LED Driver for Automotive Panel Backlight

4ch White LED Driver Built-in Current Driver Boost DC/DC Converter for Automotive BD81A74EFV-M Evaluation Board

BD81A74EFV-TSB-001

Introduction

This user's guide will provide the necessary steps to operate the Evaluation Board of ROHM's BD81A74EFV-M LED Driver. This document includes the external parts, operating procedures and application data.

Description

This Evaluation Board was developed for ROHM's LED Driver BD81A74EFV-M. BD81A74EFV-M is a white LED driver with the capability of withstanding high input voltage (maximum 35 V). This driver has 4ch constant current drivers in 1-chip, where each channel can draw up to 120 mA (Max), and it is suitable for high illumination LED drive. Furthermore, a boost current mode DC/DC converter is also built to achieve stable operation during power voltage fluctuation. Dimming control (10,000: 1 @ 100 Hz) by PWM input is possible.

Application

Automotive backlight application for CID, cluster panel, car navigation, HUD, or car audio system.

Evaluation board operating condition (default setting)

Table 1. Evaluation board operating condition (default setting)

Parameter	Min	Typ	Max	Unit
Power supply voltage *1	7	13.5	18	V
LEDs in series	6	-	10	pcs
LEDs in parallel	-	4	-	ch
Output voltage *2	20	-	34	V
Output current (per channel)	-	85	-	mA
DC/DC oscillation frequency	-	400 *3	-	kHz
Over voltage limit	-	38	-	V
Over current limit	-	3.9	-	A

*1 This indicates the voltage near the VCC pin. Be careful of voltage drop by the impedance of power line.

*2 Output voltage is determined by the Vf value of the connected LED and the number of series. Since this evaluation board has a boost-configuration, output voltage should be higher than input voltage. Also, output voltage should be lower than OVP voltage.

*3 The default frequency is set to 400kHz so that it is higher than the EMC standard (LW: 150kHz to 300kHz) even if variations and SSCG functions are considered.

