User guide for IRDC38263 evaluation board

OptiMOS™ iPOL

About this document

Scope and purpose

The IR38263 OptiMOS™ iPOL is an easy-to-use, fully integrated and highly efficient DC/DC regulator with Intel SVID and I2C/SMBus interface. The onboard PWM controller and low duty cycle optimized MOSFETs make IR38263 a space-efficient solution, providing accurate power delivery for low output voltage and high current applications.

IR38263 is a versatile regulator which offers programmability of switching frequency, output voltage, and fault/warning thresholds and fault responses while operating over a wide input and output voltage range. Thus, it offers flexibility as well as system level security in event of fault conditions.

The switching frequency is programmable from 166 kHz to 1.5 MHz for an optimum solution. The on-chip sensors and ADC along with the SVID and PMBus interfaces make it easy to monitor and report input voltage, output voltage, output current and temperature.

This user guide contains the schematic and bill of materials for the IRDC38263 evaluation board. The guide describes the use of the evaluation board itself. Detailed application information for IR38263 is available in the IR38263 data sheet

Intended audience

This user guide is intended as a reference for designer's evaluating the IRDC38263 board, OptiMOS™ iPOL.

Table of Contents

1 Board features

- V_{in} = +12 V
- Vout = +0.72 V to +1.8 V
- Idc = 30 A
- F_s = 762 kHz
- L = 120 nH (10.2 mm X 7 mm X 4.96 mm, DCR=0.39 mΩ)
- C_{in} = 7x22 uF (16 V, ceramic 1206) + 1X330 uF (16 V, electrolytic, *Note*1)
- C_{out} = 9 X 100 uF (6.3 V/X5R/1206)

Note 1: The electrolytic input capacitor is used to damp the parasitic inductance of input supply cables. It can be eliminated if the input is from nearby power planes.

2 Connections and operating instructions

IR38163 VCCIO demo board requires a single +12 V for the input power. It can deliver up to 30 A load current. Table 1 lists the connectors, jumpers and test points on the board.

Table 1 Connections

Label		Descriptions
Power Connectors	PVIN	Connect input power (+12 V) to this connector
	GND	Return of input power
Power Connectors	VOUT	Vout, connect a load (30 A max) to this connect
	GND	Return of Vout
Vcc inputs/outputs	Vcc, GND	Measure Vcc voltage To apply external 5 V Vcc, depopulate R12 and populate R11 with a 0 ohm resistor
P15	I2c supply	Populate the jumper for this header to pull up the SALERT# line to Vcc
P16	ALERT	SM Bus Line
	GND	
	DATA	
	CLK	
P17	Enable input	Populate the jumper for the VIN_D header (red position in Figure 1) to allow Enable to be derived from PVIN. The other header positions correspond to connecting Enable to either Vcc, or an external supply or to Gnd.
P20	Mini Slammer	An Intel mini slammer could be connected to this connector
Test Points	PGOOD	Test point for Power Good
	Enable	Test point for Enable pin

Typically the PVID supply jumper (P8) should be set to Vcc (pink position in Figure 1.) The PVID [2:0] select jumpers (P9, P11 and P13) can be set to pull the PVID high (blue position) or low (pink position). To select one of 8 output voltages as shown in Table 2 below:

Table 2 PVID to out voltage mapping

PVID2	PVID1	PVID0	Vout (V)
0	0	0	0.85
0	0	1	1.00
0	1	0	0.90
0	1	1	0.80
1	0	0	0.72
1	0	1	1.10
1	1	0	0.95
1	1	1	1.2

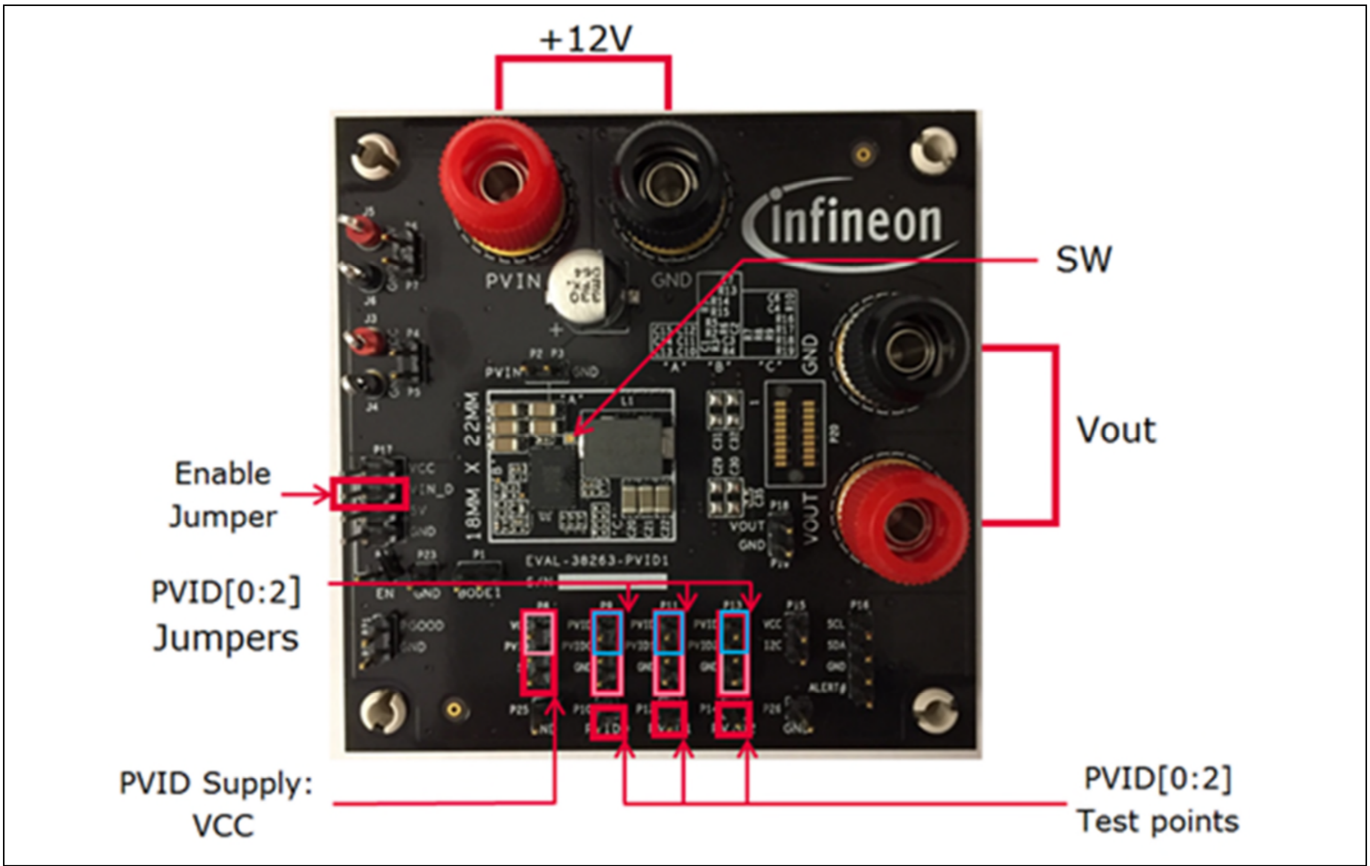

Figure 1 Top view of IR38263 evaluation board

The PCB of IR38263 demo board is a 3"x 3" 8-layer board using FR4 material. All layers use 2 Oz. copper.

