EVAL_3826 P1V2 user guide

User guide for EVAL_3826 evaluation board

About this document

Scope and purpose

The IR3826 is a synchronous buck converter, providing a compact, high performance and flexible solution in a small 5mm X 6 mm Power QFN package.

Key features offered by the IR3826 include internal Digital Soft Start, precision 0.6V reference voltage, Power Good, thermal protection, programmable switching frequency, Enable input, input under-voltage lockout for proper start-up, enhanced line/ load regulation with feed forward, and pre-bias start-up.

Output over-current protection function is implemented by sensing the voltage developed across the on-resistance of the synchronous MOSFET for optimum cost and performance and the current limit is thermally compensated.

This user guide contains the schematic and bill of materials for the IR3826 engineering evaluation board. The guide describes operation and use of the evaluation board itself. Detailed application information for IR3826 is available in the IR3826 data sheet.

Intended audience

This document is intended as a guide for design engineers evaluating IR3826 performance with EVAL_3826 engineering demo board.

Table of contents

1 Board information

1.1 Board features

V_{in} = +12 V

Vout = +1.2 V @ 0- 23 A

F_s = 600 kHz

L = 215 nH (10.1 mm x 7.8 mm x 7.3 mm, DCR=0.29 mΩ)

C_{in} = 8 x 22 µF + 1 x 10 µF (25 V, ceramic 0805) + 1 x 330 µF (25 V, electrolytic, optional)

C_{out} = 10 x 47 µF (6.3 V, ceramic 0805)

1.2 Connections and operating instructions

IR3826 demo board requires a single +12 V for the input power and can deliver up to 23 A load current. The operation modes and OCP limits can be selected through jumpers.

Table 1 Connections

Label		Descriptions
Input	PVIN	Connect input power (+12 V) to this pin
	GND	Return of input power
	PV_{in}, GND	Sense pins for the input voltage
Output	VOUT	V_{out} (+1.2 V), connect a load (23 A max) to this pin
	GND	Return of Vout
	V_{out}, GND	Sense pins for the output voltage
Enable	ENABLE	Connect a scope probe to this pin to monitor Enable Signal
	GND	Or, an external Enable signal can be applied to this Pin to overdrive the on-board Enable signal
OCP Limits	VCC	Used to set different OCP limits.
	ILIM	Connect ILIM to VCC: highest OCP limit
	GND	Leave ILIM floating: medium OCP limit Connect ILIM to GND: lowest OCP limit
BODE	A	For bode plot measurement.
	B	
PGood	PGOOD	Connect a scope probe to this pin to monitor Power Good Signal
	GND	GND
Vsns	Vsns	Connect a scope probe to this pin to monitor Vsns Signal
	GND	GND
Vcc	Vcc	Standard demo board is configured to use the internal LDO. Connect a scope probe to this pin to minitor the output of the internal LDO.
	GND	

1.3 Layout

The PCB is a 6-layer board (3.0”x3.0”) using FR4 material. Top and bottom layers use 1.5 oz copper and inner layers use 2 oz. copper. The PCB thickness is 0.062”. The IR3826 and other major power components are mounted on the top side of the board.

