

Switching Regulator Series

Buck Converter with Integrated FET BD9B304QWZ EVK

BD9B304QWZ-EVK-001 (5.0V → 1.2V, 3.0A)

Introduction

This user's guide will provide the necessary steps to operate the EVK of ROHM's BD9B304QWZ 1channel Buck DC/DC converter. This include the external parts, operating procedures and application data.

Description

This EVK was developed for ROHM's synchronous buck DC/DC converter BD9B304QWZ. The BD9B304QWZ accepts a power supply input range of 2.7V to 5.5V, and generates an output voltage from 0.8V to $0.8 \times V_{IN}$ using external resistors. It has a built-in 40mΩ N-channel MOSFET for High side and Low Side that is operating frequency is 1.0MHz/2.0MHz selectable. It adopts a Deep-SLLM compliant fixed on-time control method that consumes low current at light loads, making it ideal for equipment that wants to reduce standby power consumption. It has a fixed 1ms soft start function to prevent rush current at startup, UVLO (Under Voltage Lock Out), TSD (Thermal Shutdown Detection), OCP (Over Current Protection), SCP (Short Circuit Protection) functions.

Application

Step-down power supply for DSP, FPGA, microprocessor, etc.

Laptop PC/Tablet PC/Server

LCD TV

Storage device (HDD/SSD)

Printers and OA equipment

Distribution power supply, secondary power supply

EVK Operating Limits

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage	2.7	5.0	5.5	V	
Output Voltage		1.2		V	
Output Current Range			3.0	A	
Operating Frequency		1.0		MHz	By VIN applying to FREQ pin.
Maximum Efficiency		88		%	$I_o = 1A$
UVLO Detect Voltage		2.450		V	VIN sweep down
UVLO Release Voltage		2.550		V	VIN sweep up

EVK Overview

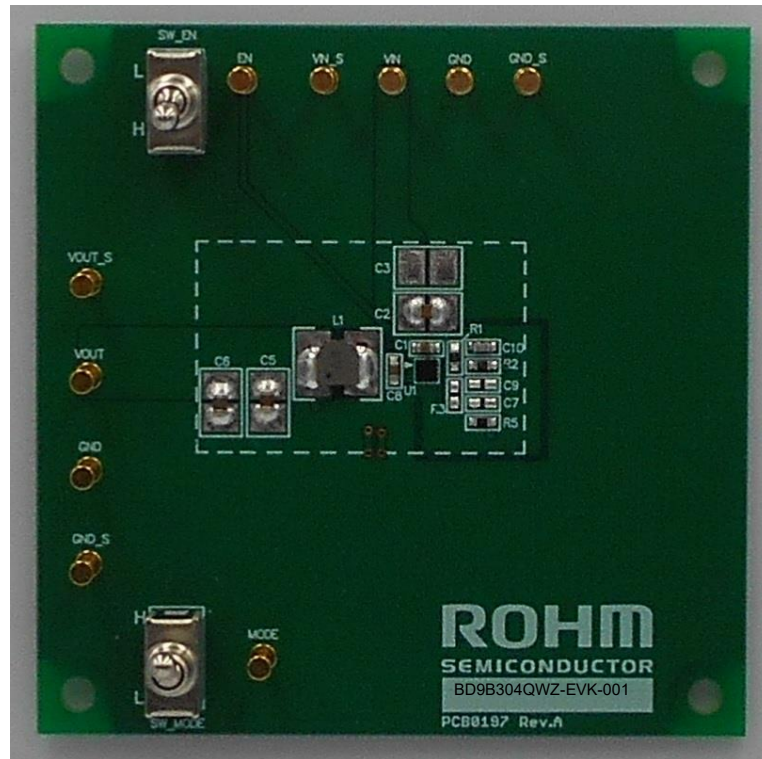


Figure 1. BD9B304QWZ-EVK-001(Top View)

* A 3 points switch implements on either SW_MODE and SW_IN on actual EVK.

