EVAL_3826A P1V2 user guide

User guide for EVAL_3826A evaluation board

About this document

Scope and purpose

The IR3826A is a synchronous buck converter, providing a compact, high performance and flexible solution in a small 5 mm X 6 mm Power QFN package.

Key features offered by the IR3826A include internal Digital Soft Start, precision 0.6 V 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 EVAL_3826A engineering evaluation board. The guide describes operation and use of the evaluation board itself. Detailed application information for IR3826A is available in the IR3826A data sheet.

Intended audience

This document is intended as a guide for design engineers evaluating IR3826A performance with the engineering EVAL_3826A demo board.

Table of contents

1 Board information

1.1 Board features

- V_{in} = +12 V
- V_{out} = +1.2 V @ 0- 16 A
- F_s=1000 kHz
- L= 215 nH (10.4 mm x 8.0 mm x 7.5 mm, DCR=0.29 mΩ)
- C_{in}= 4 x 22 µF+1x10 µF (25 V, ceramic 0805) + 1 x 330 µF (25 V, electrolytic, optional)
- C_{out}=5 x 22 µF (6.3 V, ceramic 0805)

1.2 Connections and operating instructions

IR3826A demo board requires a single +12 V for the input power and can deliver up to 16 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 (16 A max) to this pin
	GND	Return of V_{out}
	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. - Connect ILIM to VCC: highest OCP limit - Leave ILIM floating: medium OCP limit - Connect ILIM to GND: lowest OCP limit
	ILIM	
	GND	
BODE	A	For bode plot measurement.
	B	
PGood	PGOOD	Connect a scope probe to this pin to monitor Power Good Signal
	GND	GND
V_{sns}	V_{sns}	Connect a scope probe to this pin to monitor V_{sns} Signal
	GND	GND
V_{cc}	V_{cc}	Standard demo board is configured to use the internal LDO. Connect a scope probe to this pin to monitor 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 IR3826A and other major power components are mounted on the top side of the board.

