Switching Regulator Series

Buck Converter with Integrated FET BD9A201FP4-LBZ EVK

BD9A201FP4-EVK-001 (5V→1.8V, 2.0A)

Introduction

This user's guide provides the necessary steps to operate the EVK of ROHM's BD9A201FP4-LBZ 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 BD9A201FP4-LBZ and outputs 1.8V from 5V input voltage. The BD9A201FP4-LBZ accepts a power supply input range of 2.7V to 5.5V and generates output voltage ranging from 0.8V to 0.7 x V_{IN} using external resistors. The operating frequency is fixed at 1000 kHz. 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, OVP(Over Voltage Protection), UVLO (Under Voltage Lock Out), TSD (Thermal Shutdown Detection), SCP (Short Circuit Protection) and OCP (Over Current Protection).

Application

Industrial Equipment
Products for Industrial Equipment such as NC Machine Tools
Secondary Power Supply and Adapter Equipment
Communication Infrastructure Equipment

Operating Limits

Table 1. Operating Limits

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage	2.7	5.0	5.5	V	
Output Voltage		1.8		V	
Output Current Range			2.0	A	
Operating Frequency		1000		kHz	
Maximum Efficiency		91		%	
UVLO Detect Voltage		2.45		V	VCC sweep down
UVLO Hysteresis Width		100		mV	

No. 63UG151E Rev.001
APR.2021

EVK

Figure 1. BD9A201FP4-EVK-001(Top View)

EVK Schematic

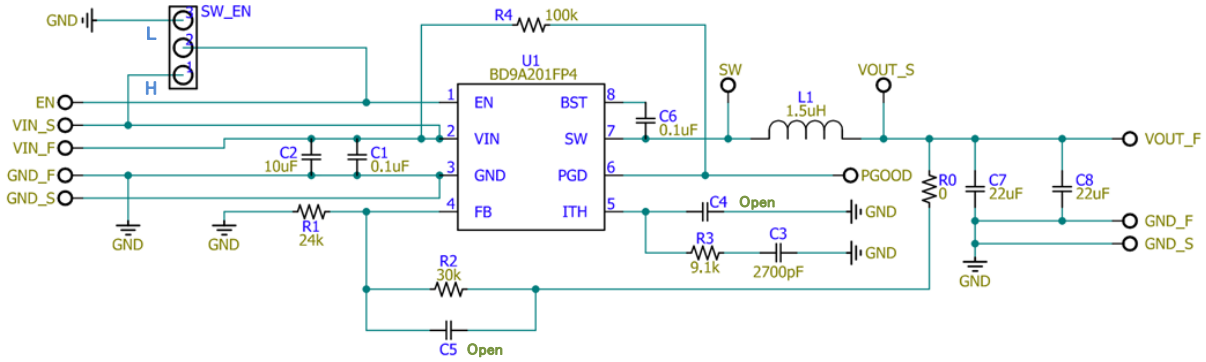

Figure 2. BD9A201FP4-EVK-001 Circuit Diagram

Operating Procedure

1. Turn off the DC power supply and connect the GND terminal of the power supply to the GND_F terminal of the EVK.
2. Connect the positive terminal of the DC power supply to the VIN_F pin of the EVK.
3. Connect the load to the VOUT_F and GND_F terminals 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 VOUT_S terminal and the GND terminal to the EVK's GND_S terminal.
5. Connect the jumper of SW_EN to H side.
6. Turn on the DC power supply. Make sure the voltmeter shows 1.8V.
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 BD9A201FP4-LBZ condition selectable using SW_EN.

Table 2. SW_EN Settings

SW_EN state	BD9A201FP4-LBZ Condition
H (short to VIN)	Enable
L (short to GND)	Shutdown