EVK Schematic

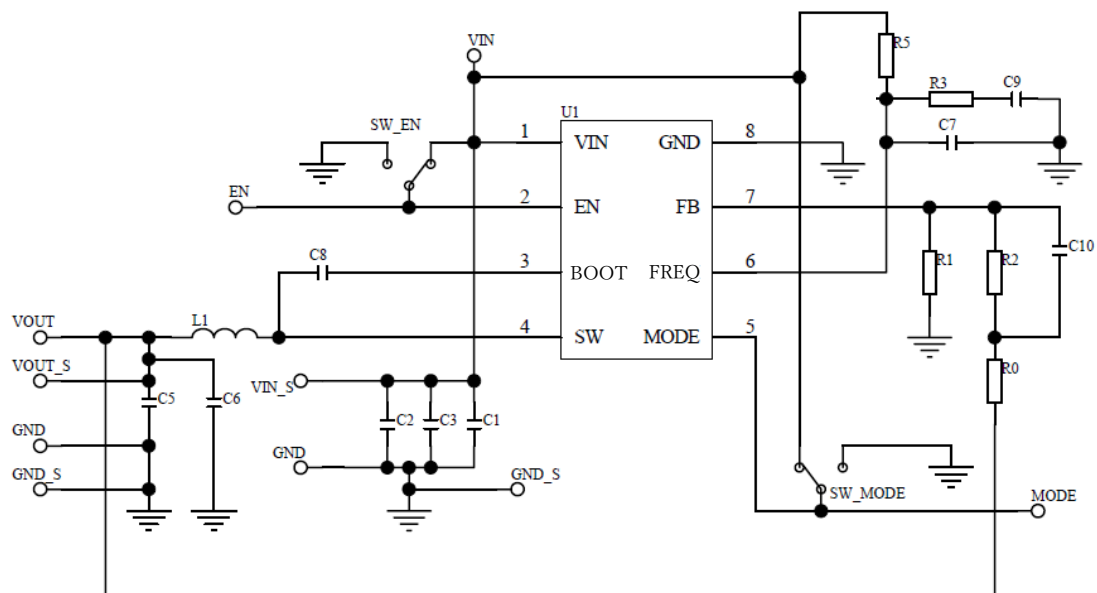


Figure 2. BD9B304QWZ-EVK-001 Circuit Diagram

Operating Procedure

1. Turn off the DC power supply and connect the GND terminal of the power supply to the GND terminal of EVK.
2. Connect VCC pin of DC power supply to the VIN pin of the EVK.
3. Connect the load to the EVK's VOUT and GND terminals. When using an electronic load, connect with the load turned off.
4. Connect a voltmeter to the EVK's VOUT and GND terminals.
5. Connect the EN to the VIN terminal of the EVK by switching SW_EN to H.
6. Set SW_MODE to H when forced PWM mode is required; otherwise, set L to specify Deep-SLLM.
7. Turn on the DC power supply. Make sure the voltmeter shows 1.2V.
8. 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 BD9B304QWZ condition selectable using EN pin via SW_EN switch.

Table 1. EN Pin Settings

SW_EN switch	EN Pin	BD9B304QWZ Condition
H	VIN	Enable
L	GND	Shutdown

Operation Mode Settings

Below is a table of BD9B304QWZ operation modes selectable using MODE pin via SW_MODE switch.

Table 2. MODE Pin Settings

SW_MODE switch	MODE Pin	BD9B304QWZ Operation Mode
H	VCC	Forced PWM
L	GND	Automatic switching between Deep-SLLM and PWM

Parts list

Table 3. Parts list

Part No	Value	Manufacturer	Model number	Size [Unit: mm(inch)]
IC				
U1	-	ROHM	BD9B304QWZ	2.00 x 2.00
Inductor				
L1	1.0μH	MURATA	FDSD0420-H-1R0M	4.20 x 4.20
Capacitor				
C1	0.1μF	MURATA	GRM188B31H104MA92D	1608(0603)
C2	10μF	MURATA	GRM21BB31A106ME18	2012(0805)
C3	No mount	-	-	-
C5, C6	22μF	MURATA	GRM21BR61C226ME44	2012(0805)
C7	No mount	-	-	-
C8	0.1μF	MURATA	GRM188B31H104MA92D	1608(0603)
C9	No mount	-	-	-
C10	150pF	MURATA	GCM1882C1H151JA01	1608(0603)
Resistor				
R0	0Ω	ROHM	MCR03 Series	1608(0603)
R1	150kΩ	ROHM	MCR03 Series	1608(0603)
R2	75kΩ	ROHM	MCR03 Series	1608(0603)
R3	No mount	-	-	-
R5	0Ω	ROHM	MCR03 Series	1608(0603)
Switch				
SW_EN, SW_MODE	3 Points	-	-	-
Contact pin				
GND, GND_S, VOUT, VOUT_S, EN, MODE, VIN, VIN_S	Test pins	-	-	-

Board Layout

EVK PCB information

Number of Layers	Material	Board Size	Copper Thickness
4	FR-4	50mm x 40mm x 1.6mmt	1oz (35μm)

The layout of BD9B304QWZ-EVK-001 is shown below.

