Switching Regulator Series

Synchronous Buck-Boost DC/DC Converter BD83070GWL Evaluation Board

BD83070GWL-EVK-002

Introduction

This application note will provide the steps necessary to operate and evaluate ROHM's synchronous buck-boost DC/DC converter using BD83070GWL evaluation board. Component selection and operating procedures are included.

Description

The BD83070GWL converter is a power supply solution designed for battery powered devices. It can operate at pulse frequency modulation (PFM) to suppress loss and current consumption during light load which has 2.8μA quiescent current at no load. Capable to support up to 1A output on pulse width modulation (PWM) and provides high efficiency for heavy load. It is possible to disable auto-PFM/PWM mode by via MODE pin. User can select from 2 preset output voltage via VSEL pin and it changes between buck and boost operations depending on the relation between input voltage and output voltage.

Application

Single Cell Li-ion or 3 Cell NiMH Battery-Powered Portable Products

Tablet Terminal Device

Smartphone

Features

Automation PFM/PWM Mode and Fixed PWM Mode

Input Voltage Range : 2.0 V to 5.5 V

Output Current : Up To 1 A (VIN > 2.7 V, VOUT = 3.3 V)

Selectable Output Voltage : 2.5 V or 3.3 V

Efficiency : Up To 95 %

Switching Frequency : 1.5 MHz(Typ)

Quiescent VIN Current : 2.8 μA(Typ)

UCSP50L1C package (1.20 mm × 1.60 mm × 0.57 mm)

UVLO Detection : 1.61 V(Max)

Built-in Thermal, Over Voltage, And Over Current Protection

Evaluation Board Operating Limits

Parameter	Symbol	Limit			Unit	Conditions
		MIN	TYP	MAX		
Supply Voltage	V_{IN}	2.0	-	5.5	V	
Output Current	I_{OUT}	1	-	-	A	VIN>2.7V, VOUT=3.3V

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Evaluation Board

Material of PCB: FR-4
Number of Layer 4
PCB thickness: 1.6mm

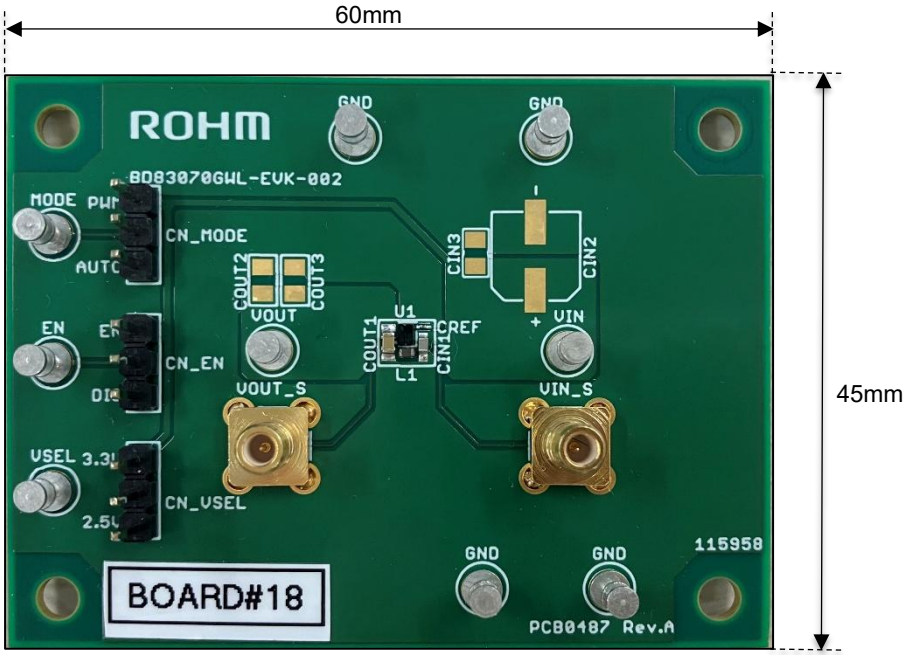


Figure 1. BD83070GWL Evaluation Board

Board Schematic

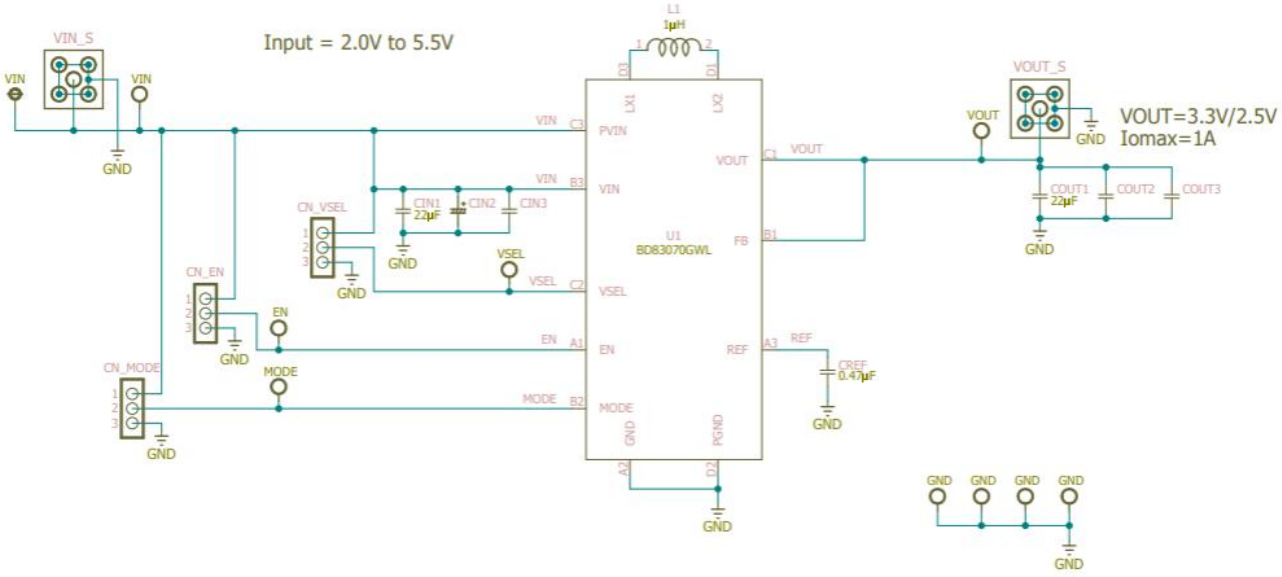


Figure 2. BD83070GWL Evaluation Board Schematic

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Output Voltage Settings

Below is a table of output voltages selectable using VSEL pin.