Parts list

Table 3. Parts list

Count	Parts No.	Type	Value	Description	Manufacturer Part Number	Manufacturer	Size [Unit: mm(inch)]
IC							
1	U1	DCDC	-	Buck Converter	BD9A201FP4-LBZ	ROHM	2.8 x 2.92 (0.110x0.114)
Inductor							
1	L1	Inductor	1.5µH	±20%,4.3A DCR=30.6mΩmax,	FDSD0420-H-1R5M	MURATA	4040(1616)
Capacitor							
2	C1, C6	MLCC	0.1µF	50V, X5R, ±10%	GRM155R61H104KE19D	MURATA	1005(0402)
1	C2	MLCC	10µF	10V, X5R, ±10%	CC0805KKX5R6BB106	YAGEO	2012(0805)
1	C3	MLCC	2700pF	50V, X7R, ±10 %	CC0402KRX7R9BB272	YAGEO	1005(0402)
2	C4, C5	MLCC	OPEN	-	-	-	-
2	C7, C8	MLCC	22µF	6.3V, X7R, ±10%	GRM31CR70J226KE19L	MURATA	3216(1206)
Resistor							
1	R0	Resistor	0Ω	1/16W, 50V, ±5%	MCR01MZPJ000	ROHM	1005(0402)
1	R1	Resistor	24kΩ	1/16W, 50V, ±1%	MCR01MZPF2402	ROHM	1005(0402)
1	R2	Resistor	30kΩ	1/16W, 50V, ±1%	MCR01MZPF3002	ROHM	1005(0402)
1	R3	Resistor	9.1kΩ	1/16W, 50V, ±1%	MCR01MZPF9101	ROHM	1005(0402)
1	R4	Resistor	100kΩ	1/16W, 50V, ±1%	MCR01MZPF1003	ROHM	1005(0402)
Connector							
1	SW_EN	Pin header	-	2.54mm × 3 contacts	68000-103HLF	Amphenol ICC	-
1	SW_EN	Jumper	-	Jumper pin for SW_EN	MJ254-6BK	USECONN	-
Contact pin							
11	VIN_F, VIN_S, VOUT_F, VOUT_S, GND_F, GND_S, EN, PGOOD, SW	Test Pin	-	Turret Terminal L=5.56mm	1502-2	Keystone Electronics	-

The product and manufacturer names listed in the parts list are current at the time this application note was prepared, and some parts may not be available. Please select the equivalent product based on the characteristics listed in the table. Select a ceramic capacitor with the same actual capacitance in consideration of the DC bias characteristics.

Board Layout

EVK PCB information

Number of Layers	Material	Board Size	Copper Thickness
4	FR-4	70mm x 70mm x 1.6mmt	1oz (35µm)

The layout of BD9A201FP4-EVK-001 is shown below.

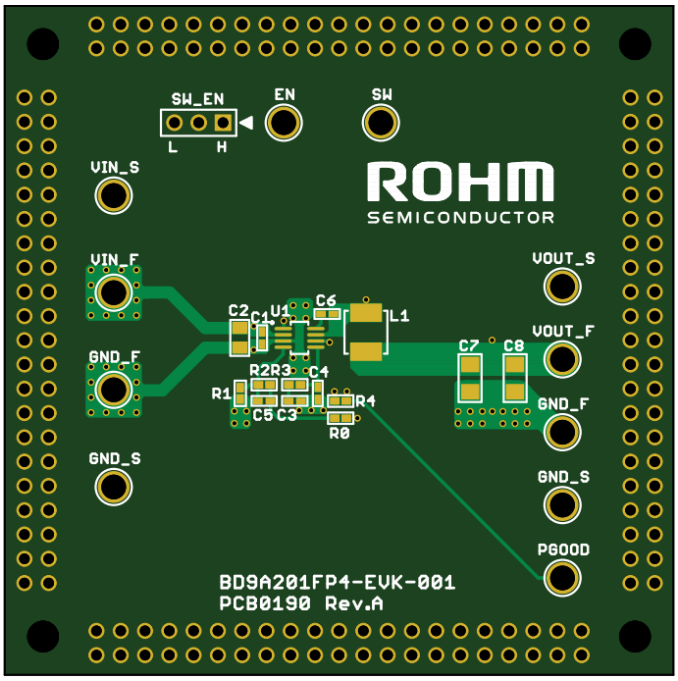

Figure 3. Top PCB Image
(Top View)