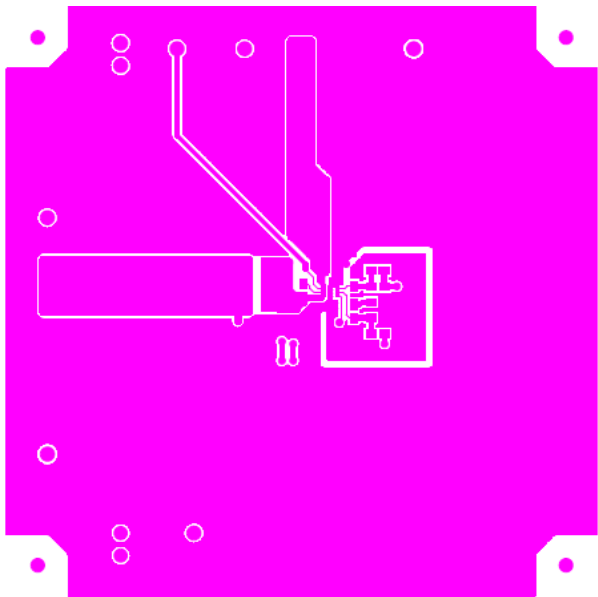


Figure 3. Top Layer Layout
(Top View)

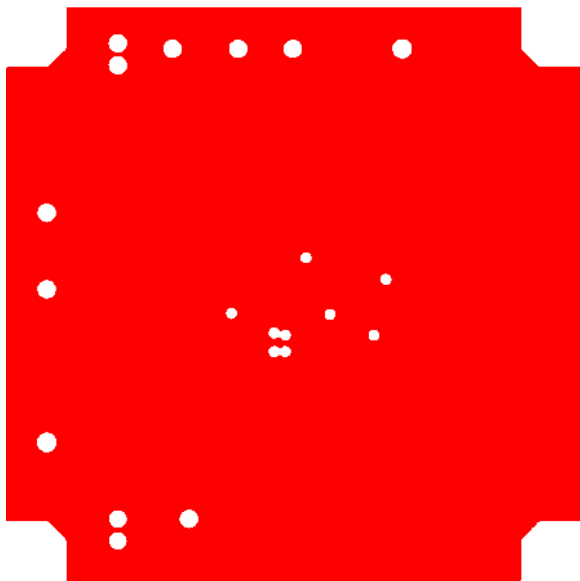


Figure 4. Middle1 Layer Layout
(Top View)

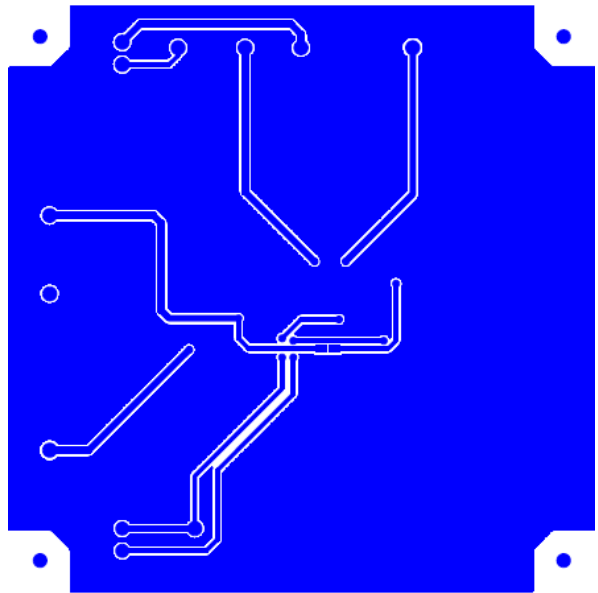


Figure 5. Middle2 Layer Layout
(Top View)