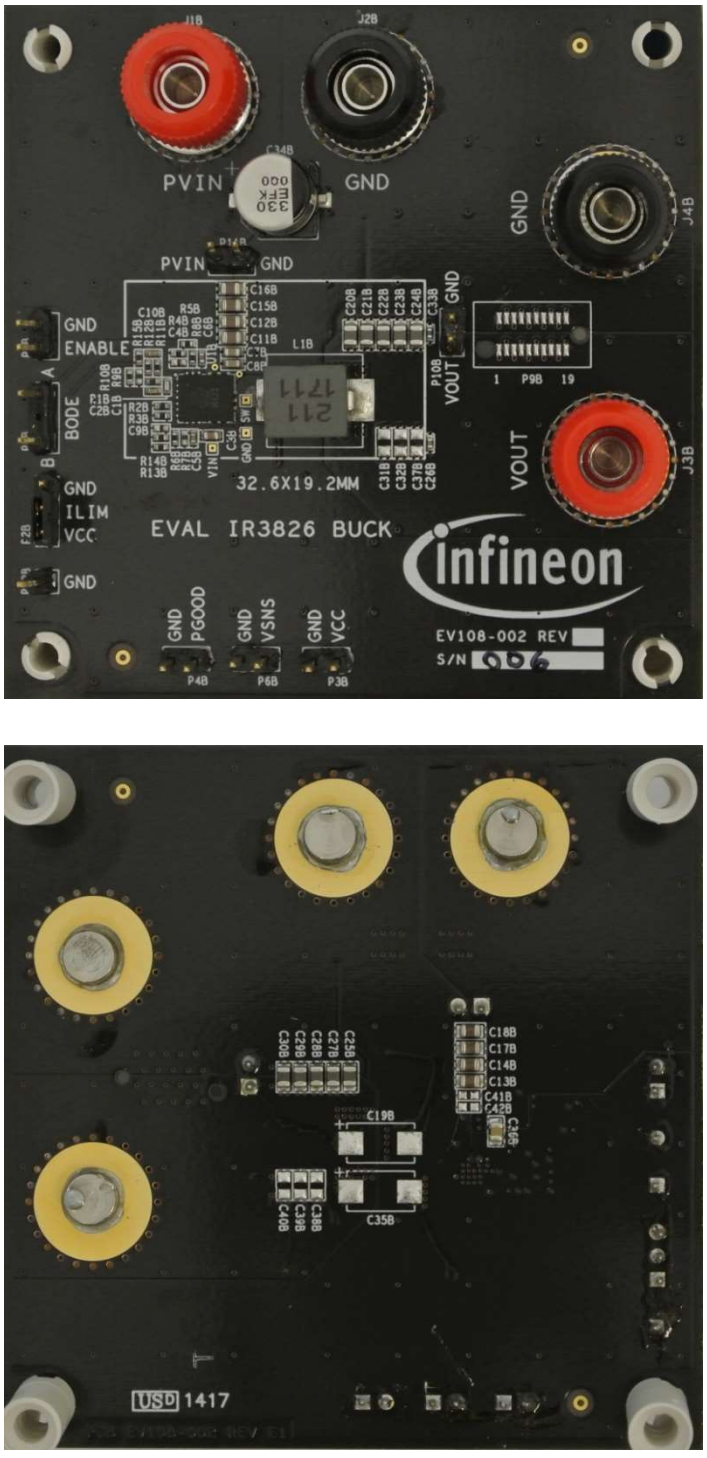

Figure 1 Top and bottom view of IR3826 evaluation board

1.4 PCB Layout

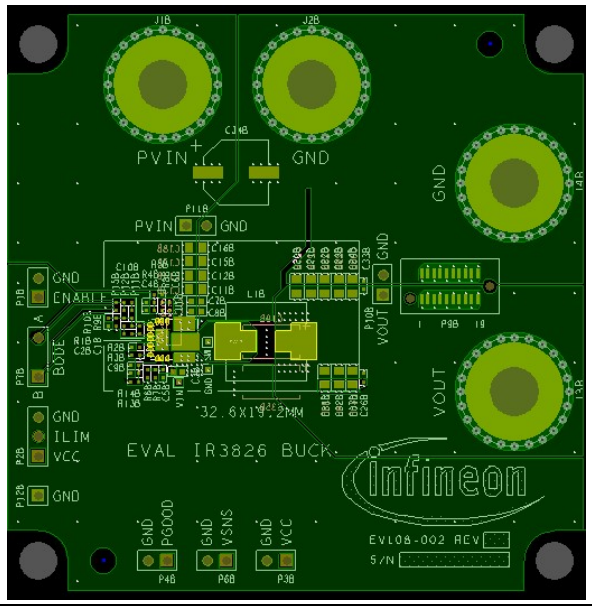

Figure 2 Top layer

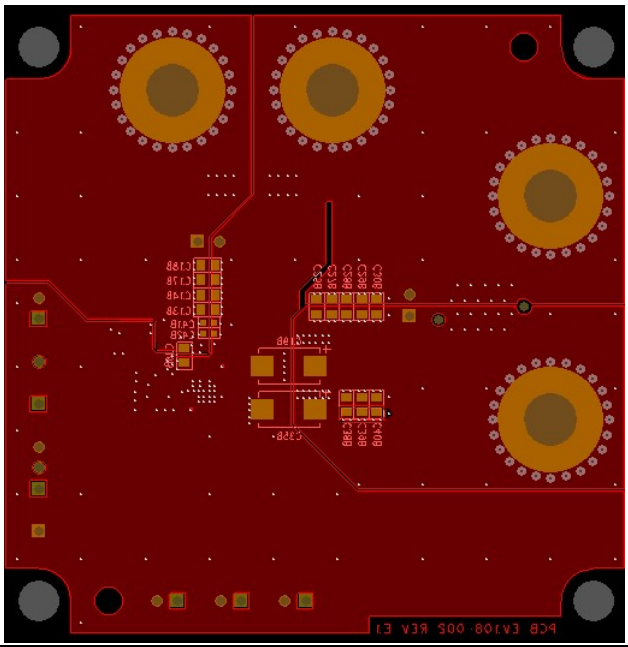

Figure 3 Bottom layer

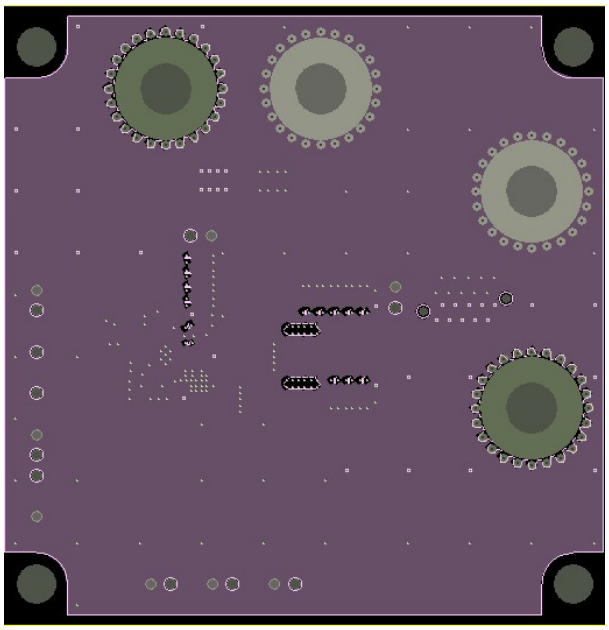

Figure 4 Mid layer 1

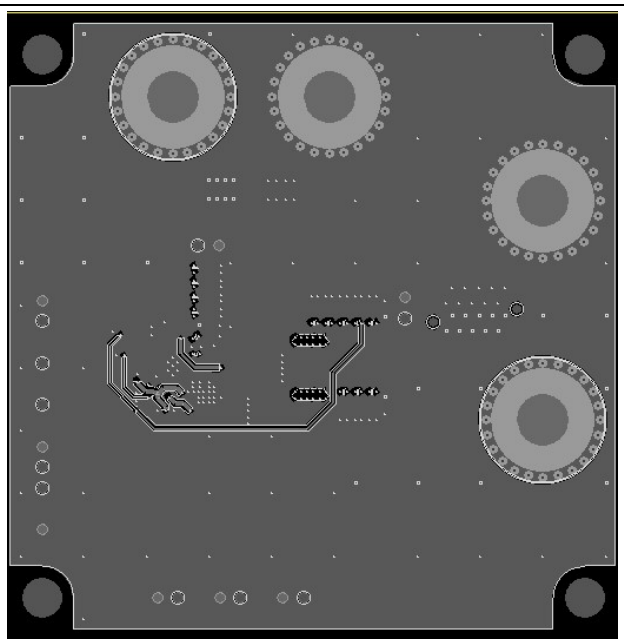

Figure 5 Mid layer 2

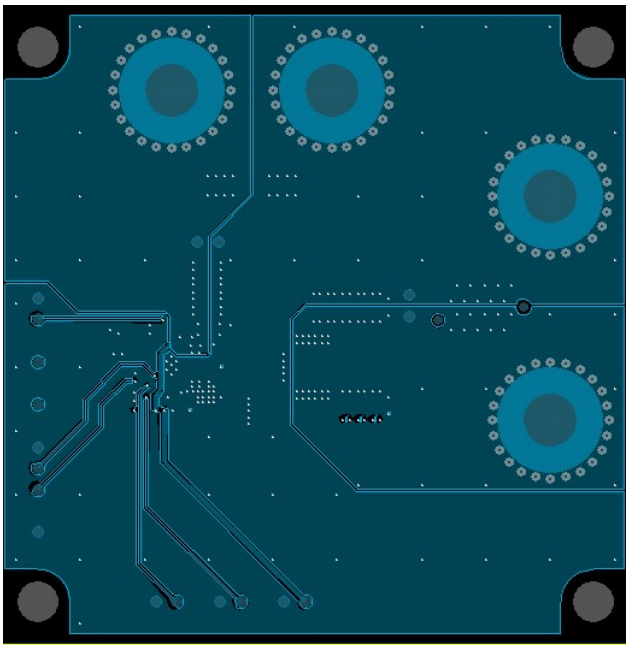

Figure 6 Mid layer 3

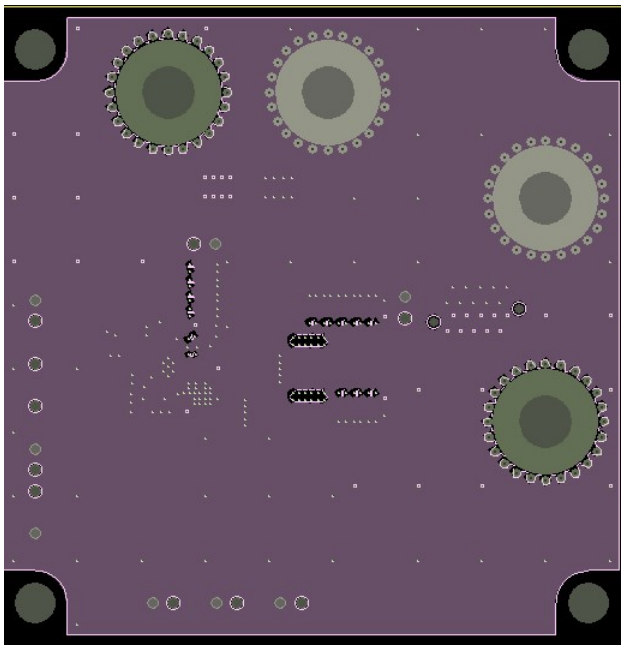

Figure 7 Mid layer 4

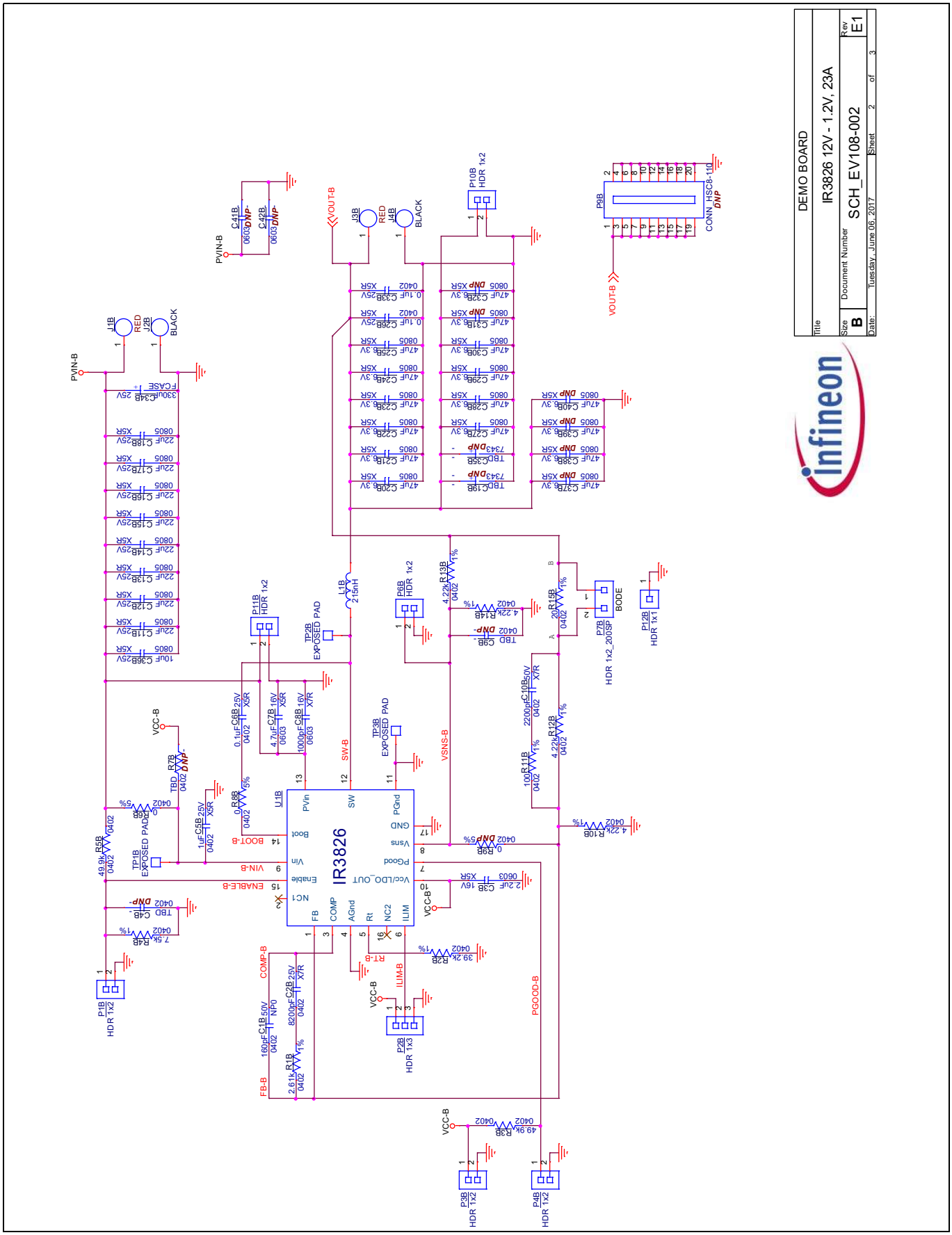

Figure 8 Schematic of the IR3826 evaluation board V_{in} = 12 V, V_O = 1.2 V, $I_O$max = 23 A

1.5 Bill of materials

Table 2 Bill of materials

Item	Quantity	Part Reference	Value	Description	Part Number	Manufacturer
1	1	C1B	160 pF	CAP CER 160 PF 50 V 5% NP0 0402	GRM1555C1H161JA01D	Murata
2	1	C2B	8200 pF	CAP CER 8200 PF 25 V 10% X7R 0402	GRM155R71E822KA01D	Murata
3	1	C3B	2.2 µF	CAP CER 2.2 µF 16 V 10% X5R 0603	GRM188R61C225KE15D	Murata
4	1	C5B	1 µF	CAP CER 1 µF 25 V 10% X5R 0402	GRM155R61E105KA12D	Murata
5	3	C6B,C26B, C33B	0.1 µF	CAP CER 0.1 µF 25 V 10% X7R 0402	GRM155R71E104KE14J	Murata
6	1	C7B	4.7 µF	CAP CER 4.7 µF 16 V 10% X5R 0603	GRM188R61C475KAAJD	Murata
7	1	C8B	1000 pF	CAP CER 1000 PF 16 V 10% X7R 0603	GRM188R71C102KA01D	Murata