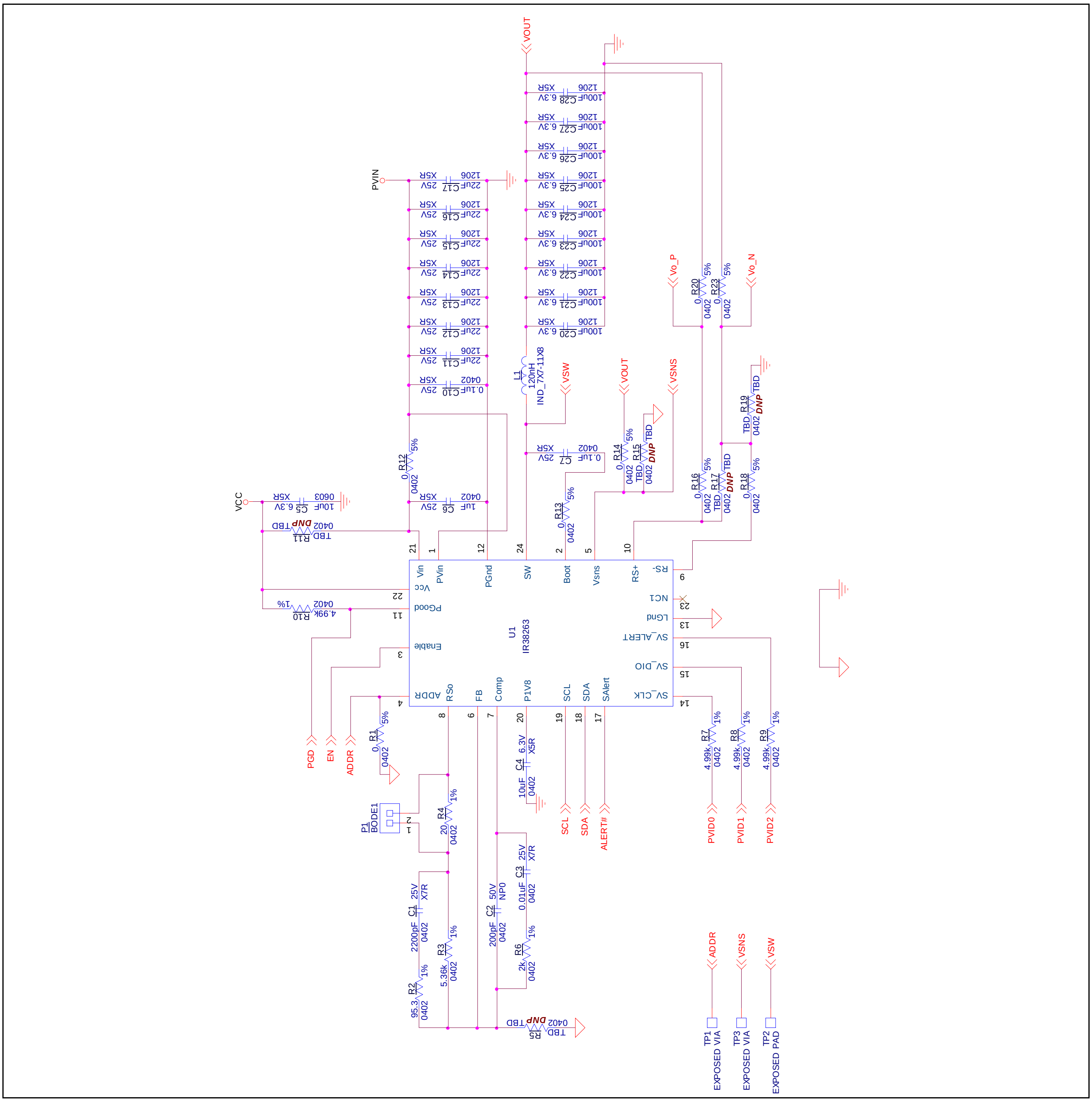

Figure 2 Schematic of the IRDC38263 evaluation board

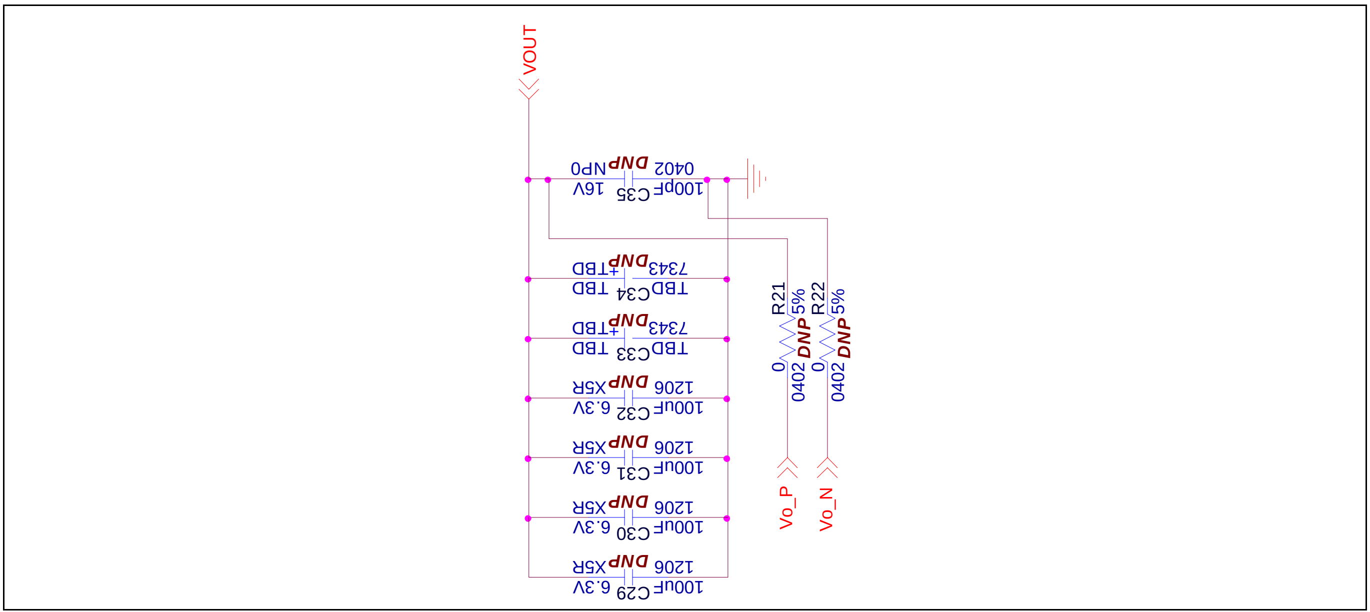

Figure 3 **Schematic of the IRDC38263 evaluation board**

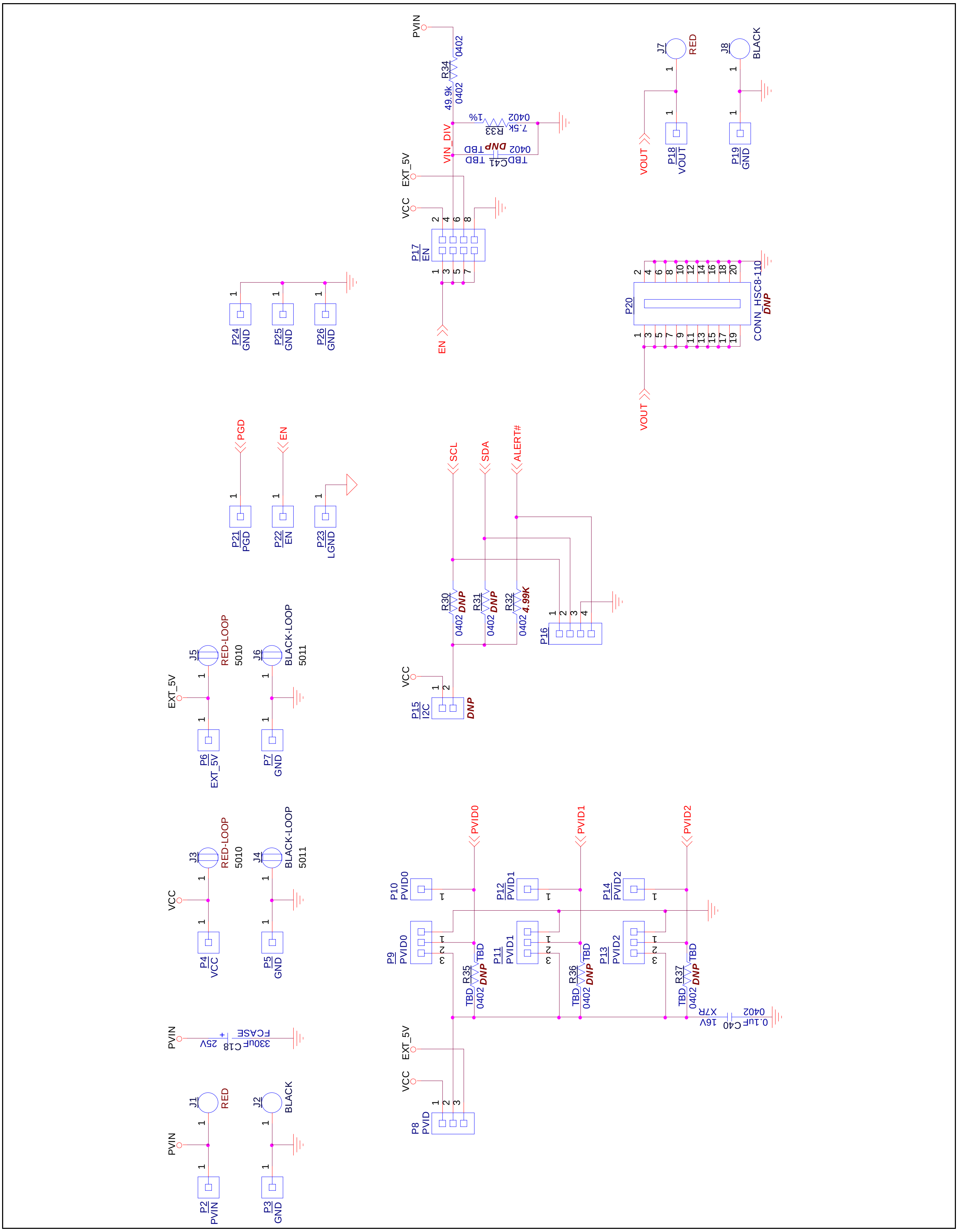

Figure 4 Schematic of the IRDC38263 evaluation board

3 Bill of materials

Table 3 Bill of materials

Item Number	Quantity	Part Reference	Value	Description	Manufacturer	Part Number
1	1	C1	2200 pF	CAP CER 2200PF 25V 10% X7R 0402	Kemet	C0402C222K3RACTU
2	1	C2	200 pF	CAP CER 200PF 50V 5% NP0 0402	Murata	GRM1555C1H201JA01D
3	1	C3	0.01uF	CAP CER 10000PF 25V 10% X7R 0402	Murata	GRM155R71E103KA01D
4	1	C4	10 uF	CAP CER 10UF 6.3V 20% X5R 0402	Murata	GRJ155R60J106ME11D
5	1	C5	10 uF	CAP CER 10UF 6.3V 20% X5R 0603	Murata	GRM188R60J106ME47D
6	1	C6	1 uF	CAP CER 1UF 25V 10% X5R 0402	Murata	GRM155R61E105KA12D
7	2	C7,C10	0.1 uF	CAP CER 0.1UF 25V 10% X5R 0402	Taiyo Yuden	TMK105BJ104KV-F
8	7	C11,C12,C13,C14,C15,C16,C17	22 uF	CAP CER 22UF 25V 10% X5R 1206	Murata	GRM31CR61E226KE15L
9	1	C18	330 uF	CAP ALUM 330UF 20% 25V SMD	Panasonic	PCE3410CT-ND
10	9	C20,C21,C22,C23,C24,C25,C26,C27,C28	100 uF	CAP CER 100UF 6.3V 20% X5R 1206	Murata	GRM31CR60J107ME39L
11	1	C40	0.1 uF	CAP CER 0.1UF 16V 10% X7R 0402	Murata	GRM155R71C104KA88D
12	2	J1,J7	RED	CONN JACK BANANA PANEL MOUNT, Red	Taiwan Connector	3111-R
13	2	J2,J8	BLACK	CONN JACK BANANA PANEL MOUNT, Black	Taiwan Connector	3111-B
14	2	J3,J5	RED-LOOP	TESTPOINT MULTI-PURPOSE	Keystone Electronics	5010
15	2	J4,J6	BLACK-LOOP	TESTPOINT MULTI-PURPOSE	Keystone Electronics	5011
16	1	L1	120 nH	INDUCTOR ,120nH, 0.39 mohm DCR	Pulse	PA0511.101NL
17	1	P1	BODE1	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 2 POS	-	BULK
18	1	P2	PVIN	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
19	7	P3,P5,P7,P19,P24,P25,P26	GND	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
20	1	P4	VCC	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
21	1	P6	EXT_5V	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
22	1	P8	PVID	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 3 POS	-	BULK
23	1	P9	PVID0	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 3 POS	-	BULK
24	1	P10	PVID0	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
25	1	P11	PVID1	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 3 POS	-	BULK
26	1	P12	PVID1	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
27	1	P13	PVID2	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 3 POS	-	BULK
28	1	P14	PVID2	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
29	1	P16	HDR 1x4	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 4 POS	-	BULK
30	1	P17	EN	HEADER, 0.100 x 0.100, DUAL ROW, MALE, STRAIGHT ANGLE, 4 POS	-	BULK
31	1	P18	VOUT	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
32	1	P21	PGD	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
33	1	P22	EN	HEADER, 0.100, SINGLE ROW, MALE,	-	BULK

				STRAIGHT ANGLE, 1 POS		
34	1	P23	LGND	HEADER, 0.100, SINGLE ROW, MALE, STRAIGHT ANGLE, 1 POS	-	BULK
35	8	R1,R12,R13,R14,R16,R18,R20,R23	0	RES 0.0 OHM 1/10W 0402 SMD	Panasonic	ERJ-2GE0R00X
36	1	R2	95.3	RES 95.3 OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF95R3X
37	1	R3	5.36 k	RES 5.36K OHM 1/16W 1% 0402 SMD	Yageo	RC0402FR-075K36L
38	1	R4	20	RES 20.0 OHM 1/16W 1% 0402 SMD	Vishay Dale	CRCW040220R0FKED
39	1	R6	2 k	RES 2.00K OHM 1/16W 1% 0402 SMD	Vishay Dale	CRCW04022K00FKED
40	5	R7,R8,R9,R10, R32	4.99 k	RES 4.99K OHM 1/16W 1% 0402 SMD	Panasonic	ERJ-2RKF4991X
41	1	R33	7.5 k	RES 7.50K OHM 1% 0402 SMD	TBD	TBD
42	1	R34	49.9 k	RES 49.9K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF4992X

4 Typical operating waveforms

4.1 Waveforms (0.72V)

PVin = 12.0 V, Vout = 0.72 V, Iout = 0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

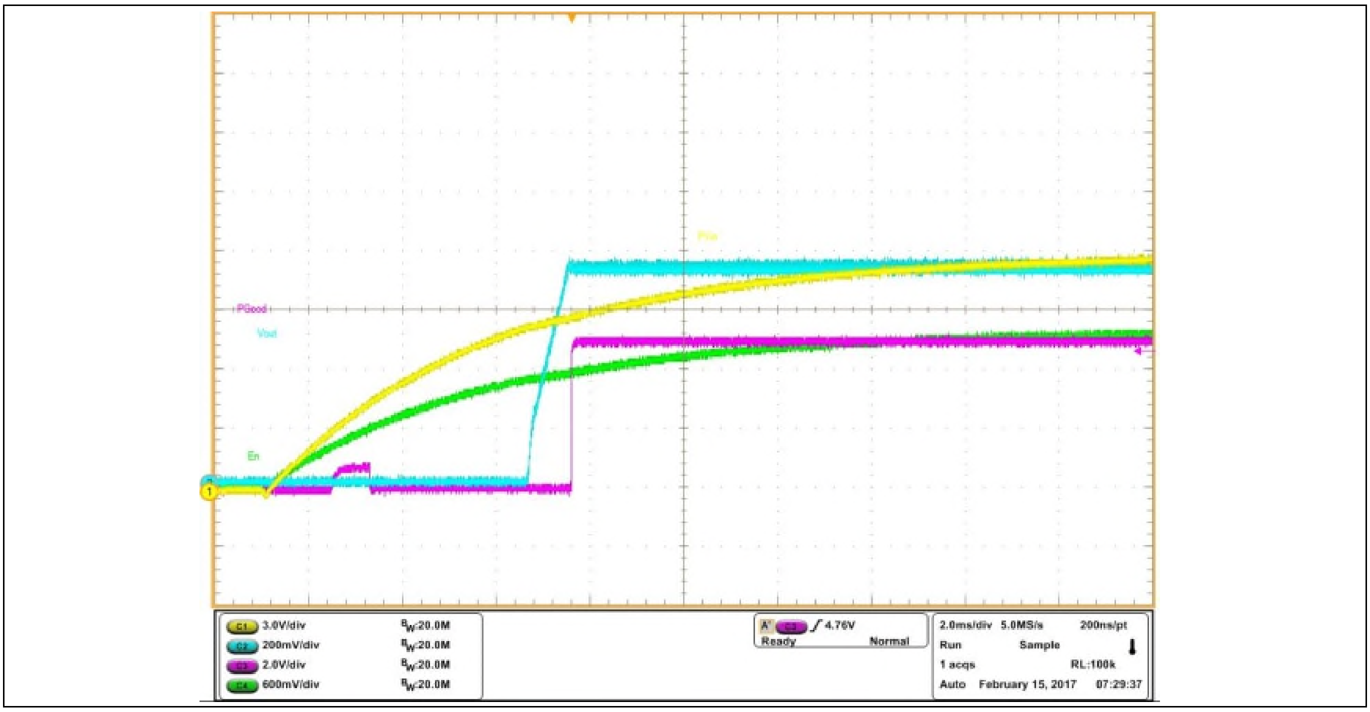

Figure 5 P_{Vin} Start up at 30 A Load, Ch_1:P_{Vin}, Ch_2:V_{out}, Ch_3:P_{Good}, Ch_4:Enable

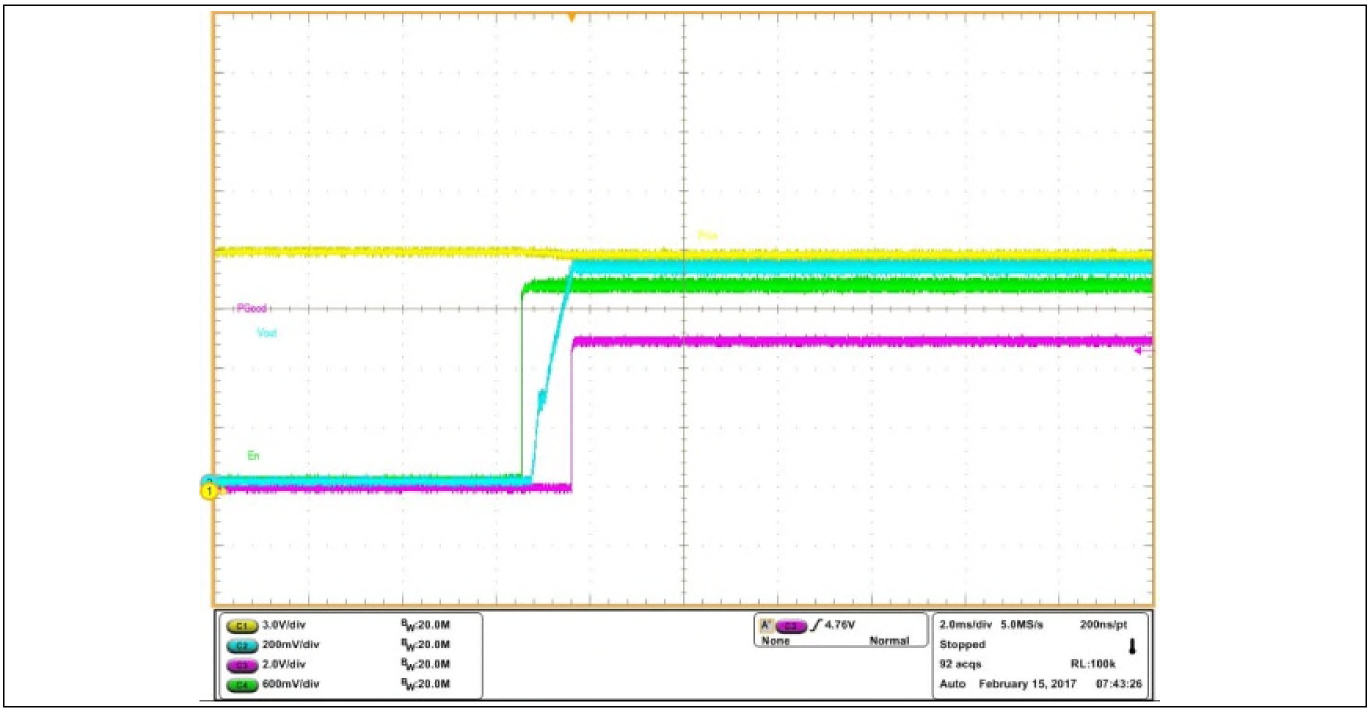

Figure 6 V_{cc} Start up at 30 A Load, Ch_1:P_{Vin}, Ch_2:V_{out}, Ch_3:P_{Good},Ch_4:Enable

