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4.5V to 18V Input, 3.0A Integrated MOSFET 1ch Synchronous Buck DC/DC Converter

BD9D323QWZ

General Description

BD9D323QWZ is a synchronous buck switching regulator with built-in low on-resistance power MOSFETs. It is capable of providing current of up to 3 A. External phase compensation circuit is not necessary for it is a constant on-time control DC/DC converter with fast transient response.

Features

- Synchronous Single DC/DC Converter
- Constant On-time Control
- Over Current Protection
- Thermal Shutdown Protection
- Under Voltage Lockout Protection
- Adjustable Soft Start
- UMMP008Z2020 Package (Backside Heat Dissipation)

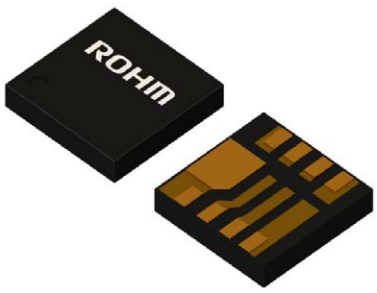
Applications

- Step-down Power Supply for DSPs, FPGAs, Microprocessors, etc.
- Set-top Box
- LCD TVs
- DVD / Blu-ray Player / Recorder
- POL Power Supply, etc.

Key Specifications

- Input Voltage Range: 4.5V to 18.0 V
- Output Voltage Setting Range: 0.765V to 7V
  (V_{IN} × 0.07)V to (V_{IN} × 0.65)V
- Output Current: 3A (Max)
- Switching Frequency: 700kHz (Typ)
- High Side MOSFET On-Resistance: 80mΩ (Typ)
- Low Side MOSFET On-Resistance: 50mΩ (Typ)
- Standby Current: 2μA (Typ)

Package	W(Typ) x D(Typ) x H(Max)
UMMP008Z2020	2.00mm x 2.00mm x 0.40mm



UMMP008Z2020

Typical Application Circuit

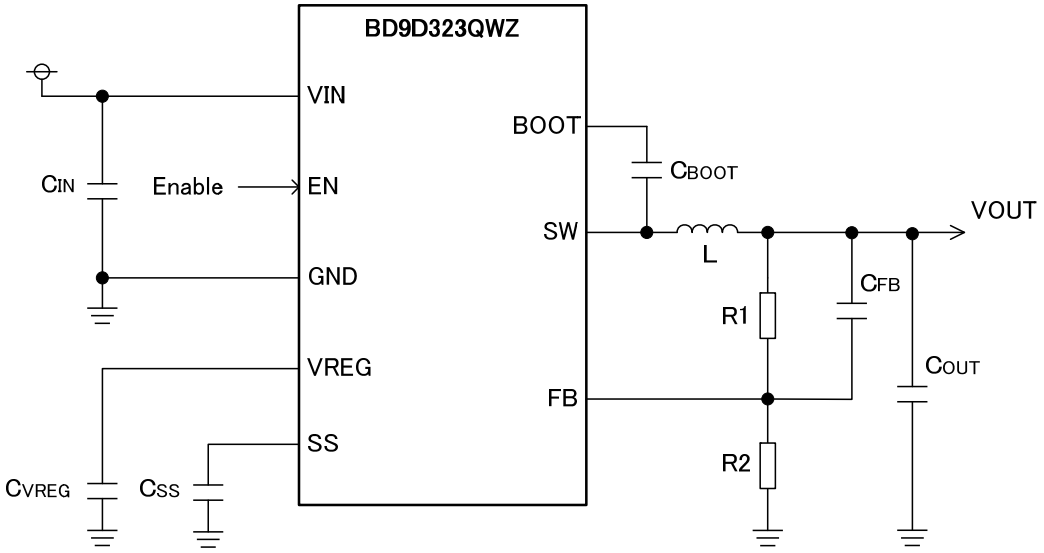


Figure 1. Typical Application Circuit

Pin Configuration

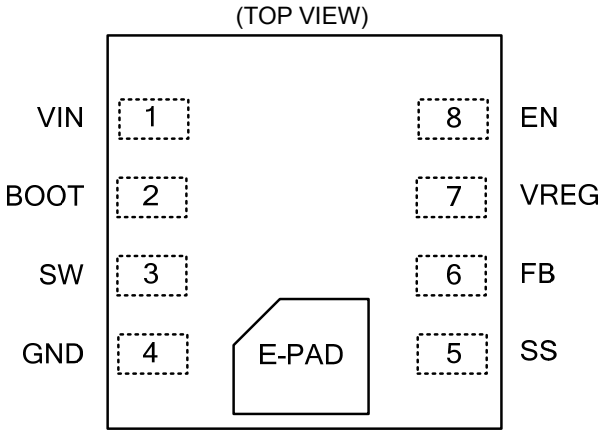


Figure 2. Pin Configuration

Pin Descriptions

Terminal No.	Symbol	Function
1	VIN	Power supply terminal for the switching regulator. Connecting 10µF and 0.1µF ceramic capacitors to ground is recommended.
2	BOOT	Connect a bootstrap capacitor of 0.1µF between this terminal and SW terminal. The voltage of this capacitor is the gate drive voltage of the high-side MOSFET.
3	SW	Switch node. This terminal is connected to the source of the high-side MOSFET and drain of the low-side MOSFET. Connect a bootstrap capacitor of 0.1µF between this terminal and BOOT terminal. In addition, connect an inductor considering the direct current superimposition characteristic.
4	GND	Ground terminal for the output stage of the switching regulator and the control circuit.
5	SS	Terminal for setting the soft start time. The rise time of the output voltage can be specified by connecting a capacitor to this terminal. Refer to page.28 for how to calculate the capacitance.
6	FB	An inverting input terminal of comparator which compares with reference voltage (V_{REF}). Refer to page.27 for how to calculate the resistance of the output voltage setting.
7	VREG	Power supply voltage terminal inside IC. Voltage of 5.25V (Typ) is outputted with more than 2.2V is impressed to EN terminal. Connect 1µF ceramic capacitor to ground.
8	EN	Turning this terminal signal low level (0.3 V or lower) forces the device to enter the shutdown mode. Turning this terminal signal high level (2.2 V or higher) enables the device. This terminal must be terminated.
-	E-PAD	A backside heat dissipation pad. Connecting to the internal PCB ground plane by using multiple via provides excellent heat dissipation characteristics.

Block Diagram

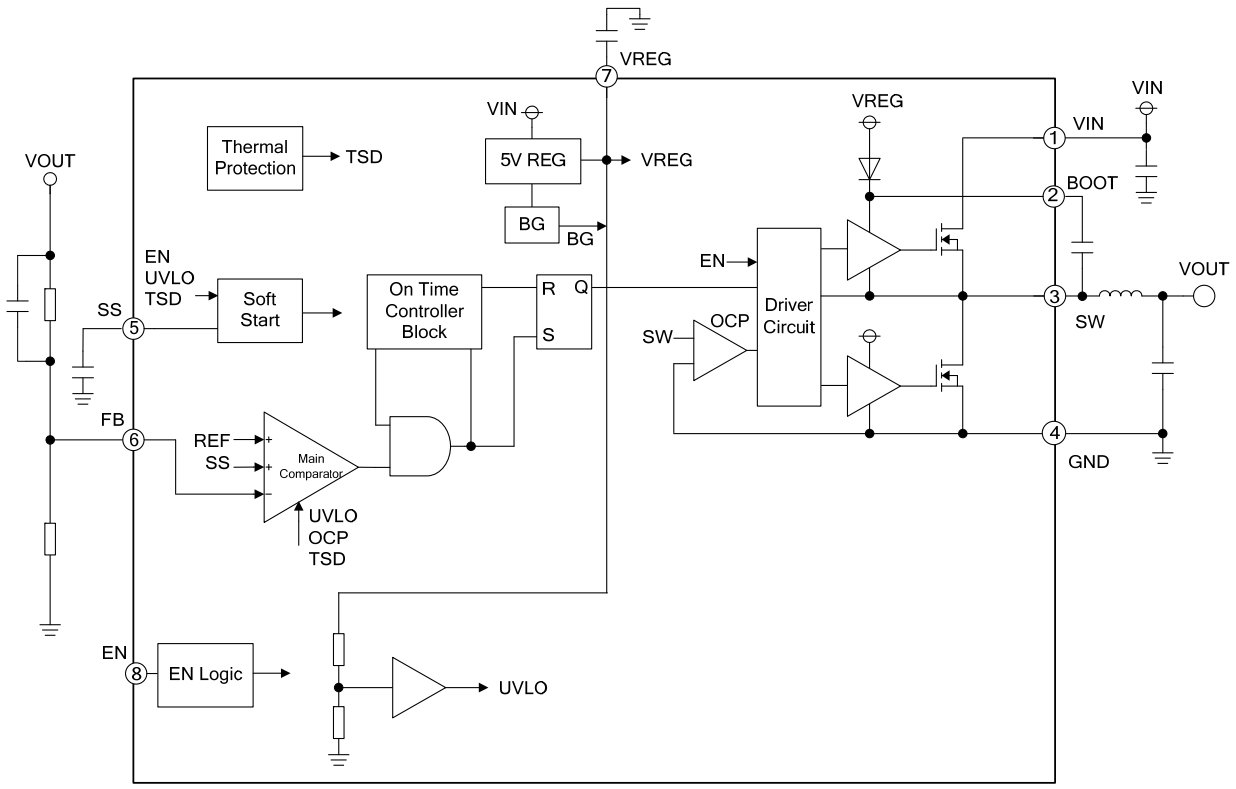


Figure 3. Block Diagram

Description of Blocks

- EN Logic
  The EN Logic block is for control IC shutdown or starts up. It will shut down the IC when EN falls to 0.3V (Max) or lower. When VEN reaches 2.2 V(Min), the internal circuit is activated and the IC starts up.

- 5V REG
  Block creating internal power supply 5.25V (Typ).

- BG
  Block creating internal reference voltage.

- Main Comparator
  When FB terminal voltage becomes lower than REF, it outputs High and reports to the On Time block that the output voltage has dropped below control voltage.

- On Time Controller Block
  This is a block which creates On Time. Desired On Time is created when Main Comparator output becomes High. On Time is adjusted to restrict frequency change even with I/O voltage change.

- Soft Start
  The Soft Start circuit slows down the rise of output voltage during start-up and controls the current, which allows the prevention of output voltage overshoot and inrush current.

- Driver Circuit
  This block is a DC/DC driver. A signal from On Time Controller Block is applied to drive the MOSFETs.

- UVLO
  UVLO is a protection circuit that prevents low voltage malfunction. It prevents malfunction of the internal circuit from sudden rise and fall of power supply voltage. It monitors the V_{IN} power supply voltage and the internal regulator voltage. If V_{IN} is higher than the threshold voltage 3.8 V (Typ), the soft-start circuit will be restarted. This threshold voltage has a hysteresis of 300 mV (Typ). If V_{IN} is less than the threshold voltage 3.5 V (Typ), the POWER MOS FET output will turn OFF.

- TSD
  Thermal shutdown block. Usually IC operating in the allowable power dissipation, but when the IC power dissipation more than rating value, Tj will increase. When the chip temperature exceeds 175°C (Typ), the thermal shutdown circuit is intended for shutting down internal power devices. When Tj decreased to 25°C (Typ) , IC will restart automatically. It is not meant to protect or guarantee the soundness of the application. Do not use the function of this circuit for application protection design.

- OCP
  Effective by controlling current which flows in low side MOSFET by 1 cycle each of switching period. With inductor current exceeding the source current restriction setting value I_{OCP} when low side MOSFET is ON, the high side MOSFET cannot turn ON even with FB voltage is lower than REF voltage and low side MOSFET continues to be ON until it is below I_{OCP}. High side MOSFET will turn ON when it goes below I_{OCP}. If low side MOSFET exceed sink current limited setting value when it is ON, low side MOSFET will turn OFF.

Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Rating	Unit
Input Voltage	V_{IN}	-0.3 ～ 20	V
BOOT-GND Voltage	V_{BOOT}	-0.3 ～ 27	V
BOOT-SW Voltage	V_{BOOT}-V_{SW}	-0.3 ～ 7	V
FB Voltage	V_{FB}	-0.3 ～ V_{REG}	V
SW Voltage	V_{SW}	-0.5 ～ V_{IN} + 0.3	V
VREG Voltage	V_{REG}	-0.3 ～ 7	V
SS Voltage	V_{SS}	-0.3 ～ 7	V
EN Input Voltage	V_{EN}	-0.3 ～ V_{IN}	V
Maximum Junction Temperature	Tjmax	150	°C
Storage Temperature Range	Tstg	-55 to +150	°C

Caution 1: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.
Caution 2: Should by any chance the maximum junction temperature rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, increase the board size and copper area to prevent exceeding the maximum junction temperature rating.