8	1	C10B	2200 pF	CAP CER 2200 PF 50 V 10% X7R 0402	GRM155R71H222KA01D	Murata
9	8	C11B,C12 B,C13B,C1 4B,C15B,C 16B,C17B, C18B	22 µF	CAP CER 22 µF 25 V 20% X5R 0805	GRM21BR61E226ME44L	Murata
10	10	C20B,C21 B,C22B,C2 3B,C24B,C 25B,C27B, C28B,C29 B,C30B	47 µF	CAP CER 47 µF 6.3 V 20% X5R 0805	C2012X5R0J476M125AC	TDK
11	1	C34B	330 µF	CAP ALUM 330 µF 20% 25 V SMD	EEV-FK1E331P	Panasonic
12	1	C36B	10 µF	CAP CER 10 µF 25 V 10% X5R 0805	GRM21BR61E106KA73L	Murata
13	1	L1B	215 nH	INDUCTOR , 215 nH, 10.1 x 7.8 x 7.3 mm, 0.29 mohm, SMD	HCB1075N-211	Delta
14	1	R1B	2.61 k	RES 2.61 K OHM 1/10 W 1% 0402 SMD	ERJ-2RKF2611X	Panasonic
15	1	R2B	39.2 k	RES 39.2 K OHM 1/10 W 1% 0402 SMD	ERJ-2RKF3922X	Panasonic
16	2	R3B,R5B	49.9 k	RES 49.9 K OHM 1/10 W 1% 0402 SMD	ERJ-2RKF4992X	Panasonic

17	1	R4B	7.5 k	RES 7.50 K OHM 1/10 W 1% 0402 SMD	ERJ-2RKF7501X	Panasonic
18	2	R6B,R8B	0	RES 0.0 OHM 1/10 W 0402 SMD	ERJ-2GE0R00X	Panasonic
19	4	R10B,R12B,R13B,R14B	4.22 k	RES 4.22 K OHM 1/10 W 1% 0402 SMD	ERJ-2RKF4221X	Panasonic
20	1	R11B	100	RES 100 OHM 1/10 W 1% 0402 SMD	ERJ-2RKF1000X	Panasonic
21	1	R15B	20	RES 20.0 OHM 1/16 W 1% 0402 SMD	CRCW040220R0FKED	Vishay Dale
22	1	U1B	IR3826	Integrated Buck Regulator PQFN 5x6mm	IR3826	Infineon