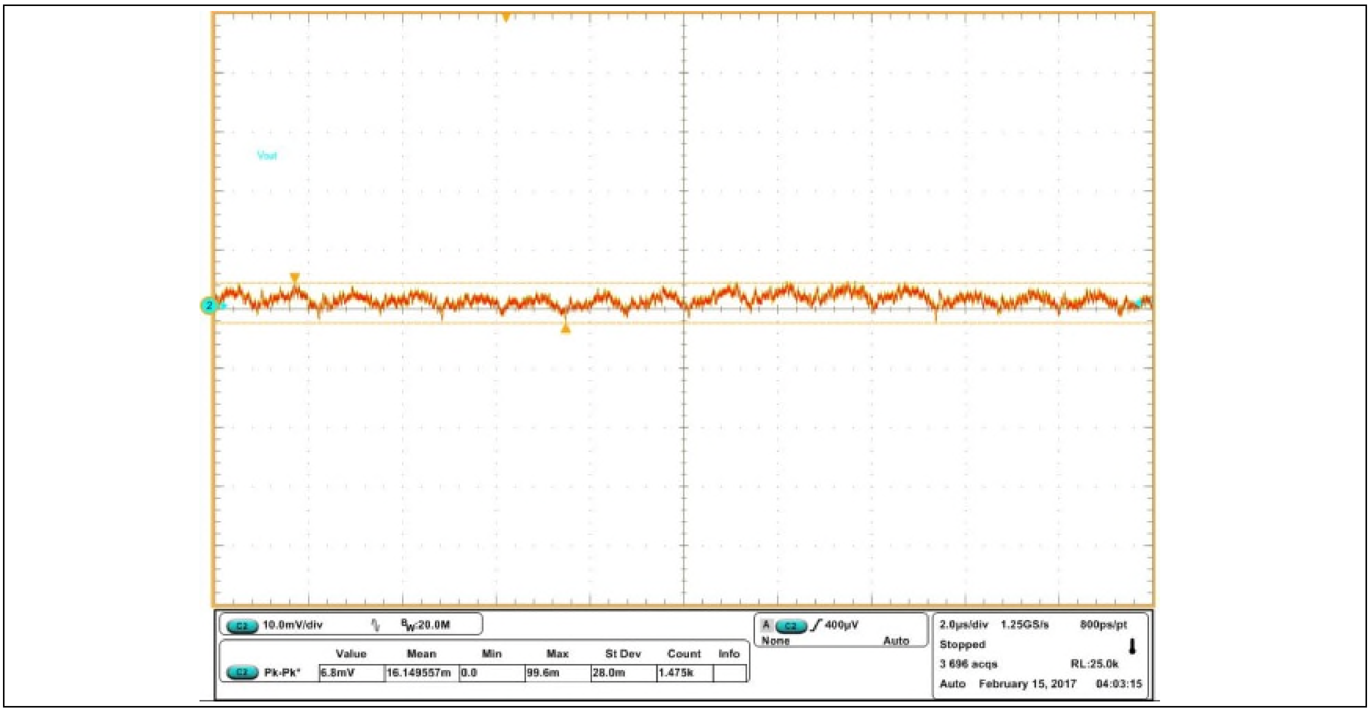

Figure 7 Vo ripple at 30 A load, Ch_2:V_{out}

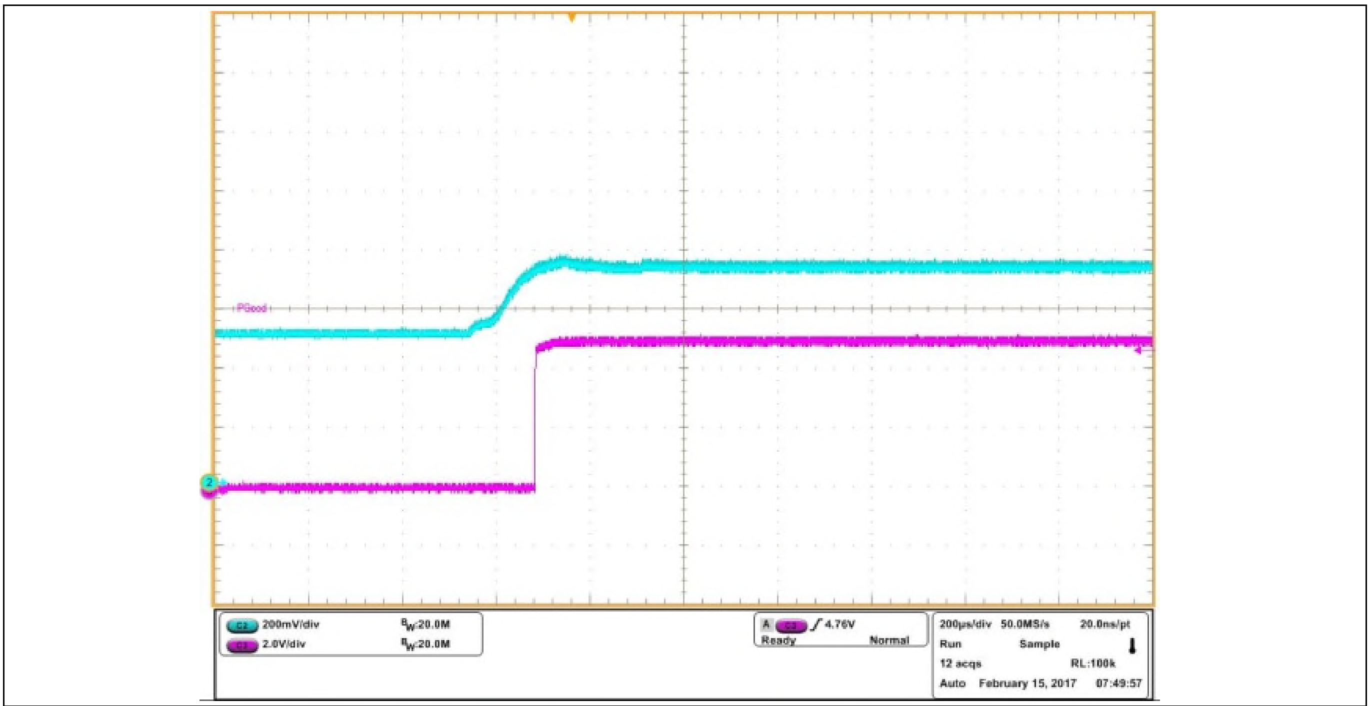

Figure 8 Fig. 8: Prebias startup at 0.5 V, Ch_2:V_{out}, Ch_3:P_{Good}

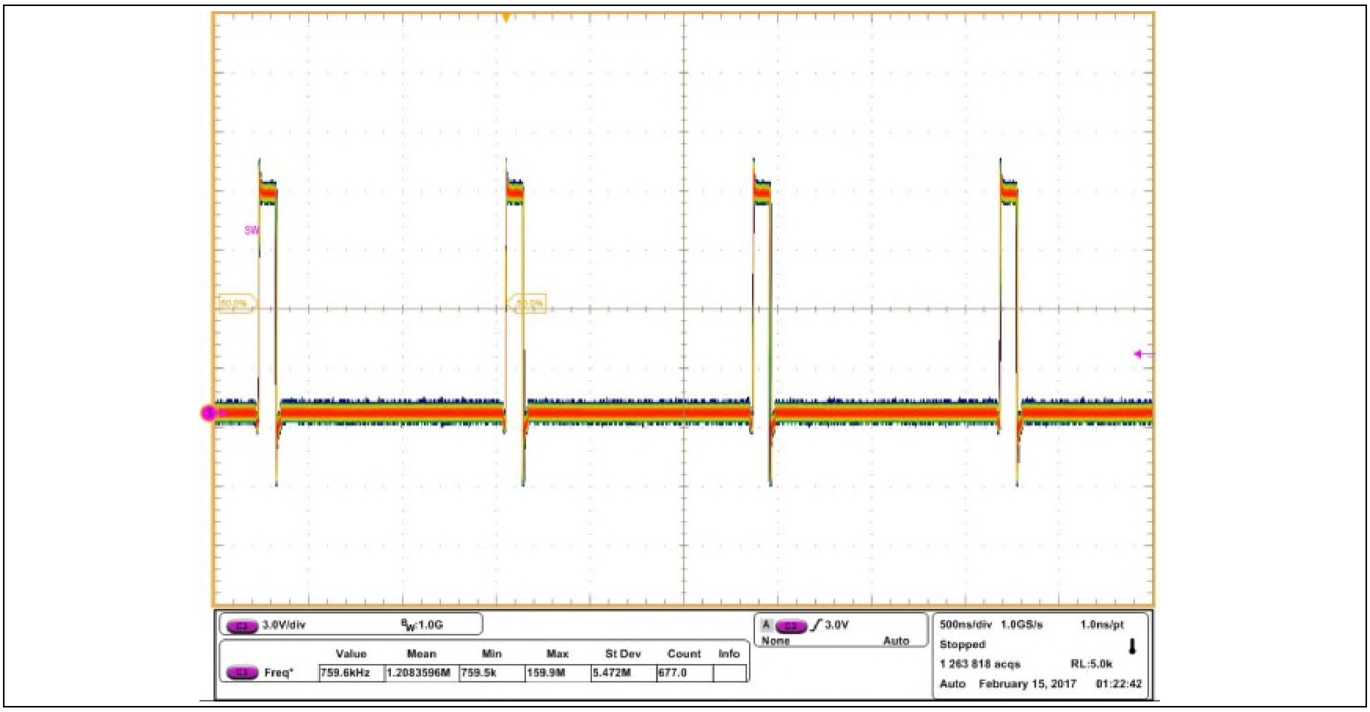

Figure 9 Inductor node at 30 A load, Ch_3:SW node

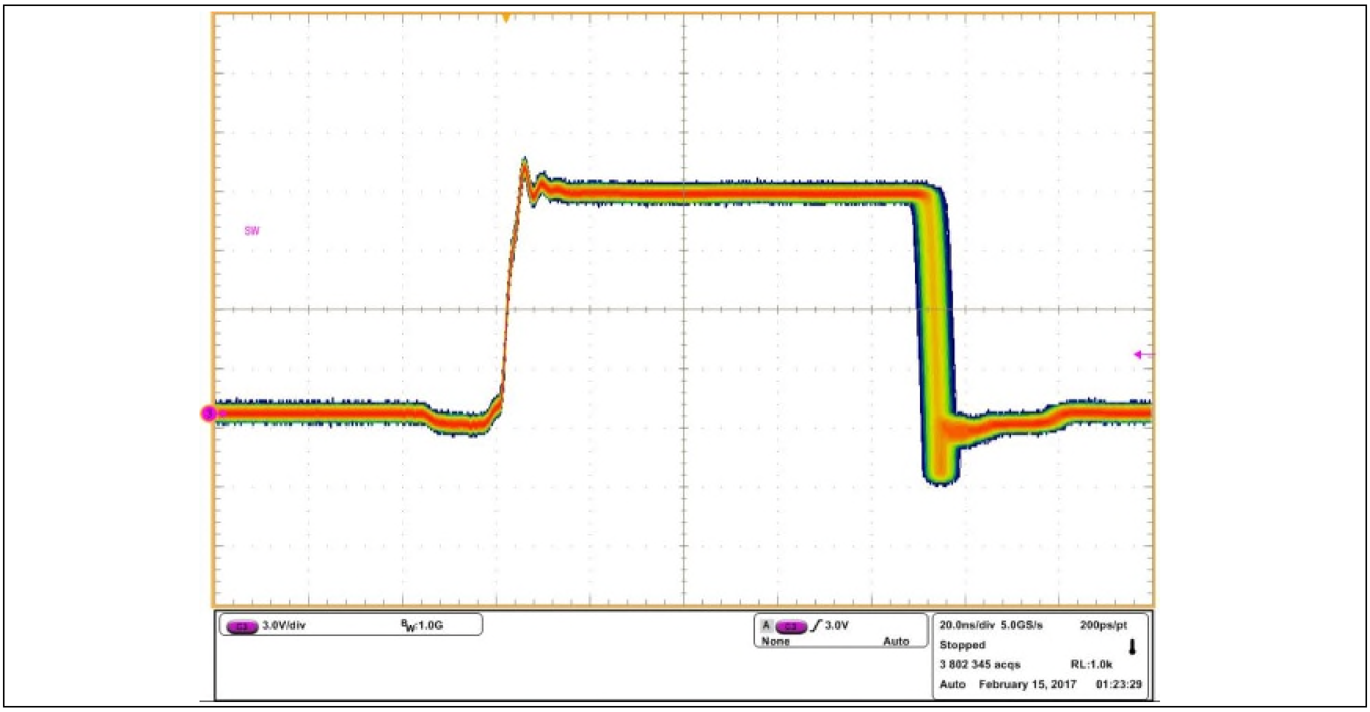

Figure 10 Sw node jitter at 30 A load, Ch_3:SW node

PVin=12.0 V, Vout=0.72 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

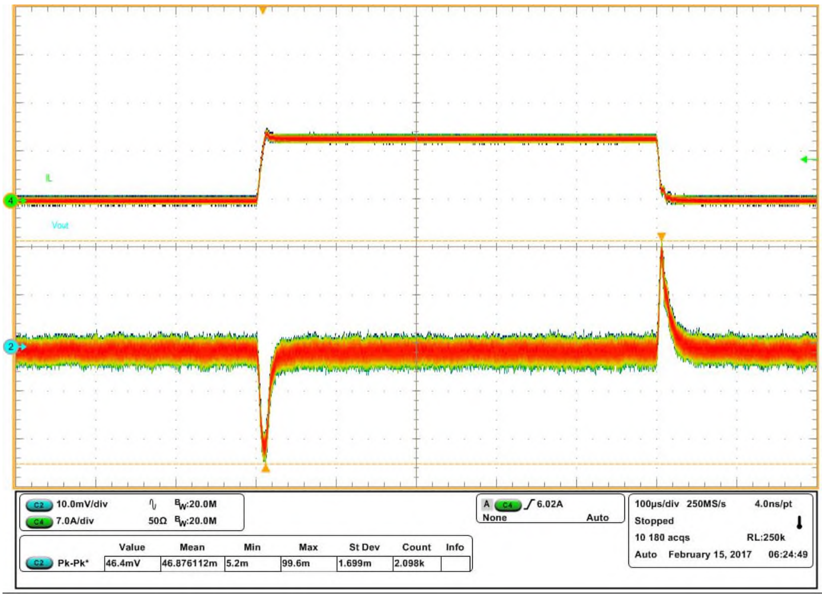

Figure 11 Load transient 3 A to 12 A at 2.5 A/us, Ch_2:V_{out}, Ch_4:I_{out}

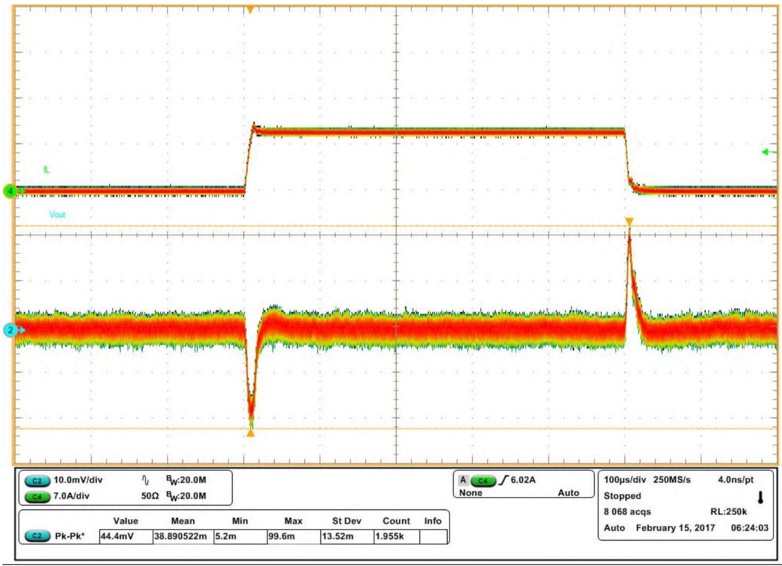

Figure 12 Load transient 21 A to 30 A at 2.5 A/us, Ch_2:V_{out}, Ch_4:I_{out}

4.2 Waveforms (1.0V)

PVin=12.0 V, Vout=1.0 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

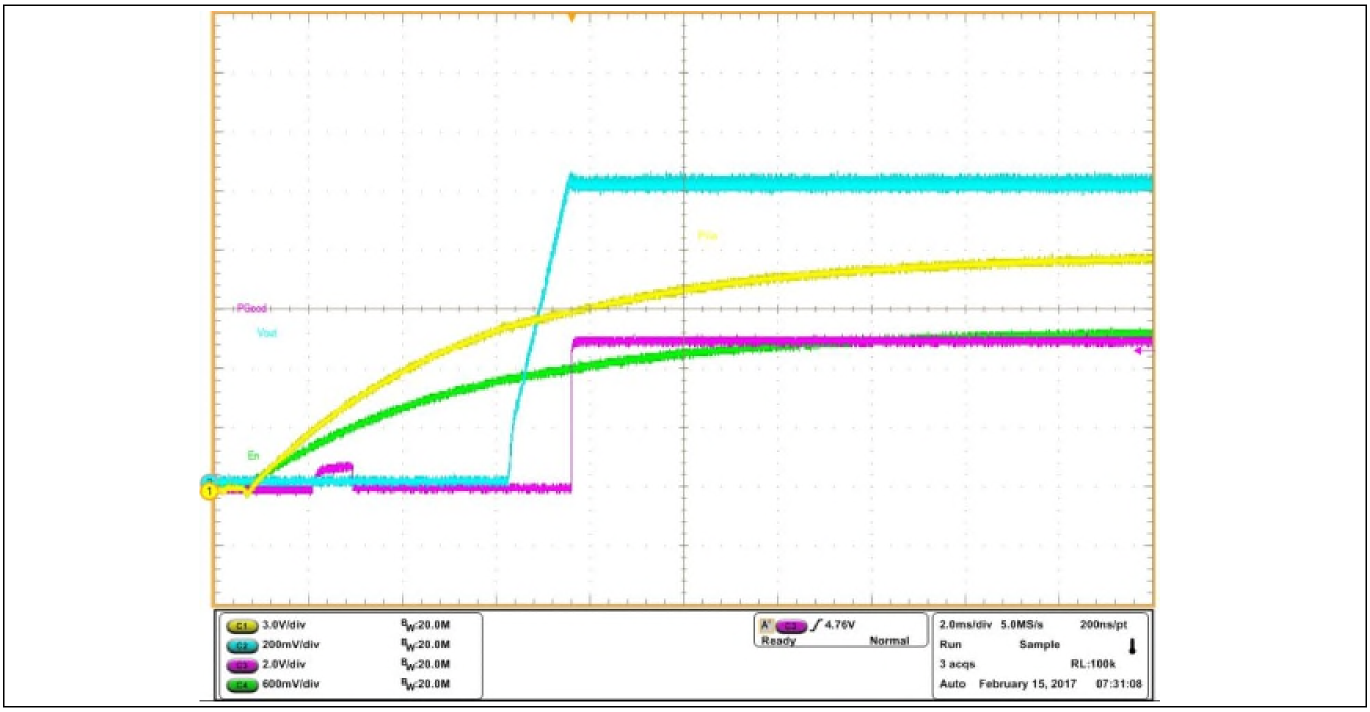

Figure 13 P_{Vin} Start up at 30 A Load, Ch_1:P_{Vin}, Ch_2:V_{out}, Ch_3:P_{Good}, Ch_4:Enable