Thermal Resistance(Note 1)

Parameter	Symbol	Thermal Resistance (Typ)		Unit
		1s(Note 3)	2s2p(Note 4)	
UMMP008Z2020				
Junction to Ambient	θ_{JA}	-	58.3	°C/W
Junction to Top Characterization Parameter(Note 2)	Ψ_{JT}	-	11	°C/W

(Note 1)Based on JESD51-2A(Still-Air)
(Note 2)The thermal characterization parameter to report the difference between junction temperature and the temperature at the top center of the outside surface of the component package.
(Note 3)Using a PCB board based on JESD51-3.

Layer Number of Measurement Board	Material	Board Size
Single	FR-4	114.3mm x 76.2mm x 1.57mmt

Top	
Copper Pattern	Thickness
Footprints and Traces	70µm

(Note 4)Using a PCB board based on JESD51-5, 7

Layer Number of Measurement Board	Material	Board Size	Thermal Via(Note 5)	
			Pitch	Diameter
4 Layers	FR-4	114.3mm x 76.2mm x 1.6mmt	-	Φ0.30mm

Top		2 Internal Layers		Bottom	
Copper Pattern	Thickness	Copper Pattern	Thickness	Copper Pattern	Thickness
Footprints and Traces	70µm	74.2mm x 74.2mm	35µm	74.2mm x 74.2mm	70µm

(Note 5) This thermal via connects with the copper pattern of all layers.

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Input voltage	V_{IN}	4.5	12	18	V
Operating Temperature Range	Topr	-40	-	+85 (Note 1)	°C
Output Current	I_{OUT}	0	-	3	A
Output Voltage Range	V_{RANGE}	0.765 (Note 2)	-	7 (Note 3)	V

(Note 1) Tj must be lower than 150°C under actual operating environment.
(Note 2) Please use under the condition of VOUT ≥ VIN × 0.07 [V].
(Note 3) Please use under the condition of VOUT ≤ VIN × 0.65 [V].
(Refer to the page 27 for how to calculate the output voltage setting.)

Electrical Characteristics (Ta = 25°C, V_{IN} = 12V, V_{EN} = 3V unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Standby Circuit Current	I_{STB}	-	2	15	μA	V_{EN}=GND
Operating Circuit Current	I_{VIN}	-	1	2	mA	I_{OUT}=0mA when no switching
EN Low Voltage	V_{ENL}	GND	-	0.3	V	
EN High Voltage	V_{ENH}	2.2	-	V_{IN}	V	
EN Input Current	I_{EN}	-	3	10	μA	V_{EN}=3V
VREG Standby Voltage	V_{VREG_STB}	-	-	0.1	V	V_{EN}=GND
VREG Output Voltage	V_{VREG}	5	5.25	5.5	V	
VREG Output Current	I_{REG}	-	10	-	mA	
UVLO Threshold Voltage	V_{VREG_UVLO}	3.4	3.8	4.2	V	VREG: Sweep up
UVLO Hysteresis Voltage	dV_{VREG_UVLO}	200	300	400	mV	VREG: Sweep down
Reference Voltage	V_{REF}	0.753	0.765	0.777	V	V_{IN}=12V, V_{OUT}=1.8V
FB Input Current	I_{FB}	-	-	1	μA	V_{FB}=1V
SS Charge Current	I_{SSC}	1.4	2.0	2.6	μA	
SS Discharge Current	I_{SSD}	0.1	0.2	-	mA	VREG=5.25V, V_{SS}=0.5V
On Time	Ton	-	215	-	ns	V_{IN}=12V, V_{OUT}=1.8V
Minimum Off Time	Toffmin	100	200	-	ns	
High Side FET ON Resistance	R_{ONH}	-	80	160	mΩ	
Low Side FET ON Resistance	R_{ONL}	-	50	100	mΩ	
Over Current Protection Current Limit	Iocp	-	5 (Note 4)	-	A	

(Note 4) No tested on outgoing inspection.

Typical Performance Curves

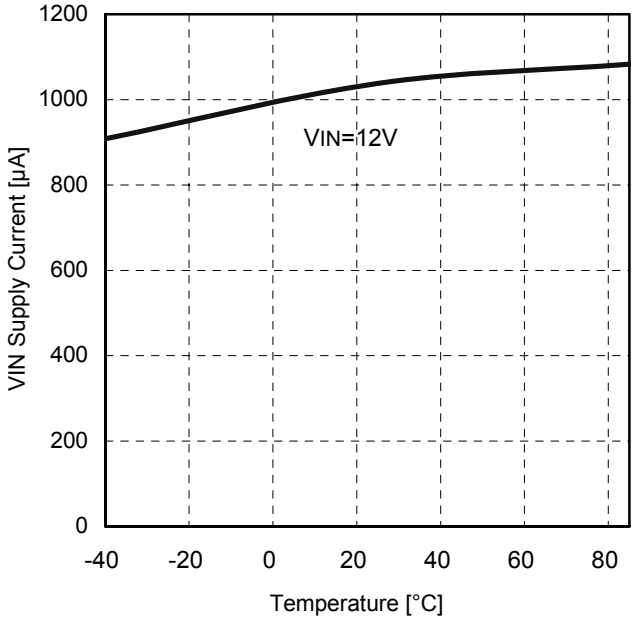


Figure 4. Operating Circuit Current vs Temperature

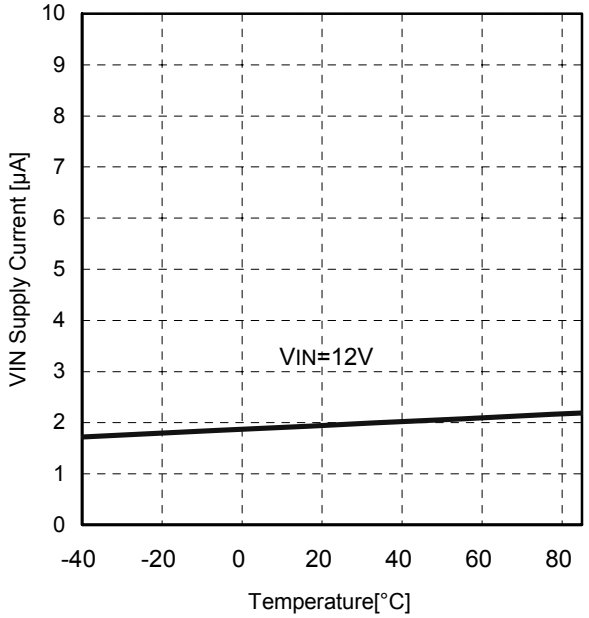


Figure 5. Standby Circuit Current vs Temperature

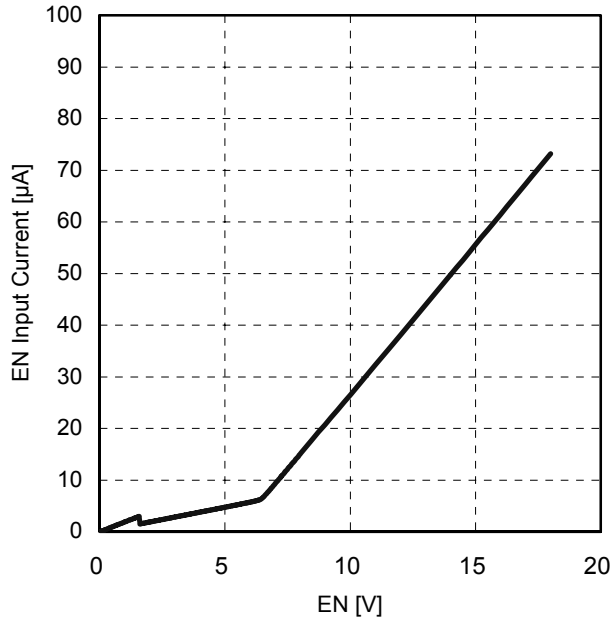


Figure 6. EN Input Current vs EN Voltage

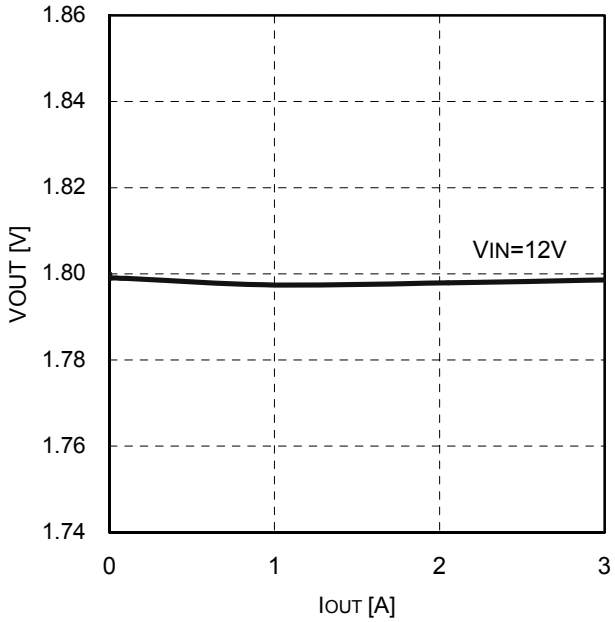


Figure 7. Output Voltage vs Output Current

Typical Performance Curves (Continued)

