jumper pin for SW1	60900213421	Wurth Elektronik	-

Board Layout

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

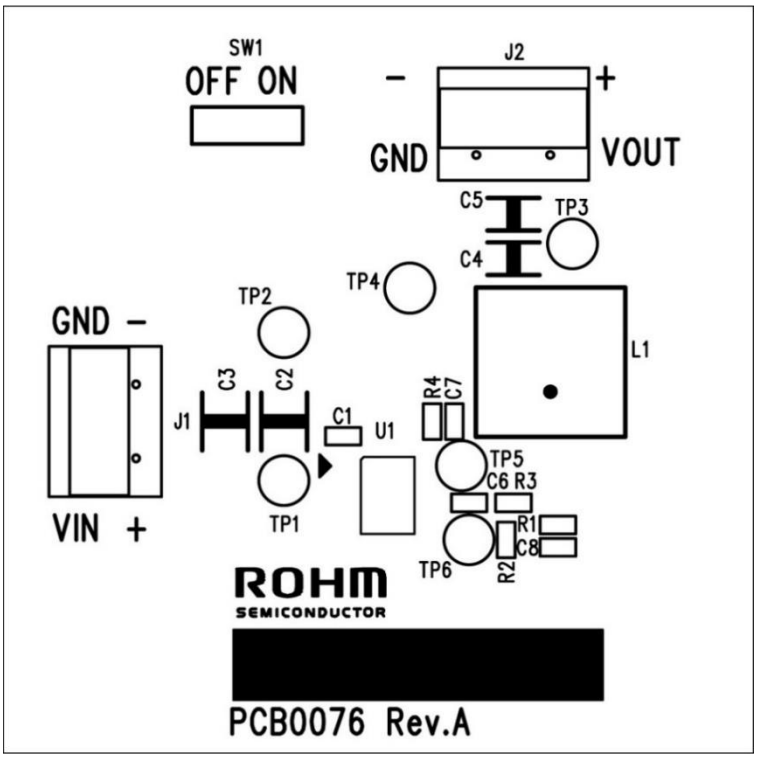

Figure 5. Top Silk Screen (Top view)

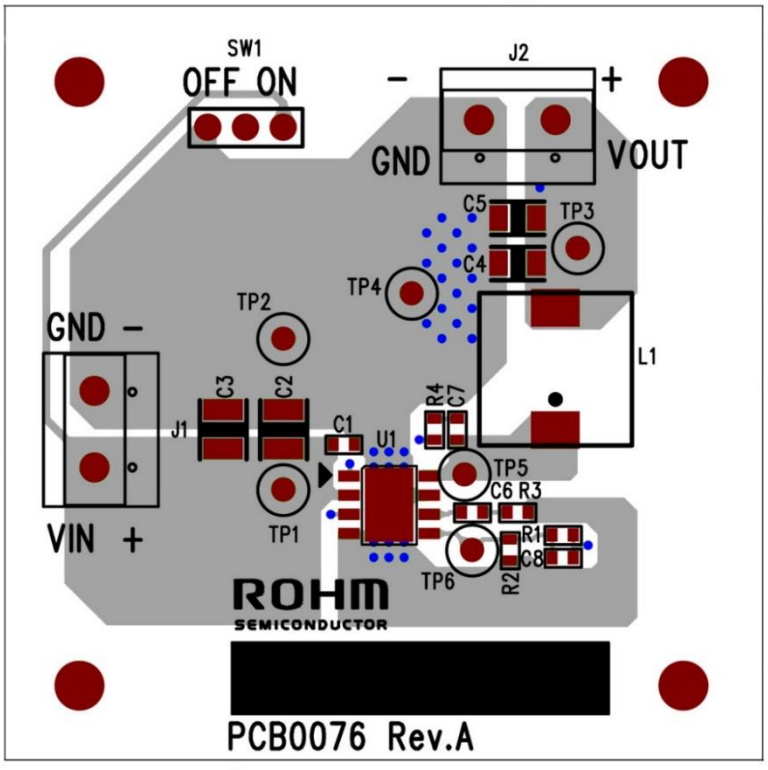

Figure 6. Top Silk Screen and Layout (Top view)