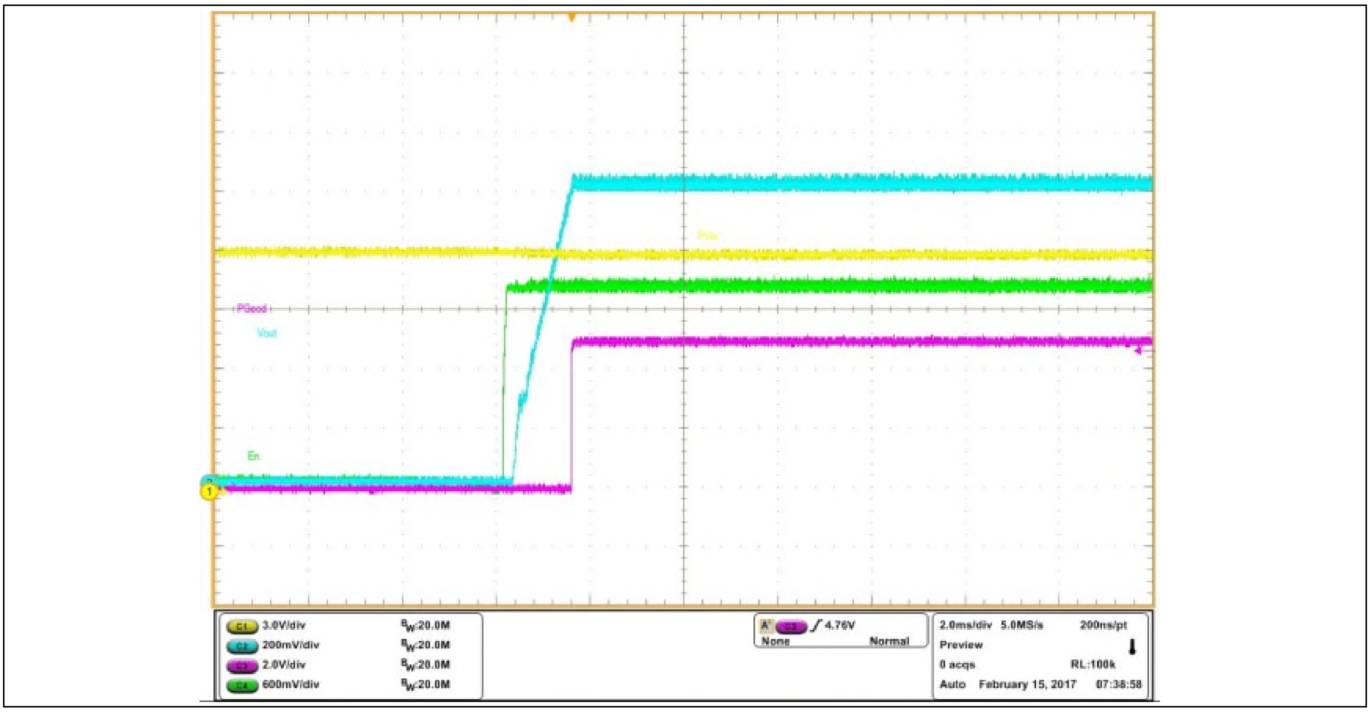

Figure 14 V_{cc} Start up at 30 A Load, Ch_1:P_{Vin}, Ch_2:V_{out}, Ch_3:P_{Good},Ch_4:Enable