VSEL Pin	VOUT
HIGH (≥ VIN-0.3 V)	3.3V
LOW (≤ 0.3 V)	2.5V

Table 1. Output Voltage Settings

Operation State Settings

Below is a table of BD83070GWL Condition selectable using EN pin.

EN Pin	BD83070GWL Condition
HIGH (≥ 1.2 V)	Enable
LOW (≤ 0.4 V)	Shutdown

Table 2. EN Pin Settings

Operation Mode Settings

Below is a table of operation modes selectable using MODE pin.

MODE Pin	MODE
HIGH (≥ 1.2 V)	Forced PWM
LOW (≤ 0.4 V)	Automatic PFM-PWM

Table 3. MODE Pin Settings

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Evaluation Board BOM

Below is a table showing the Bill of Materials. Part numbers and suppliers are included.

Reference	Part Number	Manufacturer	Description [Unit: inch (mm)]	Qty.
CIN1	GRM158R61A226ME15D	Murata	22µF, 15V, X5R, 0402 (1005)	1
CIN2	-	-	-	1
CIN3, COUT2, COUT3	-	-	-	3
VIN_S, VOUT_S	CONSMB001-G	TE Connectivity Linx	50ohm SM PC Mount Straight Jack Receptacle	2
CN_EN, CN_MODE, CN_VSEL	M20-9990345	Harwin	HDR1X3 Switch, Through Hole, Pitch 2.54	3
COUT1	GRM188R60J226MEA0D	Murata	22µF, 6.3V, X5R, 0603 (1608)	1
CREF	GRM022R60J474ME15L	Murata	0.47µF, 6.3V, X5R, 01005 (0402)	1
L1	LSCNB1005EET1R0MB	TAIYO YUDEN	1µH, 0.8A, 0402 (1005)	1
VIN, EN, MODE, VSEL, GND, GND, GND, GND, VOUT	1502-2	Keystone Electronics	TEST POINT PC MULTI PURPOSE	9
U1	BD83070GWL	ROHM	3.3V/2.5V 2A Buck-Boost DC/DC	1

Table 4: Bill of Materials

Board Operating Procedure

1. Set the output voltage using the switch settings at CN_VSEL. (refer to Table 1)
2. Set the operation mode using the switch settings at CN_MODE. (refer to Table 3)
3. Disable the IC by setting the CN_EN jumper to the upper position (EN → GND).
4. Connect the power supply's GND terminal to one of each of the GND test point on the evaluation board.
5. Connect the power supply's VCC terminal to the VIN test point on the evaluation board. This will provide VIN to the IC. Please note that VIN should be in the range of 2.0V to 5.5V.
6. Connect the electronic load to one of each of GND and VOUT. Connect the voltmeter to one of each of GND and VOUT_S.
7. Turn on the power supply and enable the IC by setting the jumper at CN_EN to the lower position (EN → VIN). The output voltage can be measured at test point VOUT_S. Now turn on the load. The load can be increased up to 1.0A.