2 Typical operating waveforms

V_{in} = 12.0 V, V_o = 1.2 V, I_o = 0 – 23 A, Room Temperature, no airflow

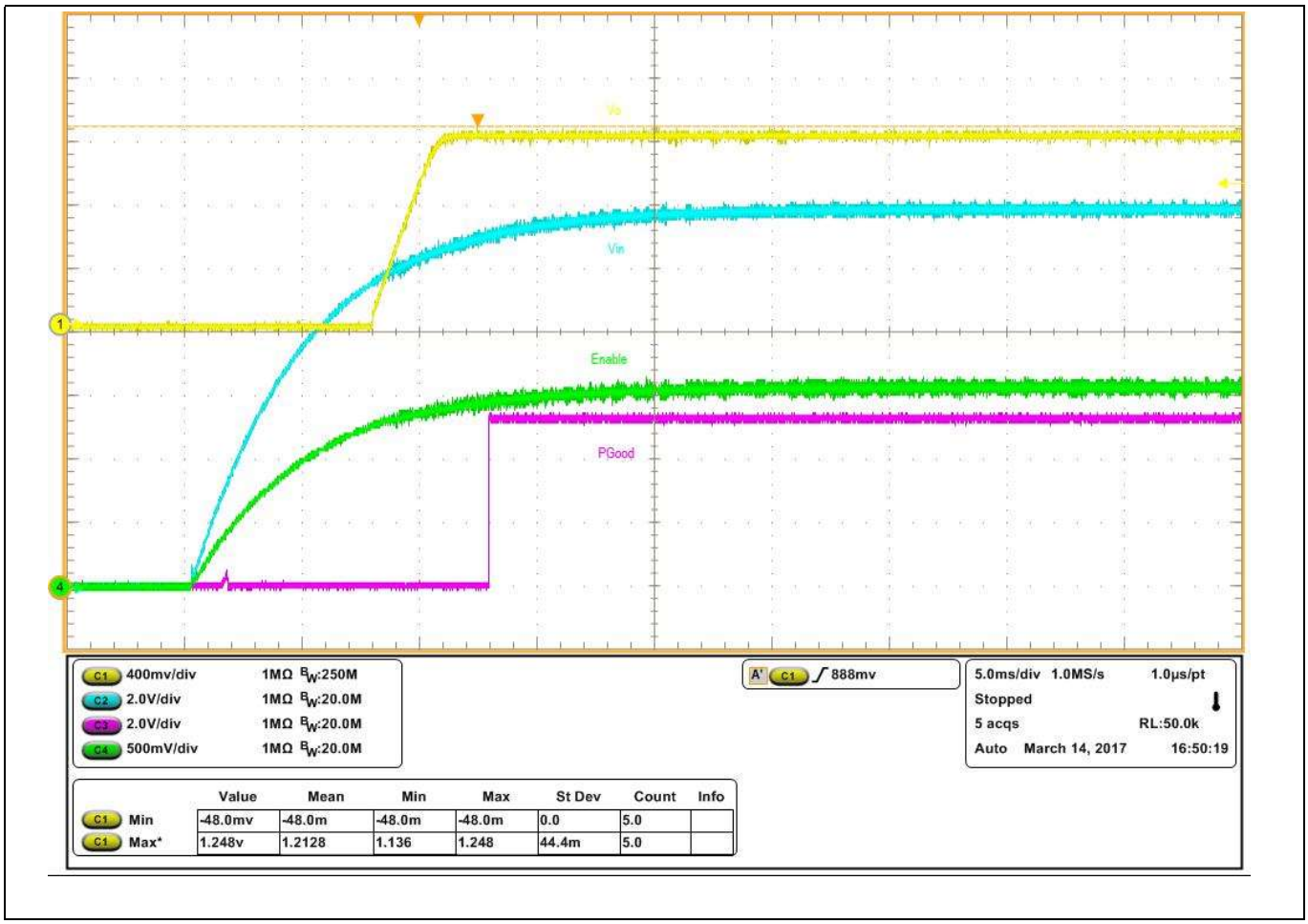

Figure 9 Start up at 23 A Load, (Ch_1: V_o, Ch_2: PV_{in}, Ch_3:P_{Good} ,Ch_4:Enable)

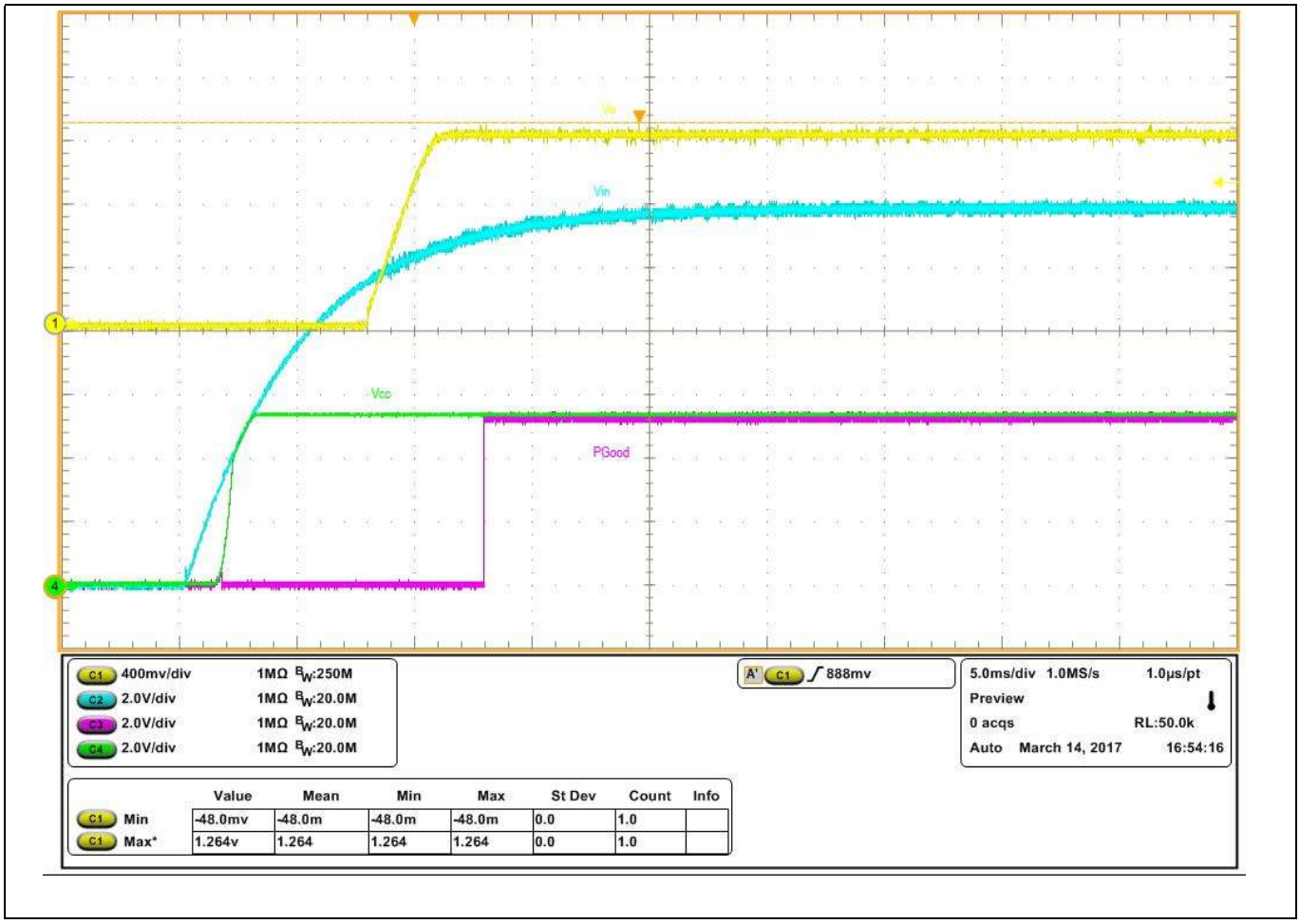

Figure 10 Start up at 23 A Load, (Ch_1: V_o, Ch_2: PV_{in}, Ch_3: P_{Good} , Ch_4: V_{cc})

Figure 11 Pre-bias Start up at 0 A Load, (Ch_1: V_o, Ch_2: PV_{in}, Ch_3:P_{Good} ,Ch_4:Enable)