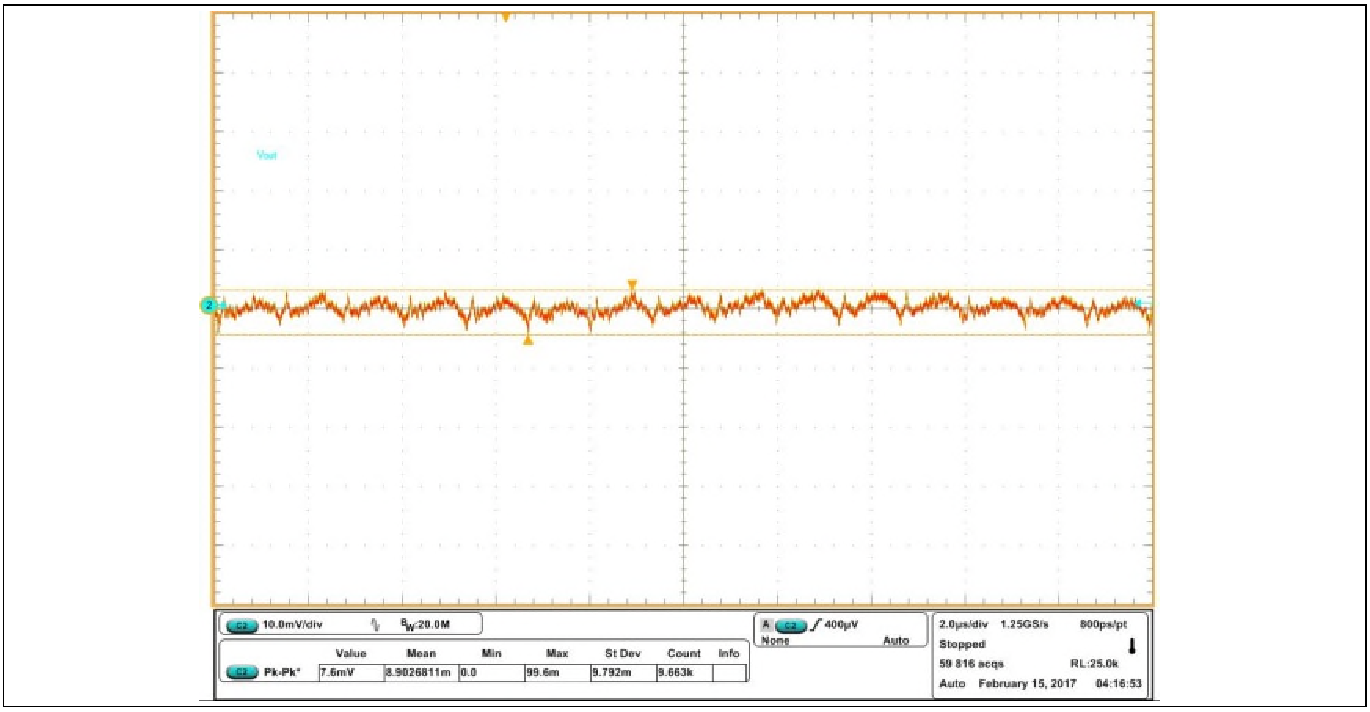

Figure 15 Vo ripple at 30 A load, Ch_2:V_{out}

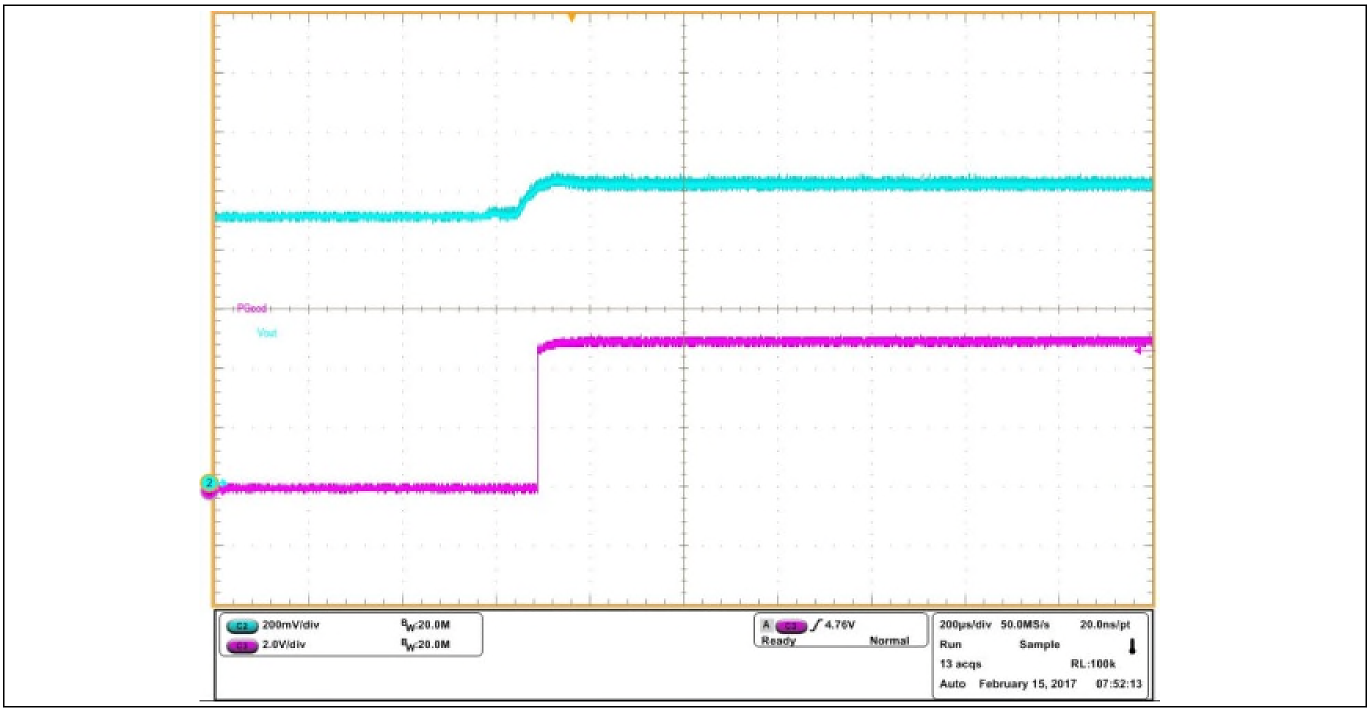

Figure 16 Prebias startup at 0.9 V, Ch_2:V_{out}, Ch_3:P_{Good}

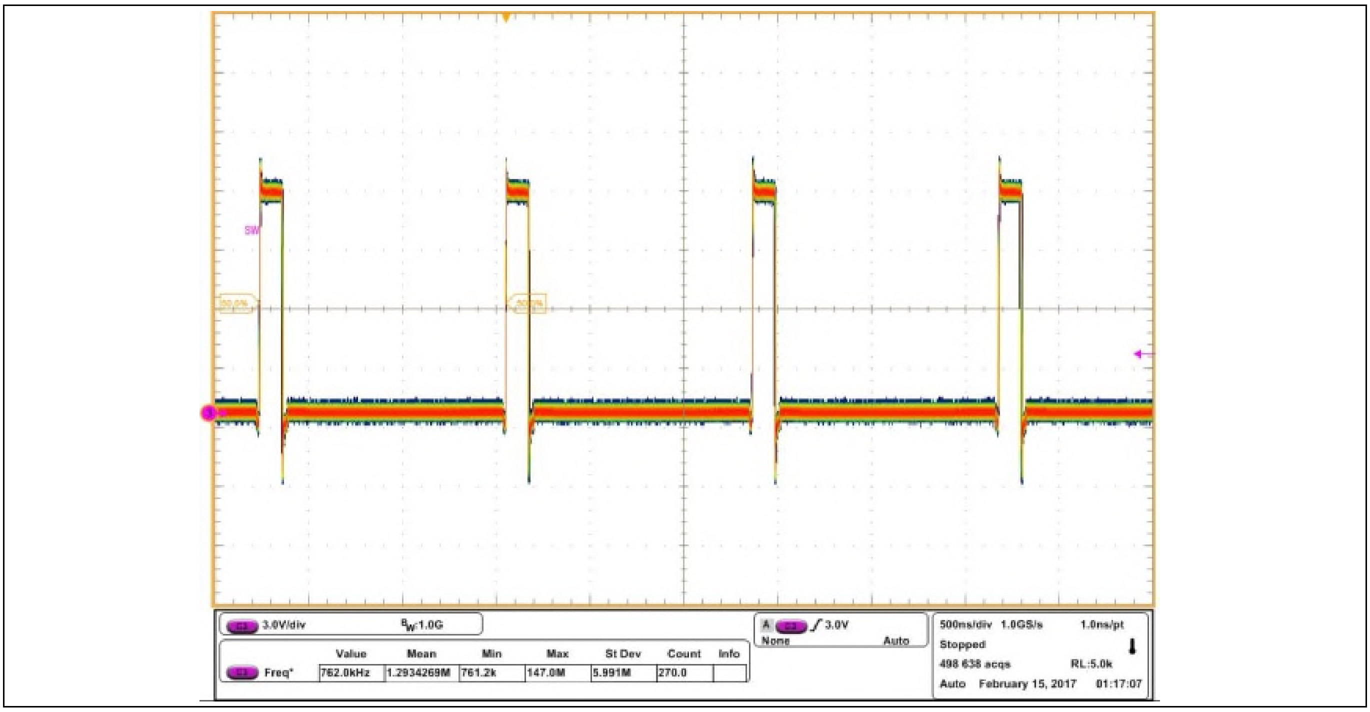

Figure 17 Inductor node at 30 A load, Ch_3:SW node

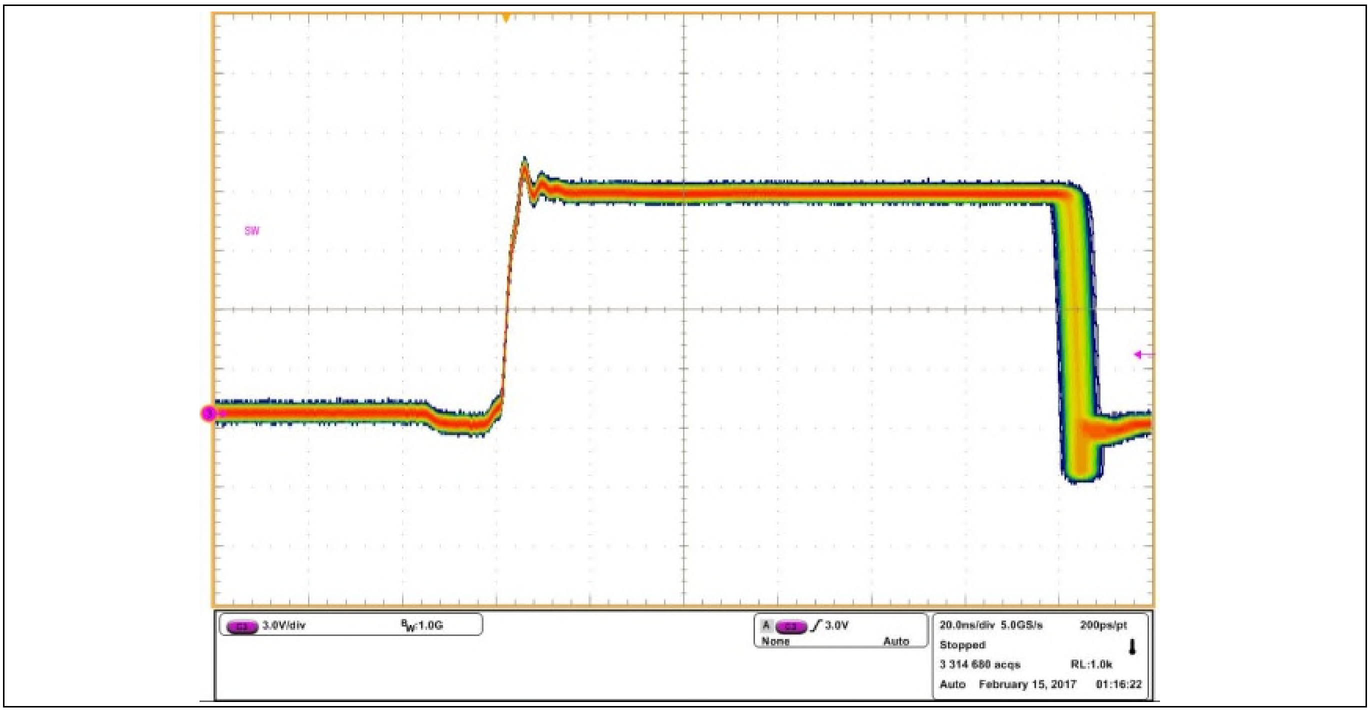

Figure 18 Sw node jitter at 30 A load, Ch_3:SW node

PVin=12.0 V, Vout=1.0 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

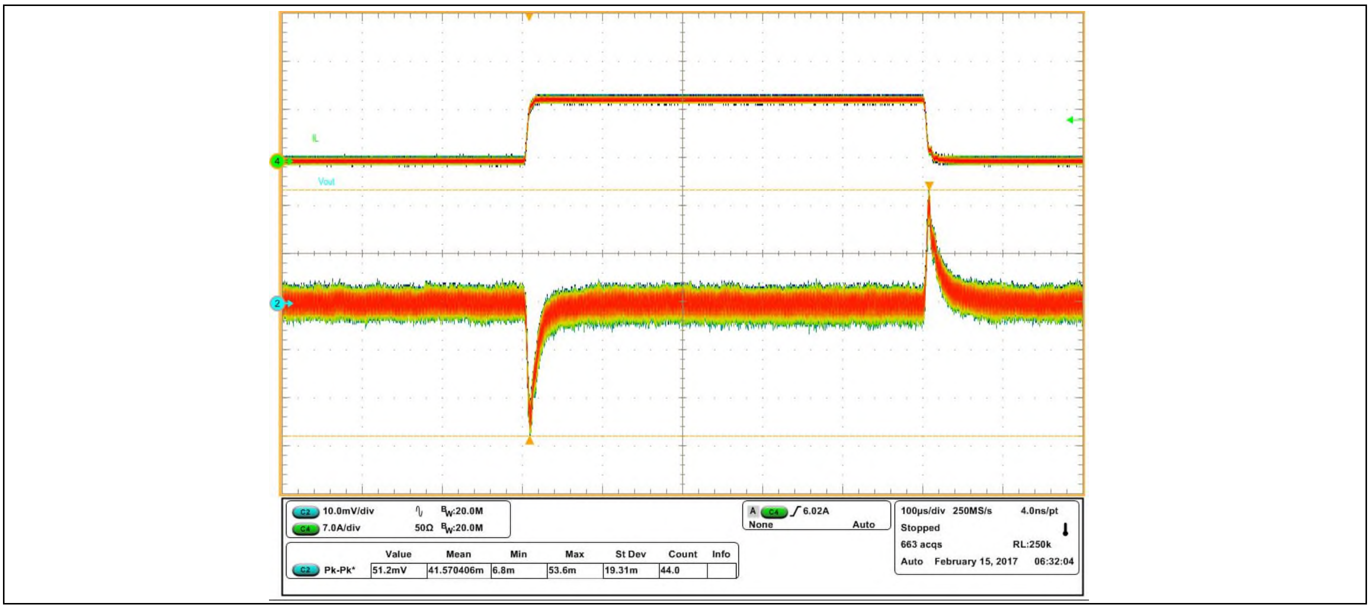

Figure 19 Load transient 3 A to 12 A at 2.5 A/us, Ch_2:V_{out}, Ch_4:I_{out}

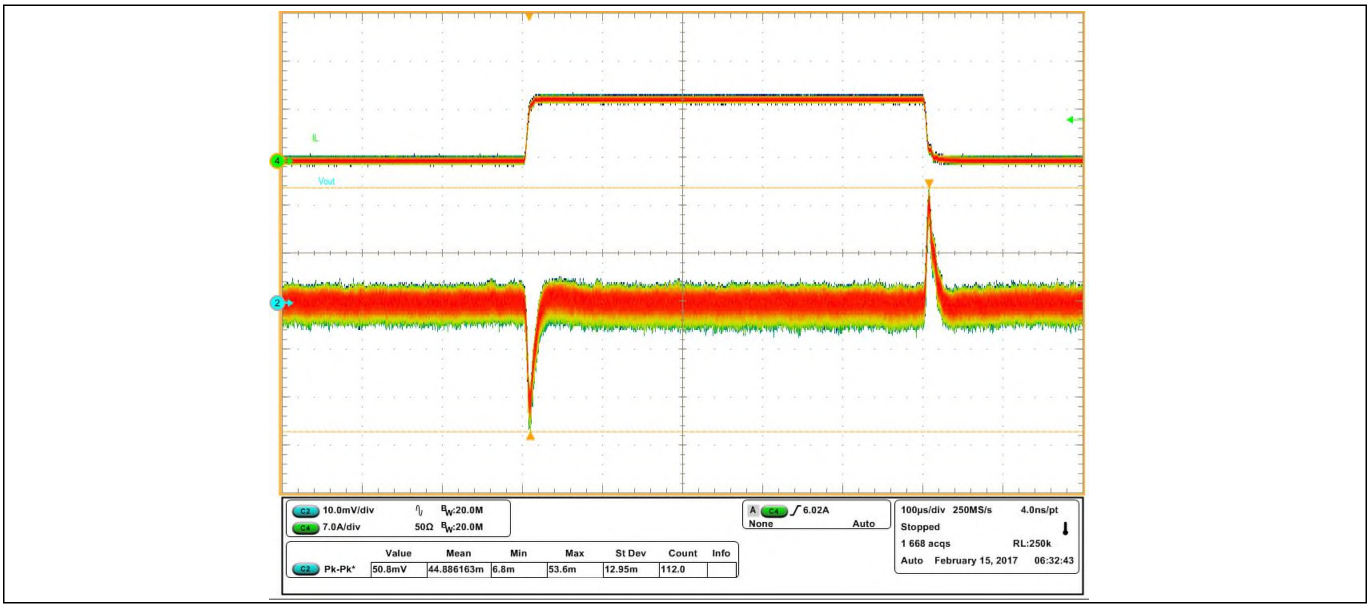

Figure 20 Load transient 21 A to 30 A at 2.5 A/us, Ch_2:V_{out}, Ch_4:I_{out}

4.3 Waveforms (1.8V)

PVin=12.0 V, Vout=1.8 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

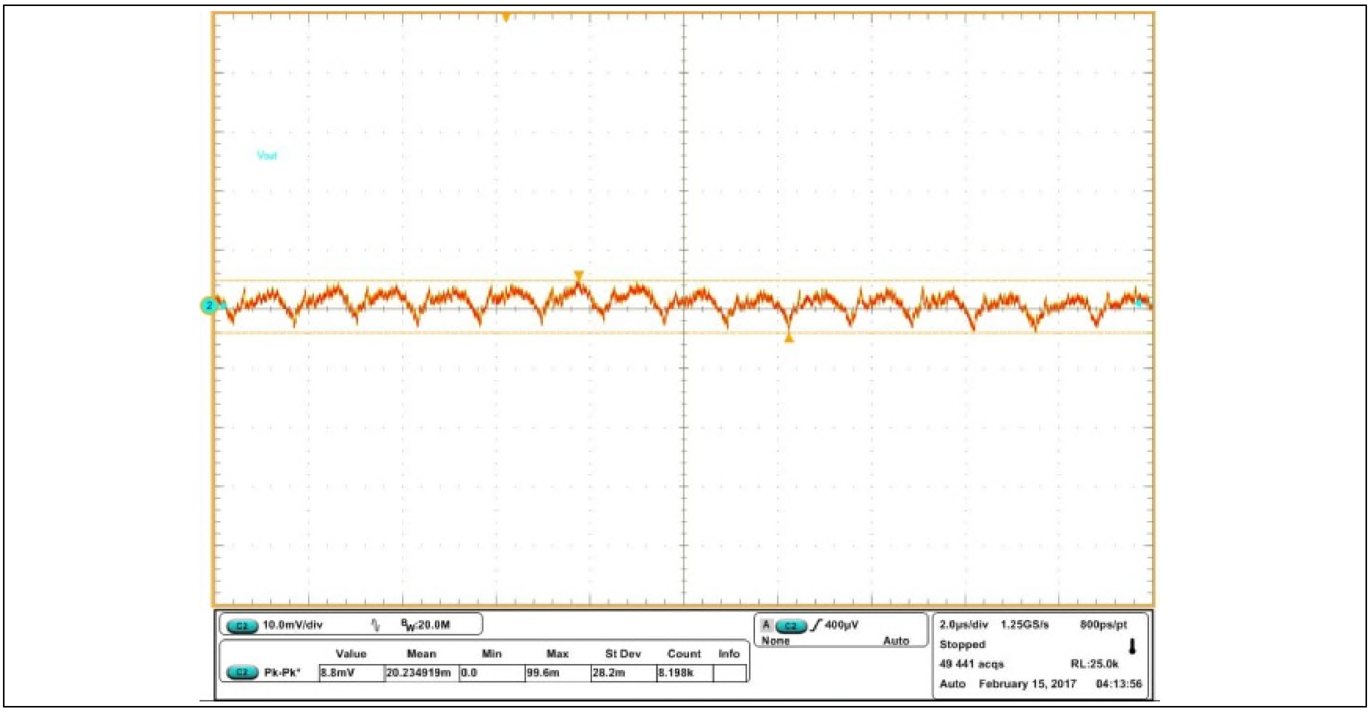

Figure 21 Vo ripple at 30 A load, Ch_2:V_{out}

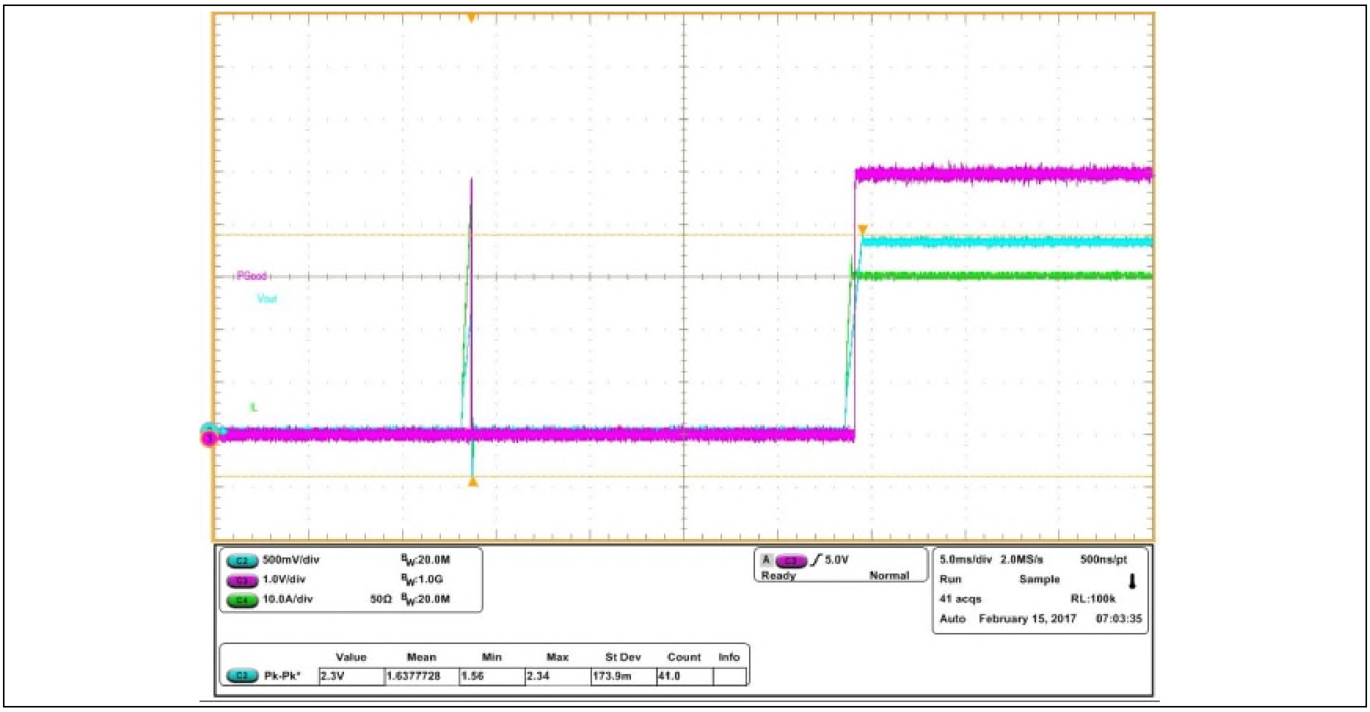

Figure 22 Hiccup recovery at 30 A Load, Ch_2:V_{out}, Ch_3:P_{Good},Ch_4:I_{out}

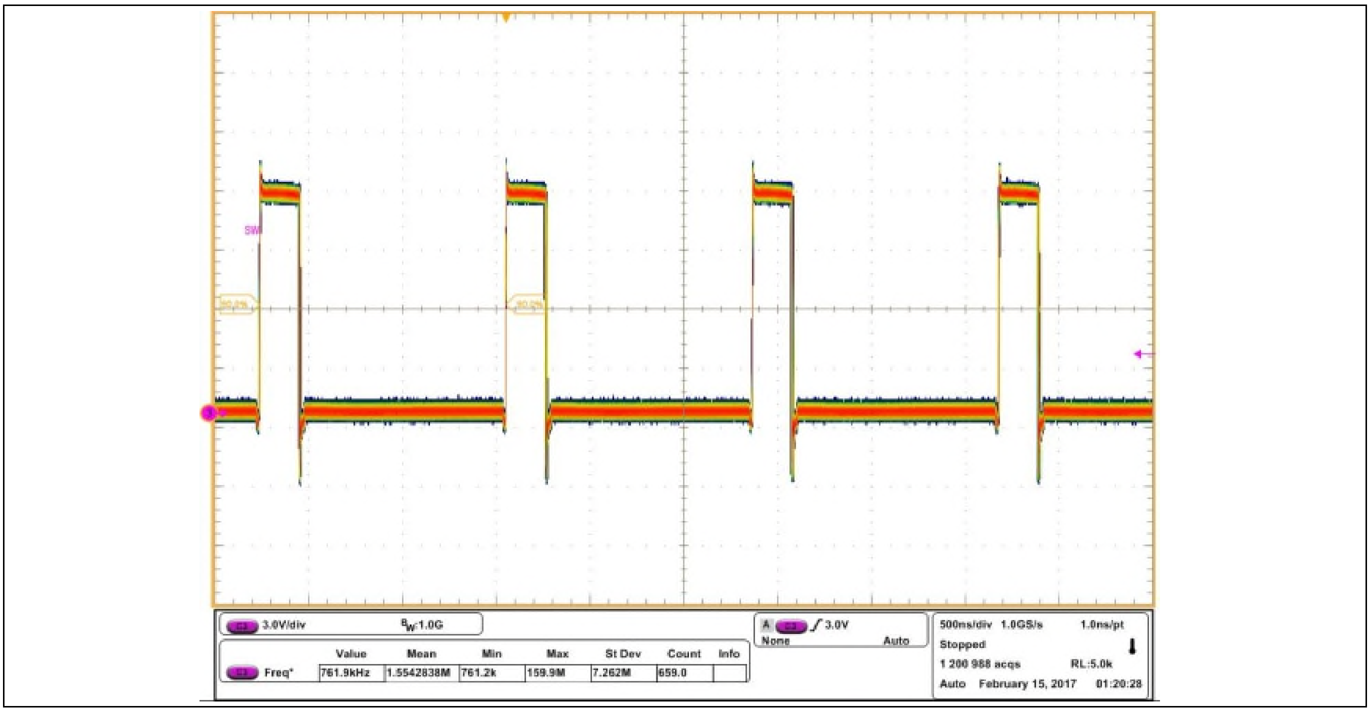