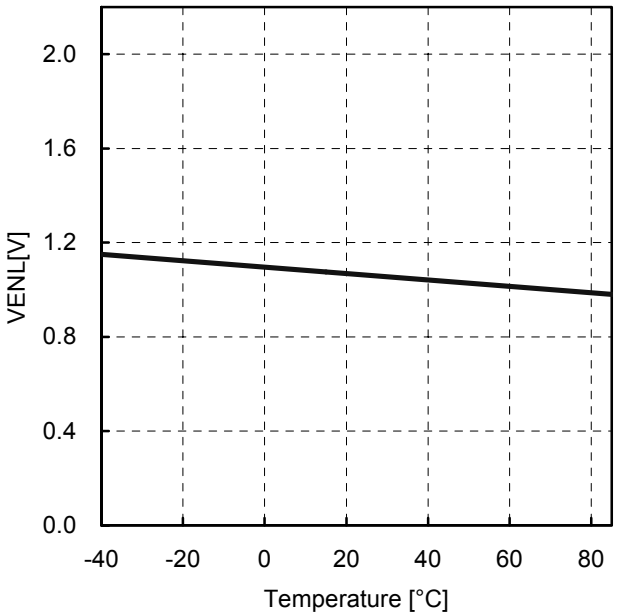


Figure 8. EN OFF Threshold Voltage vs Temperature

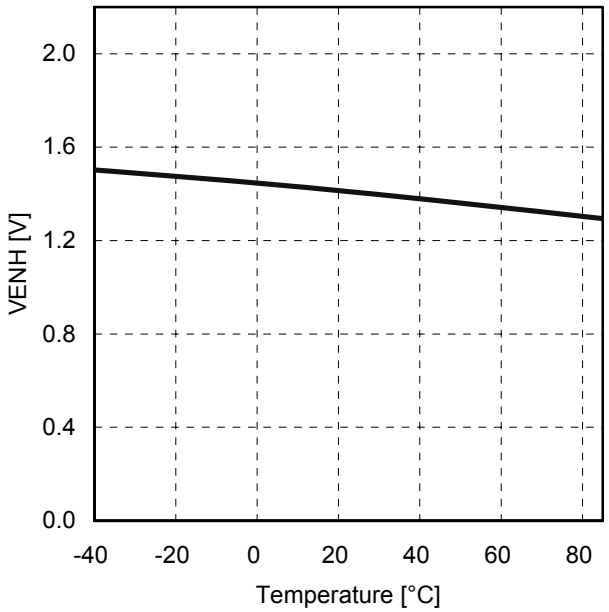


Figure 9. EN ON Threshold Voltage vs Temperature

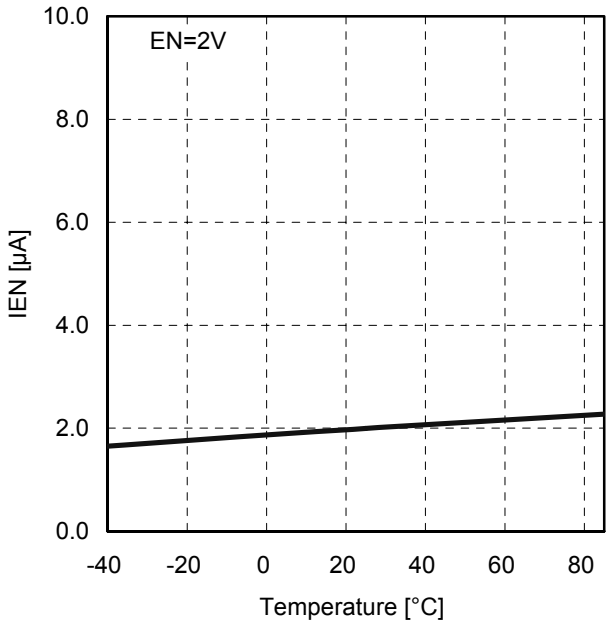


Figure 10. EN Input Current vs Temperature

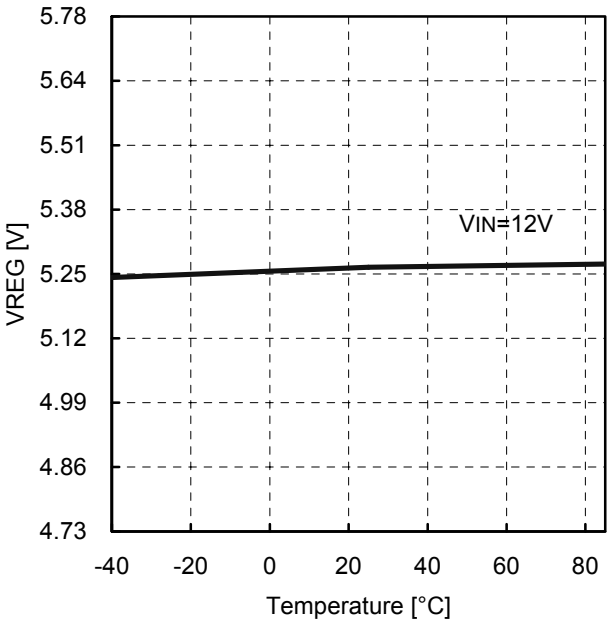


Figure 11. VREG Output Voltage vs Temperature

Typical Performance Curves (Continued)

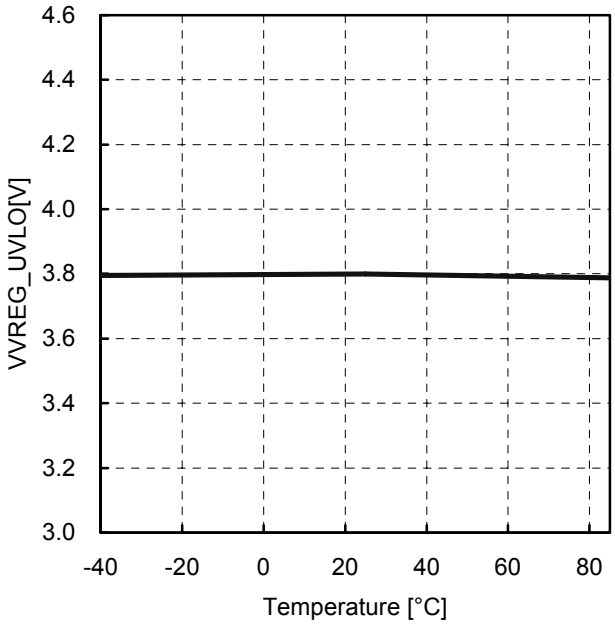


Figure 12. UVLO Threshold Voltage vs Temperature

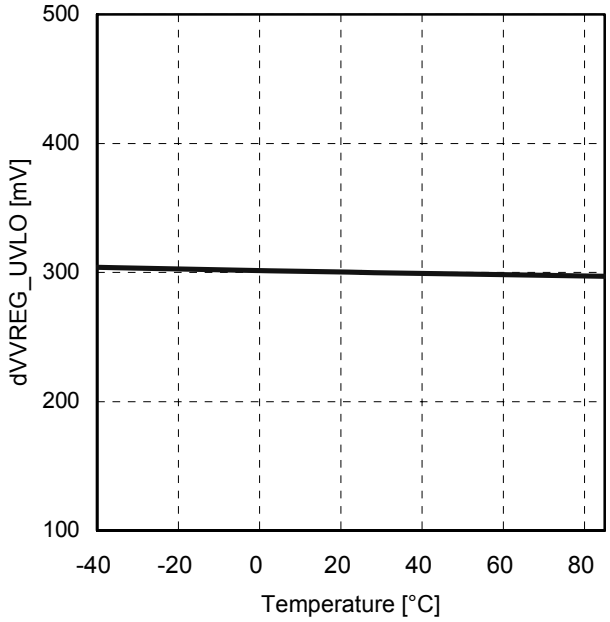


Figure 13. UVLO Hysteresis Voltage vs Temperature

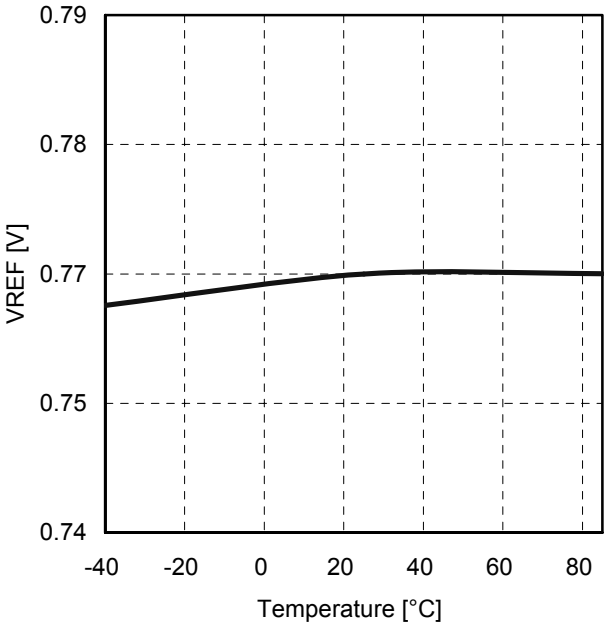


Figure 14. Reference Voltage vs Temperature

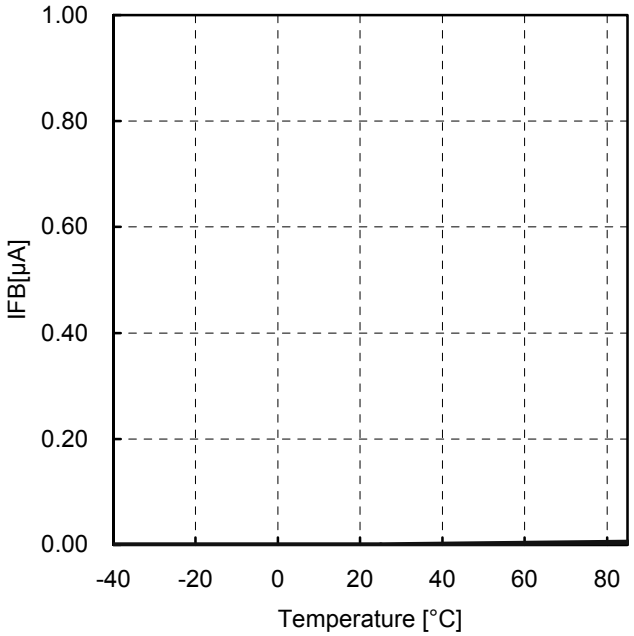


Figure 15. FB Input Current vs Temperature

Typical Performance Curves (Continued)

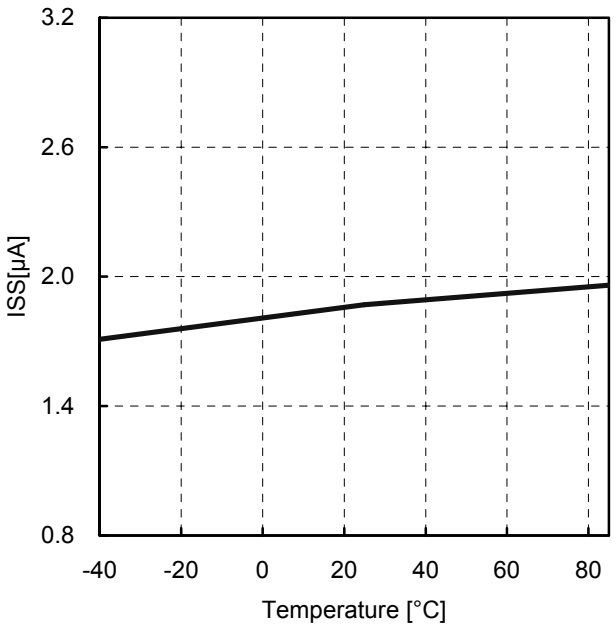


Figure 16. SS Charge Current vs Temperature

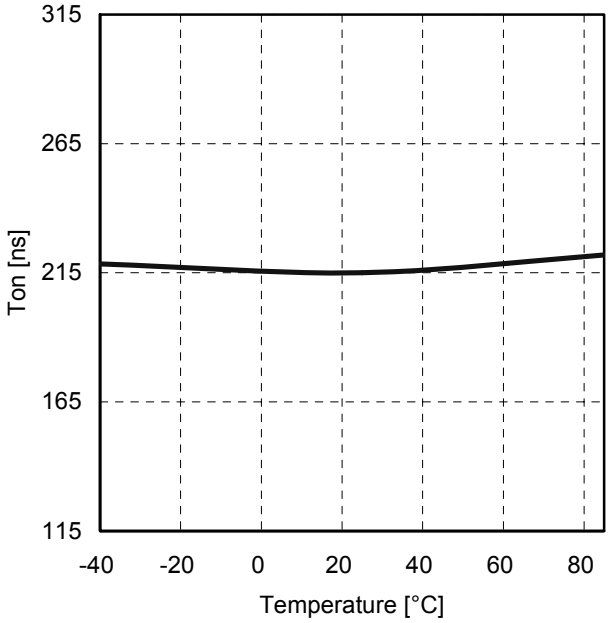


Figure 17. On Time vs Temperature

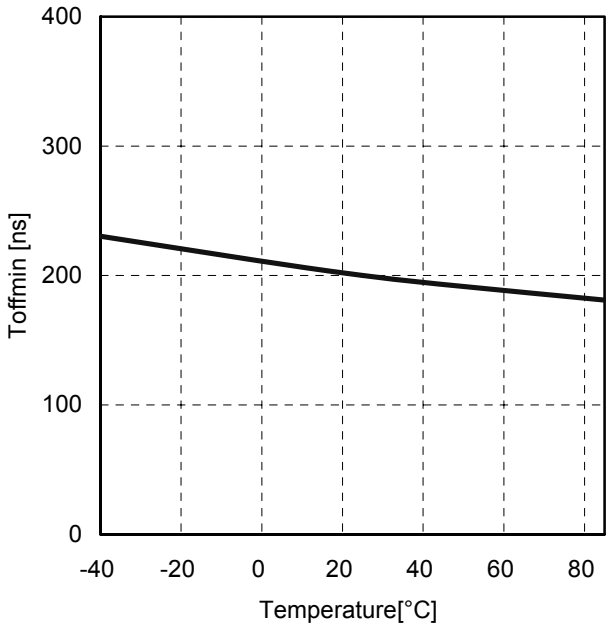


Figure 18. Minimum Off Time vs Temperature

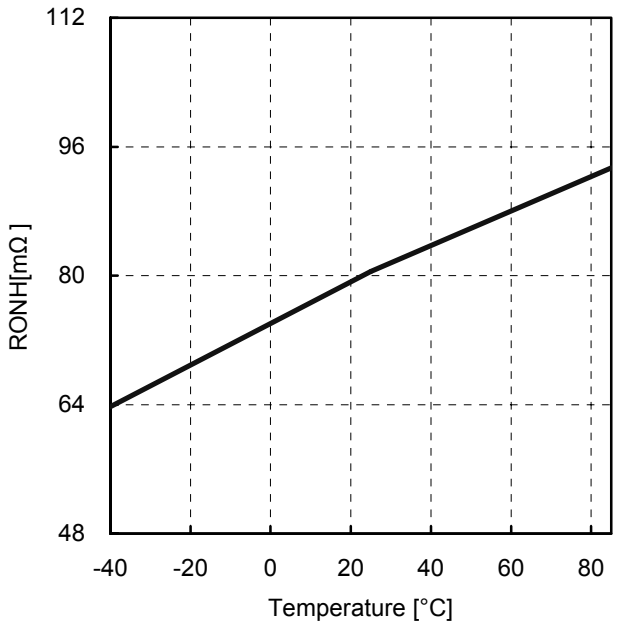


Figure 19. High Side MOSFET On-Resistance vs Temperature

Typical Performance Curves (Continued)