Evaluation board

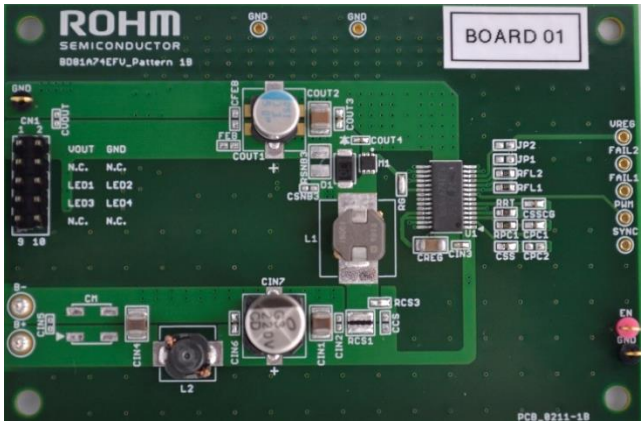

Figure 1. Top view

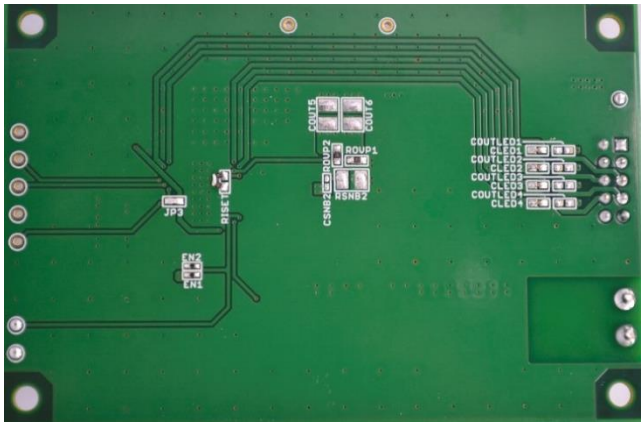

Figure 2. Bottom view

Evaluation board setup

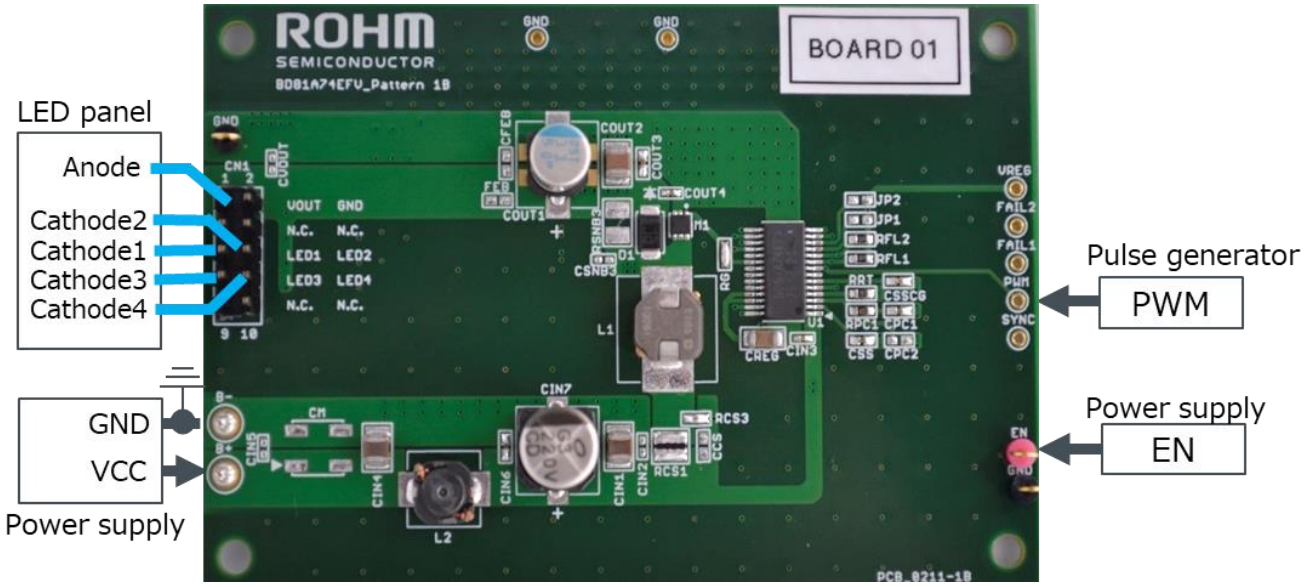

Figure 3. Evaluation board setup

Operating procedure

1. Connect panel or LEDs to evaluation board. (Anode to VOUT-pin. Cathode to LEDx-pin.)
2. Connect power supply to +B-pin and –B-pin of the evaluation board.
3. Connect power supply to EN-pin. It must be less than 7V.
4. Connect pulse generator to PWM-pin. It should be 100Hz to 20kHz and the minimum pulse width must be longer than 1µs.
5. Turn on the power supply for +B-pin.
6. Turn on the power supply for EN-pin.
7. Turn on the pulse generator for PWM-pin.

Operation mode settings

The table below describes the settings for LEDEN1,2, SYNC and SSCG terminals.

Table 2. Mode settings

Terminal	Setting	Function
LEDEN1,2	LEDEN1=High (JP1=short) LEDEN2=High (JP2=short)	LED1=ON, LED2,3,4=OFF
	LEDEN1=Low (JP1=open) LEDEN2=High (JP2=short)	LED1,2=ON, LED3,4=OFF
	LEDEN1=High (JP1=short) LEDEN2=Low (JP2=open)	LED1,2,3=ON, LED4=OFF
	LEDEN1=Low (JP1=open) LEDEN2=Low (JP2=open)	LED1,2,3,4=ON
SYNC	Input clock signal *1	External synchronization oscillation frequency
	Low	Internal oscillation frequency
SSCG	Connect capacitor (Typ.0.01μF)	Enable spread spectrum (Frequency is decided by capacitance)
	Connect to GND	Disable spread spectrum

(Note) Setting=High: the terminal is shorted to VREG, Setting=Low: the terminal is shorted to GND or OPEN.

*1 When using the SYNC pin, the input frequency should be -20% to + 20% of the setting frequency according to the resistance value of the RT pin.