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Board Layout

The following are layers of the Evaluation Board of BD83070GWL

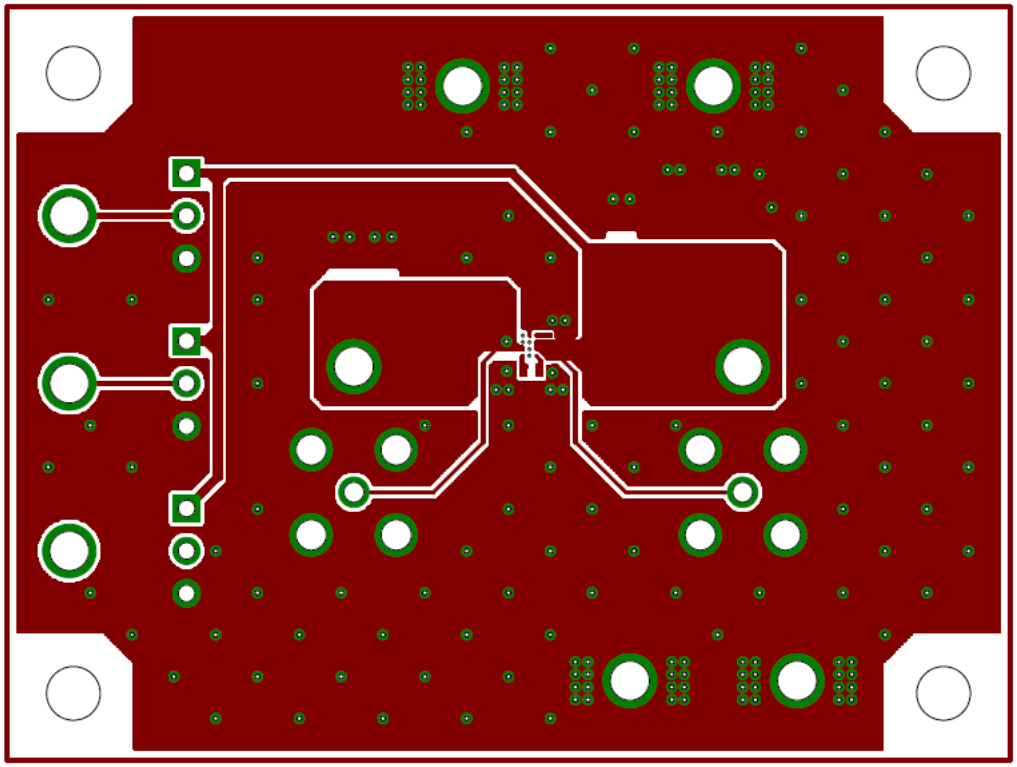


Figure 3. Top Layer

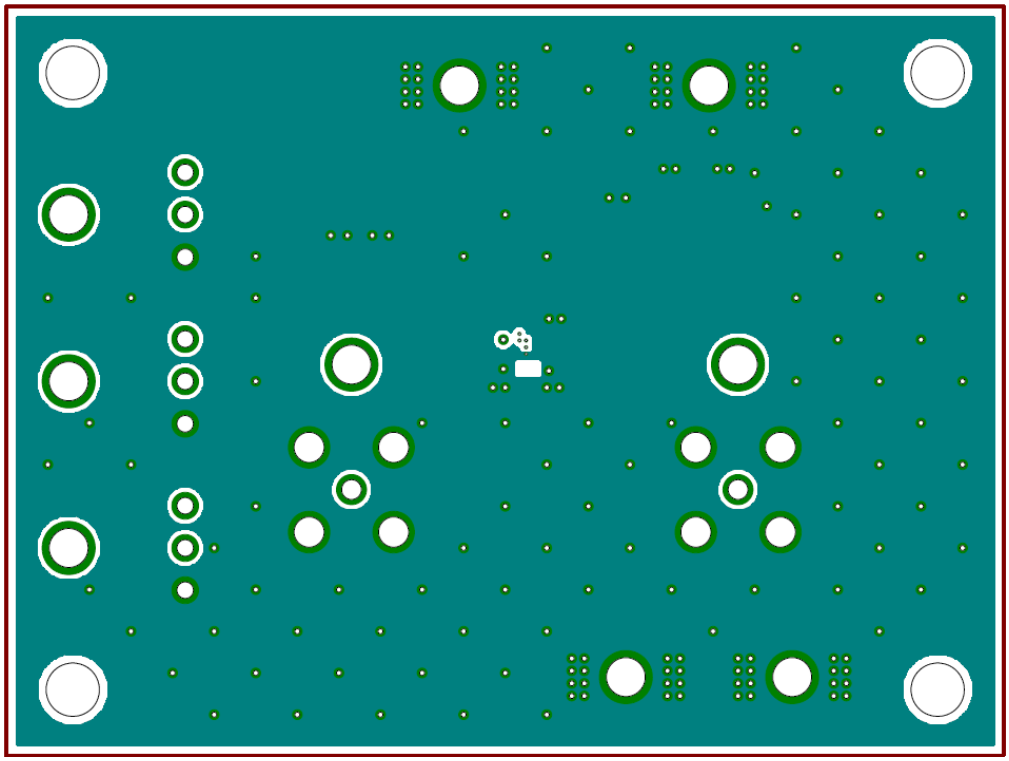


Figure 4. Middle 1 Layer

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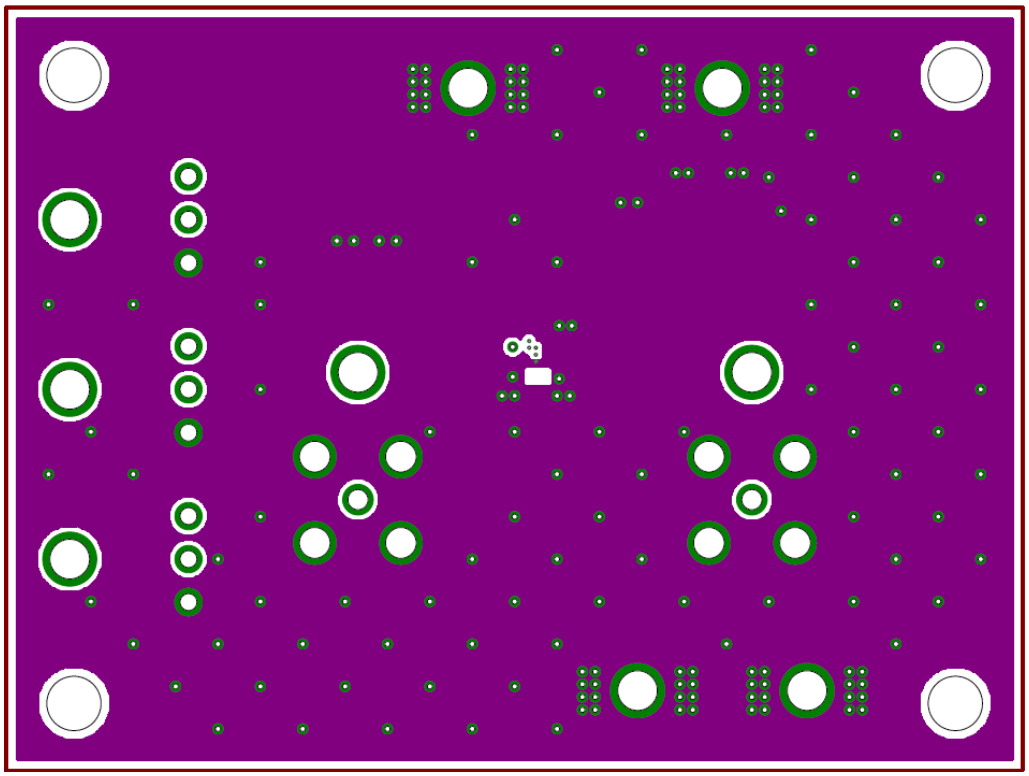