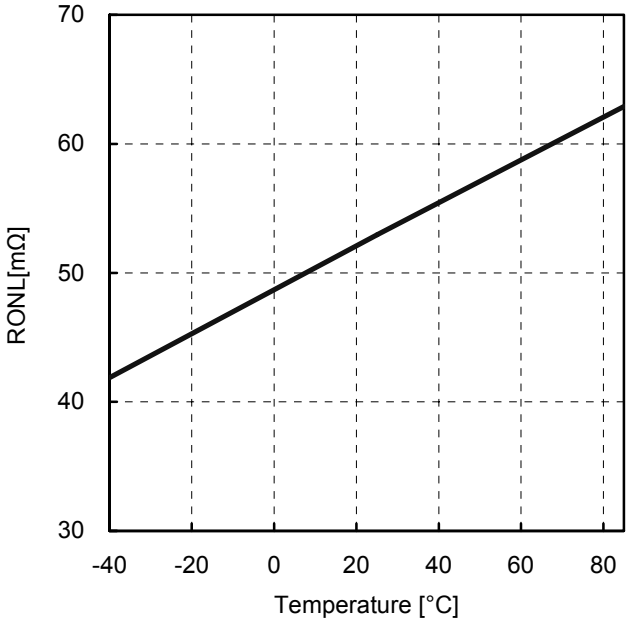


Figure 20. Low Side MOSFET On-Resistance vs Temperature

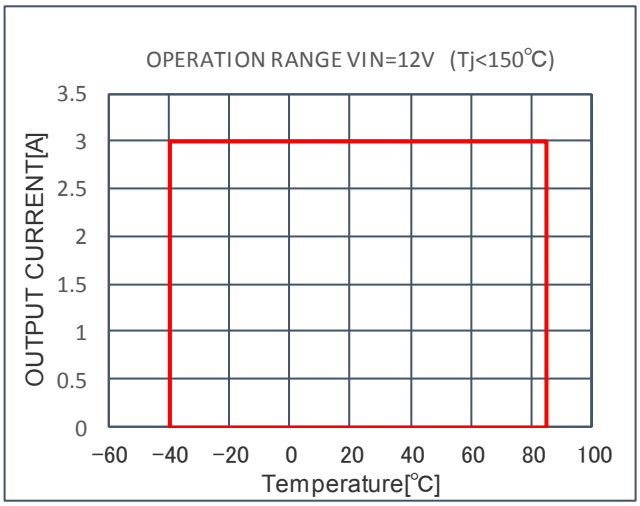


Figure 21. Output Current vs Temperature
(VIN=12V, VOUT=1V, Measured ON FR-4 board 67.5 mm x 67.5 mm, Copper Thickness : Top and Bottom 70µm, 2 Internal Layers 35µm)

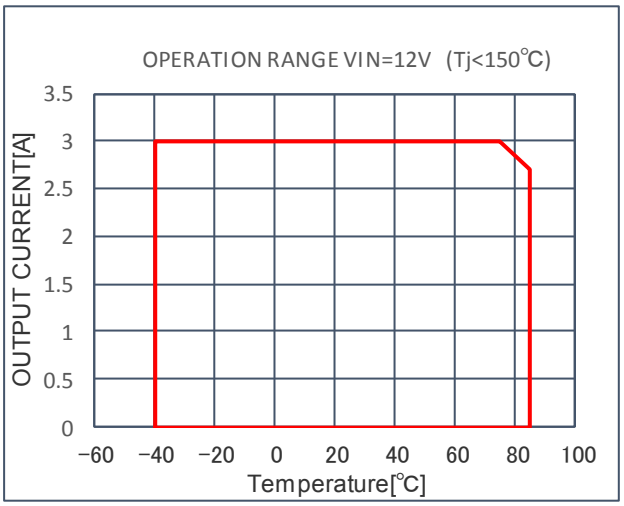


Figure 22. Output Current vs Temperature
(VIN=12V, VOUT=5V, Measured ON FR-4 board 67.5 mm x 67.5 mm, Copper Thickness :Top and Bottom 70µm, 2 Internal Layers 35µm)

Typical Performance Curves (Continued)

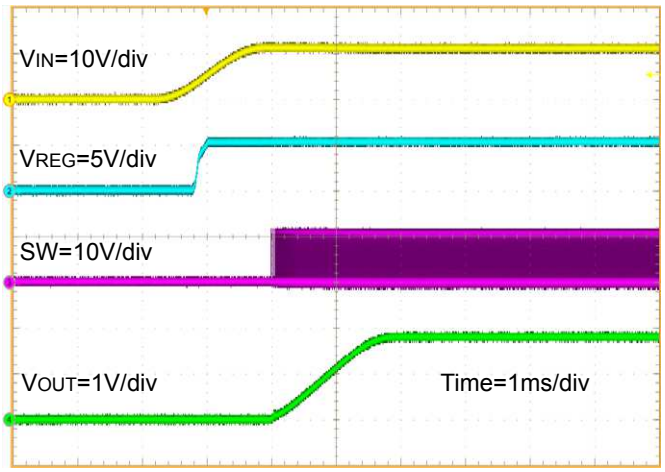


Figure 23. Power ON (VIN = EN)
(VIN=12V, VOUT=1.8V, IOUT=3A, Css=3300pF)

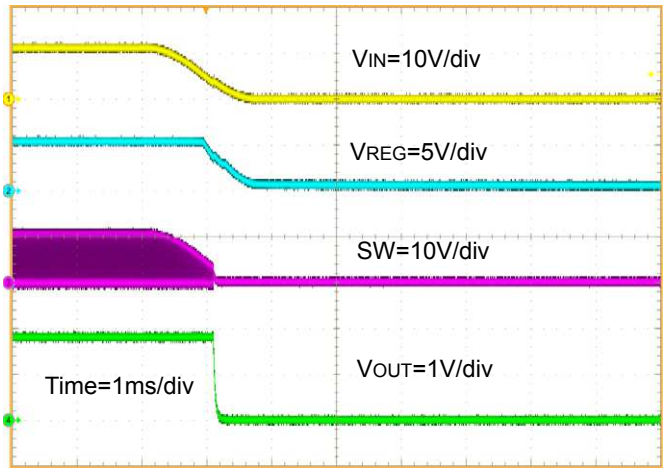


Figure 24. Power OFF (VIN = EN)
(VIN=12V, VOUT=1.8V, IOUT=3A, Css=3300pF)

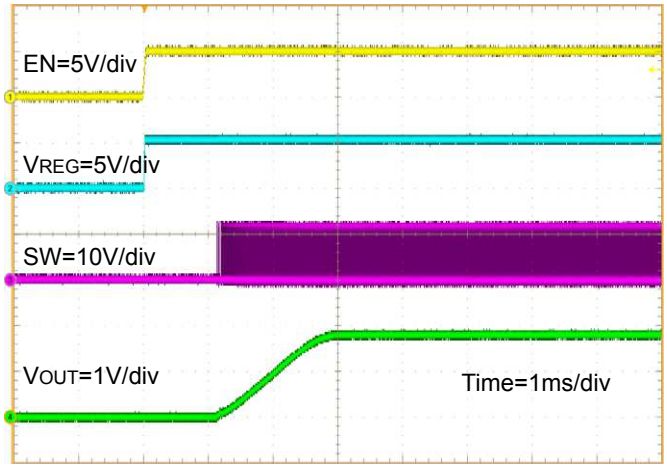


Figure 25. Power ON（EN = 0V→5V）
(VIN=12V, VOUT=1.8V, IOUT=3A, Css=3300pF)

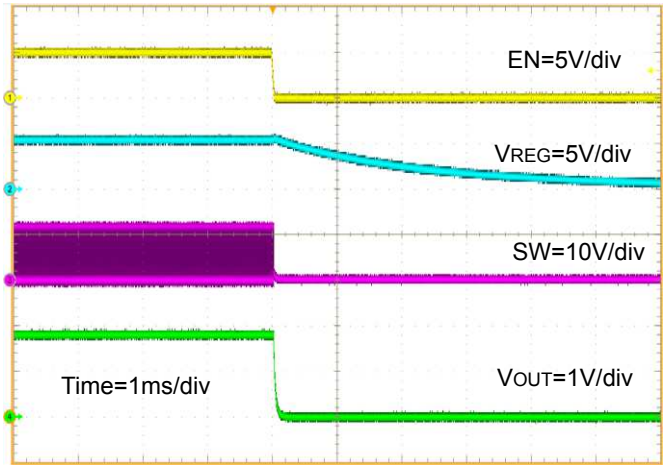


Figure 26. Power OFF (EN = 5V→0V)
(VIN=12V, VOUT=1.8V, IOUT=3A, Css=3300pF)

Typical Performance Curves (Continued)

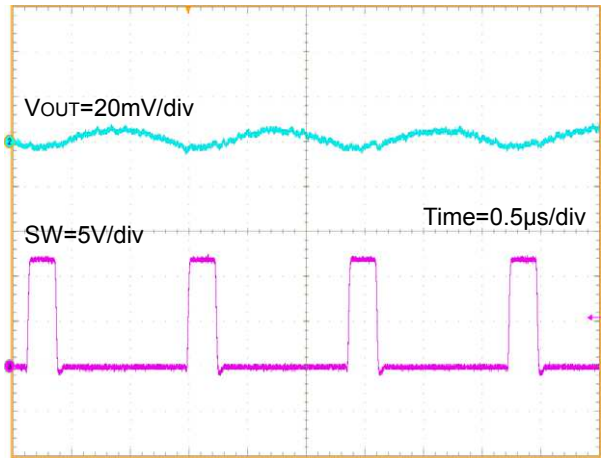


Figure 27. VOUT Ripple
(VIN=12V, VOUT=1.8V, IOUT=3A, L=2.2μH, COUT=22μF x 2)

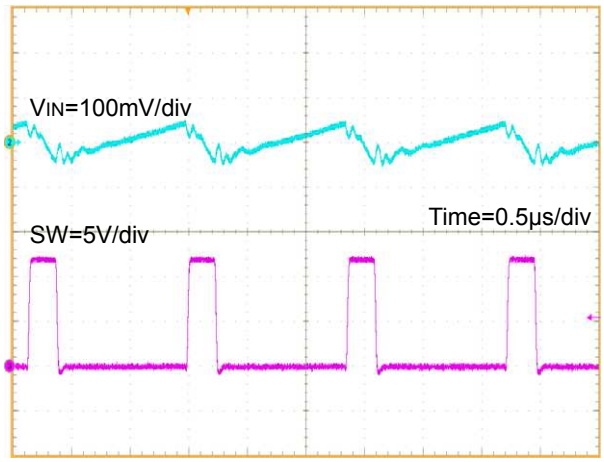


Figure 28. VIN Ripple
(VIN=12V, VOUT=1.8V, IOUT=3A, L=2.2μH, COUT=22μF x 2)

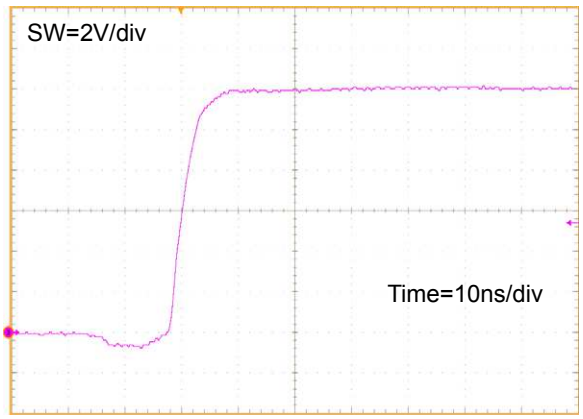


Figure 29. SW Turn ON
(VIN=12V, VOUT=1.8V, IOUT=3A, L=2.2μH, COUT=22μF x 2)