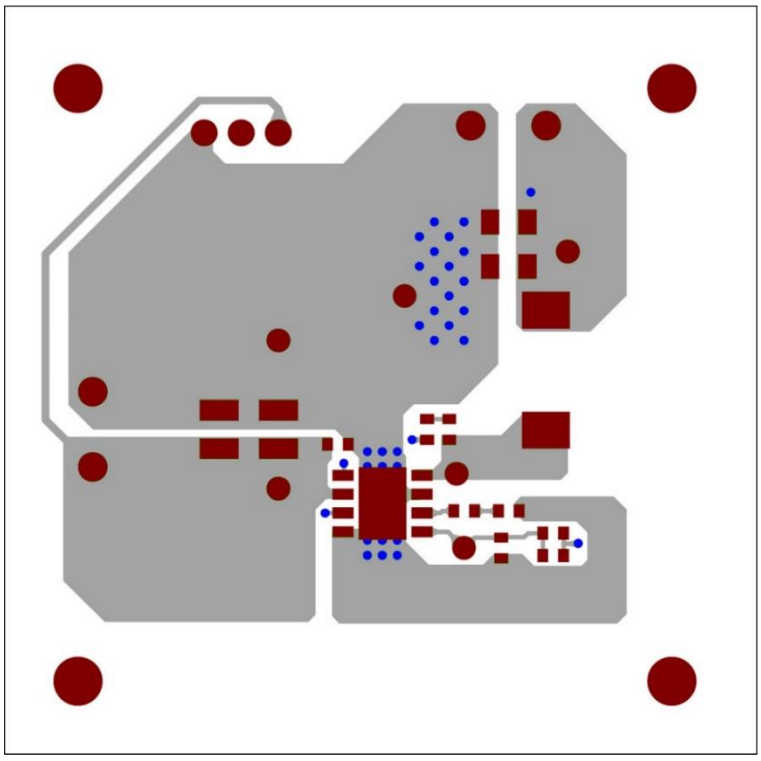

Figure 7. Top Side Layout (Top view)

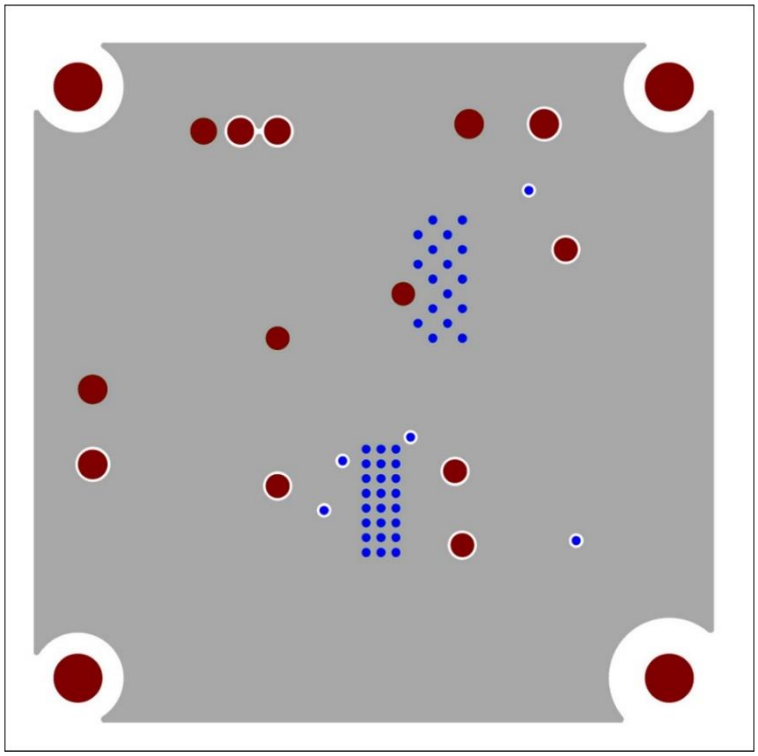

Figure 8. Middle1 Layer Layout (Top view)