Figure 5. Middle 2 Layer

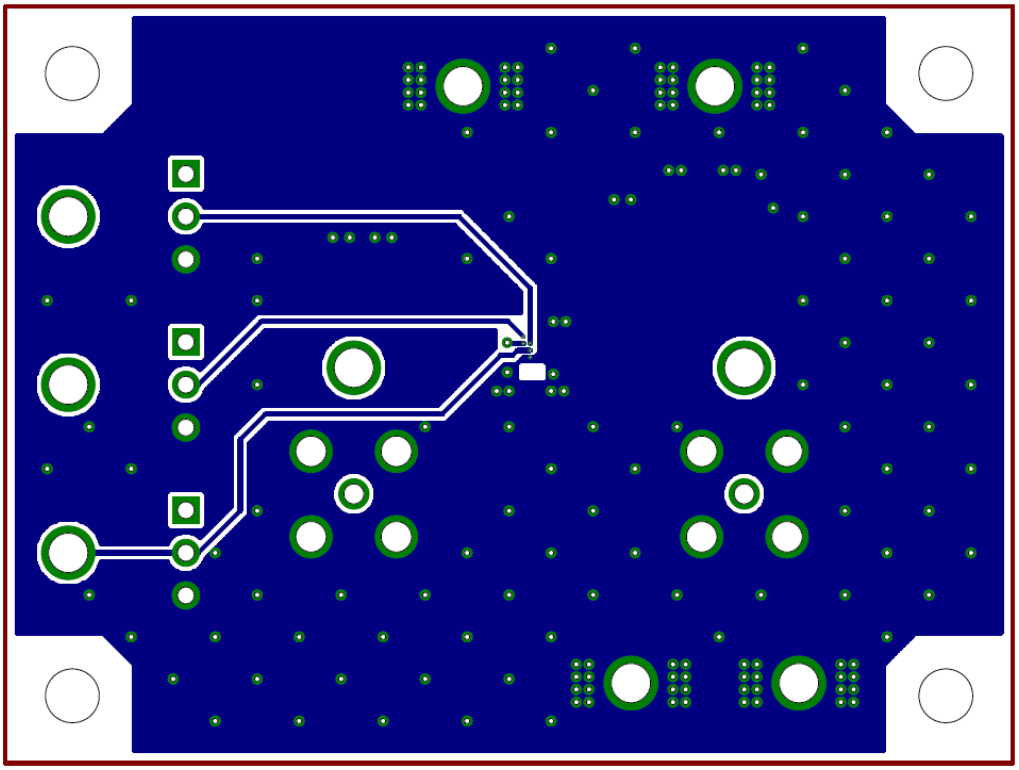


Figure 6. Bottom Layer

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Reference Application Data

The following are graphs of efficiency, switching frequency, load response, output voltage, ripple, startup and shutdown.

Typical Performance Curves

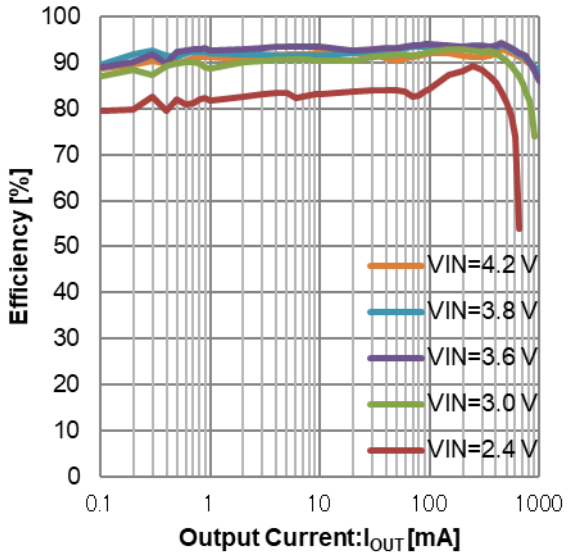


Figure 7. Efficiency vs Output Current
(VSEL=High, MODE=Low: Auto-PFM/PWM)

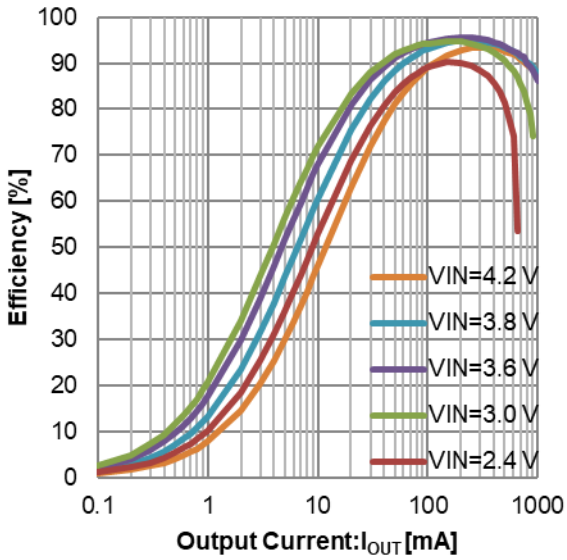


Figure 8. Efficiency vs Output Current
(VSEL=High, MODE=High: Forced-PWM)