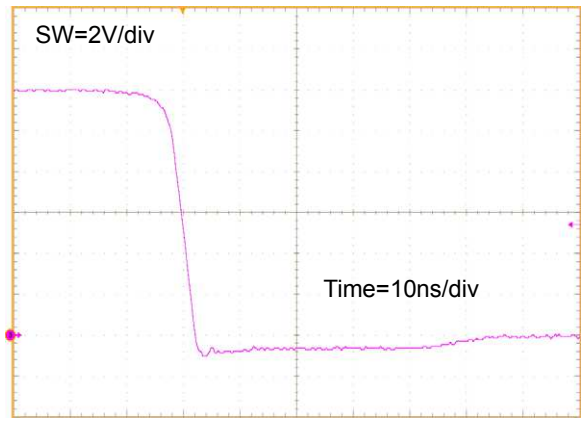


Figure 30. SW Turn OFF
(VIN=12V, VOUT=1.8V, IOUT=3A, L=2.2μH, COUT=22μF x 2)

Typical Performance Curves (Continued)

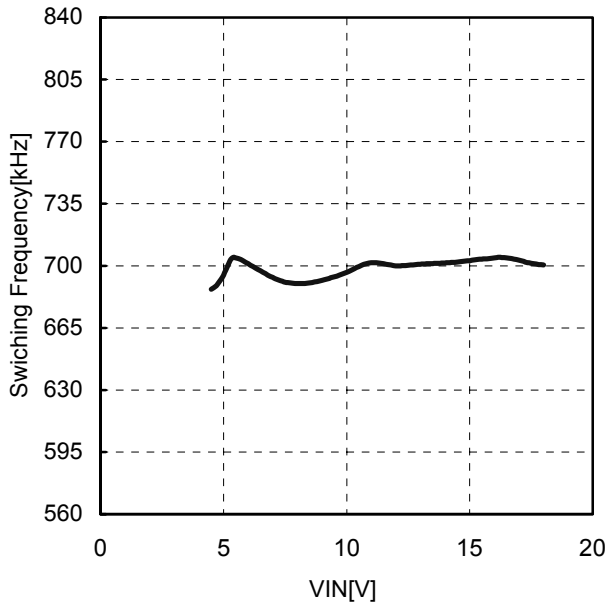


Figure 31. Switching Frequency vs Input Voltage
(VOUT=1.8V, IOUT=3A, L=2.2μH, COUT=22μF x 2)

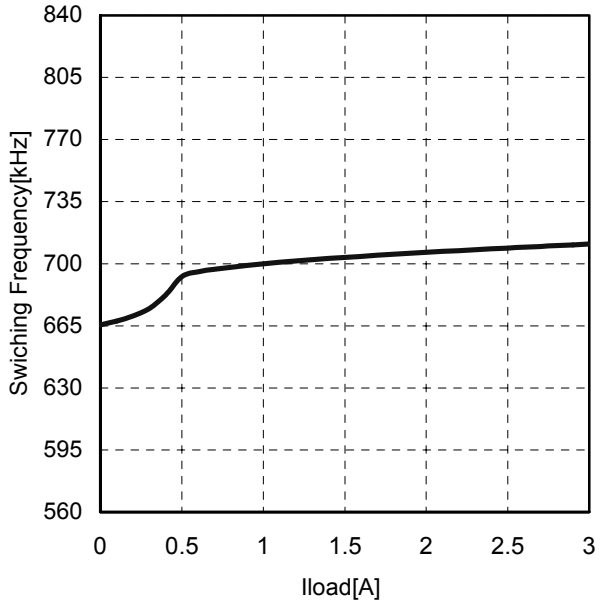


Figure 32. Switching Frequency vs Output Current
(VIN=12V, VOUT=1.8V, L=2.2μH, COUT=22μF x 2)

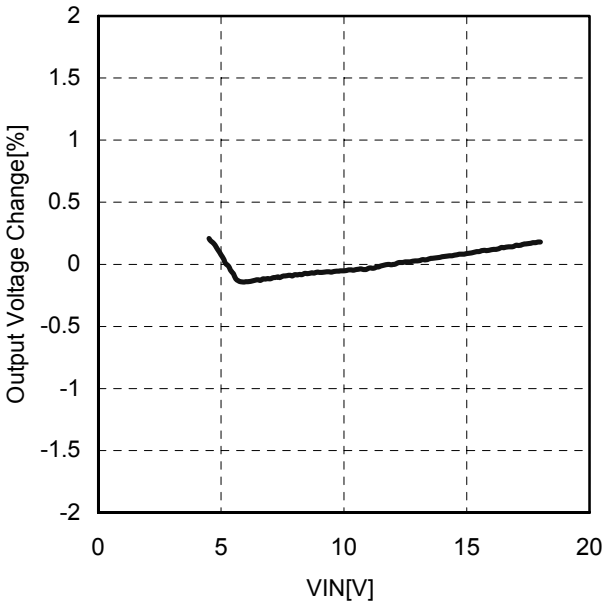


Figure 33. VOUT Line Regulation
(VOUT=1.8V)

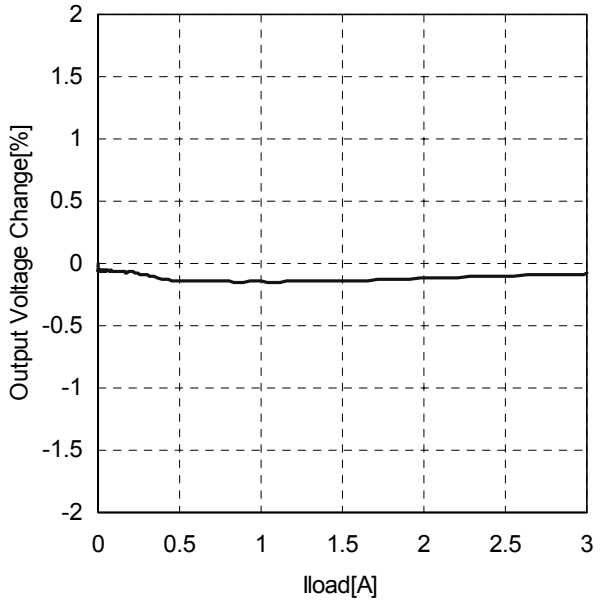


Figure 34. VOUT Load Regulation
(VIN=12V, VOUT=1.8V)

Function Explanations

1 Basic Operation

1-1 Constant On Time Control

BD9D323QWZ is a single synchronous buck switching regulator employing a constant on-time control system. It controls the on-time by using the duty ratio of V_{OUT} /V_{IN} inside IC so that a switching frequency becomes 700 kHz(Typ).Therefore it runs with the frequency of 700kHz(Typ) under the constant on-time decided with V_{OUT} / V_{IN}.

1-2 Enable Control

The IC shutdown can be controlled by the voltage applied to the EN terminal. When V_{EN} reaches 2.2 V (Min), the internal circuit is activated and the IC starts up.

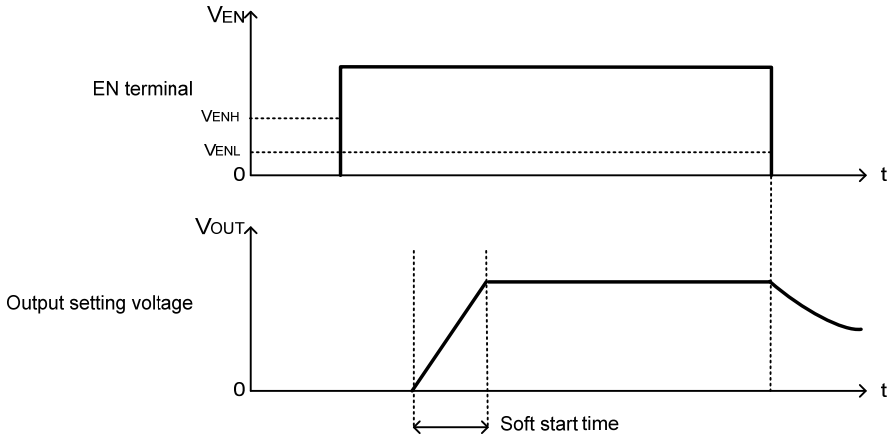


Figure35. Start-up with EN pin

1-3 Soft Start Function

By turning EN terminal to High, the soft start function operates and it gradually starts output voltage by controlling the current at start-up. Also soft start function prevents sudden current and over shoot of output voltage. Rising time can be set by connecting capacitor to SS terminal. For setting the rising time, please refer to page.28.

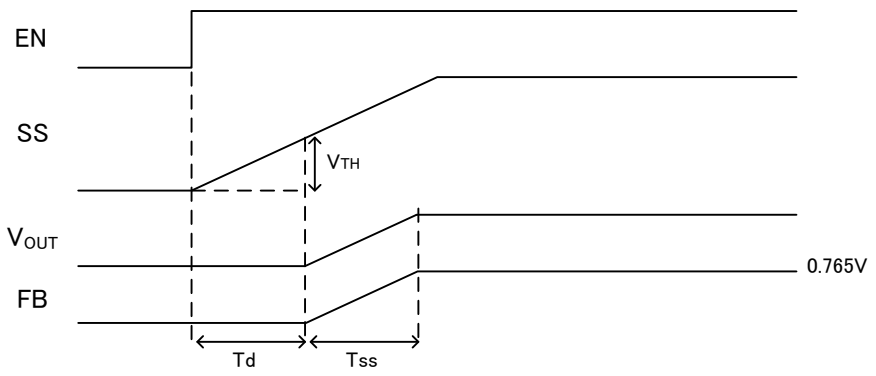


Figure 36. Soft Start Timing Chart

2 Protective Functions

The protective circuits are intended for prevention of damage caused by unexpected accidents. Do not use them for continuous protective operation.

2-1 Over Current Protection (OCP)

Over current protection function is effective by controlling current which flows in low side MOSFET by 1 cycle each of switching period. With inductor current exceeding the current restriction setting value I_{OCP} when LG is ON, the HG pulse cannot be hit even with FB voltage under REF voltage and LG continues to be ON until it is below I_{OCP}. It hits HG when it goes below I_{OCP}. As a result both frequency and duty fluctuates and output voltage may decrease.
In a case where output is decreased because of OCP, output may rise after OCP is released due to the action at high speed load response. This is non-latch protection and after over current situation is released the output voltage will recover.

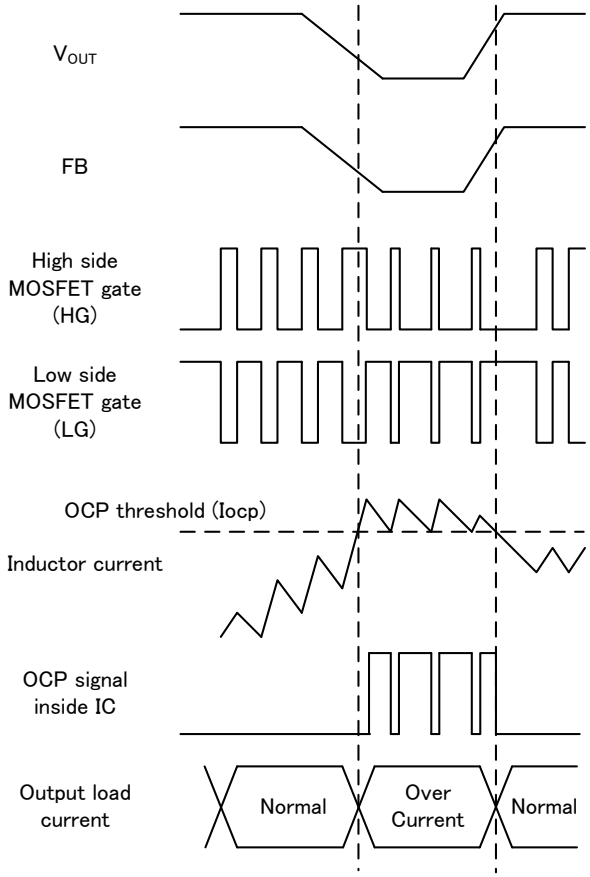


Figure 37. Over Current Protection Timing Chart

2-2 Under Voltage Lockout Protection (UVLO)

The Under Voltage Lockout Protection circuit monitors the VREG terminal voltage.
The operation enters standby when the VREG terminal voltage is 3.5 V (Typ) or lower.
The operation starts when the VREG terminal voltage is 3.8 V (Typ) or higher.