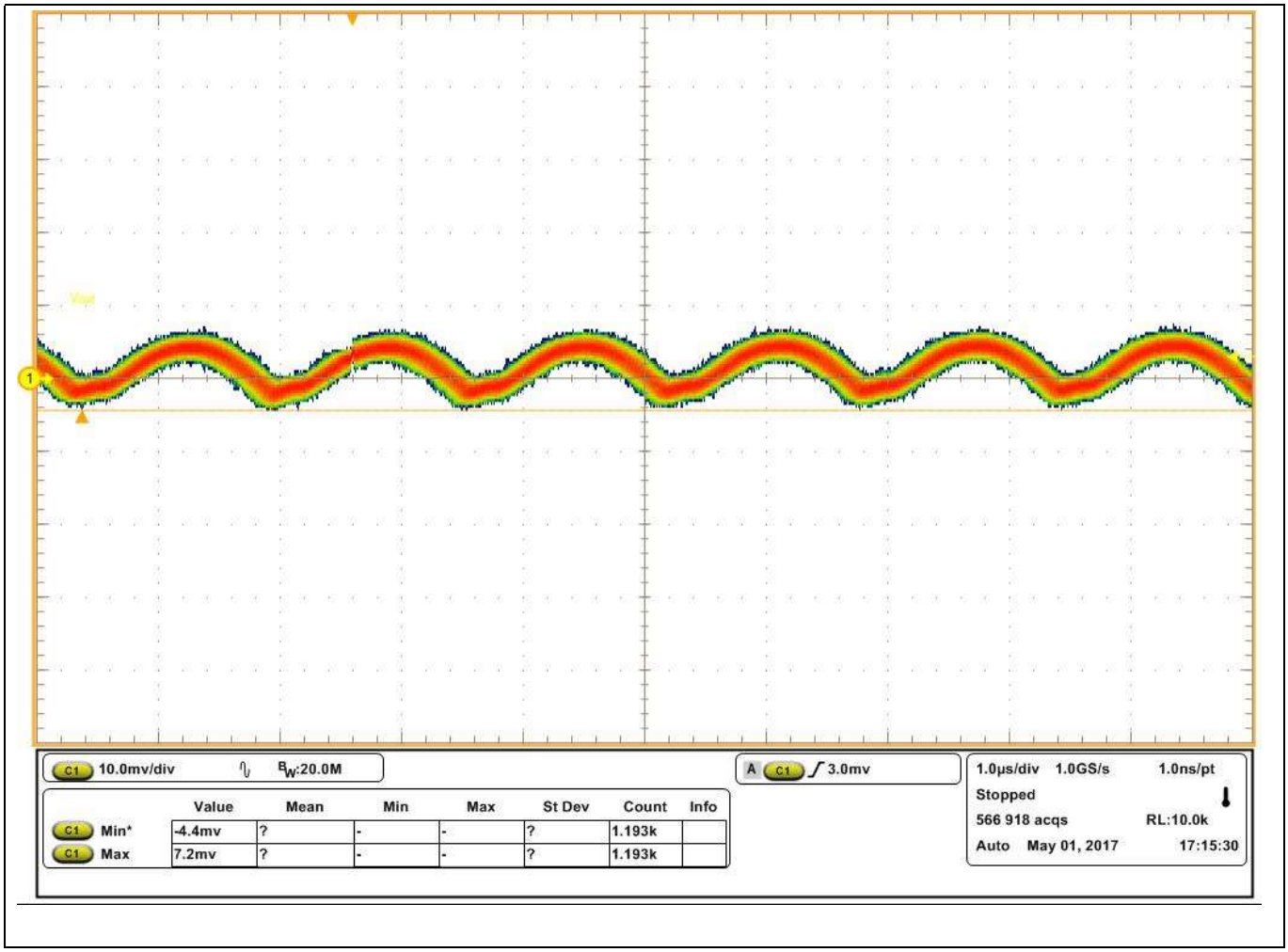

Figure 12 Vout ripple at 23 A Load, (Ch_1: V_o)

Figure 13 SW node, 23 A load

Figure 14 Short circuit (Hiccup), (Ch_1: V_o , Ch_3:P_{Good})

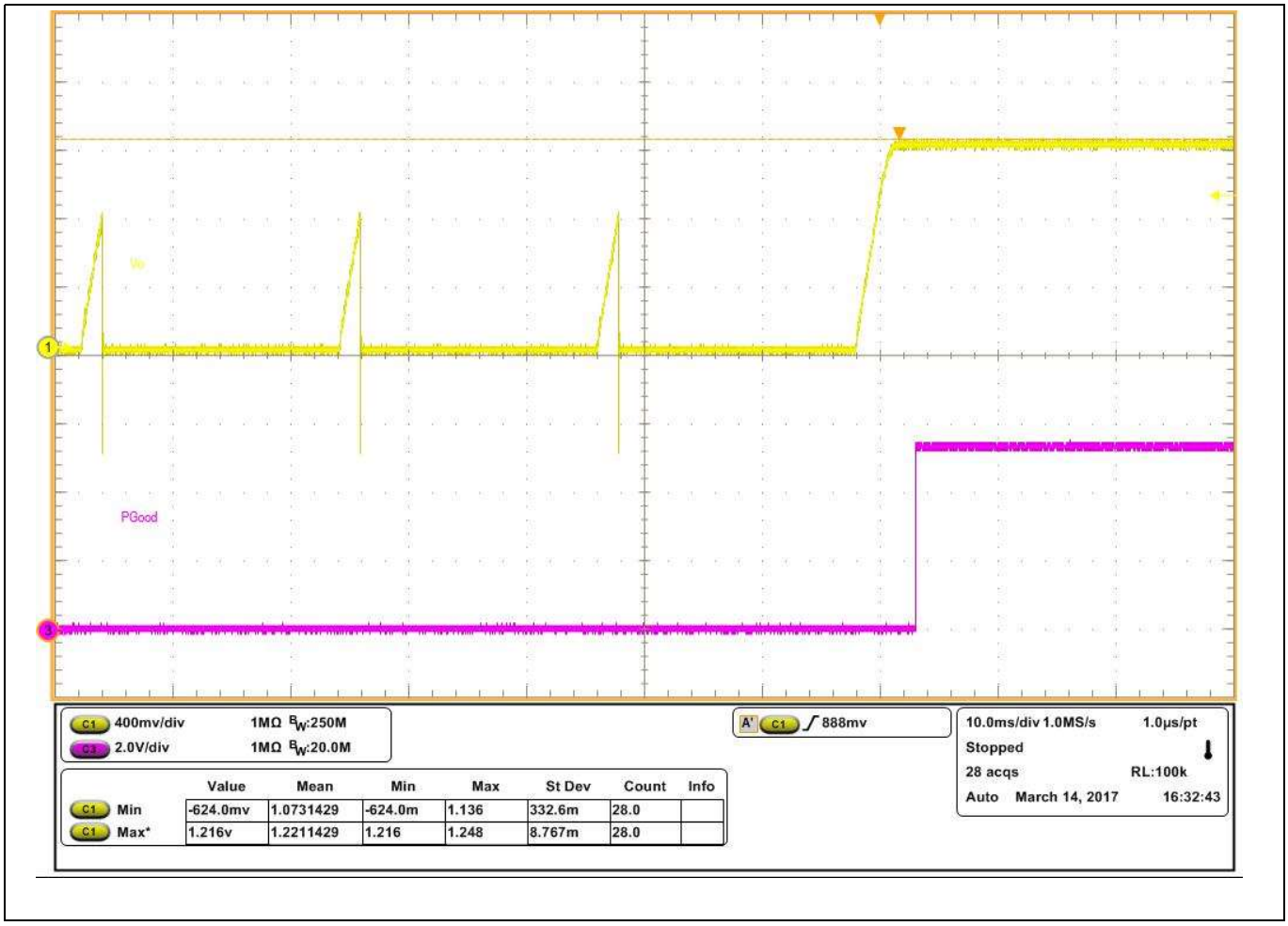

Figure 15 Short circuit (Hiccup) recover, (Ch_1: V_o , Ch_3:P_{Good})