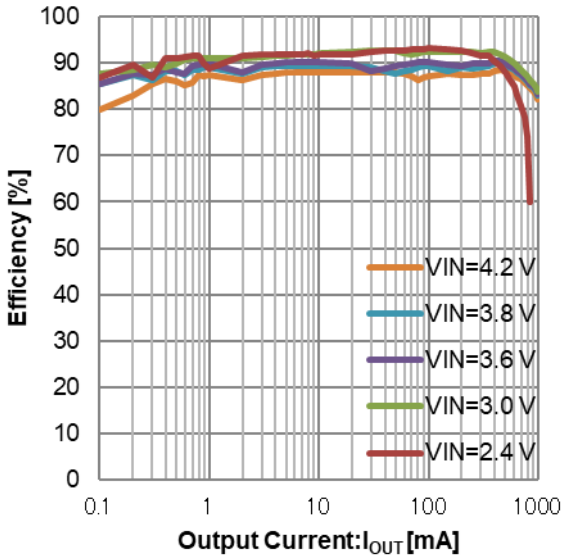


Figure 9. Efficiency vs Output Current
(VSEL=Low, MODE=Low: Auto-PFM/PWM)

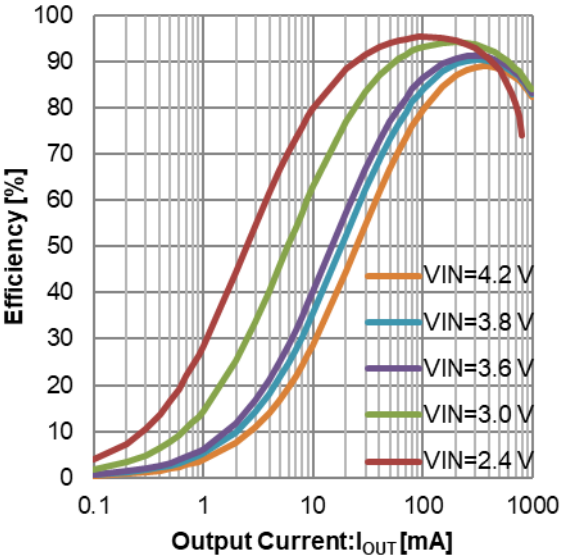


Figure 10. Efficiency vs Output Current
(VSEL=Low, MODE=High: Forced-PWM)

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Typical Performance Curves - continued

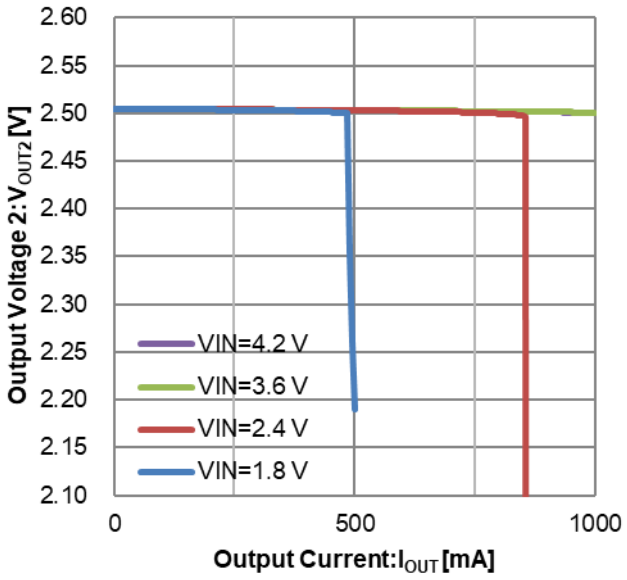


Figure 11. Output Voltage 2 vs Output Current
("Load Regulation", VSEL=Low, MODE=High: Forced-PWM)

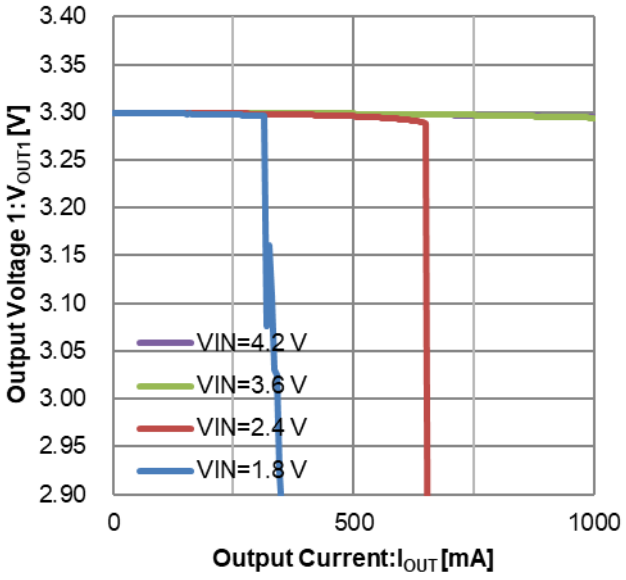


Figure 12. Output Voltage 1 vs Output Current
("Load Regulation", VSEL=High, MODE=High: Forced-PWM)

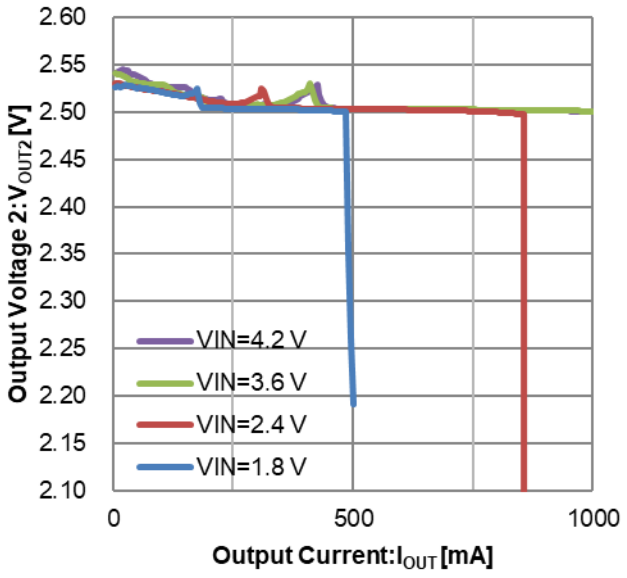


Figure 13. Output Voltage 2 vs Output Current
("Load Regulation", VSEL=Low, MODE=Low:
Auto-PFM/PWM)