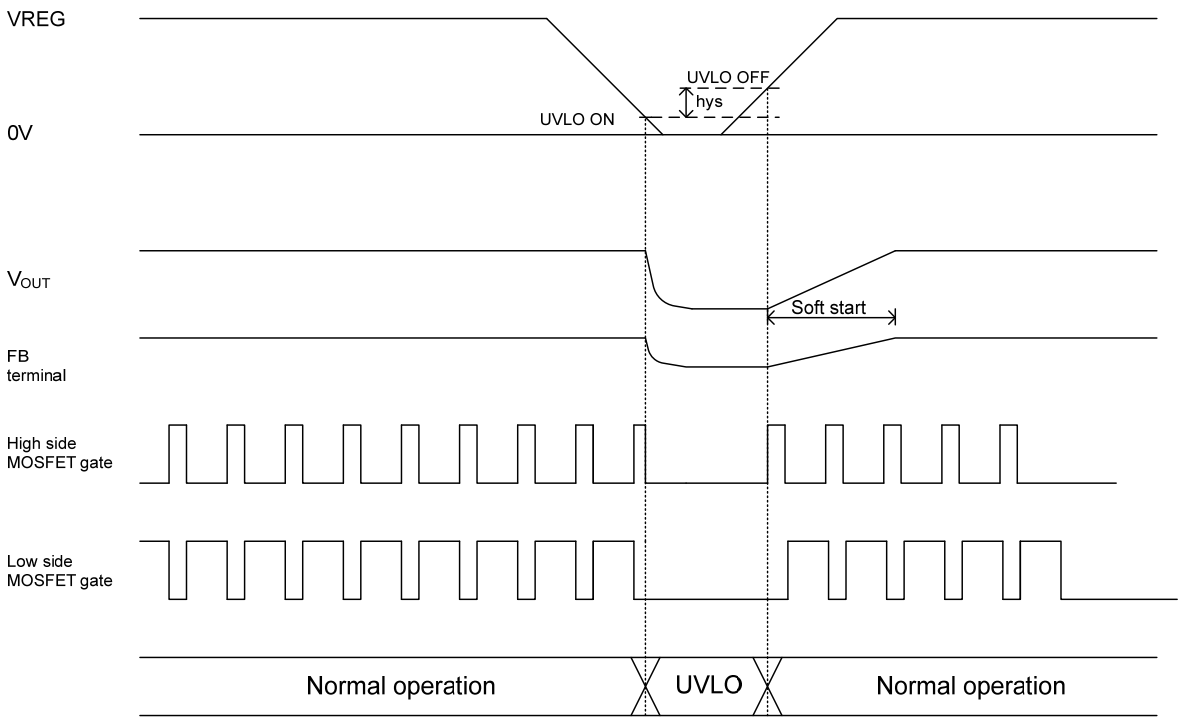


Figure 38. UVLO Timing Chart

※Load at Startup

Ensure that the respective output has light load at startup of this IC. Also, restrain the power supply line noise at start-up and voltage drop generated by operating current within the hysteresis width of UVLO. Noise exceeding the hysteresis noise width may cause the IC to malfunction.

2-3 Thermal Shutdown Function

When the chip temperature exceeds Tj = 175°C (Typ), the DC/DC converter is stopped. The thermal shutdown circuit is intended for shutting down the IC from thermal runaway in an abnormal state with the temperature exceeding Tjmax = 150°C. Do not use this function for application protection design. This is non-latch protection.

Application Example

Parameter	Symbol	Specification Example
Input Voltage	V_{IN}	12 V
Output Voltage	V_{OUT}	5.0 V
Switching Frequency	F_{OSC}	700kHz(Typ)
Maximum Output Load	I_{OMAX}	3A
Operating Temperature Range	Topr	-40 °C ~ +75°C

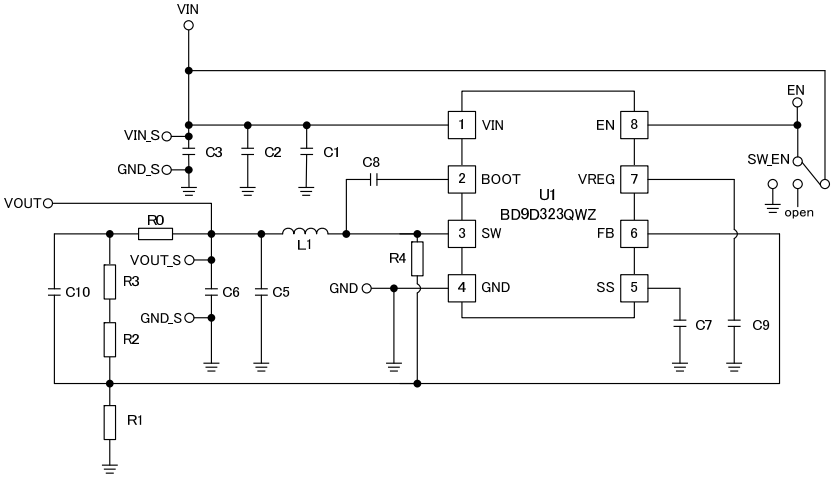


Figure 39. Application Circuit

Table 1. Recommendation Circuit constants

Part No	Value	Company	Part name
U1		ROHM	BD9D323QWZ
L1	3.3μH	TOKO	FDSD0518-H-3R3M
C1(Note 1)	0.1μF	Murata	GRM188R71H104KA93D
C2(Note 2)	10μF	Murata	GRM32DB31E106KA75L
C3(Note 2)	10μF	Murata	GRM32DB31E106KA75L
C5(Note 3)	22μF	Murata	GRM32EB31E226ME15L
C6(Note 3)	22μF	Murata	GRM32EB31E226ME15L
C7	3300pF	Murata	GRM155B11H332KA01
C8	0.1μF	Murata	GRM188R71H104KA93D
C9	1μF	Murata	GRM188B11A105KA61D
C10	22pF	Murata	GRM1552C1E220JA01
R0	0Ω	ROHM	MCR01MZPJ000
R1	22kΩ	ROHM	MCR01MZPF2202
R2	120kΩ	ROHM	MCR01MZPF1203
R3	1.8kΩ	ROHM	MCR01MZPF1801
R4	OPEN	-	-

(Note 1) In order to reduce the influence of high frequency noise, arrange the 0.1μF ceramic capacitor as close as possible to the V_{IN} pin and GND pin.
(Note 2) For capacitance of input capacitor, take temperature characteristics, DC bias characteristics, etc. into consideration to set minimum value to no less than 4.7μF. When VIN is lower than 7V at normal state, add capacitor same as C2 to C3.
(Note 3) In case capacitance value fluctuates due to temperature characteristics, DC bias characteristics, etc. of output capacitor, Loop Response may fluctuate. Please confirm on actual equipment. When selecting a capacitor, confirm the characteristics of the capacitor in its datasheet, Please use capacitors such as ceramic type are recommended for output capacitor.

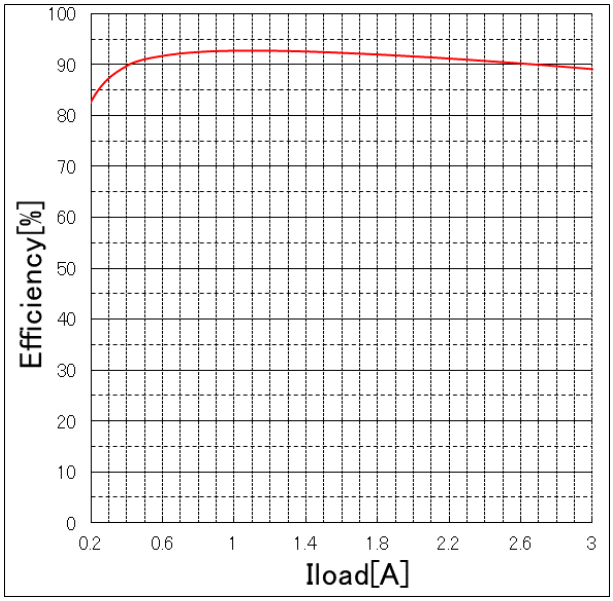


Figure 40. Efficiency vs Output Current
(VIN=12V, VOUT = 5V)

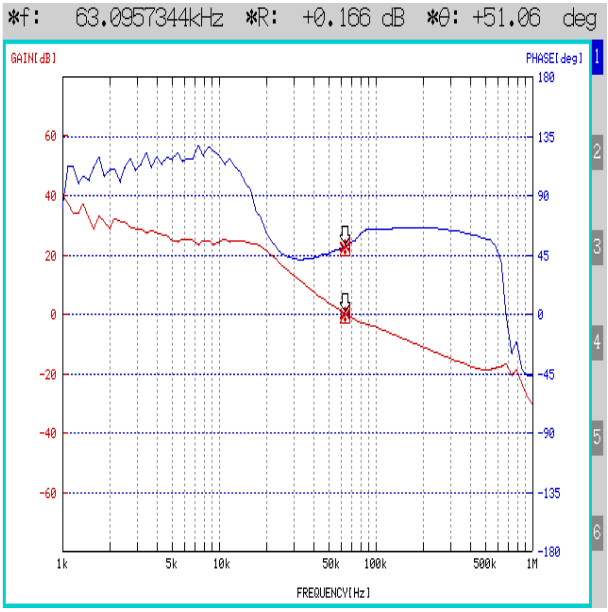


Figure 41. Loop Response IOUT=3A
(VIN=12V, VOUT=5V)

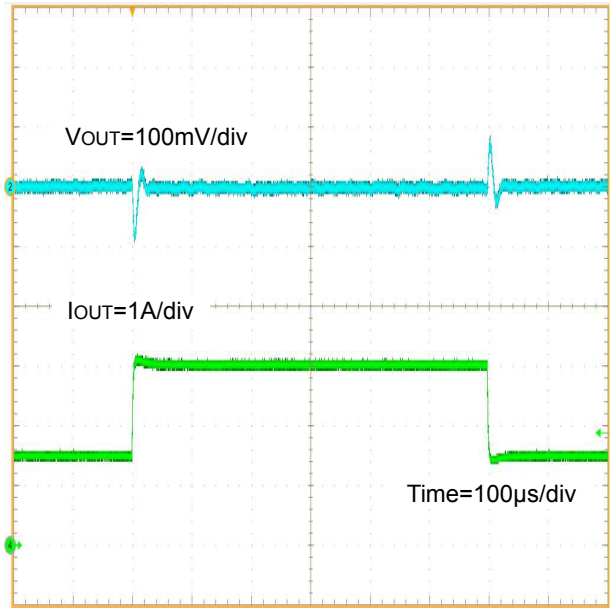


Figure 42. Load Transient Response IOUT=1.5A - 3A
(VIN=12V, VOUT=5V)

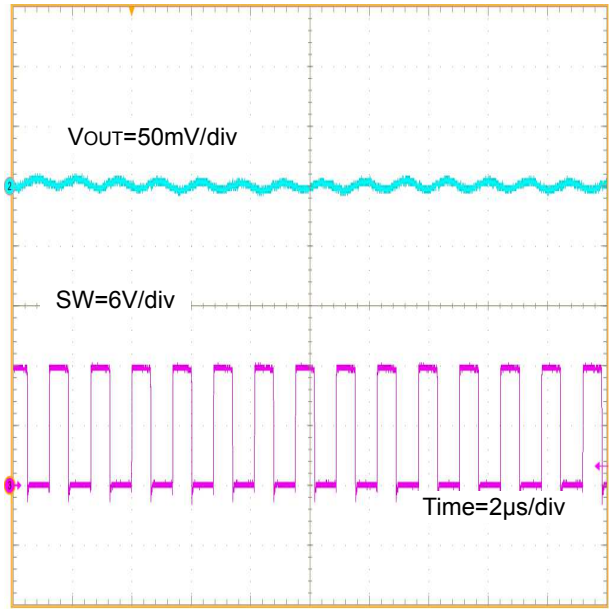


Figure 43. VOUT Ripple IOUT=3A
(VIN = 12V, VOUT = 5V)

Application Example

Parameter	Symbol	Specification Example
Input Voltage	V_{IN}	12 V
Output Voltage	V_{OUT}	3.3 V
Switching Frequency	F_{OSC}	700kHz(Typ)
Maximum Output Load	I_{OMAX}	3A
Operating Temperature Range	Topr	-40 °C ~ +85°C