Pin configuration

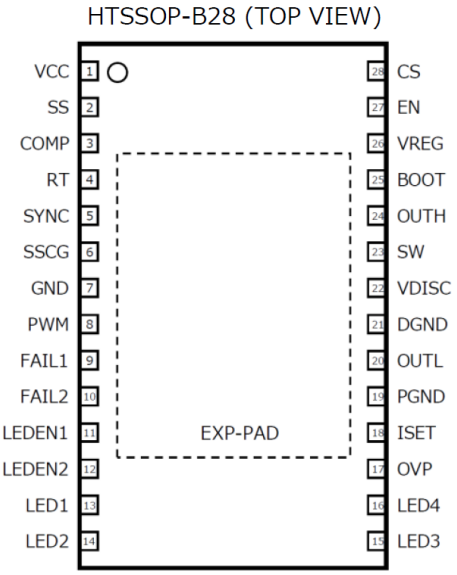

Figure 4. Pin configuration

Evaluation board schematic

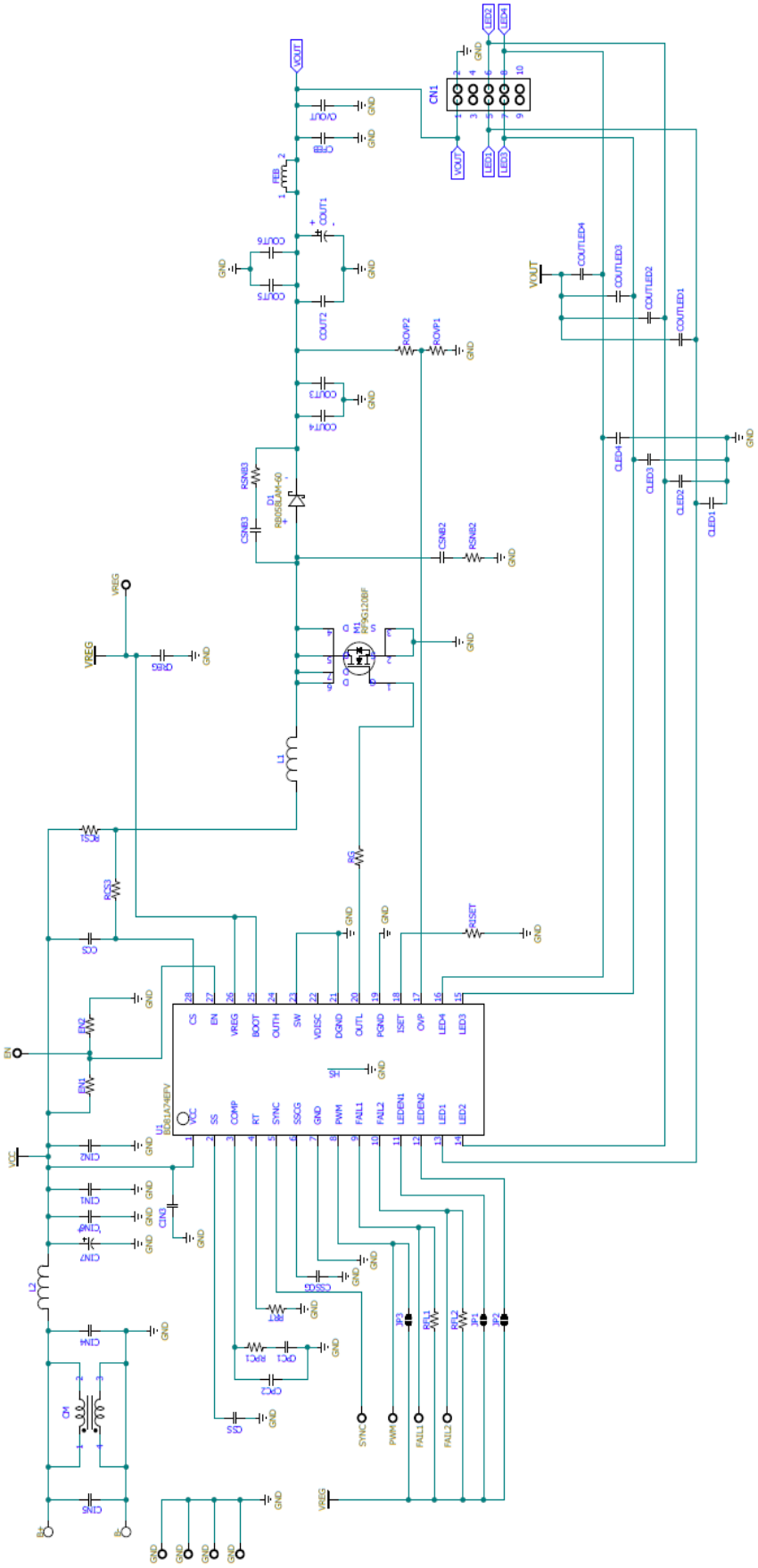

Figure 5. Evaluation board schematic

Parts list

Table 3. Parts list

No	Package	Parameters	Part name(series)	Type	Manufacturer
CIN1	3225	10μF, X7S, 50V	GCM32EC71H106KA01	Ceramic	murata
CIN2	-	Open	-	-	-
CIN3	1005	0.01μF, X7R, 50V	GCM155R11H103KA40	Ceramic	murata
CIN4	3225	10μF, X7S, 50V	GCM32EC71H106KA01	Ceramic	murata
CIN5	-	Open	-	-	-
CIN6	1005	0.1μF, X7S, 50V	GCM155R71H104KE37	Ceramic	murata
CIN7	φ8.0mm×L10.5mm	220uF/35V	UCD1V221MNL1GS	Electrolytic	Nichicon
CM	-	Open	-	-	-
RCS1	3216	51mΩ, 1%, 1W	LTR18EZPFS051	Chip resistor	Rohm
RCS3	-	Short	-	-	-
CCS	-	Open	-	-	-
CSS	1005	0.1μF, X7R, 16V	GCM155R11C104KA40	Ceramic	murata
CPC1	1005	0.047μF, X7R, 50V	GCM155R71H473KE02	Ceramic	murata
RPC1	1608	6.2kΩ, 1%, 1/16W	MCR03EZPFL6202	Chip resistor	Rohm
CPC2	-	Open	-	-	-
RRT1	1608	20kΩ, 1%, 1/10W	MCR03EZPFL2003	Chip resistor	Rohm
RFL1	1608	100kΩ, 1%, 1/10W	MCR03EZPFL1004	Chip resistor	Rohm
RFL2	1608	100kΩ, 1%, 1/10W	MCR03EZPFL1004	Chip resistor	Rohm
CREG	3216	2.2μF, X7R, 50V	GCM31CR71H225KA40	Ceramic	murata