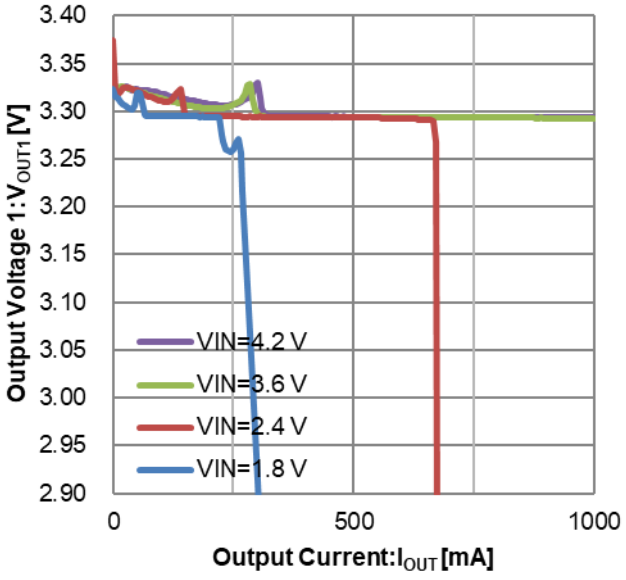


Figure 14. Output Voltage 1 vs Output Curren
("Load Regulation", VSEL=High, MODE=Low:
Auto-PFM/PWM)

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Typical Performance Curves - continued

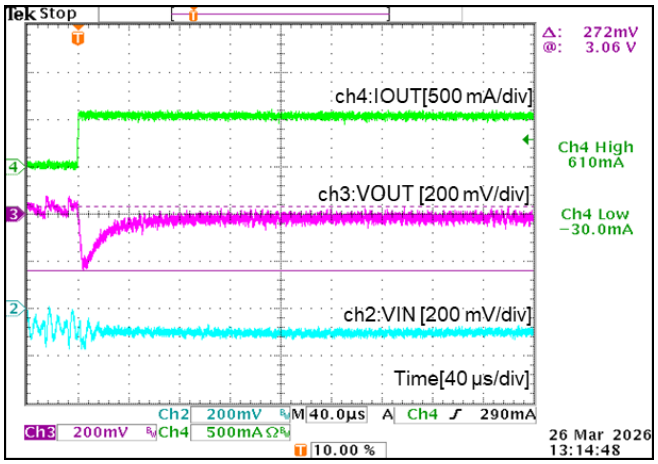


Figure 15. Transient Response
(VIN=2.3 V, VSEL=High, MODE=Low: Auto-PFM/PWM,
Output current 20 mA->600 mA)

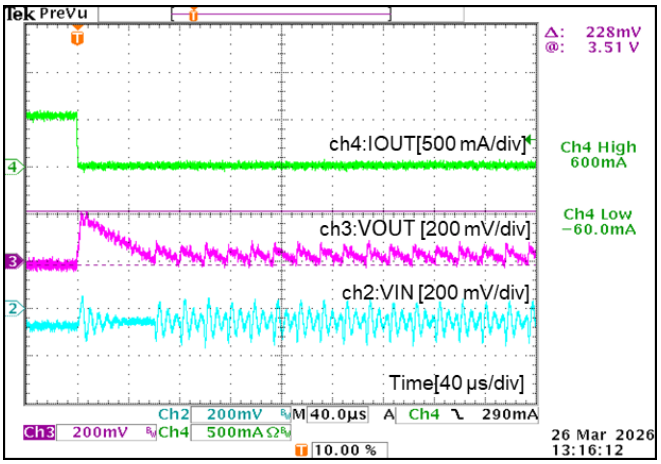


Figure 16. Transient Response
(VIN=2.3 V, VSEL=High, MODE=Low: Auto-PFM/PWM,
Output current 600 mA->20 mA)

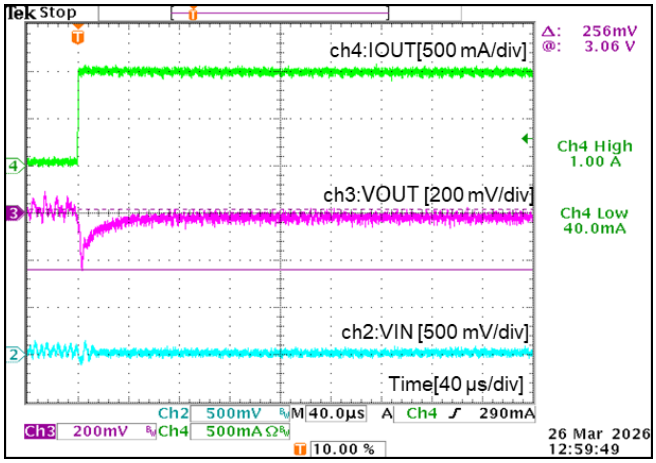


Figure 17. Transient Response
(VIN=3.6 V, VSEL=High, MODE=Low: Auto-PFM/PWM,
Output current 50 mA->1000 mA)