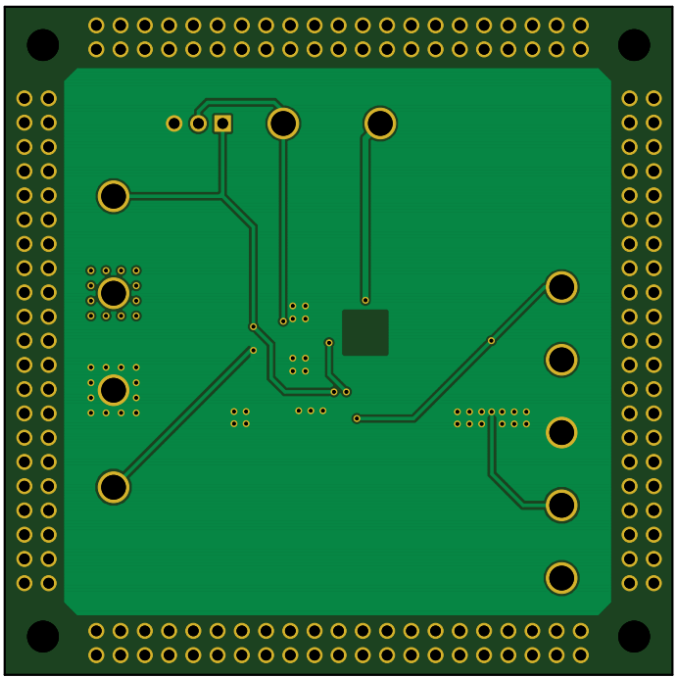

Figure 4. Bottom PCB Image
(Top View)

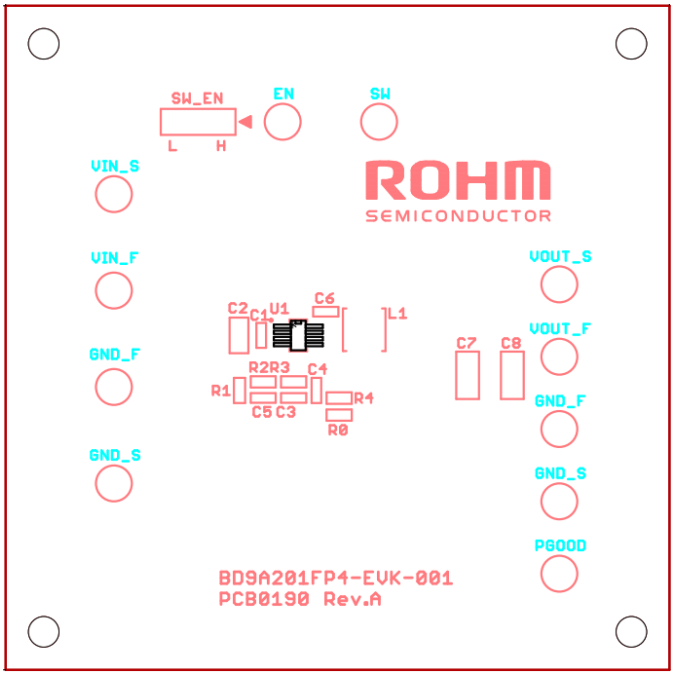

Figure 5. Top Silkscreen Layout
(Top View)

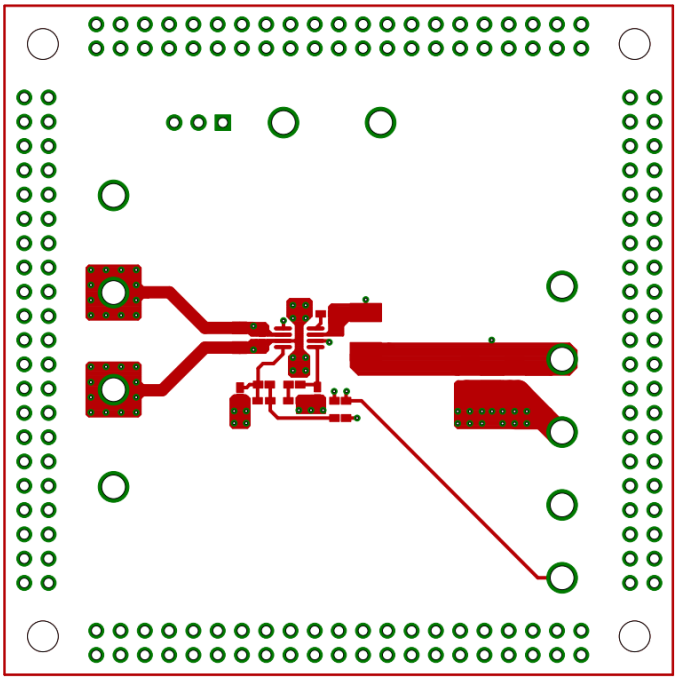

Figure 6. Top Layer Layout
(Top view)