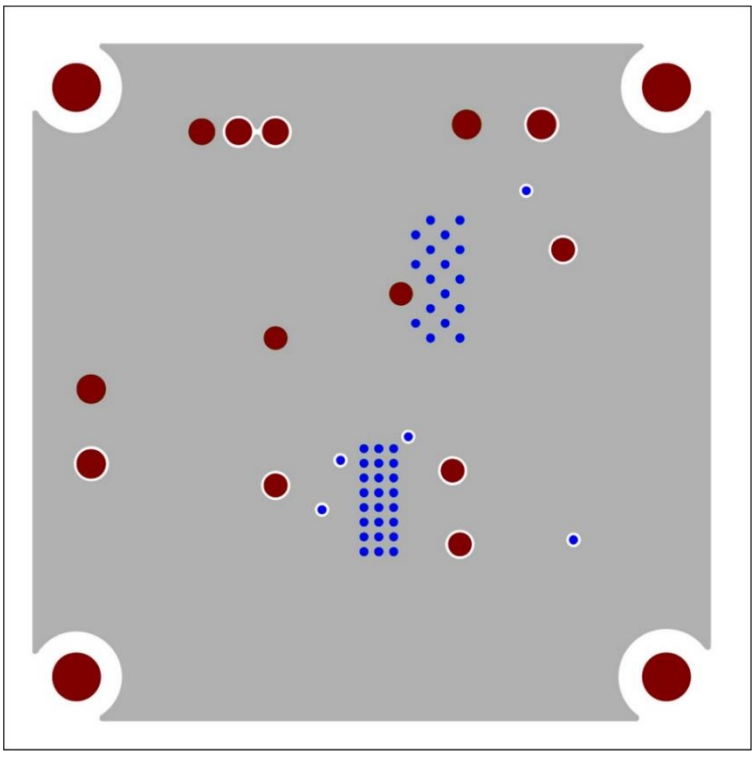

Figure 9. Middle2 Layer Layout (Top view)

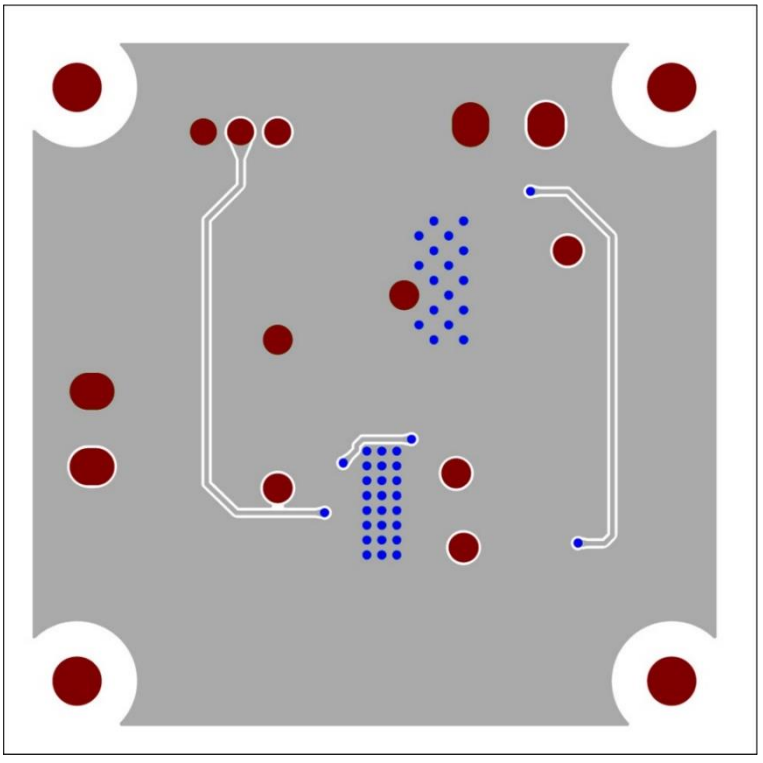

Figure 10. Bottom Side Layout (Top view)