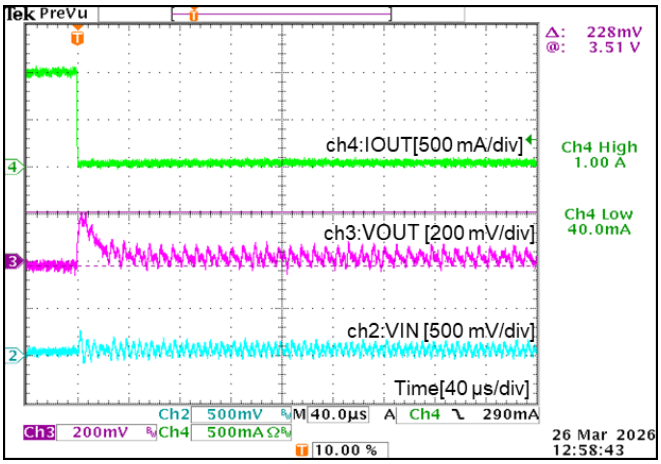


Figure 18. Transient Response
(VIN=3.6 V, VSEL=High, MODE=Low: Auto-PFM/PWM,
Output current 1000 mA->50 mA)

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Typical Performance Curves - continued

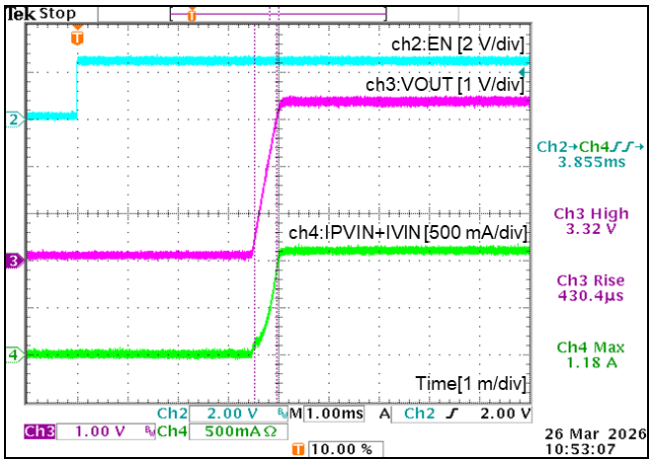


Figure 19. Startup Waveform
(VIN=2.4 V, VSEL=High, MODE=High: Forced-PWM,
5.5 Ω resistive load)

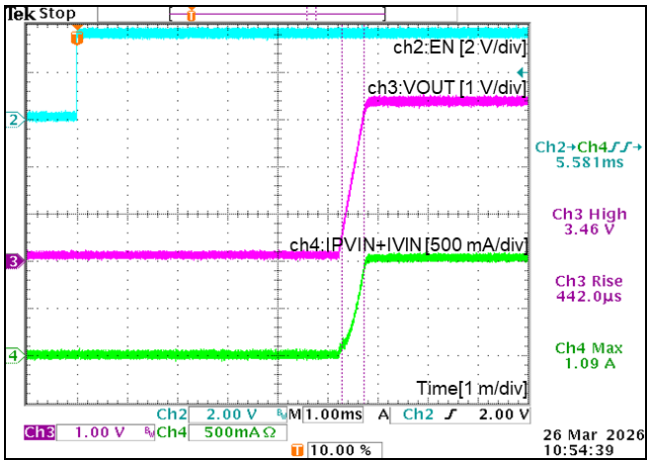


Figure 20. Startup Waveform
(VIN=3.6 V, VSEL=High, MODE=High: Forced-PWM,
3.3 Ω resistive load

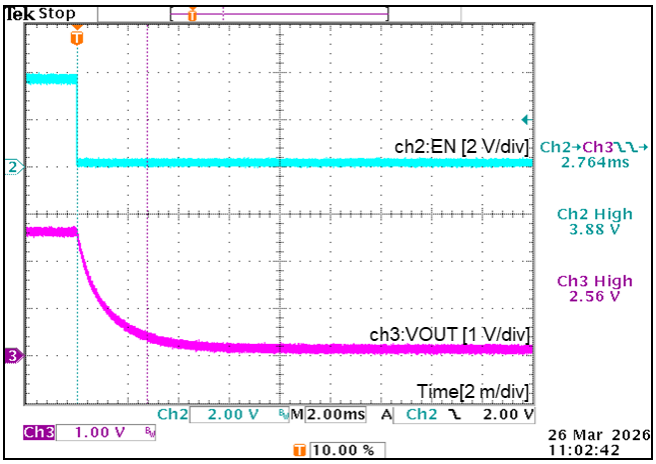


Figure 21. Shutdown Waveform
(VIN=3.6 V, VSEL=Low, MODE=Low: Auto-PFM/PWM,
No load)

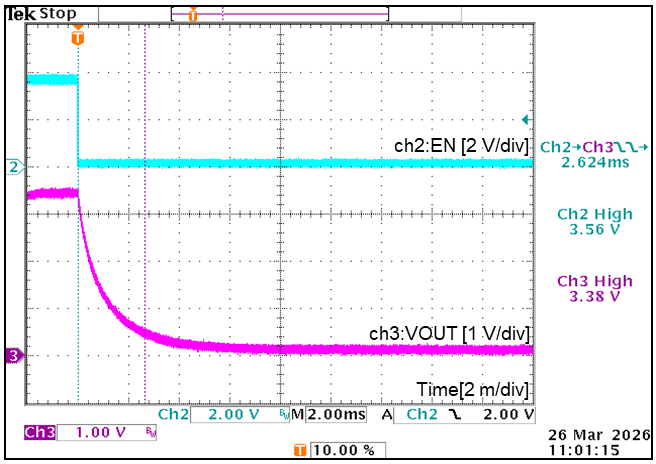


Figure 22. Shutdown Waveform
(VIN=3.6 V, VSEL=High, MODE=Low: Auto-PFM/PWM,
No load)

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Typical Performance Curves – continued