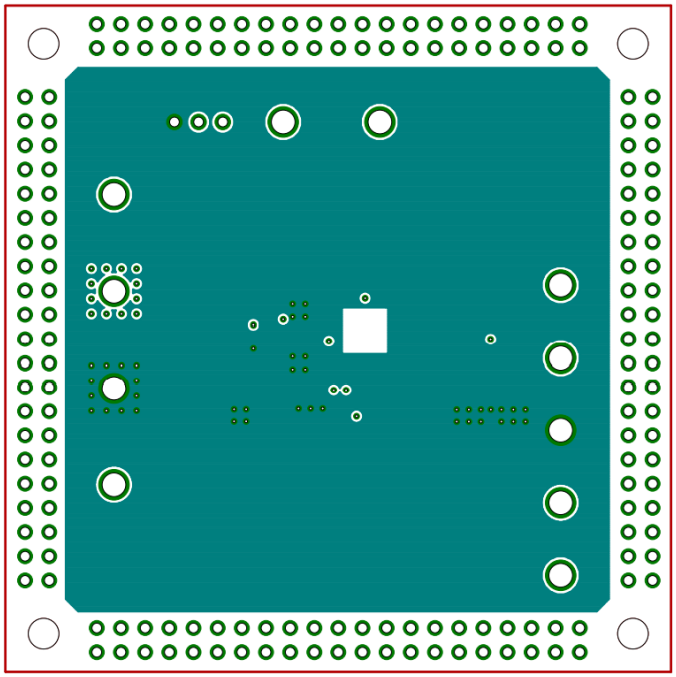

Figure 7. Middle1 Layer Layout
(Top View)

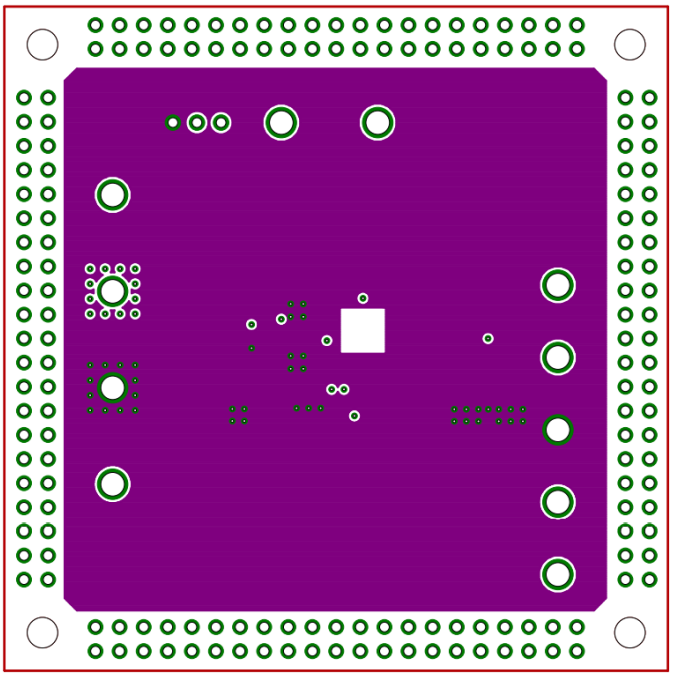

Figure 8. Middle2 Layer Layout
(Top View)

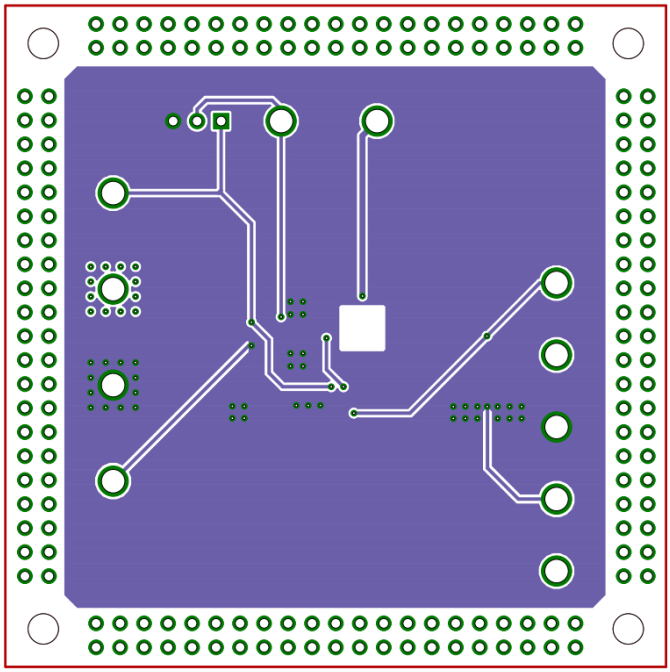

Figure 9. Bottom Layer Layout
(Top View)