L1	W7.0×H4.5×L7.4mm	15μH, 4.5A	SPM7054VT-150M	Inductor	TDK
M1	W2.0×H1.0×L2.0mm	40V/12A	RF9G120BFHZG	MOSFET	Rohm
L2	W6.0×H4.5×L6.3mm	3.3μH	CLF6045NIT-3R3N-D	Inductor	TDK
D1	W4.7×H0.95×2.5mm	60V/5A	RB088LAM-60	SBD	Rohm
COUT1	φ6.3mm×L7.7mm	33μF, ±20%. 50V	50HVPF33M	Hybrid	SunCon
COUT2	3225	10μF, X7S, 50V	GCM32EC71H106KA01	Ceramic	murata
COUT3	1005	0.1μF, X7R, 50V	GCM155R71H104KE37	Ceramic	murata
COUT4	1005	0.01μF, X7R, 50V	GCM155R11H103KA40	Ceramic	murata
COUT5	-	Open	-	-	-
COUT6	-	Open	-	-	-
ROVP1	1608	20kΩ, 1%, 1/10W	MCR03EZPFL2003	Chip resistor	Rohm
ROVP2	1608	360kΩ, 1%, 1/10W	MCR03EZPFL3604	Chip resistor	Rohm
RISET (Series)	1608	20kΩ, 1%, 1/16W	MCR03EZPFL2003	Chip resistor	Rohm
	1608	39kΩ, 1%, 1/16W	MCR03EZPFL3903	Chip resistor	Rohm
CLED1	1005	1000pF, X7R, 50V	GCM155R71H102KA37	Ceramic	murata
CLED2	1005	1000pF, X7R, 50V	GCM155R71H102KA37	Ceramic	murata
CLED3	1005	1000pF, X7R, 50V	GCM155R71H102KA37	Ceramic	murata
CLED4	1005	1000pF, X7R, 50V	GCM155R71H102KA37	Ceramic	murata
JP1	-	Open	-	-	-
JP2	-	Open	-	-	-
JP3	-	Short	-	-	-
CSSCG	1005	0.01μF, X7R, 50V	GCM155R11H103KA40	Ceramic	murata
EN1	1005	120kΩ, 1%, 1/16W	MCR01MZPFL1204	Chip resistor	Rohm
EN2	1005	39kΩ, 1%, 1/16W	MCR01MZPFL3903	Chip resistor	Rohm