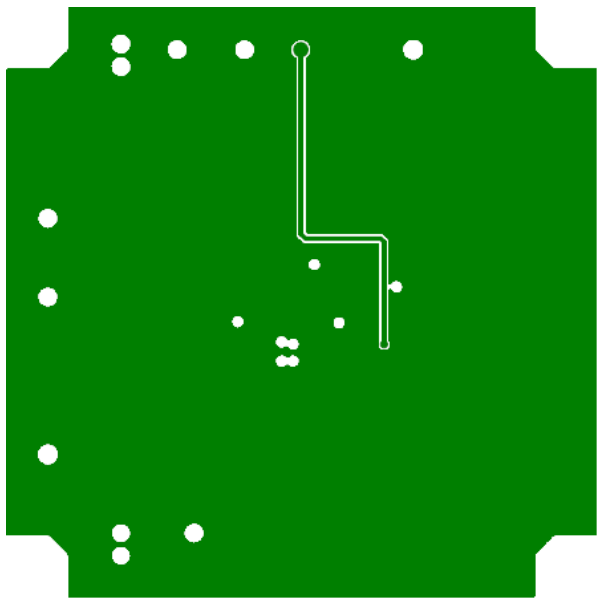


Figure 6. Bottom Layer Layout
(Top View)

Reference application data

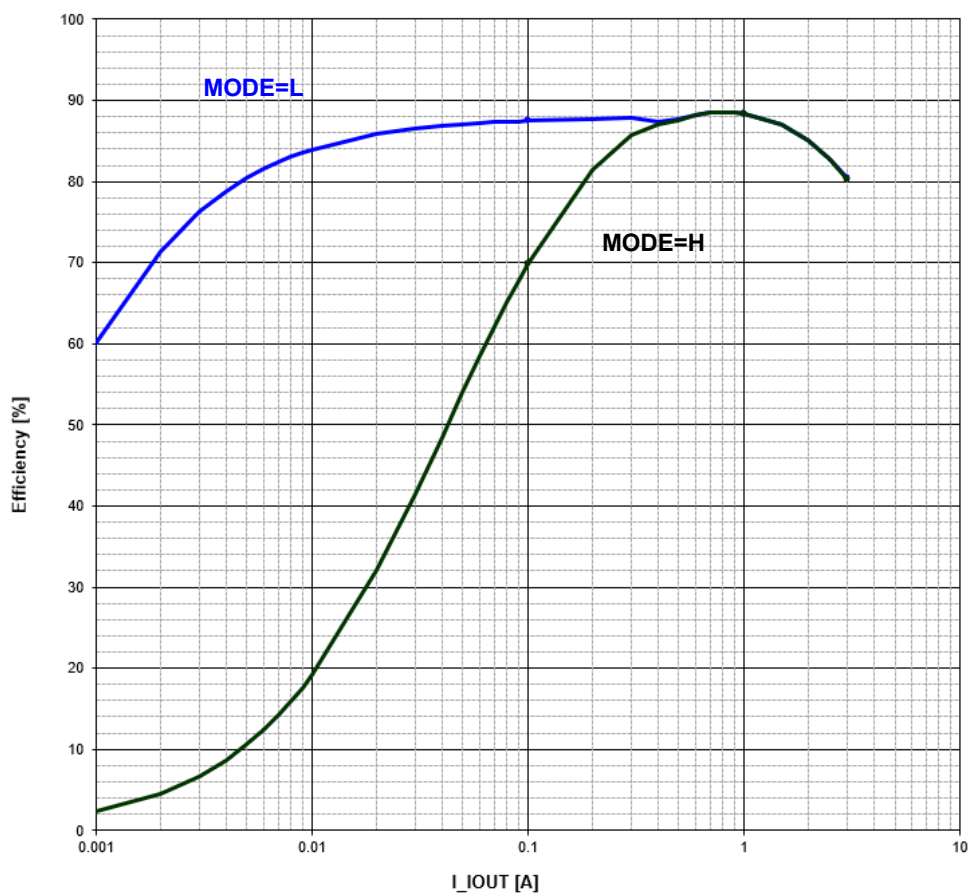


Figure 7. Efficiency vs Load Current

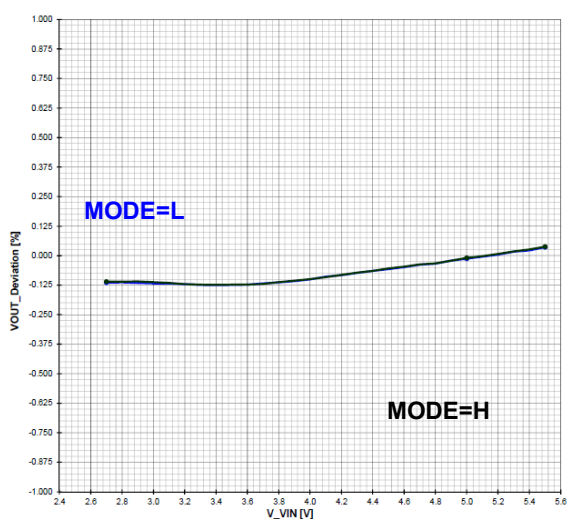
(V_{VIN}=5.0V, V_{OUT}=1.2V, L=1.0μH)

Figure 8. Line Regulation

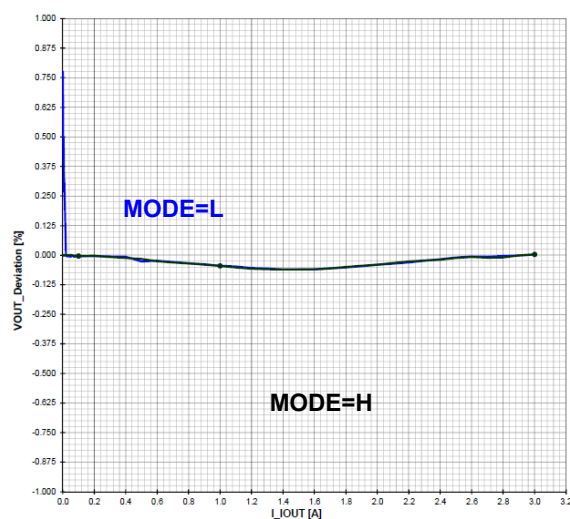