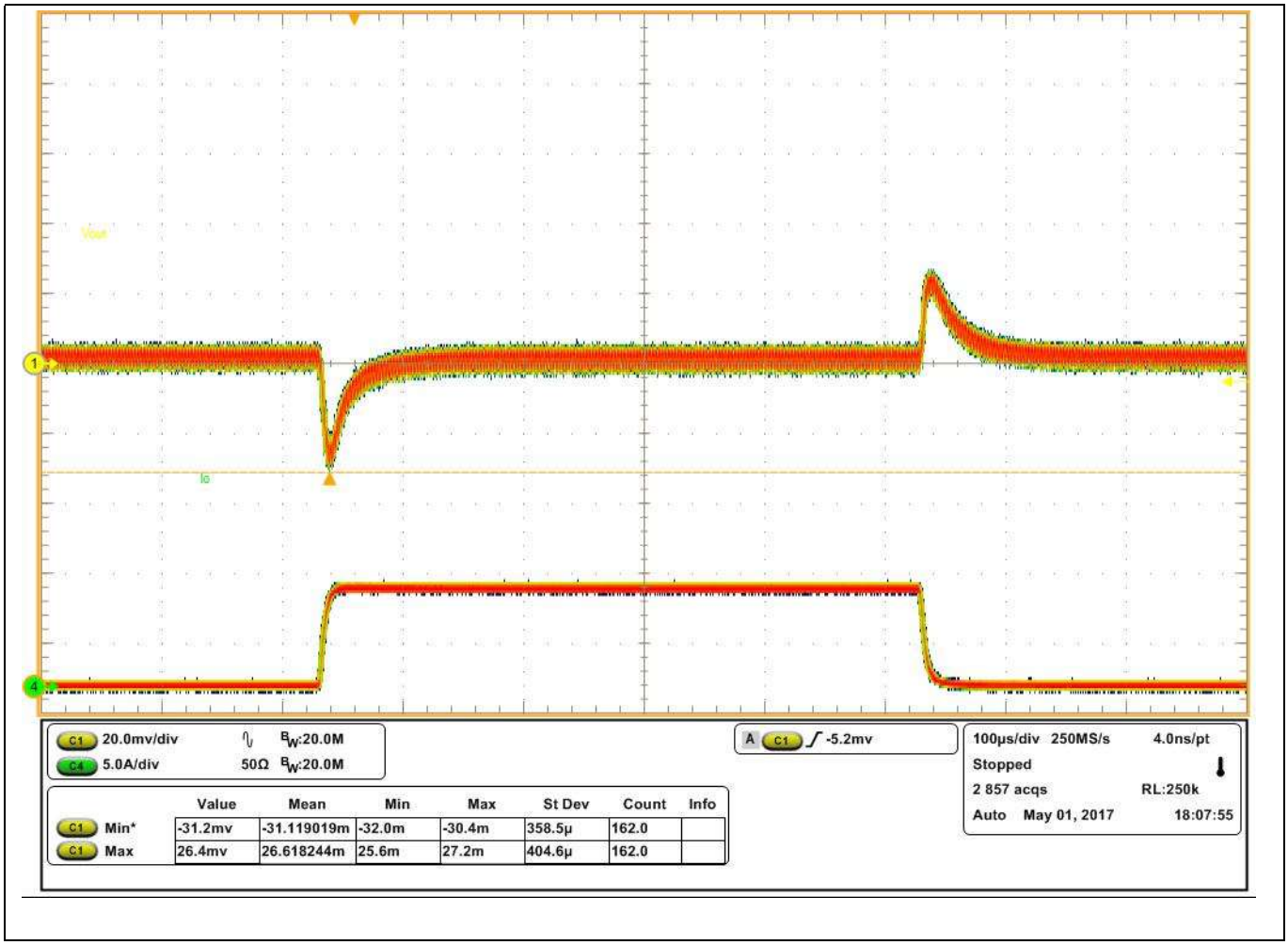

Figure 16 **Transient response at 7 A step load current @ 2.5 A/µs slew rate: Io= 0 A – 7 A, (Ch_1: V_o, Ch_4: I_o) Undershoot: -31.2 mV, Overshoot: 26.4 mV**

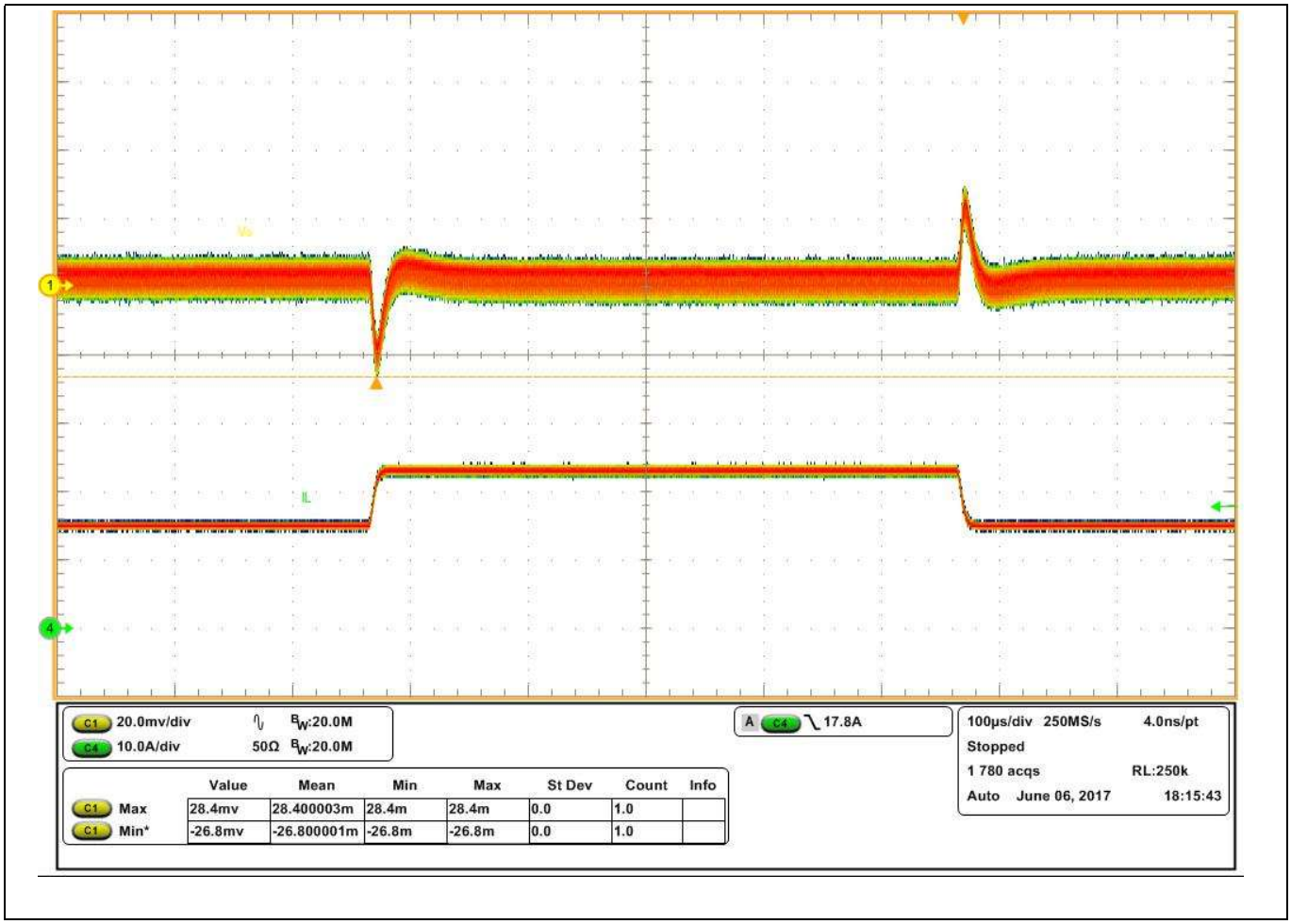

Figure 17 **Transient response at 8A step load current @ 2.5 A/µs slew rate: Io= 15 A – 23 A, (Ch_1: V_o, Ch_4: I_o), Undershoot: -26.8 mV, Overshoot: 28.4 mV**