Reference Application Data

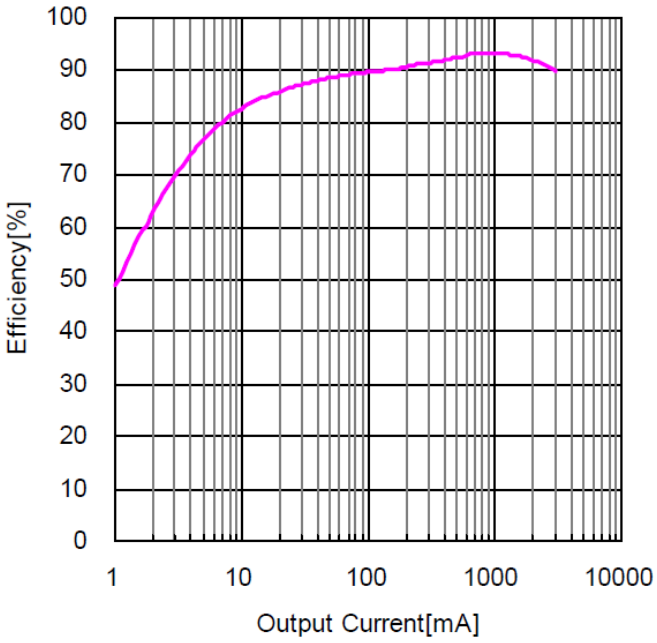

Figure 11. Efficiency vs Load Current
(V_{IN}=12V)

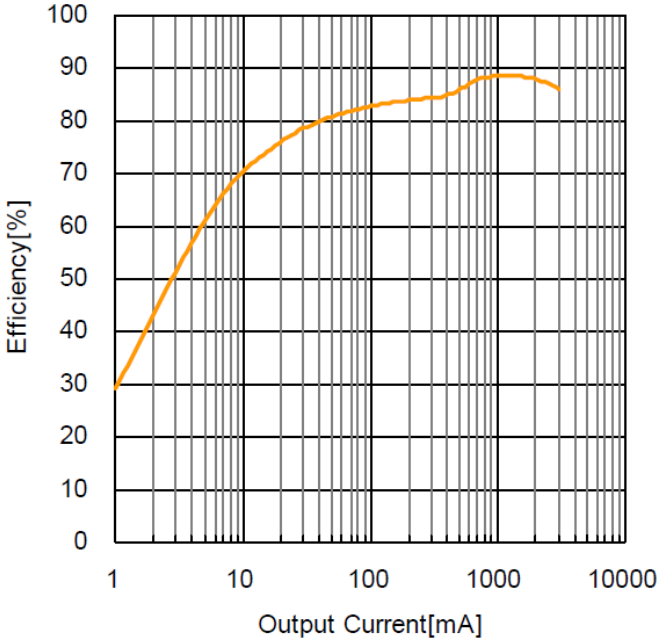

Figure 12. Efficiency vs Load Current
(V_{IN}=24V)