Parts list - continued

Table 3. Parts list - continued

No	Package	Parameters	Part name(series)	Type	Manufacturer
RG	-	Short	-	-	-
CSNB2	-	Open	-	-	-
CSNB3	-	Open	-	-	-
RSNB2	-	Open	-	-	-
RSNB3	-	Open	-	-	-
FEB	-	Open	-	-	-
CFEB	-	Open	-	-	-
CVOUT	-	Open	-	-	-
COUTLED1	-	Open	-	-	-
COUTLED2	-	Open	-	-	-
COUTLED3	-	Open	-	-	-
COUTLED4	-	Open	-	-	-

Board layout

Evaluation board PCB information

Material	FR-4 High TG
Board thickness	1.6mm
Copper thickness	1 oz
Number of layers	4
Board size	60X90mm
Minimum copper width	0.15mm
Minimum air gap	0.15mm
Minimum hole size	0.3mm

The layout of BD81A74EFV-M is shown below.

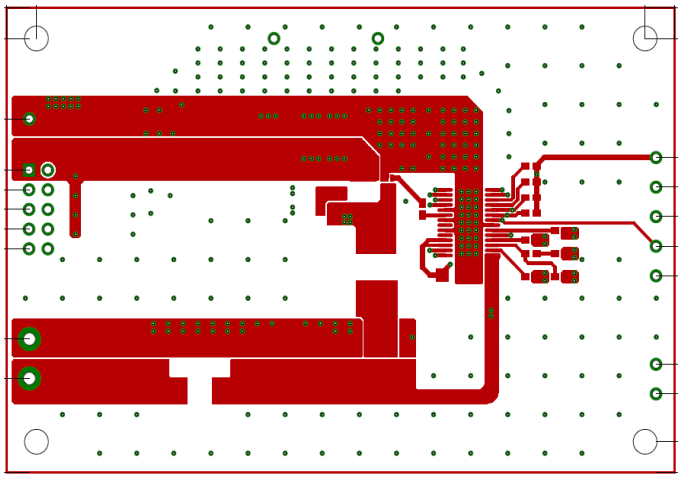

Figure 6. Top layer layout
(Top view)

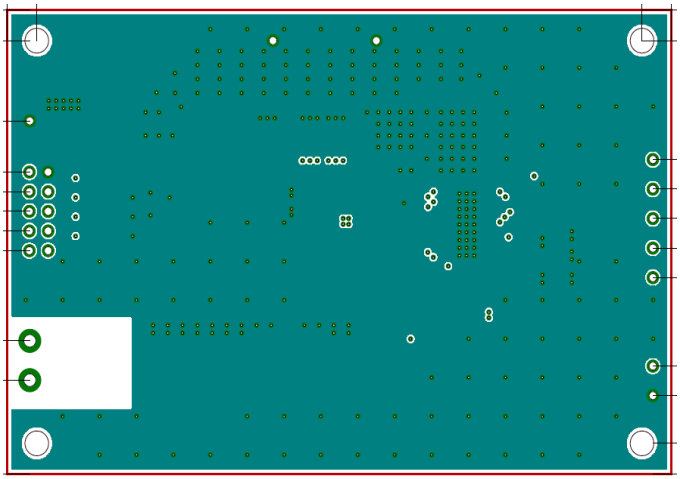

Figure 7. 2nd layer layout
(Top view)

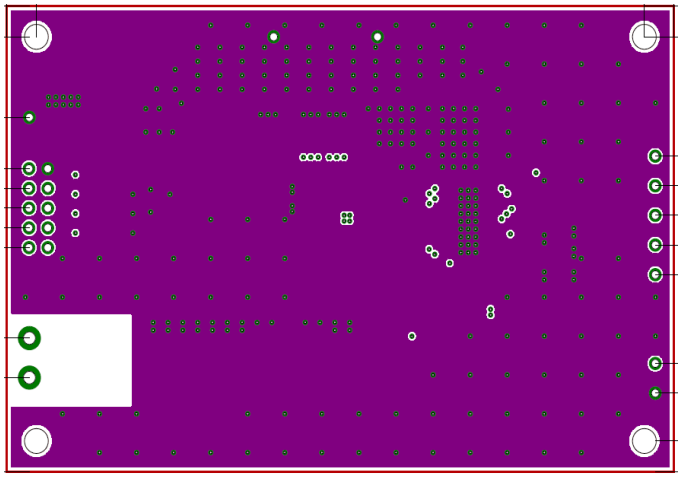

Figure 8. 3rd layer layout
(Top view)