Figure 23 Inductor node at 30 A load, Ch_3:SW node

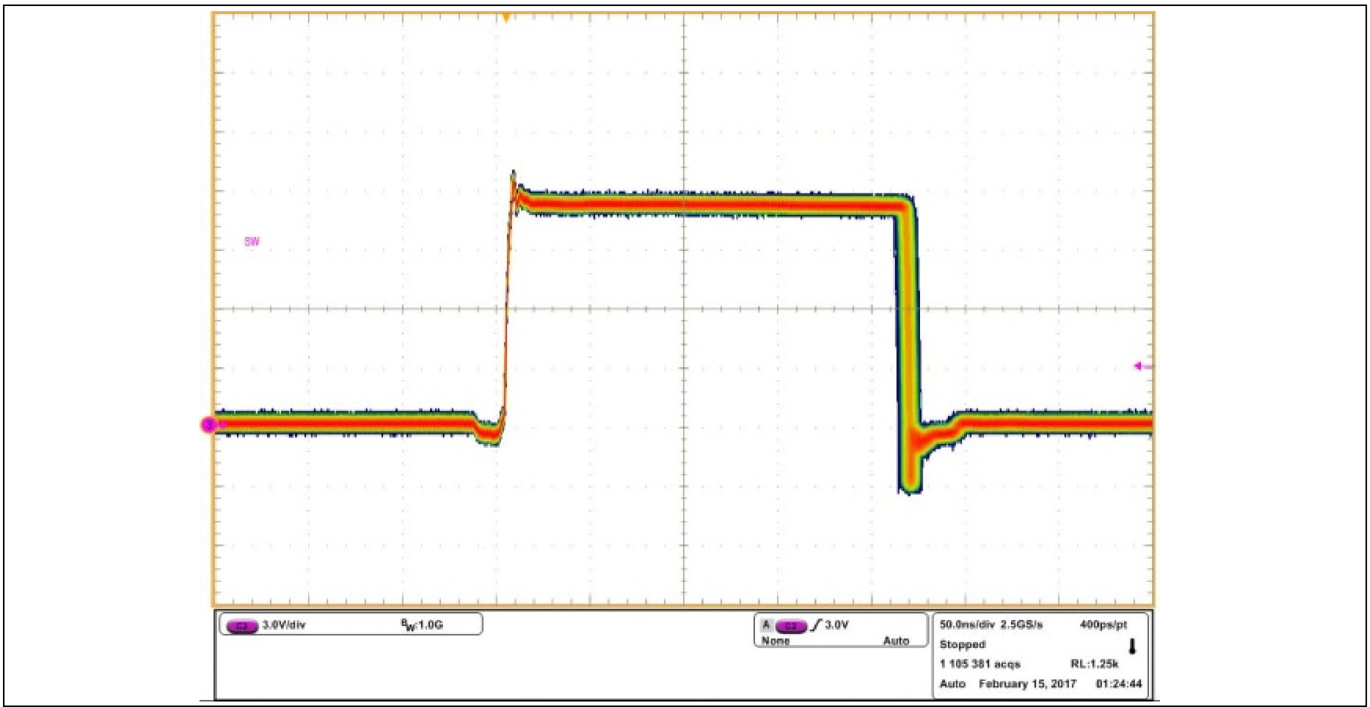

Figure 24 Sw node jitter at 30 A load, Ch_2:V_{out}

PVin=12.0 V, Vout=1.8 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

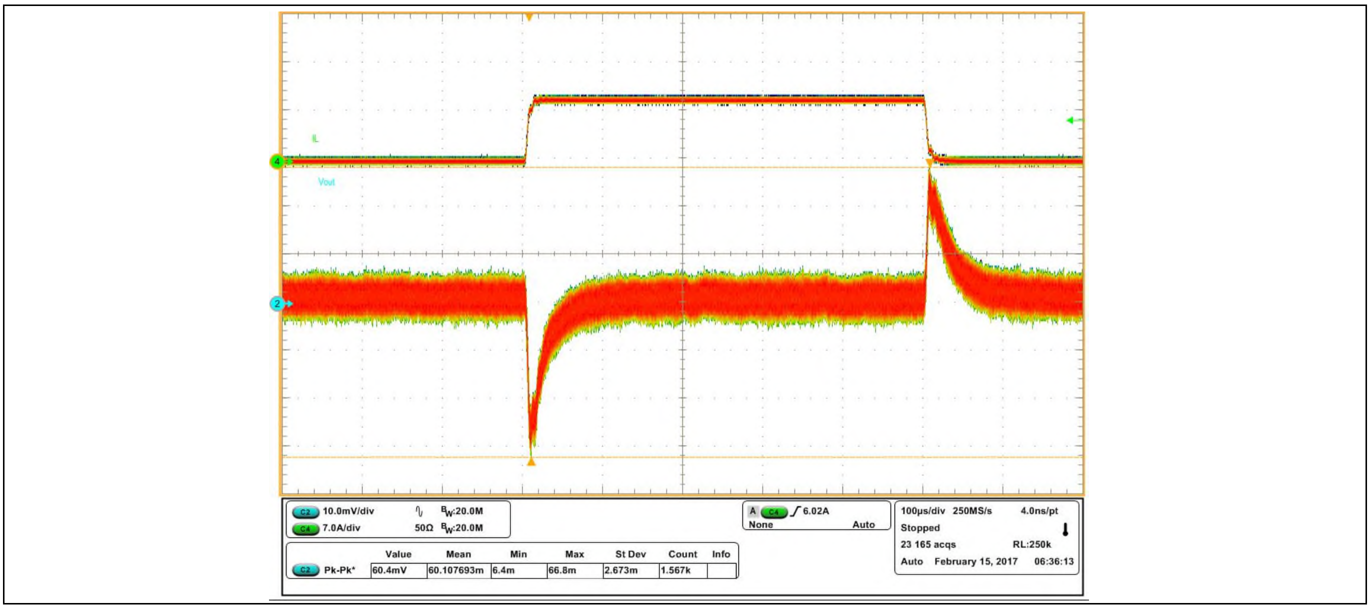

Figure 25 Load transient 3 A to 12 A at 2.5 A/us, Ch_2:V_{out}, Ch_4:I_{out}

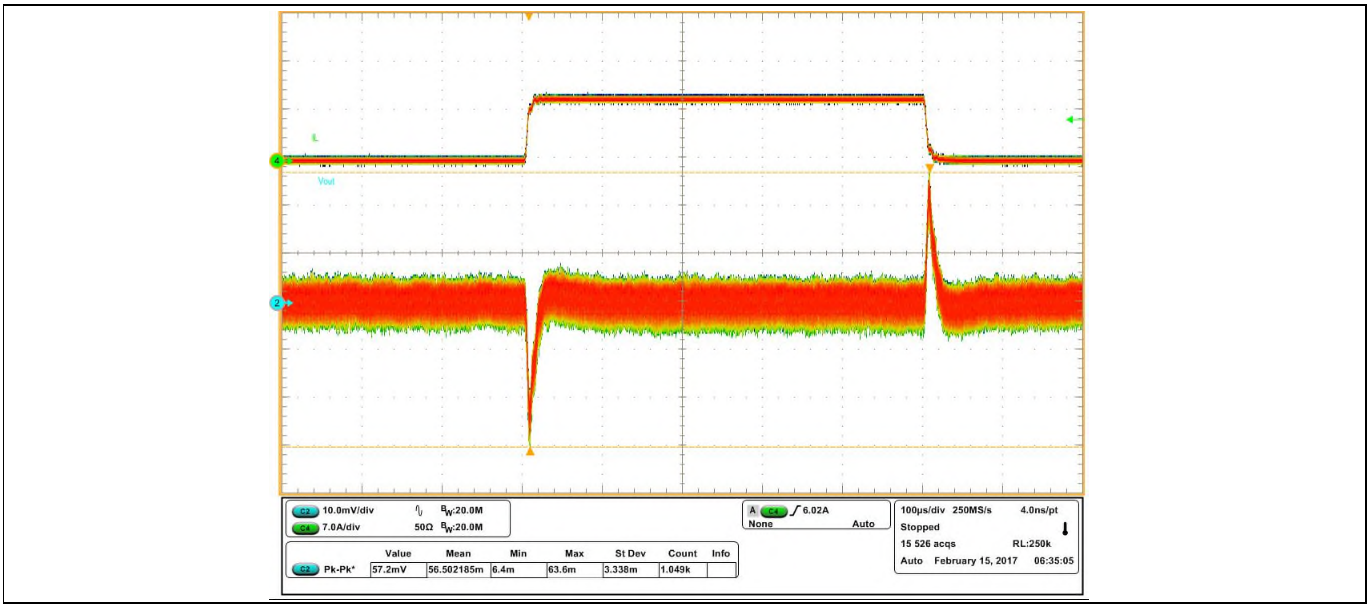

Figure 26 Load transient 21 A to 30 A at 2.5A /us, Ch_2:V_{out}, Ch_4:I_{out}

4.4 Bode Plots (0.72V)

PVin=12.0 V, Vout=0.72 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

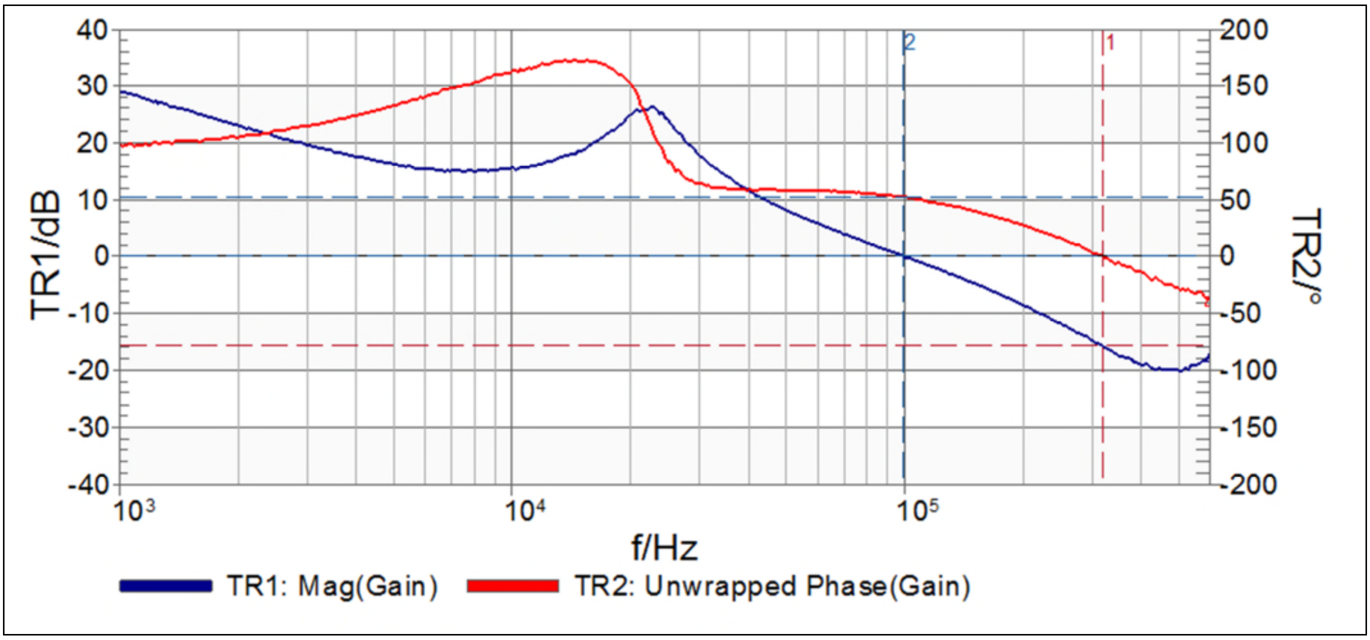

Figure 27 Bode Plot at 30 A load, Bandwidth = 99 kHz, Phase Margin = 52.4°, Gain Margin = 15.7 dB

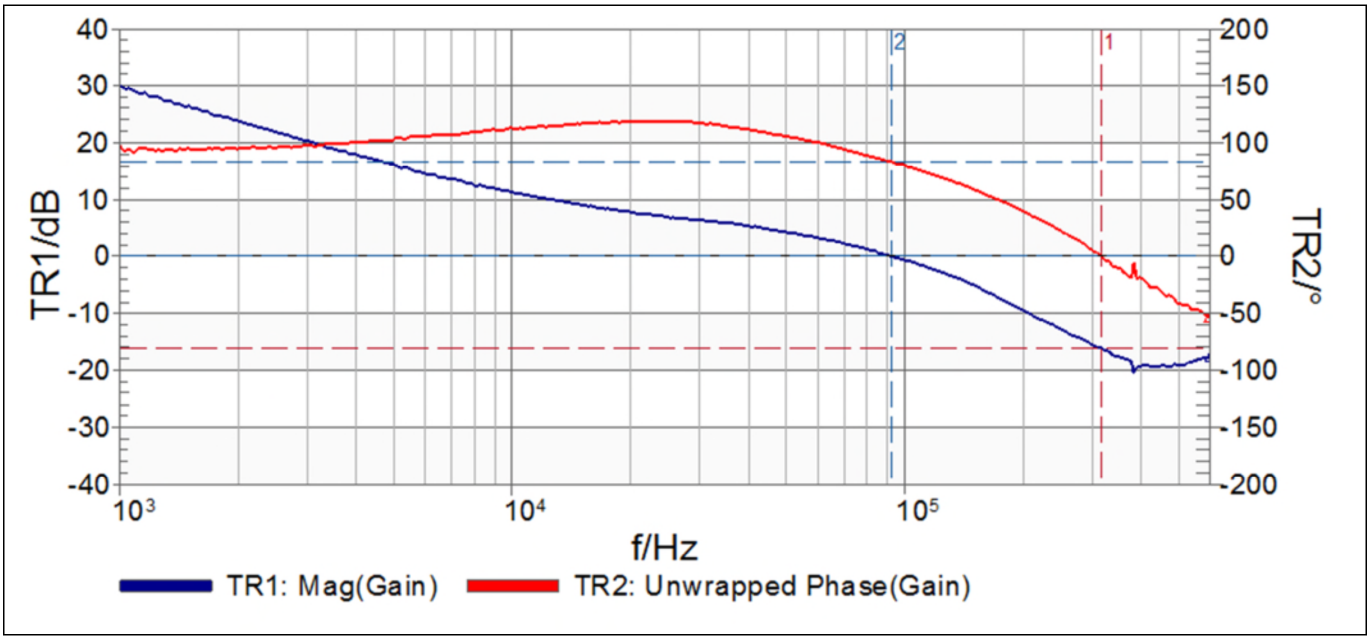

Figure 28 Bode Plot at 0 A load, Bandwidth = 93 kHz, Phase Margin = 83°, Gain Margin = 16.2 dB

4.5 Bode Plots (1.0V)

PVin=12.0 V, Vout=1.0 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

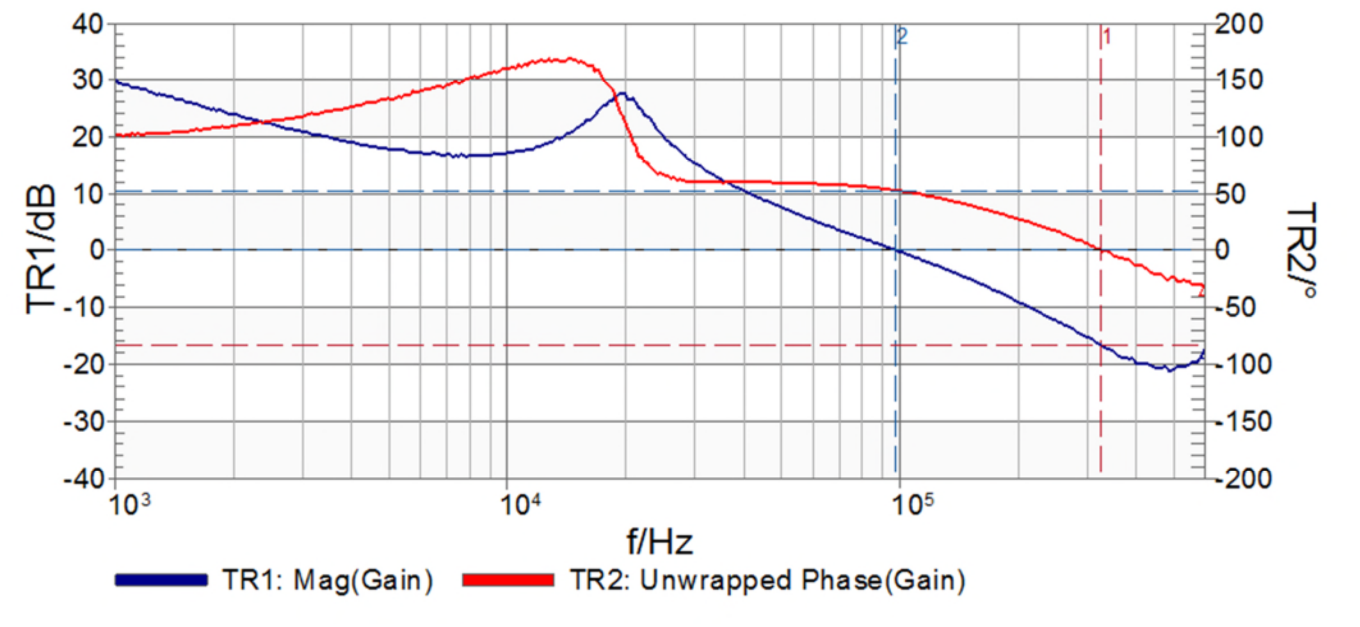

Figure 29 Bode Plot at 30 A load, Bandwidth = 98 kHz, Phase Margin = 52.6°, Gain Margin = 16.5 dB