Reference Application Data

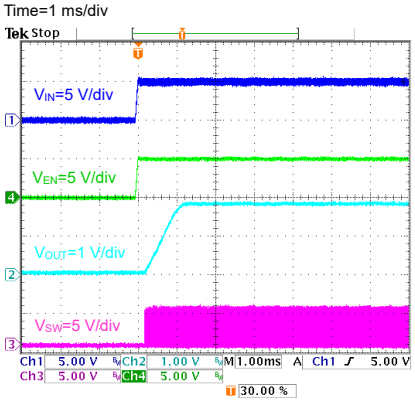

Figure 10. Start-up at R_{LOAD} = 0.9 Ω
(V_{IN} = 5 V, V_{EN} = V_{IN}, V_{OUT} = 1.8 V)

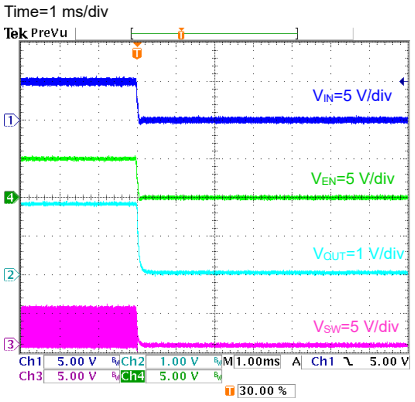

Figure 11. Shutdown at R_{LOAD} = 0.9 Ω
(V_{IN} = 5 V, V_{EN} = V_{IN}, V_{OUT} = 1.8 V)

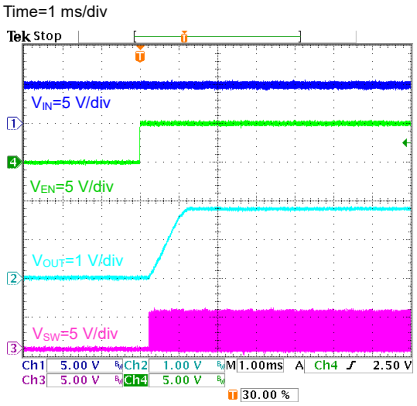

Figure 12. Start-up at R_{LOAD} = 0.9 Ω
(V_{IN} = 5 V, V_{EN} = 0 V to 5 V, V_{OUT} = 1.8 V)

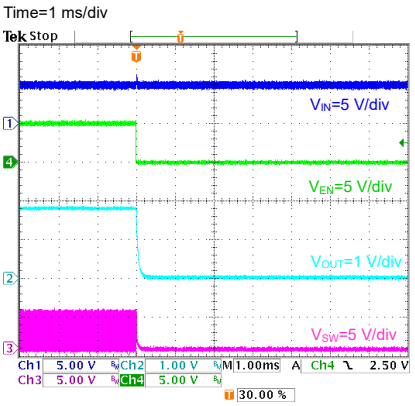

Figure 13. Shutdown at R_{LOAD} = 0.9 Ω
(V_{IN} = 5 V, V_{EN} = 5 V to 0 V, V_{OUT} = 1.8 V)

Reference Application Data - continued

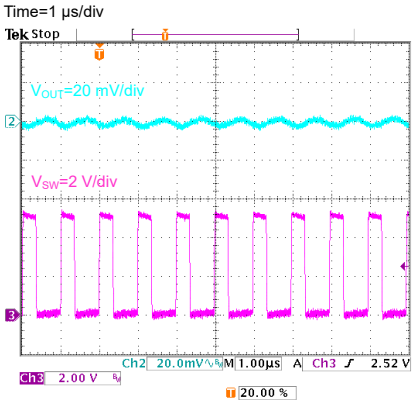

Figure 14. Output Voltage Ripple
(V_{IN} = 5 V, V_{OUT} = 1.8 V, I_{OUT} = 0 A)