(V_{OUT}=1.2V, I_{OUT}=3A)

Figure 9. Load Regulation

(V_{VIN}=5.0V, V_{OUT}=1.2V)

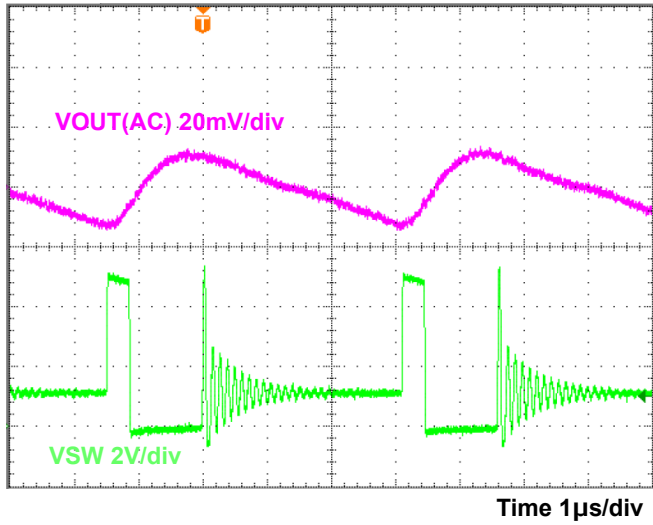


Figure 10. Switching Waveform
($V_{IN}=5.0V$, $V_{OUT}=1.2V$, $V_{MODE}=0V$, $I_{OUT}=0.2A$)

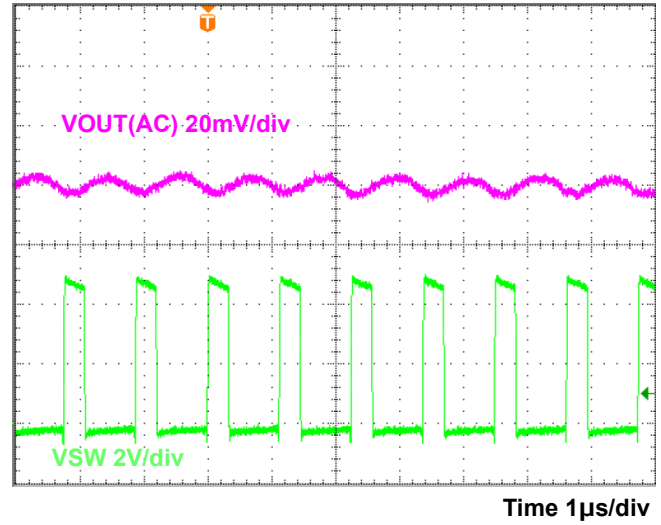


Figure 11. Switching Waveform
($V_{IN}=5.0V$, $V_{OUT}=1.2V$, $V_{MODE}=V_{IN}$, $I_{OUT}=3.0A$)