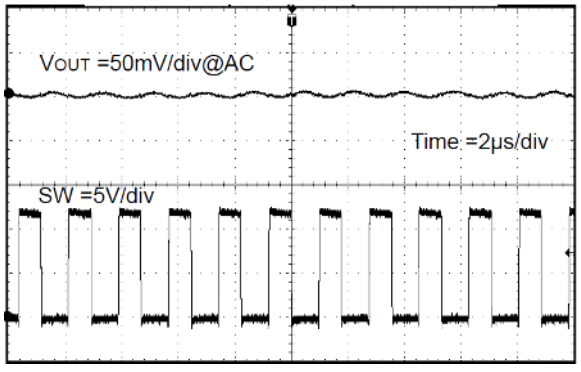

Figure 13. Output Voltage Ripple Wave
(V_{IN}=12V)

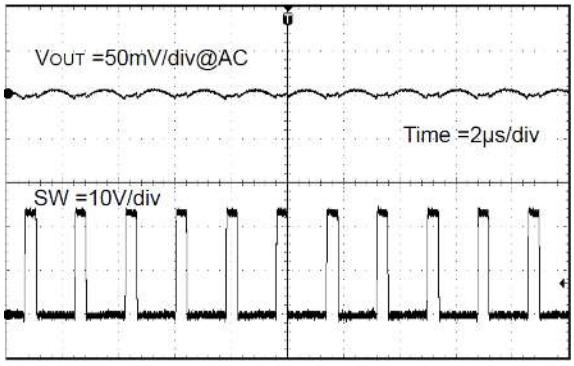

Figure 14. Output Voltage Ripple Wave
(V_{IN}=24V)

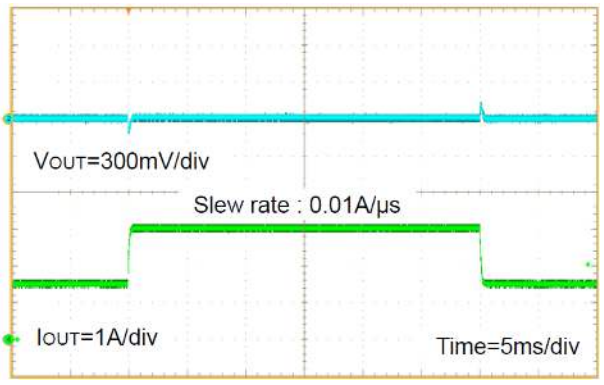

Figure 15. Load Transient Characteristics
(V_{IN} = 12V, I_{OUT} = 1.5A - 3A)

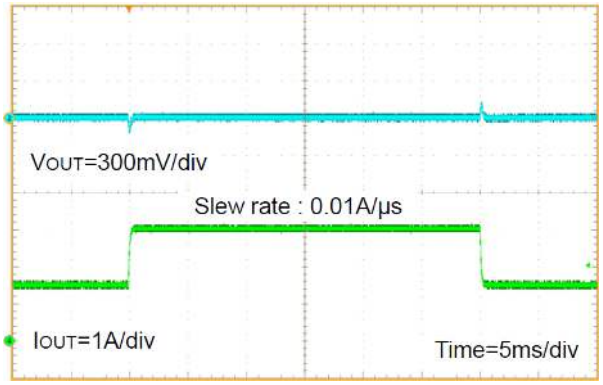

Figure 16. Load Transient Characteristics
(V_{IN} = 24V, I_{OUT} = 1.5A - 3A)

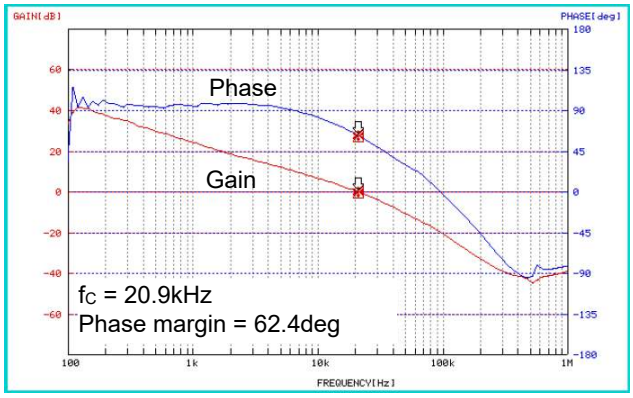

Figure 17. Loop Response
(V_{IN} = 12V, I_{OUT} = 3A)