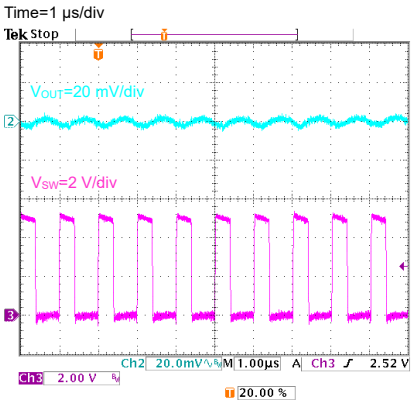

Figure 15. Output Voltage Ripple
(V_{IN} = 5 V, V_{OUT} = 1.8 V, I_{OUT} = 2 A)

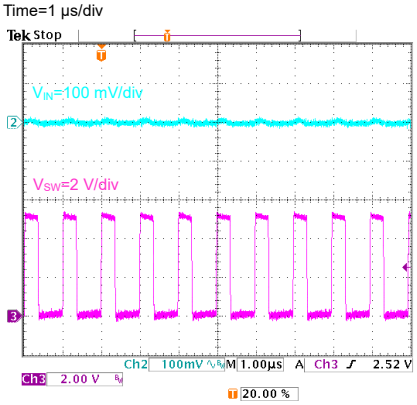

Figure 16. Input Voltage Ripple
(V_{IN} = 5 V, V_{OUT} = 1.8 V, I_{OUT} = 0 A)

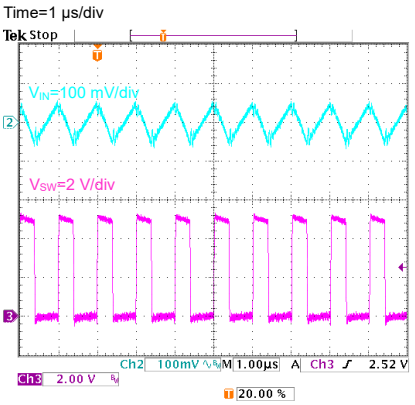

Figure 17. Input Voltage Ripple
(V_{IN} = 5 V, V_{OUT} = 1.8 V, I_{OUT} = 2 A)

Reference Application Data - continued

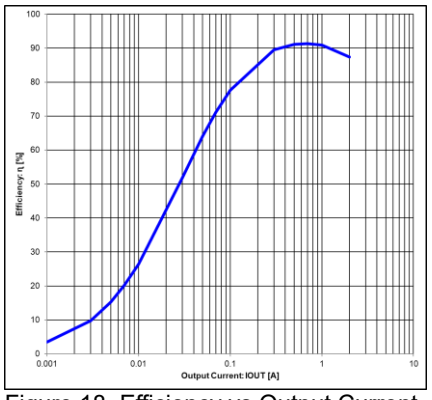

Figure 18. Efficiency vs Output Current
(V_{IN} = 5 V, V_{OUT} = 1.8 V)

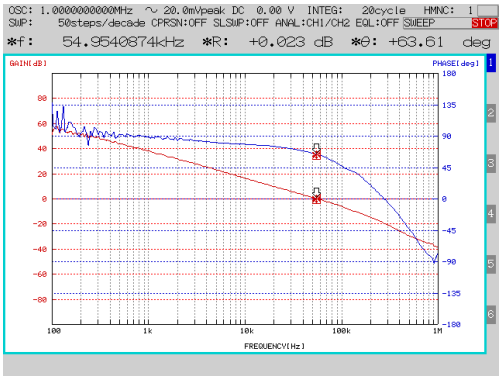

Figure 19. Frequency Characteristics
(V_{IN} = 5 V, V_{OUT} = 1.8 V, I_{OUT} = 1 A)

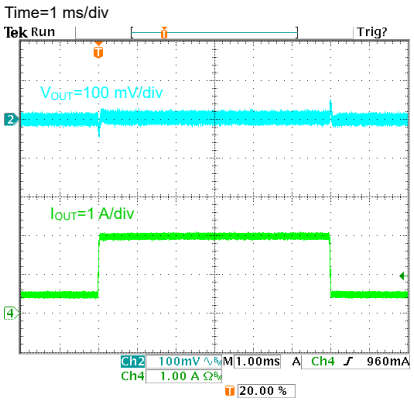

Figure 20. Load Transient Response
(V_{IN} = 5 V, V_{OUT} = 1.8 V, I_{OUT} = 0.5 A to 2.0 A)

Revision History

Date	Revision Number	Description
28. Apr. 2021	001	Initial release

Notes

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