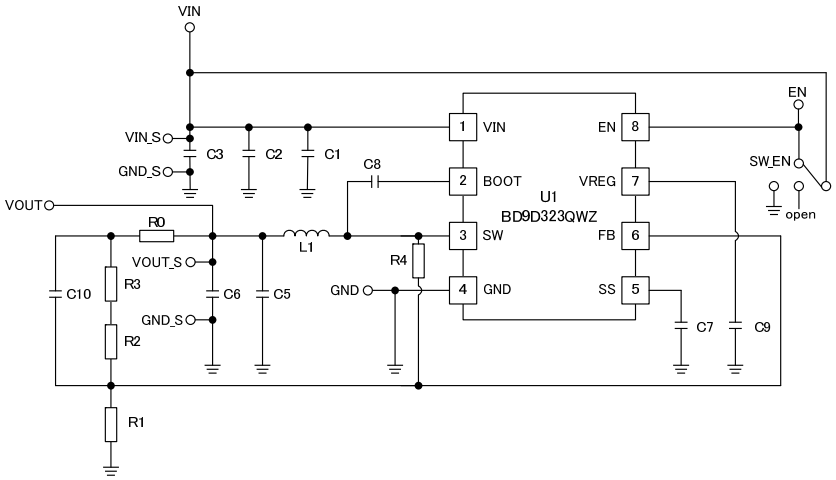


Figure 44. Application Circuit

Table 2. Recommendation Circuit constants

Part No	Value	Company	Part name
U1		ROHM	BD9D323QWZ
L1	2.2μH	TOKO	FDSD0518-H-2R2M
C1(Note 1)	0.1μF	Murata	GRM188R71H104KA93D
C2(Note 2)	10μF	Murata	GRM32DB31E106KA75L
C3(Note 2)	10μF	Murata	GRM32DB31E106KA75L
C5(Note 3)	22μF	Murata	GRM31CB31A226ME19L
C6(Note 3)	22μF	Murata	GRM31CB31A226ME19L
C7	3300pF	Murata	GRM155B11H332KA01
C8	0.1μF	Murata	GRM188R71H104KA93D
C9	1μF	Murata	GRM188B11A105KA61D
C10	27pF	Murata	GRM1552C1E270JA01
R0	0Ω	ROHM	MCR01MZPJ000
R1	22kΩ	ROHM	MCR01MZPF2202
R2	68kΩ	ROHM	MCR01MZPF6802
R3	5.1kΩ	ROHM	MCR01MZPF5101
R4	OPEN	-	-

(Note 1) In order to reduce the influence of high frequency noise, arrange the 0.1μF ceramic capacitor as close as possible to the V_{IN} pin and GND pin.
(Note 2) For capacitance of input capacitor, take temperature characteristics, DC bias characteristics, etc. into consideration to set minimum value to no less than 4.7μF. When VIN is lower than 7V at normal state, add capacitor same as C2 to C3.
(Note 3) In case capacitance value fluctuates due to temperature characteristics, DC bias characteristics, etc. of output capacitor, Loop Response may fluctuate. Please confirm on actual equipment. When selecting a capacitor, confirm the characteristics of the capacitor in its datasheet, Please use capacitors such as ceramic type are recommended for output capacitor.

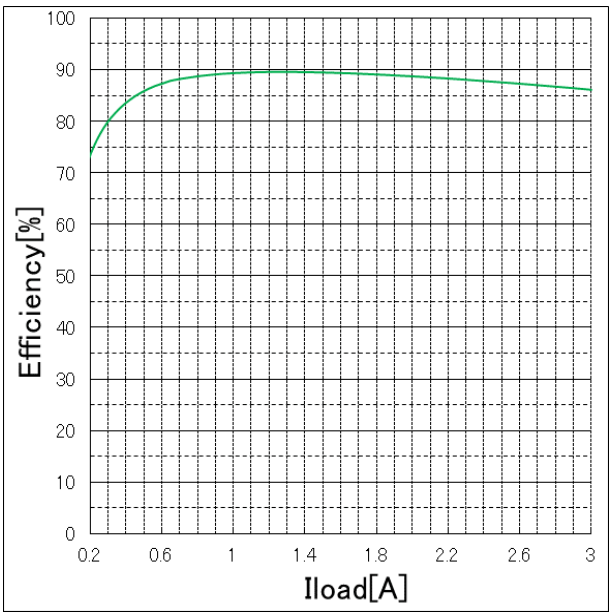


Figure 45. Efficiency vs Output Current
(VIN=12V, VOUT = 3.3V)

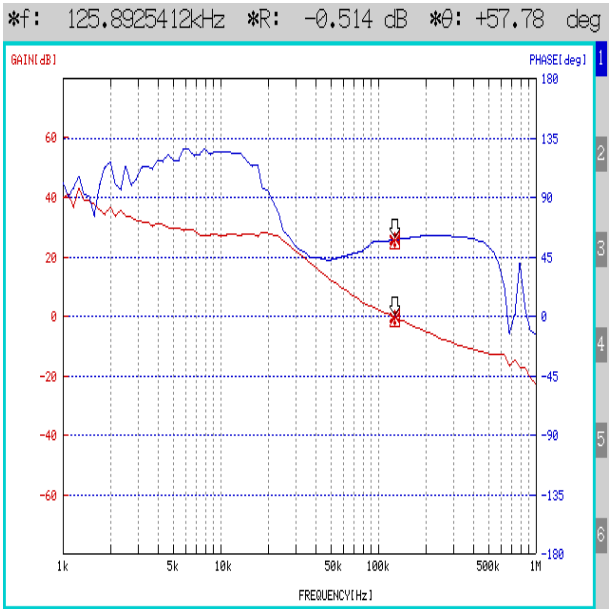


Figure 46. Loop Response IOUT=3A
(VIN=12V, VOUT=3.3V)

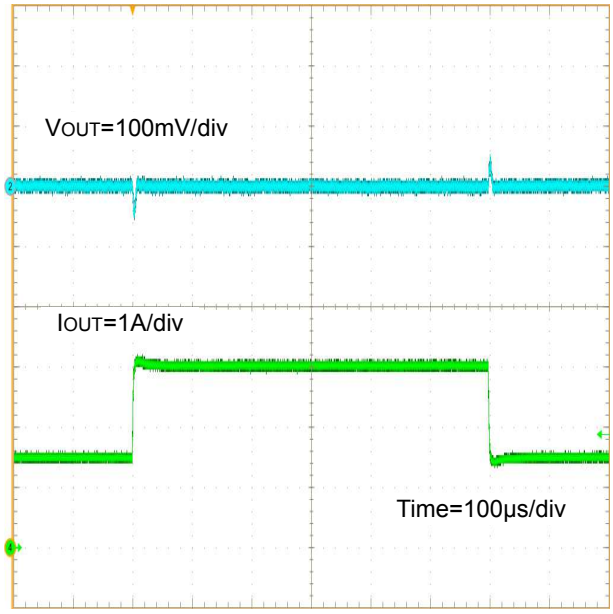


Figure 47. Load Transient Response IOUT=1.5A - 3A
(VIN=12V, VOUT=3.3V)

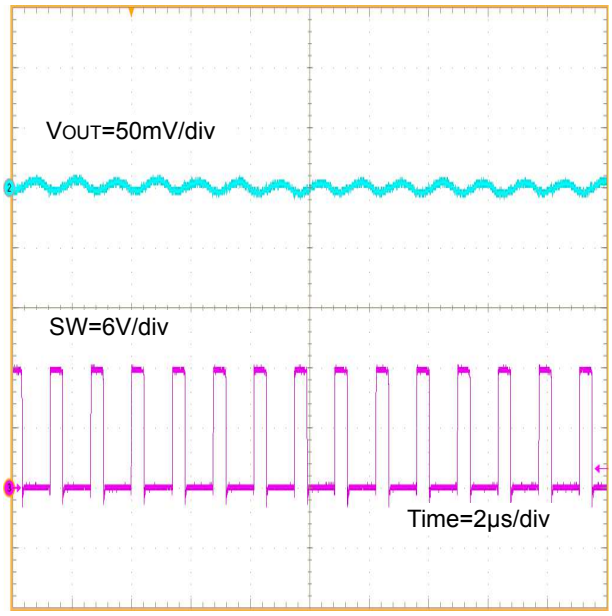


Figure 48. VOUT Ripple IOUT=3A
(VIN = 12V, VOUT = 3.3V)

Application Example

Parameter	Symbol	Specification Example
Input Voltage	V_{IN}	12 V
Output Voltage	V_{OUT}	1.8 V
Switching Frequency	F_{OSC}	700kHz(Typ)
Maximum Output Load	I_{OMAX}	3A
Operating Temperature Range	Topr	-40 °C ~ +85°C

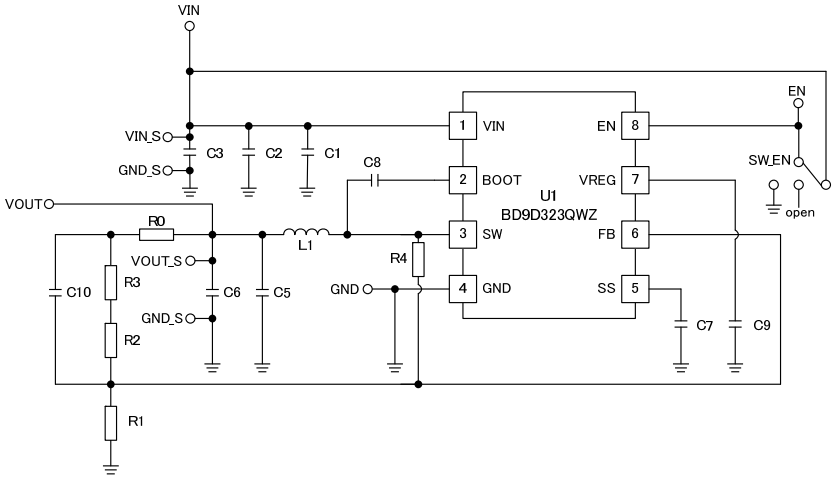


Figure 49. Application Circuit

Table 3. Recommendation Circuit constants

Part No	Value	Company	Part name
U1		ROHM	BD9D323QWZ
L1	2.2μH	TOKO	FDSD0518-H-2R2M
C1(Note 1)	0.1μF	Murata	GRM188R71H104KA93D
C2(Note 2)	10μF	Murata	GRM32DB31E106KA75L
C3(Note 2)	10μF	Murata	GRM32DB31E106KA75L
C5(Note 3)	22μF	Murata	GRM21BB30J226ME38L
C6(Note 3)	22μF	Murata	GRM21BB30J226ME38L
C7	3300pF	Murata	GRM155B11H332KA01
C8	0.1μF	Murata	GRM188R71H104KA93D
C9	1μF	Murata	GRM188B11A105KA61D
C10	47pF	Murata	GRM1552C1E470JA01
R0	0Ω	ROHM	MCR01MZPJ000
R1	22kΩ	ROHM	MCR01MZPF2202
R2	30kΩ	ROHM	MCR01MZPF3002
R3	0Ω	ROHM	MCR01MZPJ000
R4	OPEN	-	-

(Note 1) In order to reduce the influence of high frequency noise, arrange the 0.1μF ceramic capacitor as close as possible to the V_{IN} pin and GND pin.
(Note 2) For capacitance of input capacitor, take temperature characteristics, DC bias characteristics, etc. into consideration to set minimum value to no less than 4.7μF. When VIN is lower than 7V at normal state, add capacitor same as C2 to C3.
(Note 3) In case capacitance value fluctuates due to temperature characteristics, DC bias characteristics, etc. of output capacitor, Loop Response may fluctuate. Please confirm on actual equipment. When selecting a capacitor, confirm the characteristics of the capacitor in its datasheet, Please use capacitors such as ceramic type are recommended for output capacitor.