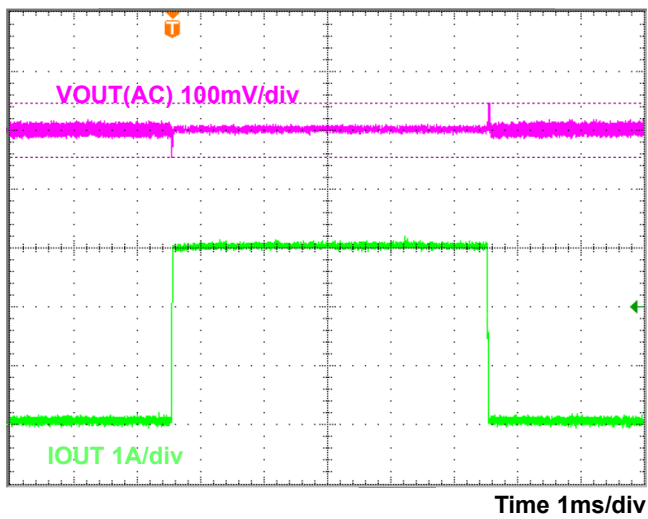


Figure 12. Load Response ($I_{OUT}=0.1A-3A$)
($V_{IN}=5.0V$, $V_{OUT}=1.2V$, $V_{MODE}=0V$, $C_{OUT}=22\mu F \times 2$)

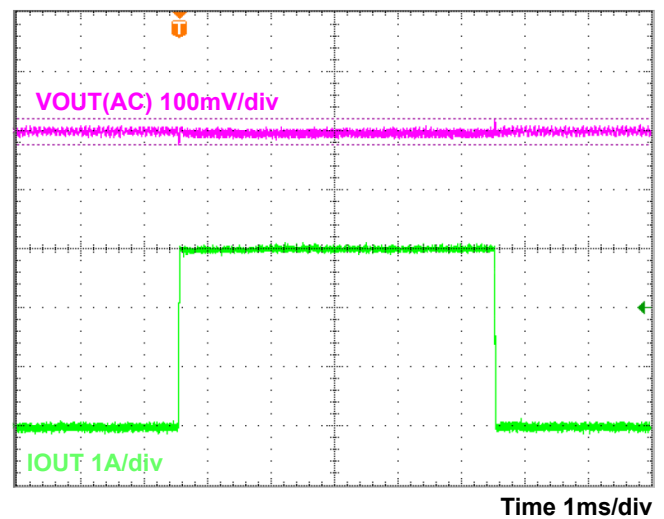


Figure 13. Load Response ($I_{OUT}=0A-3A$)
($V_{IN}=5.0V$, $V_{OUT}=1.2V$, $V_{MODE}=V_{IN}$, $C_{OUT}=22\mu F \times 2$)

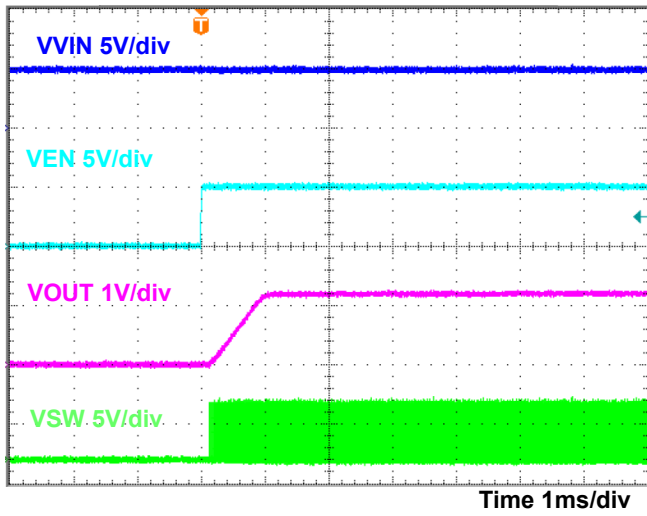


Figure 14. Boot by EN (EN=0V-5V)
(VOUT=1.2V, VFREQ= VVIN, RLOAD=0.4Ω)