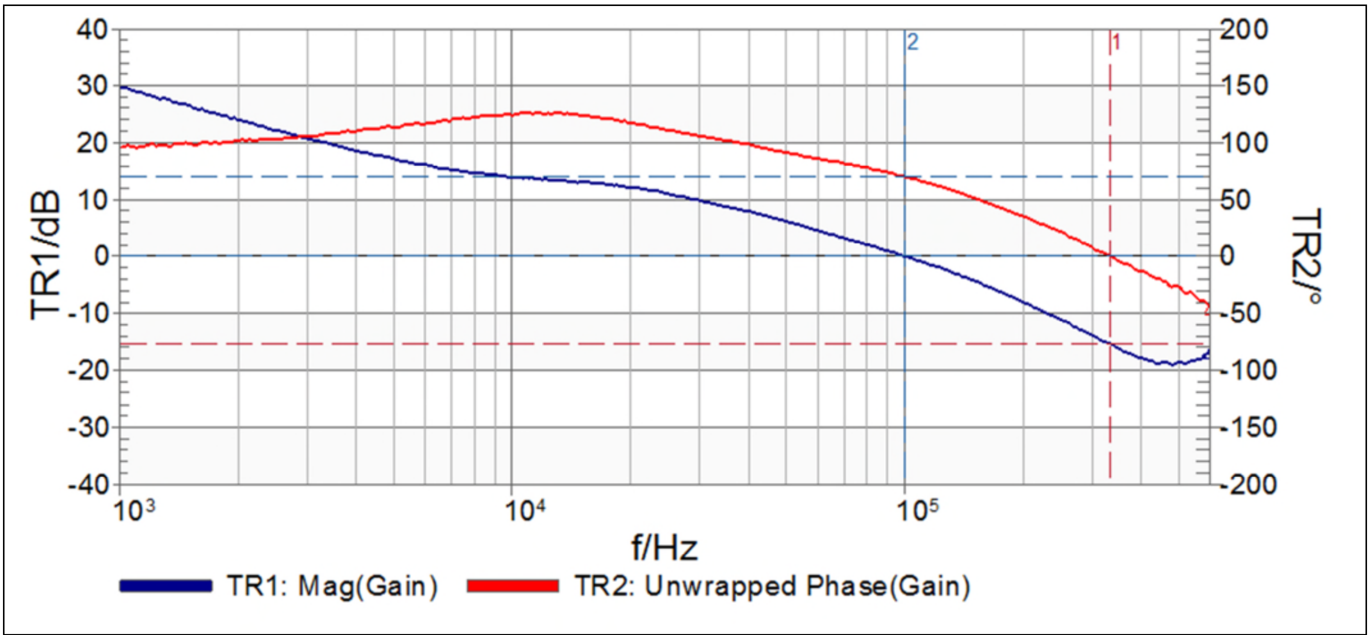

Figure 30 Plot at 0 A load, Bandwidth = 100 kHz, Phase Margin = 69.9°, Gain Margin = 15.3 dB

4.6 Bode Plots (1.8V)

PVin=12.0 V, Vout=1.8 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

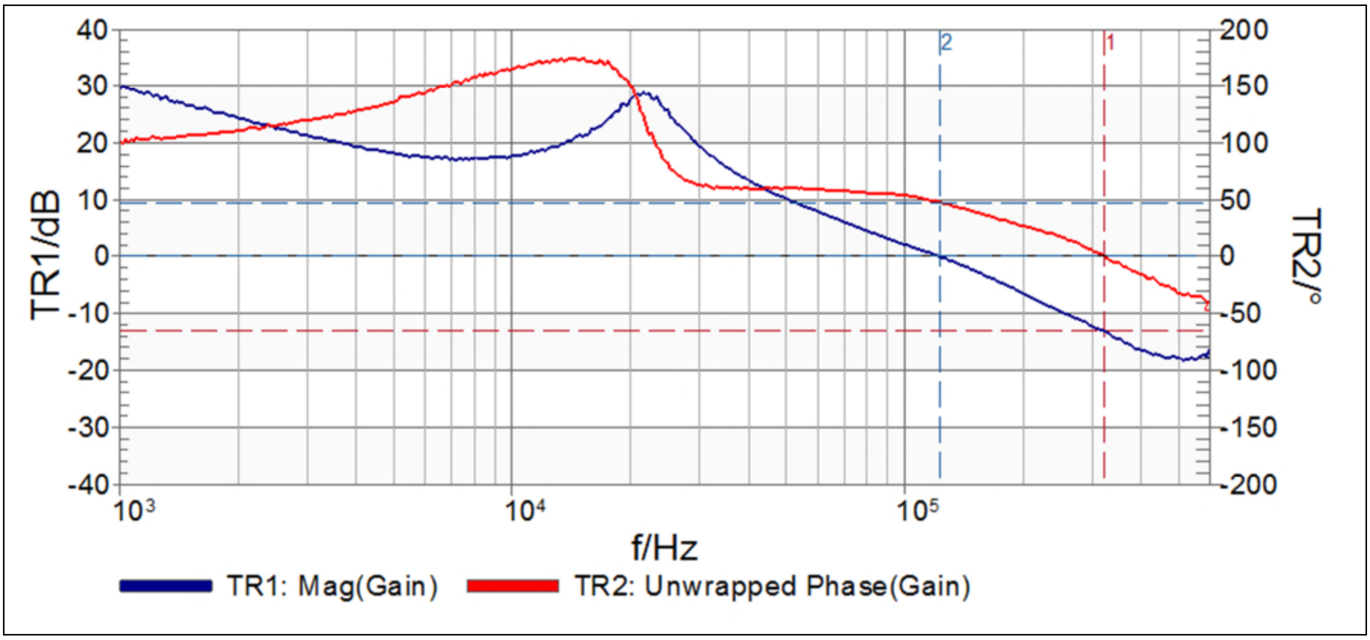

Figure 31 Bode Plot at 30 A load, Bandwidth = 127 kHz, Phase Margin = 49.2°, Gain Margin = 12.4 dB

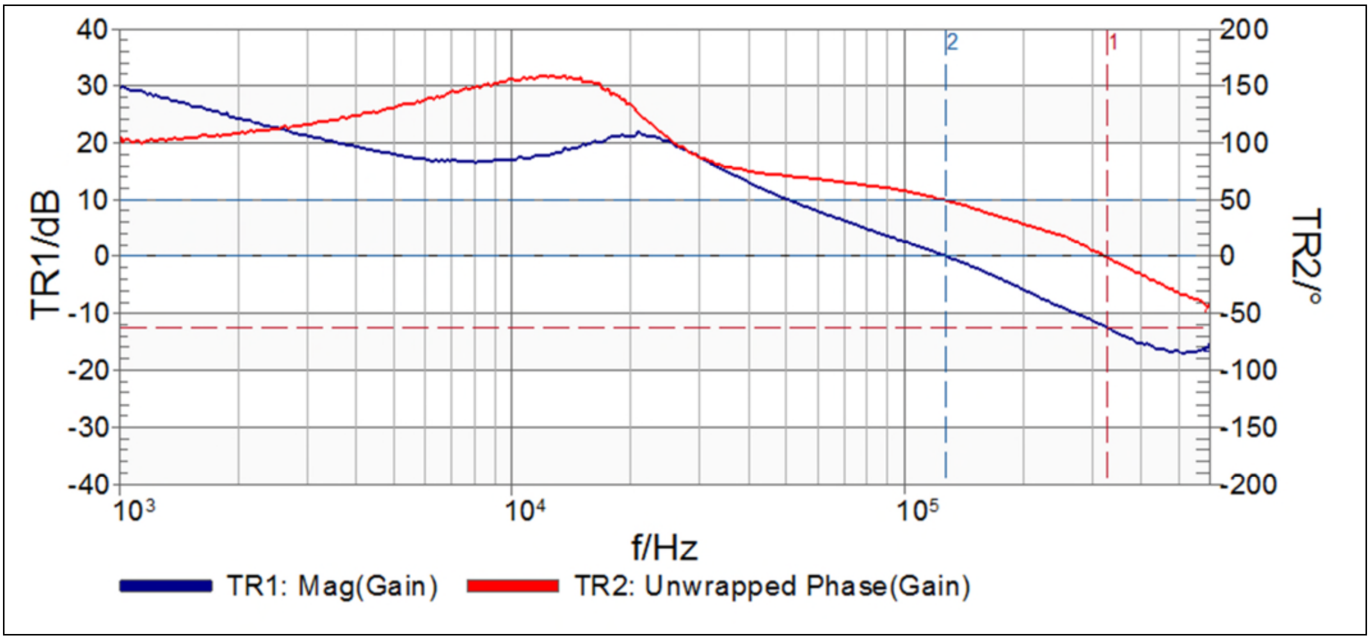

Figure 32 Bode Plot at 0 A load, Bandwidth = 134 kHz, Phase Margin = 81°, Gain Margin = 8.2 dB

4.7 Thermal Image (0.72V)

PVin=12.0 V, Vout=0.72 V, Iout=30 A, Fs=762 kHz, Room Temperature, no airflow

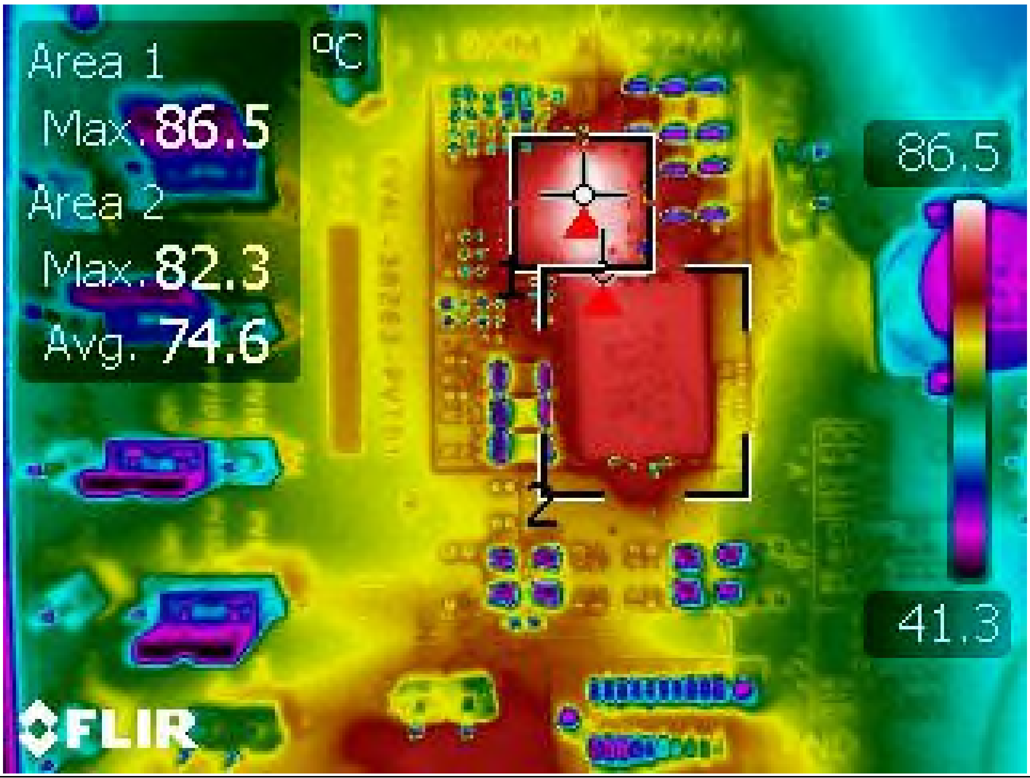

Figure 33 Thermal Image of the board at 30 A load, IR38263: 86.5°C, inductor: 82.3°C

4.8 Thermal Imafe (1.0V)

PVin=12.0 V, Vout=1.0 V, Iout=30 A, Fs=762 kHz, Room Temperature, no airflow

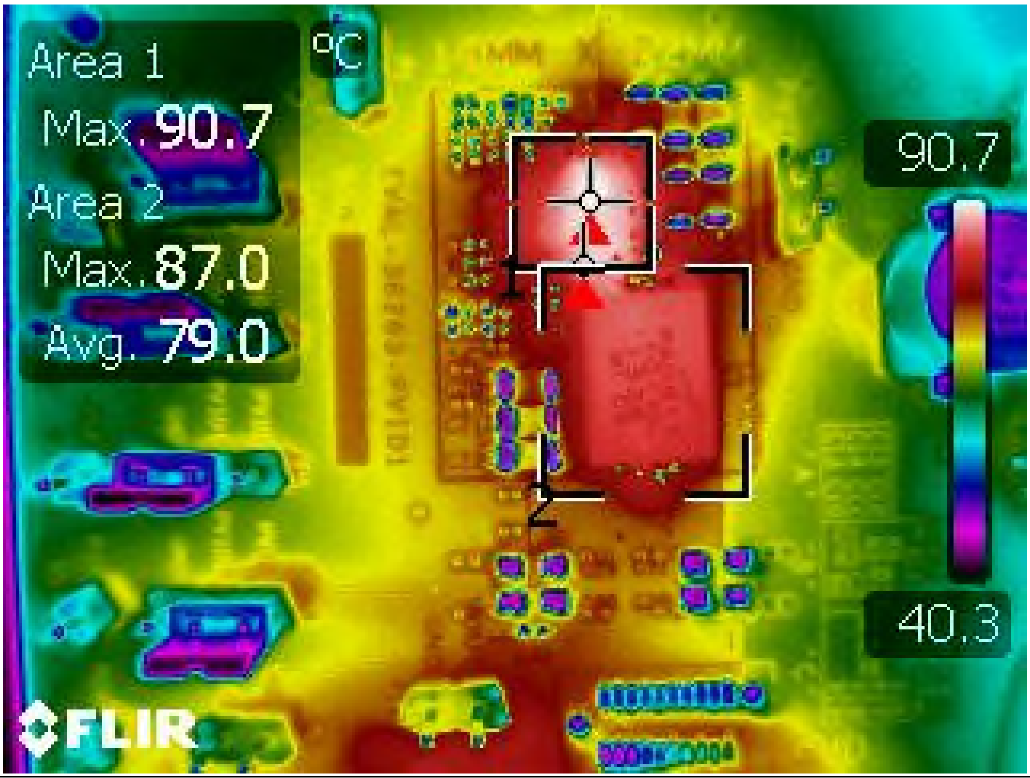

Figure 34 Thermal Image of the board at 30 A load, IR38263: 90.7°C, inductor: 87°C

4.9 Thermal Image (1.8V)

PVin=12.0 V, Vout=1.8 V, Iout=30 A, Fs=762 kHz, Room Temperature, no airflow

Figure 35 Thermal Image of the board at 30 A load, IR38263: 93.8°C, inductor: 91°C