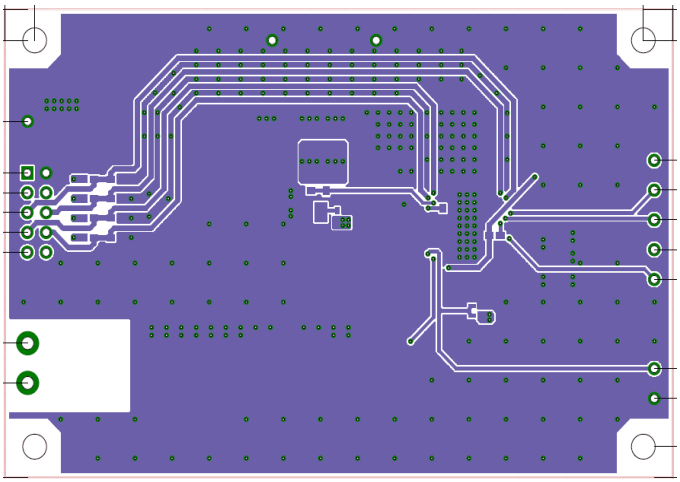

Figure 9. Bottom layer layout
(Top view)

Reference application data

(Ta=25°C, Output voltage=34V)

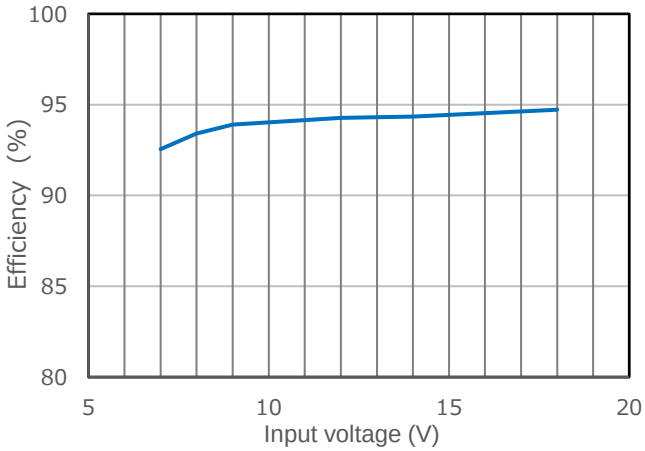

Figure 10. Efficiency vs Input voltage

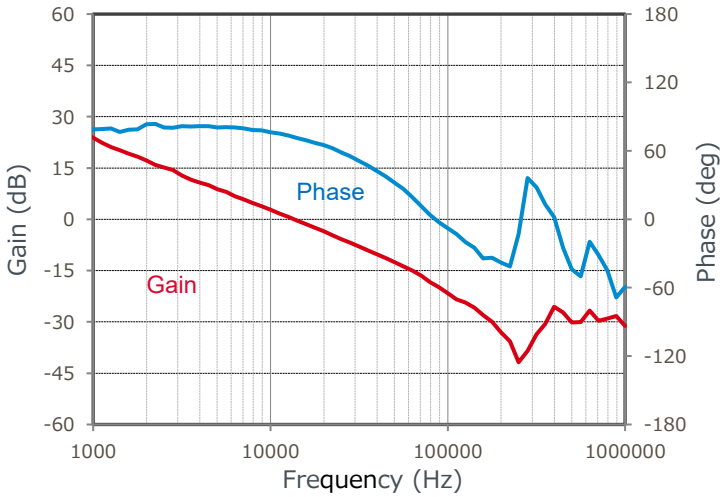

Figure 11. Gain, Phase vs Frequency (VCC=13.5V)

Revision history

Date	Revision number	Description
15. Apr. 2021	001	Initial release

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