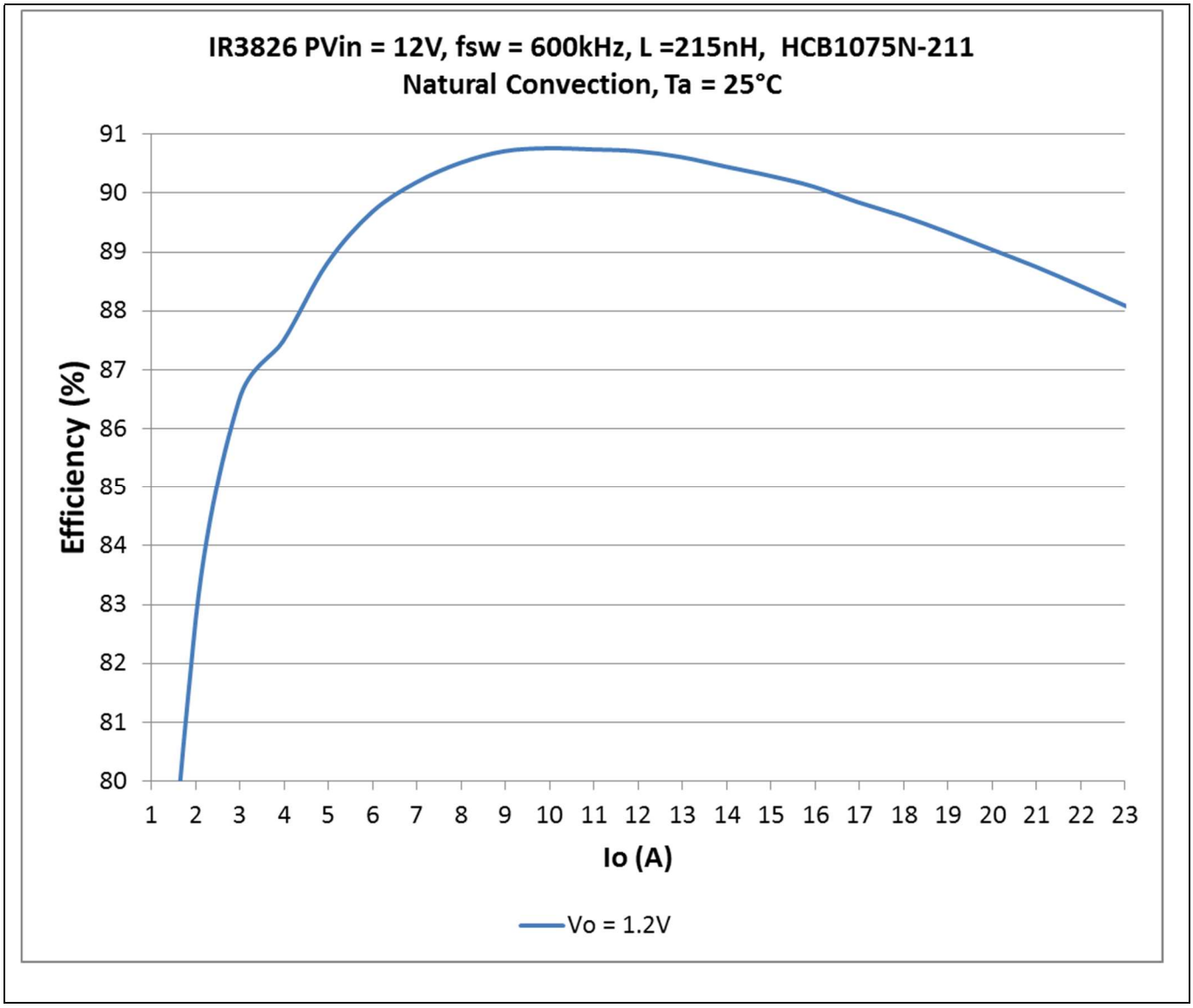

Figure 18 Efficiency versus load current with natural convection

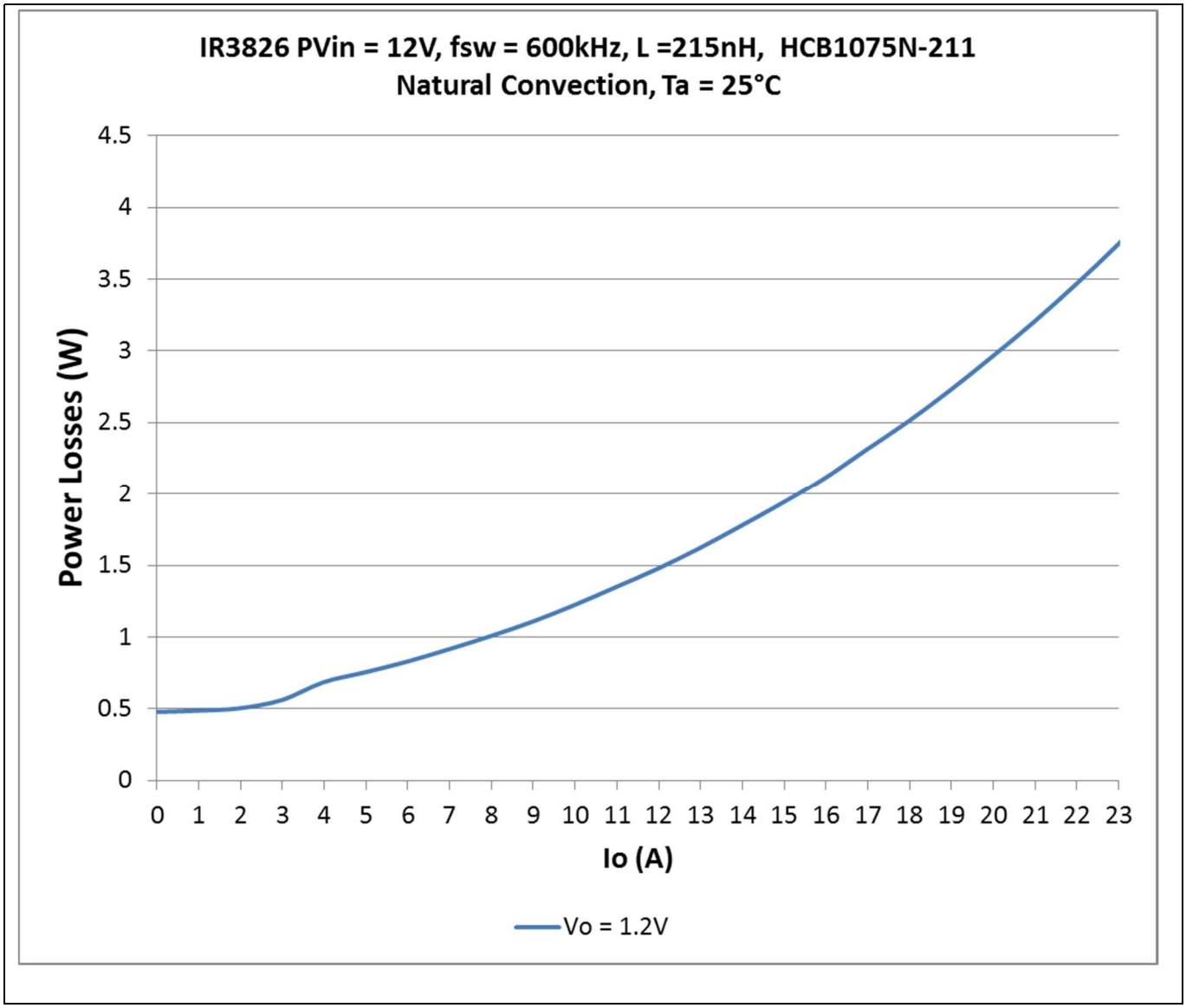

Figure 19 Power loss versus load current

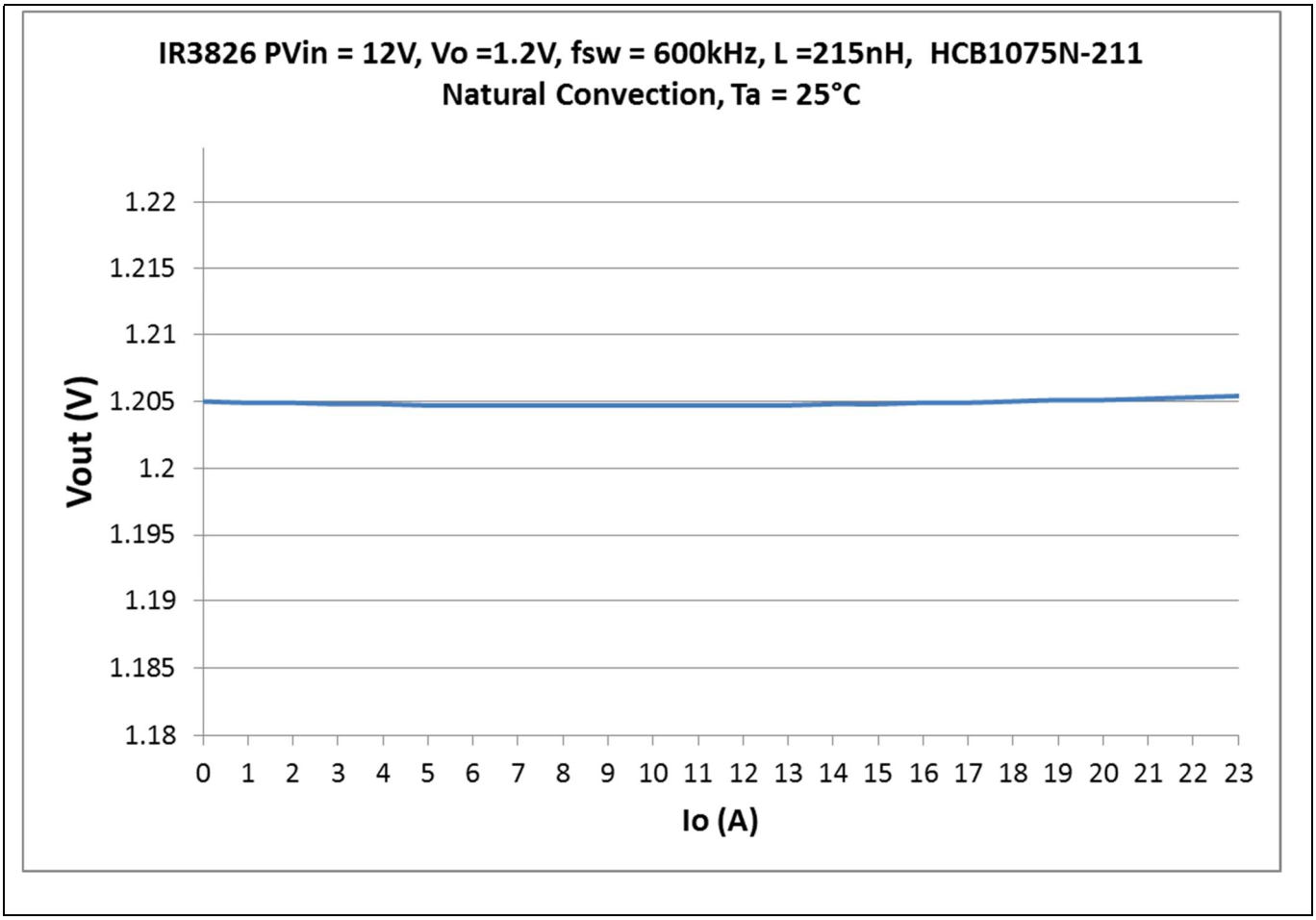

Figure 20 Load regulation

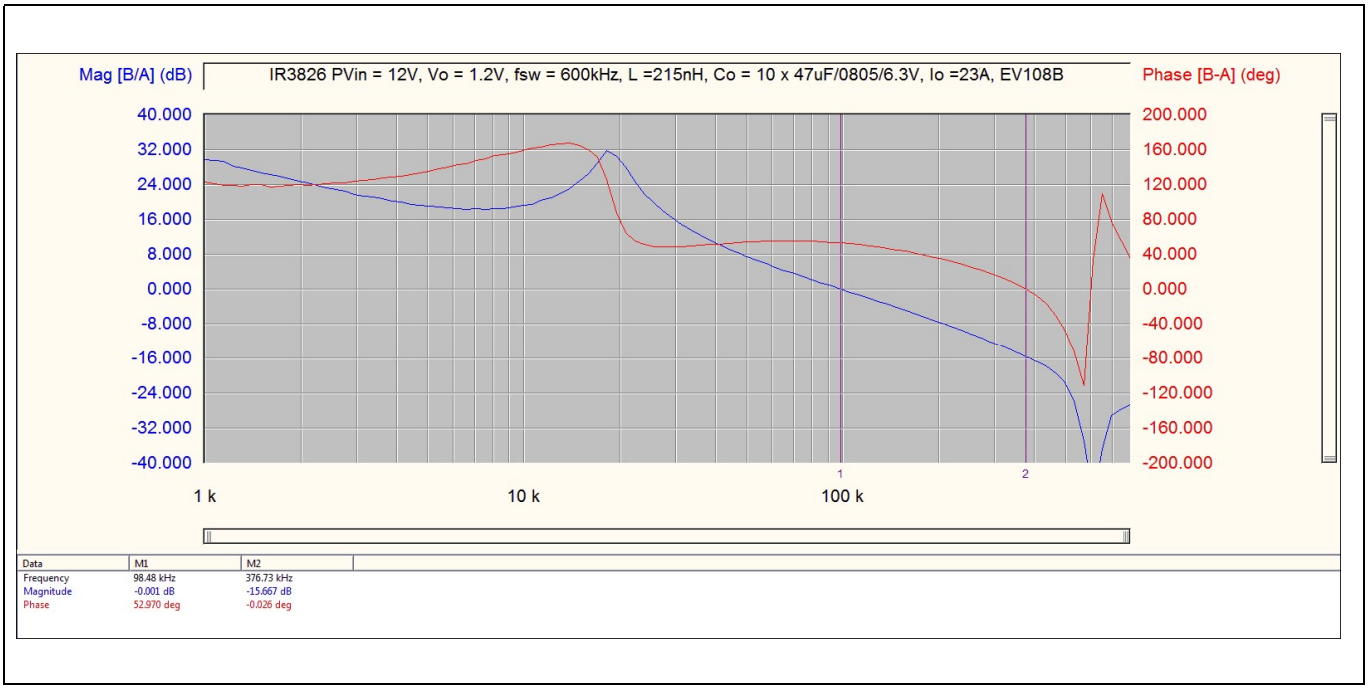

Figure 21 Bode plot of IR3826 at 23 A load, crossover frequency = 98 kHz, Phase margin = 53°, Gain Margin = -15 dB

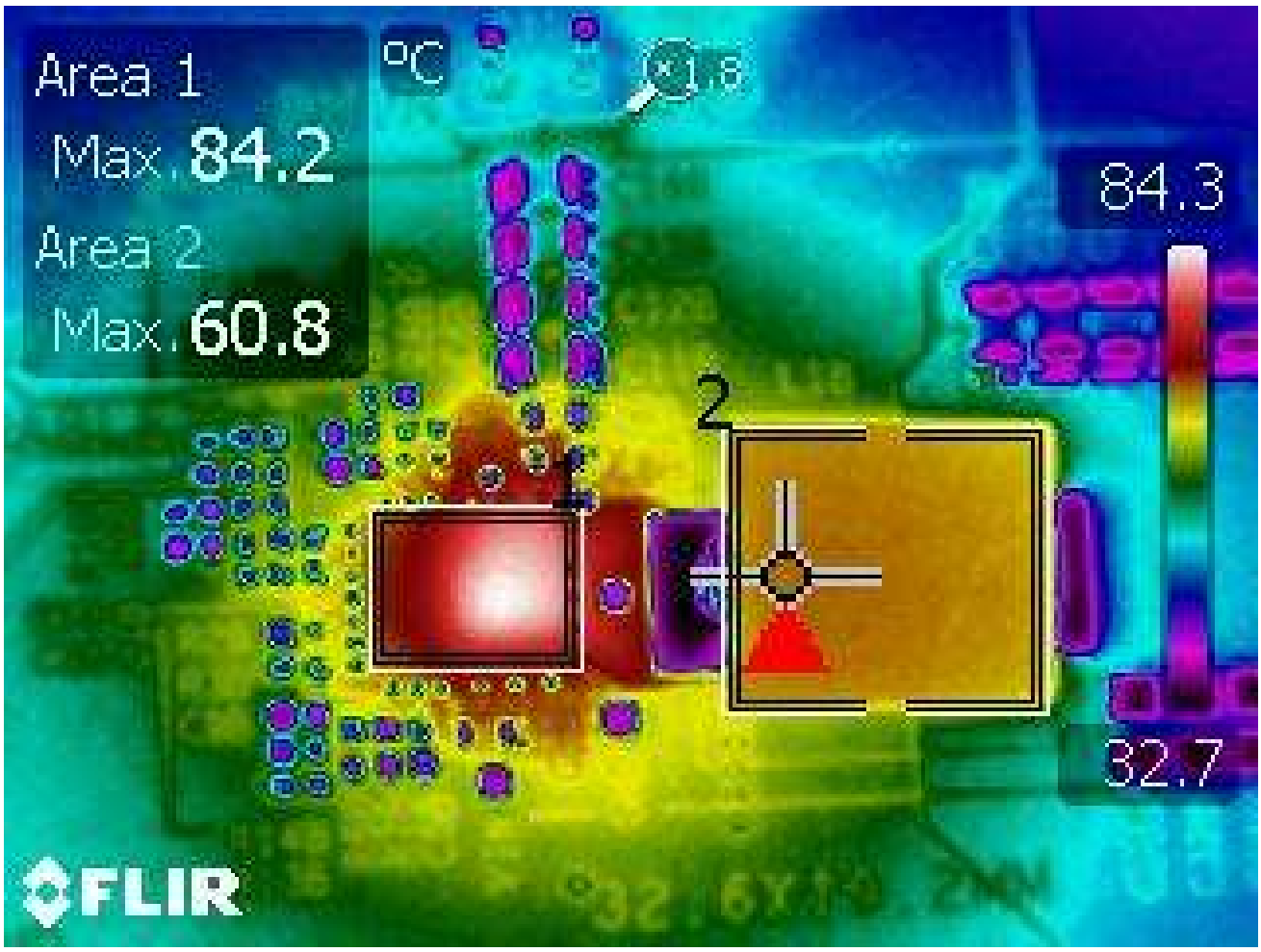

Figure 22 **Thermal Image of the board at 23 A load IR3826 = 84 °C, L= 61 °C, Amb = 25 °C, Natural convection**

Revision history

Document version	Date of release	Description of changes
1.1	2017 – 9 – 11	Preliminary User Guide
1.2	2018 – 6 – 16	Initial release
1.3	2018 – 7 – 15	Format update

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Edition 2018-07-15

Published by

Infineon Technologies AG

81726 Munich, Germany

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Email: erratum@infineon.com

Document reference
UG_201703_PL17_05

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