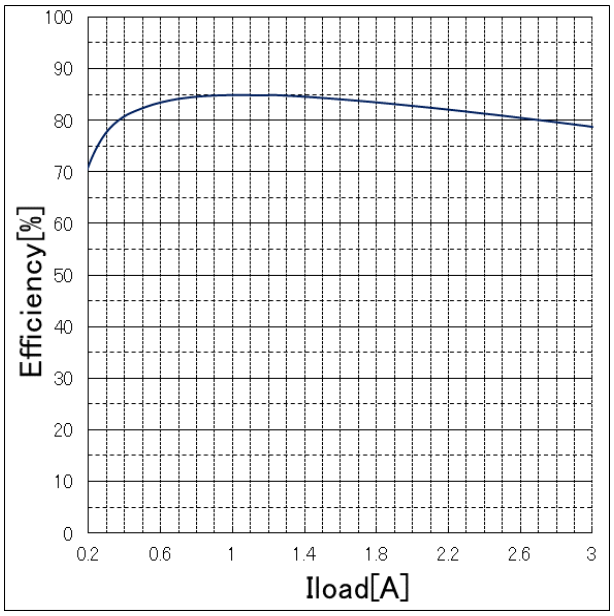


Figure 50. Efficiency vs Output Current
(VIN=12V, VOUT = 1.8V)

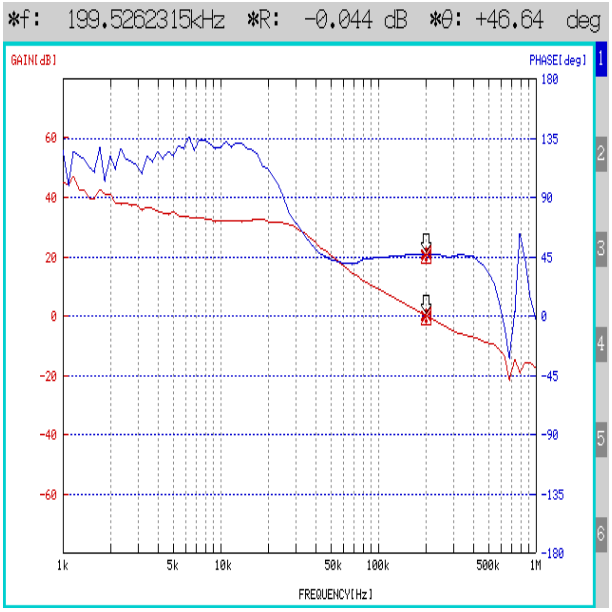


Figure 51. Loop Response IOUT=3A
(VIN=12V, VOUT=1.8V)

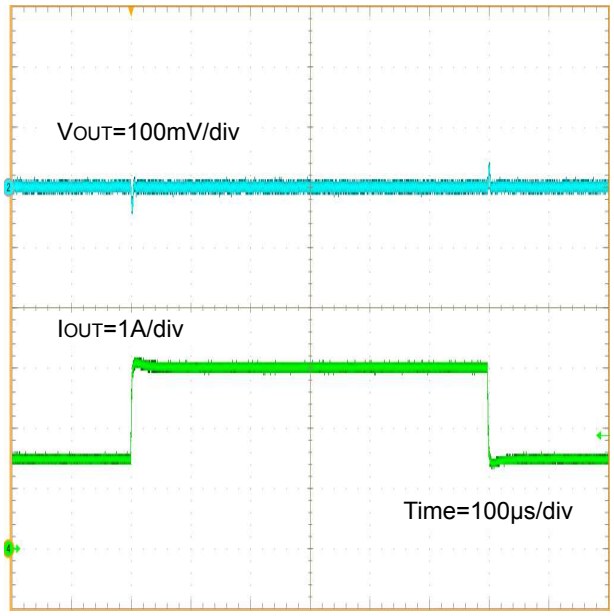


Figure 52. Load Transient Response IOUT=1.5A - 3A
(VIN=12V, VOUT=1.8V)

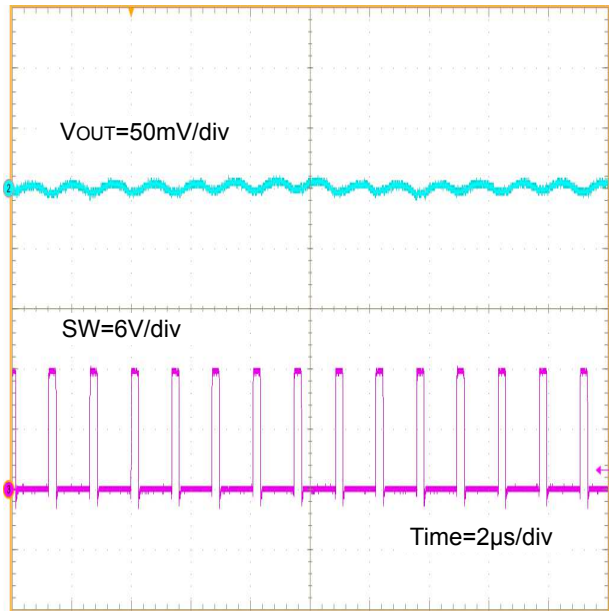


Figure 53. VOUT Ripple IOUT=3A
(VIN = 12V, VOUT = 1.8V)

Application Example

Parameter	Symbol	Specification Example
Input Voltage	V_{IN}	12 V
Output Voltage	V_{OUT}	1.2 V
Switching Frequency	F_{OSC}	700kHz(Typ)
Maximum Output Load	I_{OMAX}	3A
Operating Temperature Range	Topr	-40 °C ~ +85°C

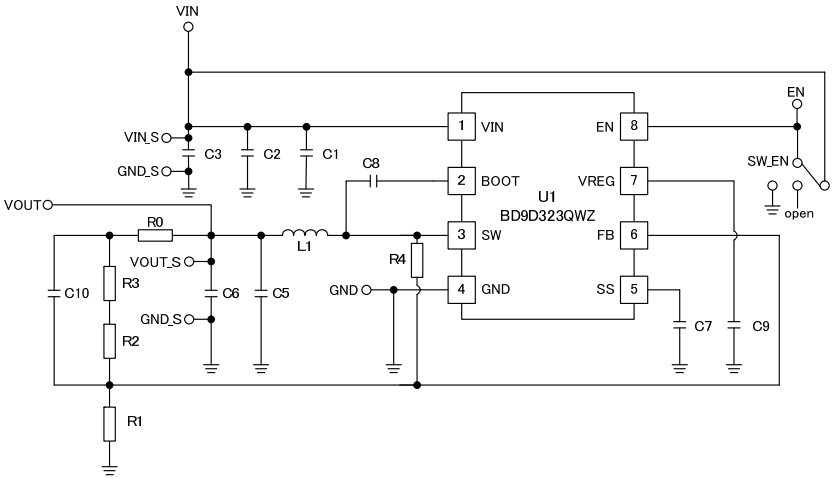


Figure 54. Application Circuit

Table 4. Recommendation Circuit constants

Part No	Value	Company	Part name
U1		ROHM	BD9D323QWZ
L1	1.5μH	TOKO	FDSD0518-H-1R5M
C1(Note 1)	0.1μF	Murata	GRM188R71H104KA93D
C2(Note 2)	10μF	Murata	GRM32DB31E106KA75L
C3(Note 2)	10μF	Murata	GRM32DB31E106KA75L
C5(Note 3)	22μF	Murata	GRM31CB31A226ME19L
C6(Note 3)	22μF	Murata	GRM31CB31A226ME19L
C7	3300pF	Murata	GRM155B11H332KA01
C8	0.1μF	Murata	GRM188R71H104KA93D
C9	1μF	Murata	GRM188B11A105KA61D
C10	220pF	Murata	GRM155B11H221KA01
R0	0Ω	ROHM	MCR01MZPJ000
R1	10kΩ	ROHM	MCR01MZPF1002
R2	4.7kΩ	ROHM	MCR01MZPF4701
R3	1kΩ	ROHM	MCR01MZPF1001
R4	300kΩ	ROHM	MCR01MZPF3003

(Note 1) In order to reduce the influence of high frequency noise, arrange the 0.1μF ceramic capacitor as close as possible to the V_{IN} pin and GND pin.
(Note 2) For capacitance of input capacitor, take temperature characteristics, DC bias characteristics, etc. into consideration to set minimum value to no less than 4.7μF. When VIN is lower than 7V at normal state, add capacitor same as C2 to C3.
(Note 3) In case capacitance value fluctuates due to temperature characteristics, DC bias characteristics, etc. of output capacitor, Loop Response may fluctuate. Please confirm on actual equipment. When selecting a capacitor, confirm the characteristics of the capacitor in its datasheet, Please use capacitors such as ceramic type are recommended for output capacitor.

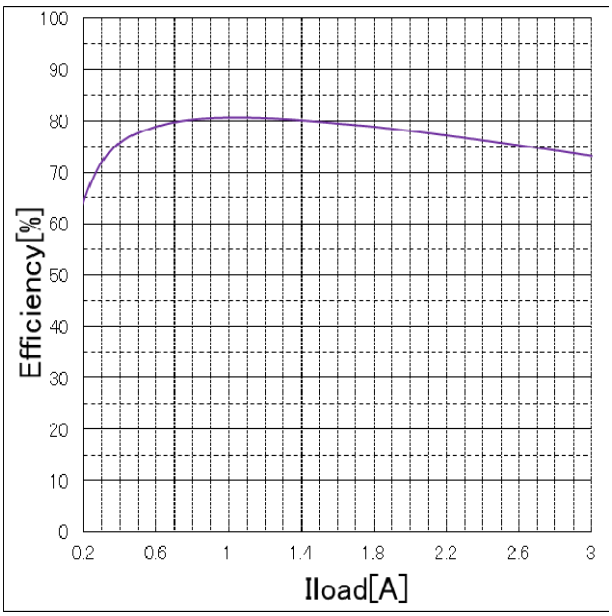


Figure 55. Efficiency vs Output Current
(VIN=12V, VOUT = 1.2V)

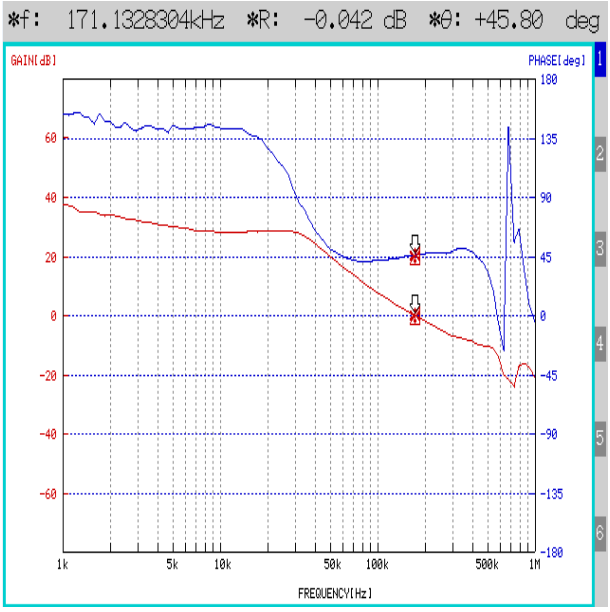


Figure 56. Loop Response IOUT=3A
(VIN=12V, VOUT=1.2V)

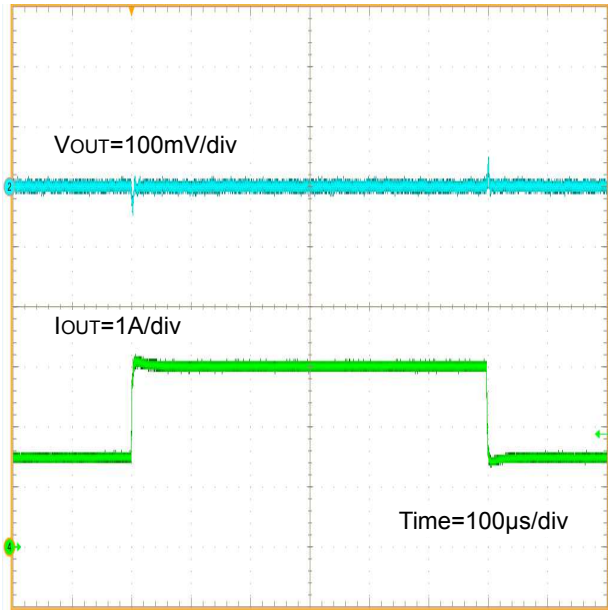


Figure 57. Load Transient Response IOUT=1.5A - 3A
(VIN=12V, VOUT=1.2V)

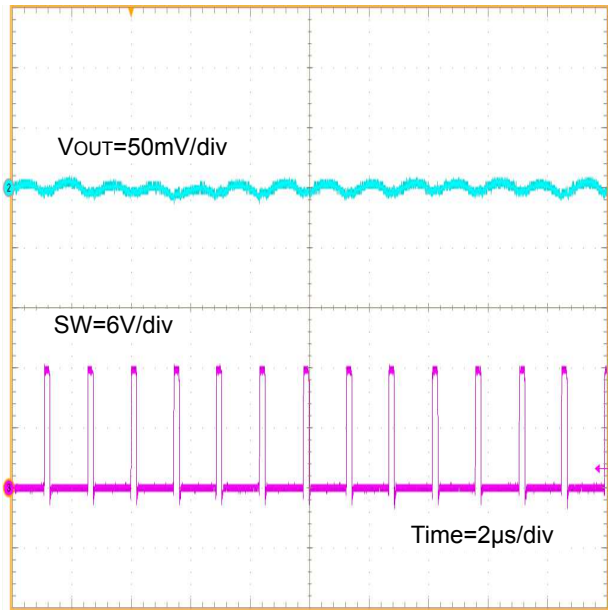


Figure 58. VOUT Ripple IOUT=3A
(VIN = 12V, VOUT = 1.2V)