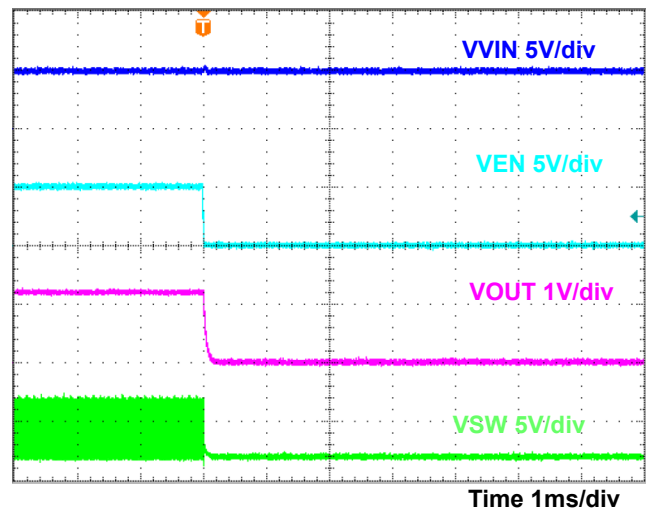


Figure 15. Shutdown by EN (EN=5V-0V)
(VOUT=1.2V, VFREQ= VVIN, RLOAD=0.4Ω)

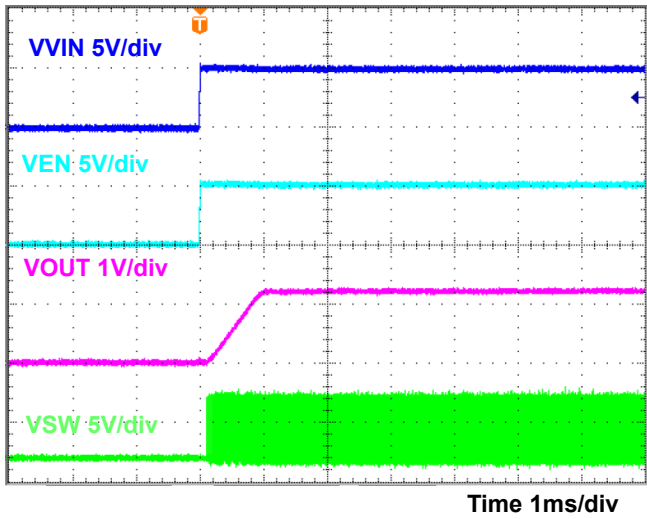


Figure 16. Boot by VIN (VIN=0V-5V)
(VOUT=1.2V, VFREQ= VVIN, RLOAD=0.4Ω)

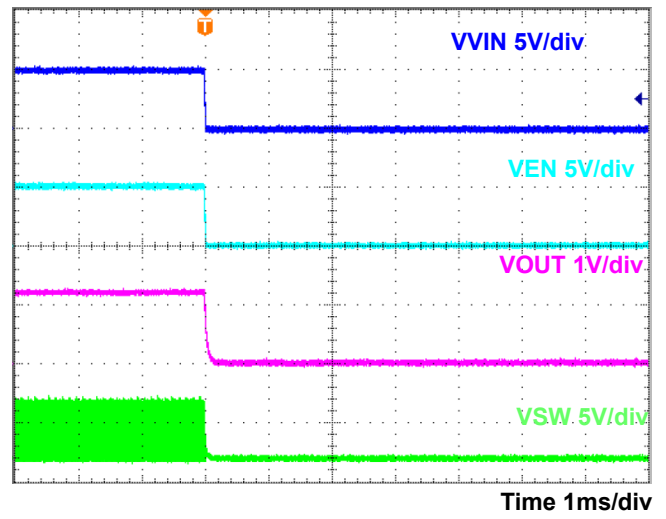


Figure 17. Shutdown by VIN (VIN=5V-0V)
(VOUT=1.2V, VFREQ= VVIN, RLOAD=0.4Ω)

Revision History

Date	Revision Number	Description
27. AUG. 2020	001	Initial release

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