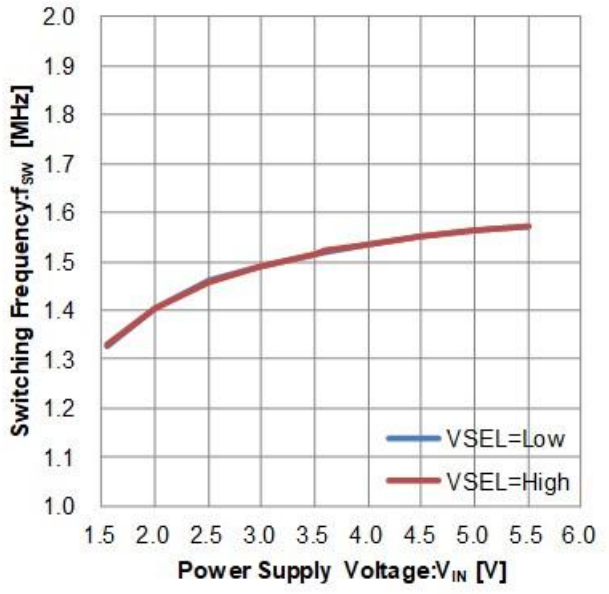


Figure 23. Switching Frequency vs Power Supply Voltage
(MODE=High: Forced-PWM, No load)

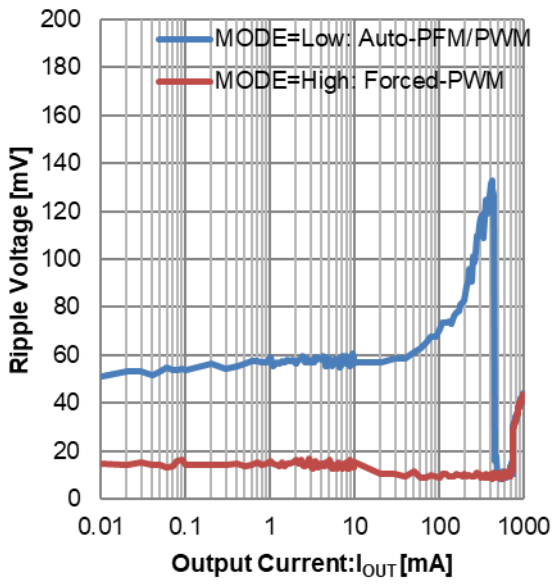


Figure 24. Ripple Voltage vs Output Current
(VIN=3.6 V, VSEL=High)

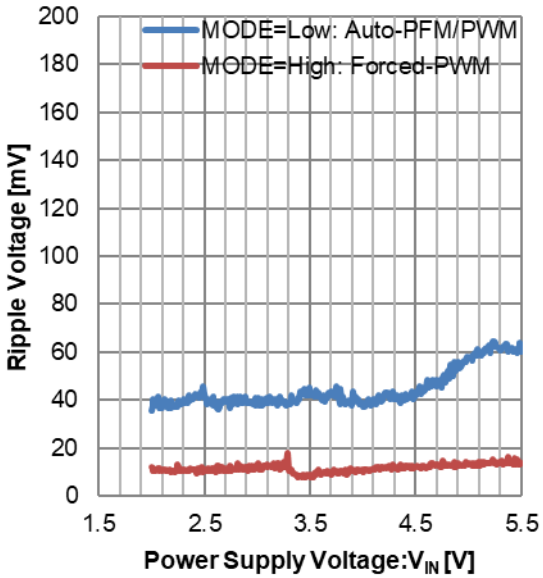


Figure 25. Power Supply Voltage vs Ripple Voltage
(IOUT=10 uA, VSEL=High)

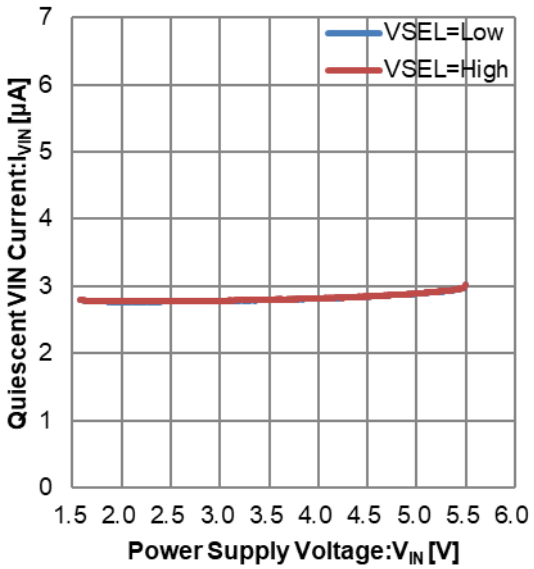


Figure 26. Quiescent VIN Current vs Power Supply Voltage
(MODE=Low: Auto-PFM/PWM, FB=3.5 V, No load)

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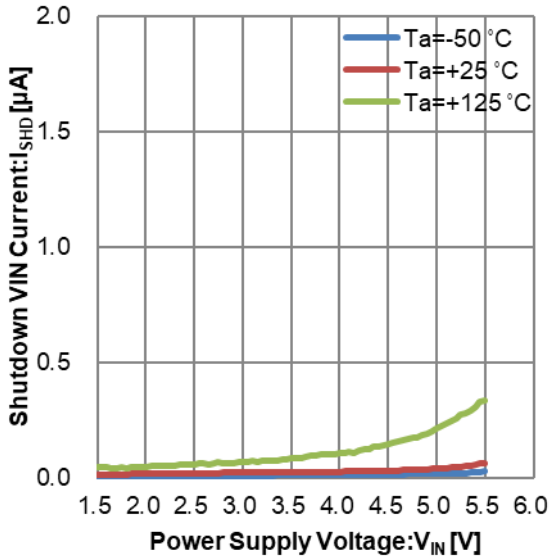


Figure 27. Shutdown VIN current vs Power Supply Voltage
(EN=MODE=Low, No load)

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Revision History

Date	Revision	Changes
14.Apr.2026	001	New Release

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ROHM SEMICONDUCTOR

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