4.10 Efficiency and Power Loss (0.72V)

PVin=12.0 V, Vout=0.72 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

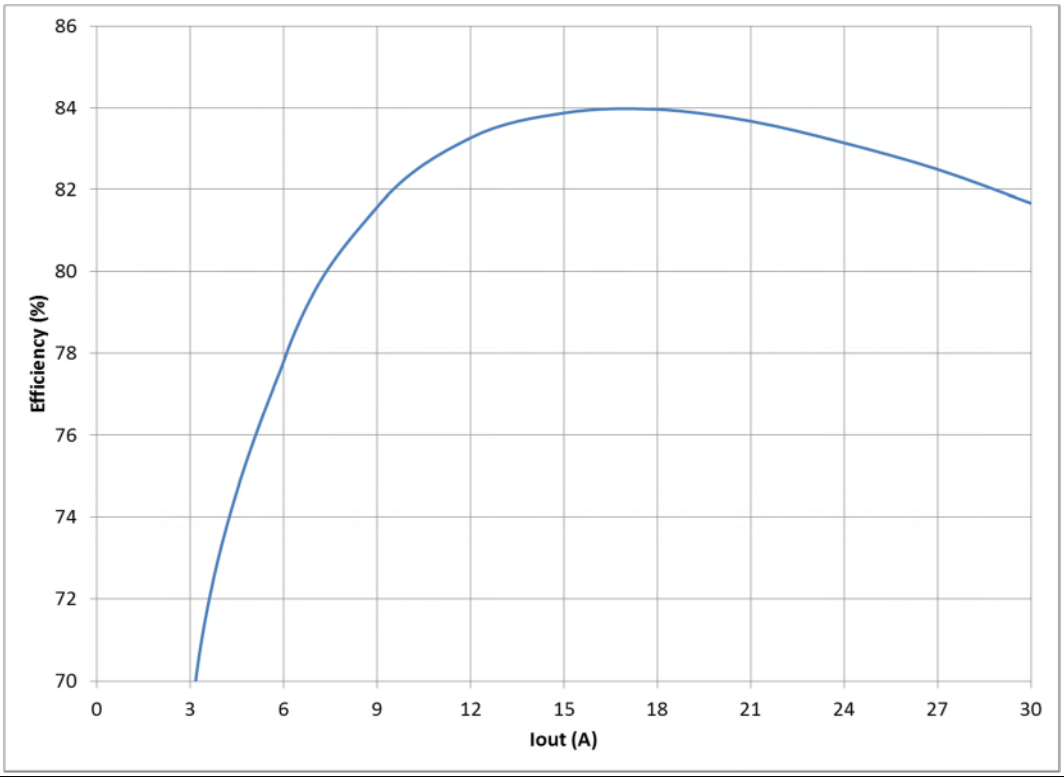

Figure 36 Efficiency vs. load current

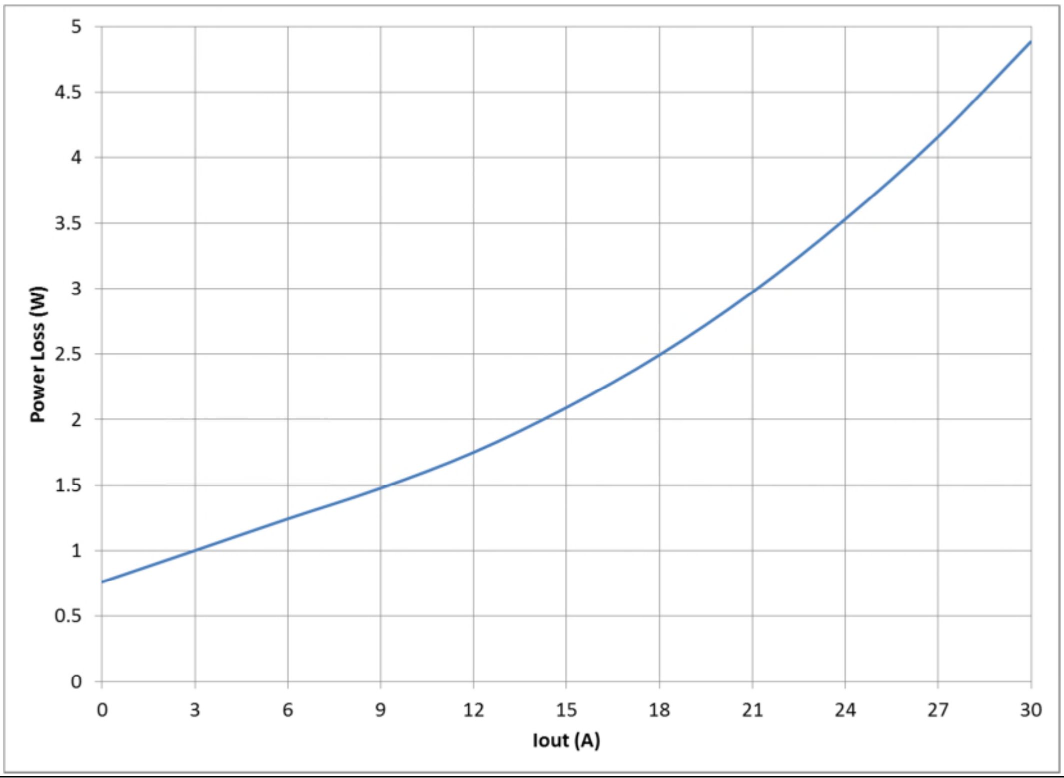

Figure 37 Power Loss vs. load current

4.11 Efficiency and Power Loss (1.0V)

PVin=12.0 V, Vout=1.0 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

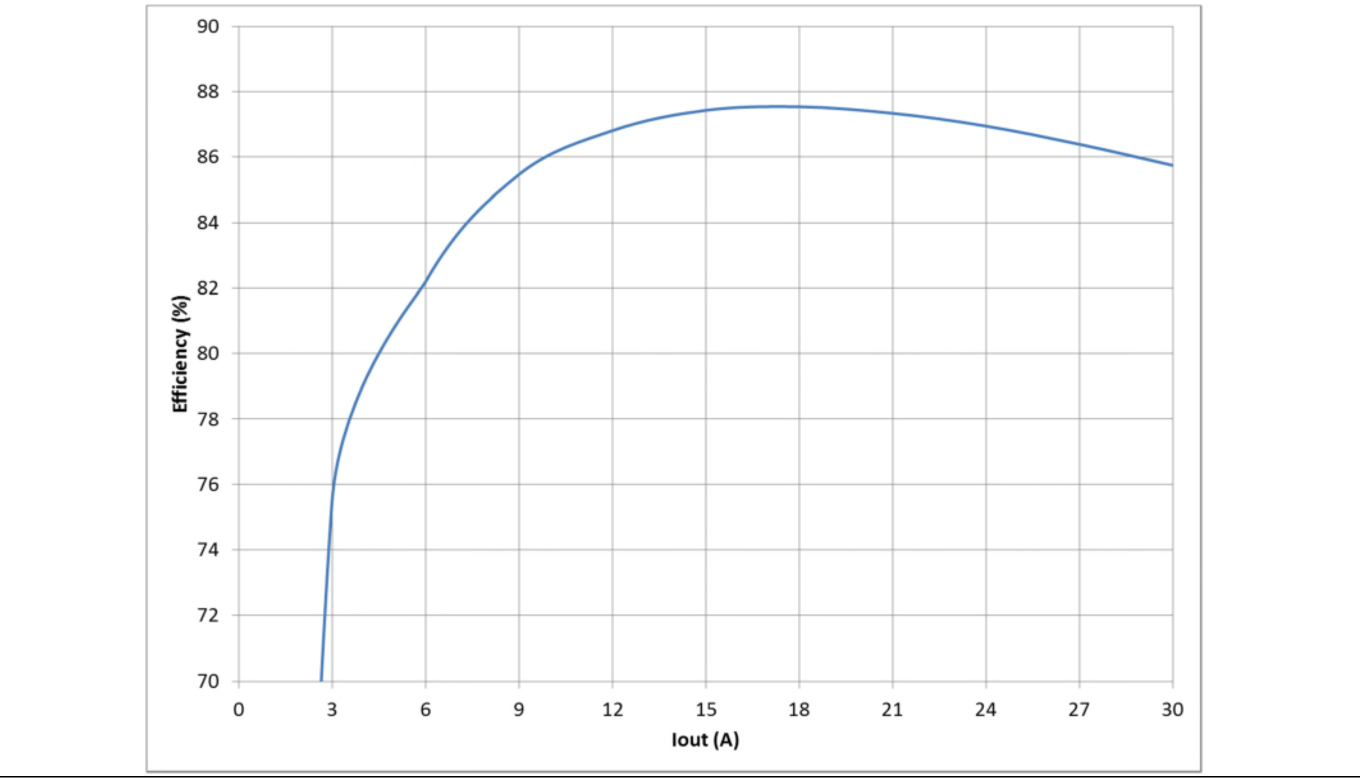

Figure 38 Efficiency vs. load current

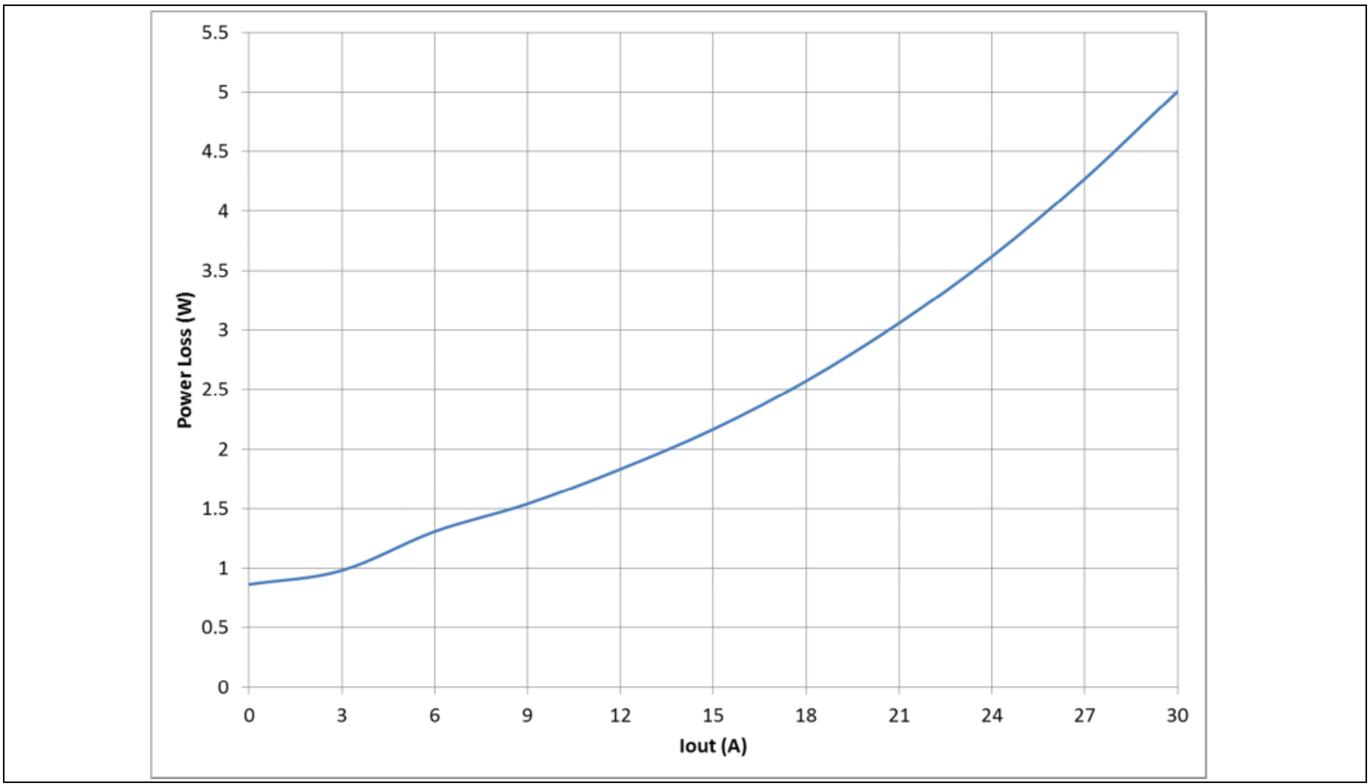

Figure 39 Power Loss vs. load current

4.12 Efficiency and Power Loss (1.8V)

PVin=12.0 V, Vout=1.8 V, Iout=0 A-30 A, Fs=762 kHz, Room Temperature, no airflow

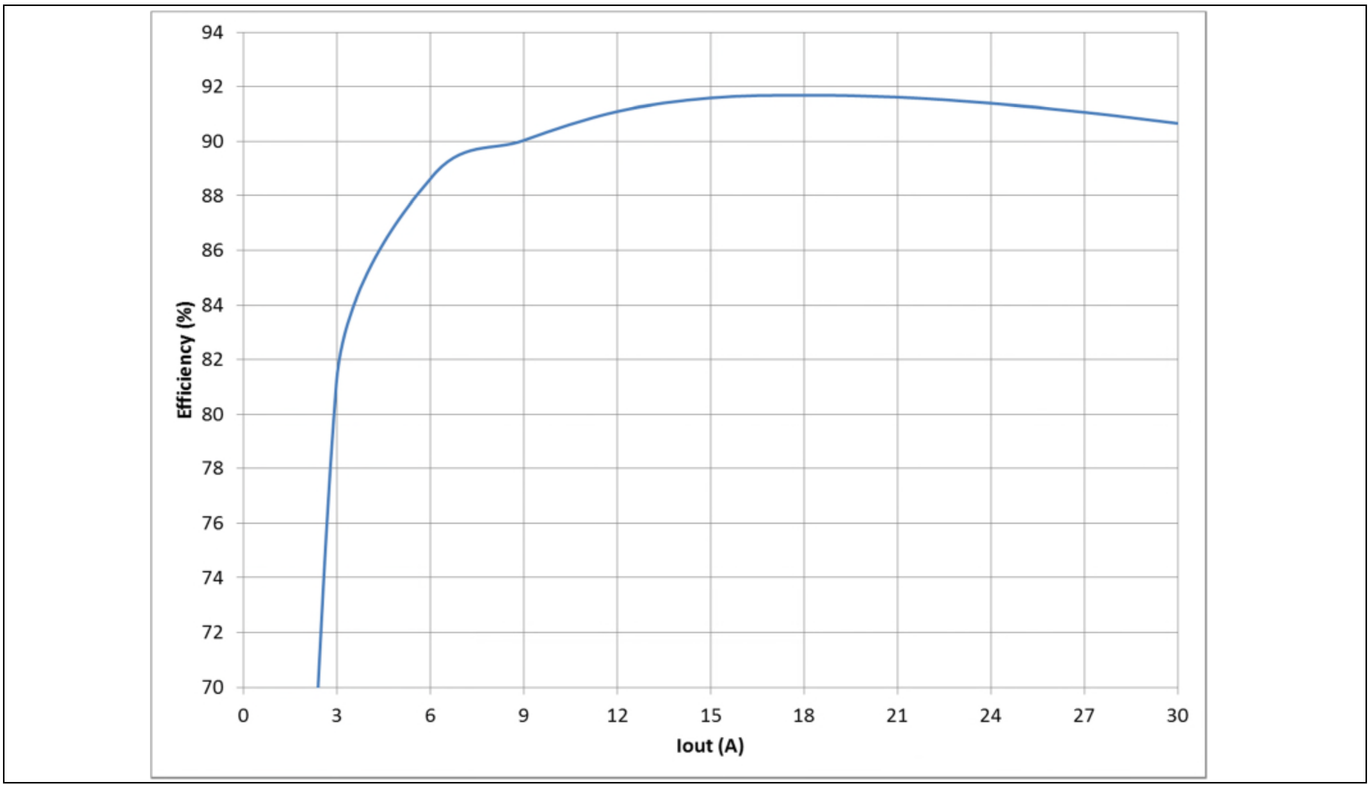

Figure 40 Efficiency vs. load current

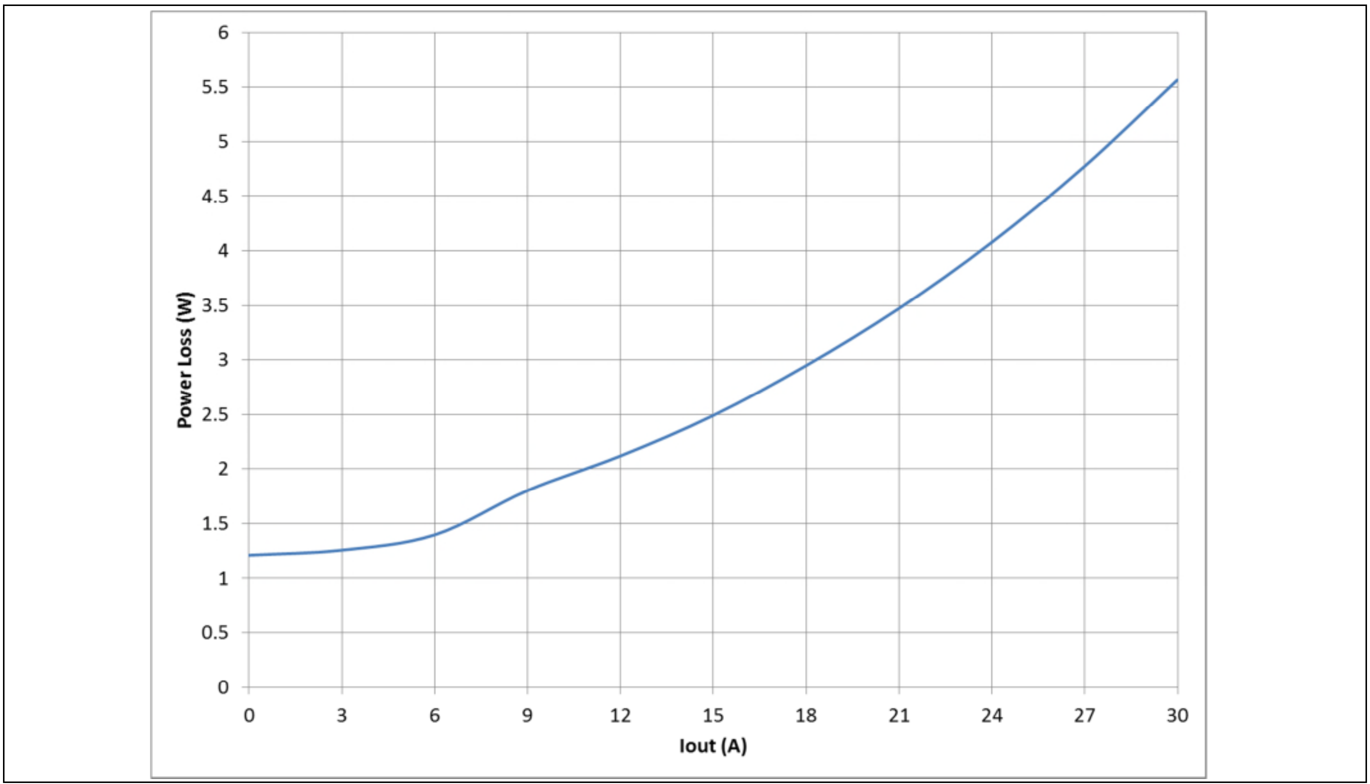

Figure 41 Power Loss vs. load current

Revision History

Major changes since the last revision

Page or Reference	Description of change
Rev 1.1	Updated C4 capacitor from 2.2uF to the recommended 10uF.

Edition <2017-10-04>
Published by
Infineon Technologies AG
81726 Munich, Germany

Do you have a question about this document?
Email: erratum@infineon.com

Document reference
UG_201703_PL17_05