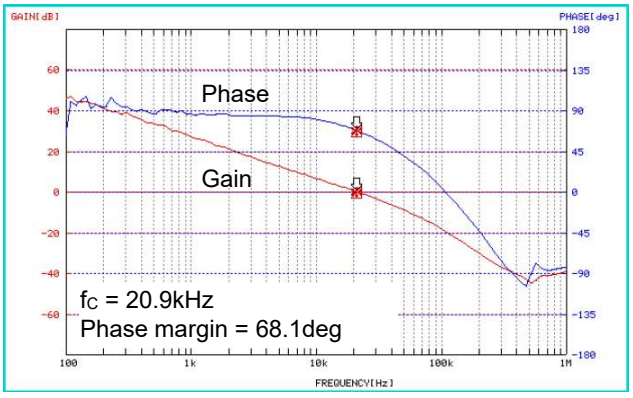

Figure 18. Loop Response
(V_{IN} = 24V, I_{OUT} = 3A)

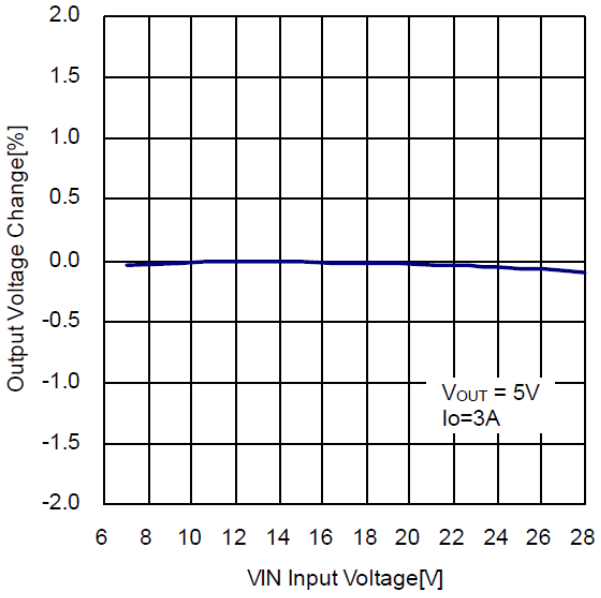

Figure 19. V_{OUT} Line Regulation

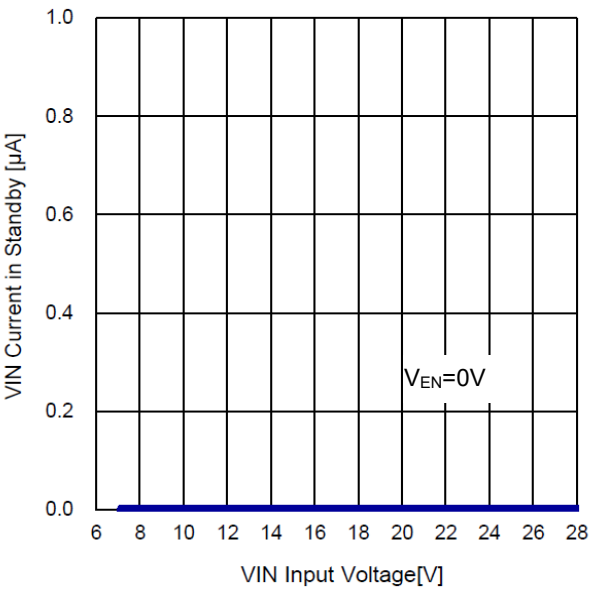

Figure 20. V_{IN} Current in Standby

Revision History

Date	Revision Number	Description
22. Jul. 2020	001	Initial release
27. Sep. 2021	002	P.2 Update Figure 3. BD9E302EFJ-EVK-001 Circuit Diagram

Notes

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