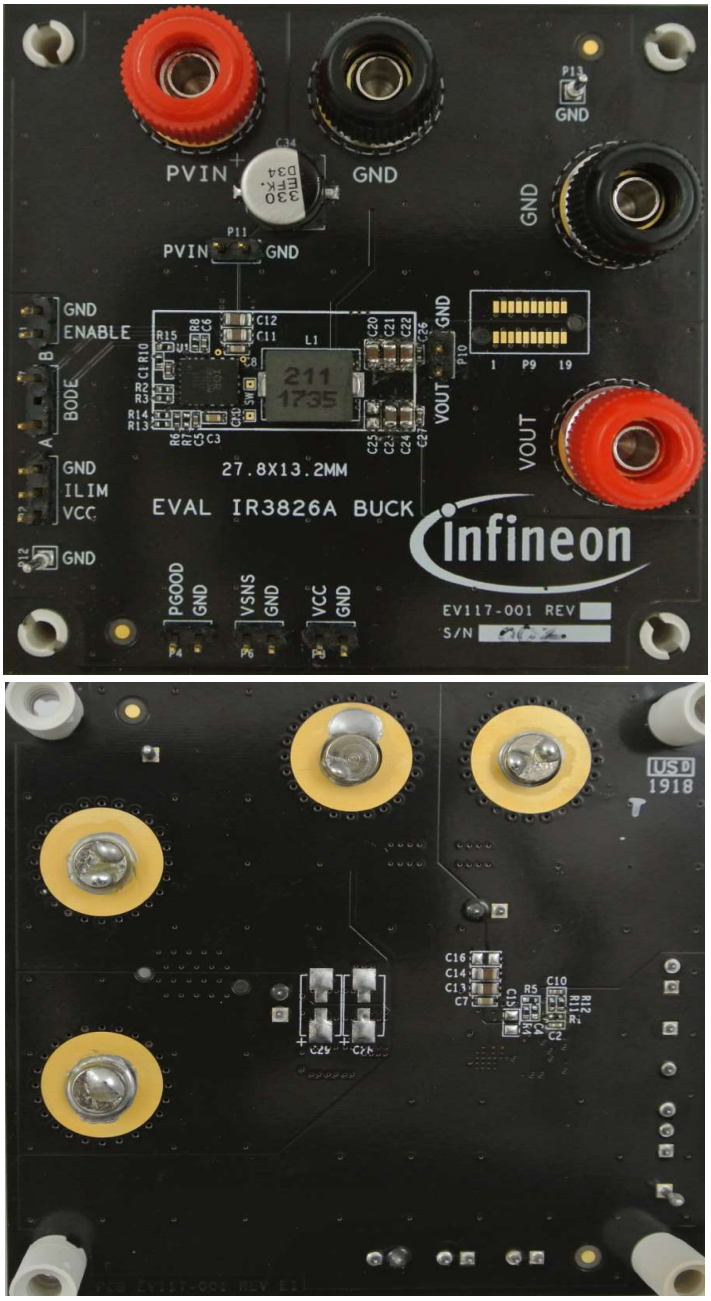

Figure 1 Top and bottom view of the EVAL_3826A evaluation board

1.4 PCB layout

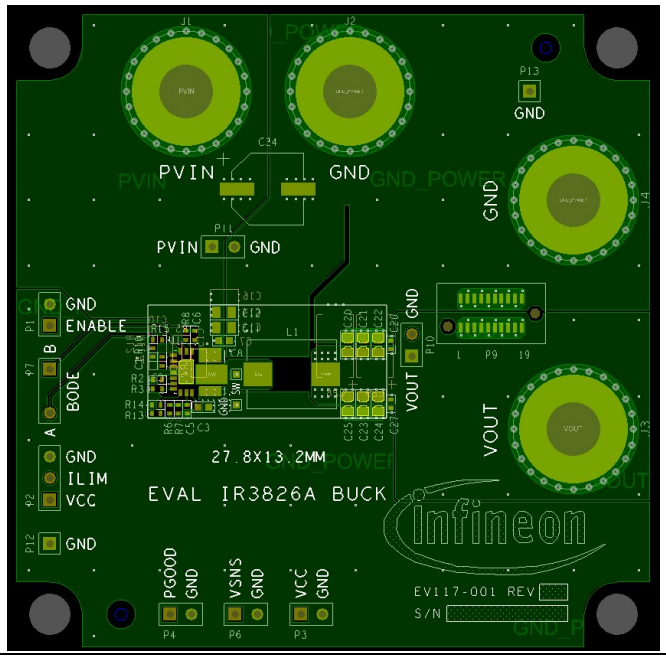

Figure 2 Top layer

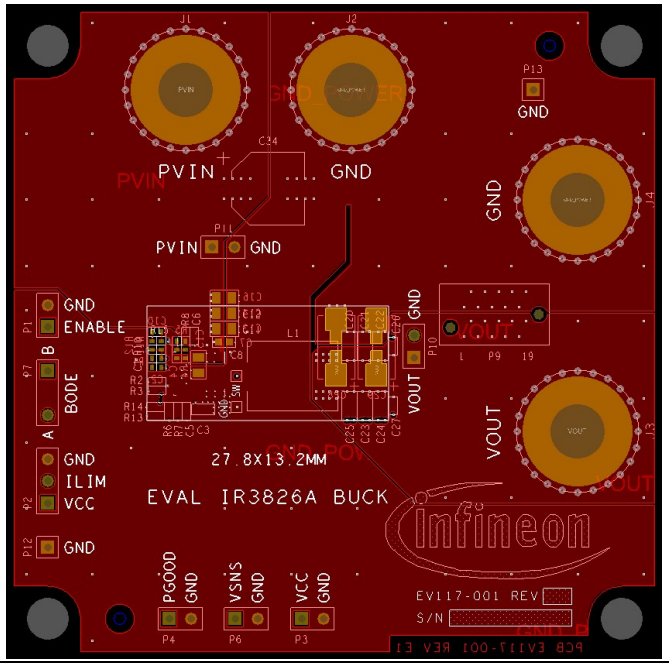

Figure 3 Bottom layer

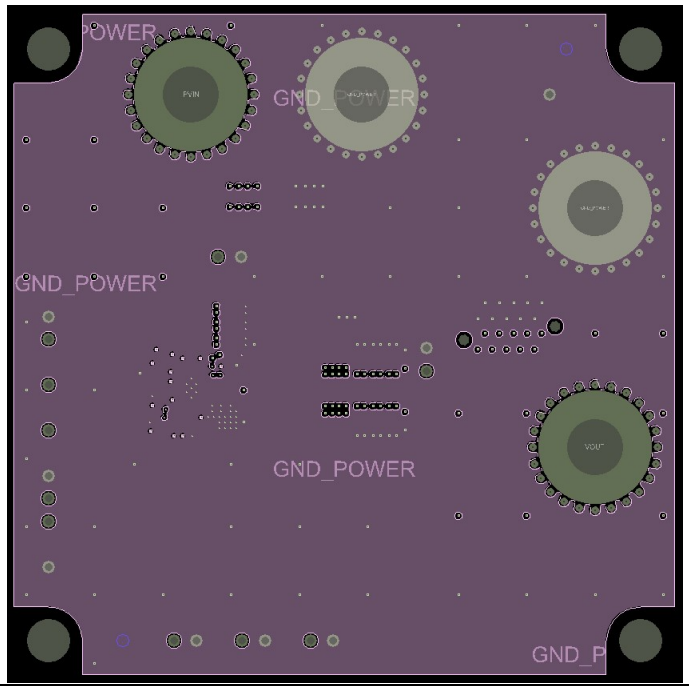

Figure 4 Mid layer 1

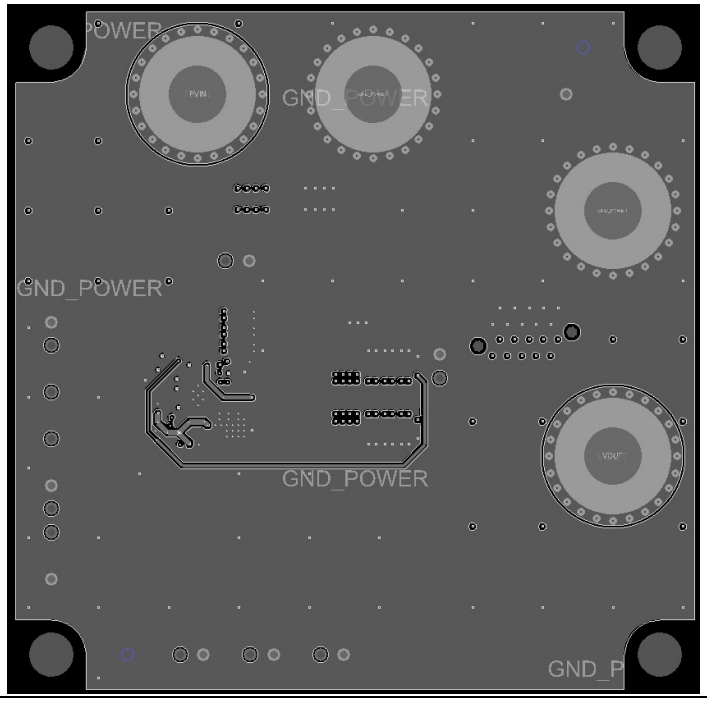

Figure 5 Mid layer 2

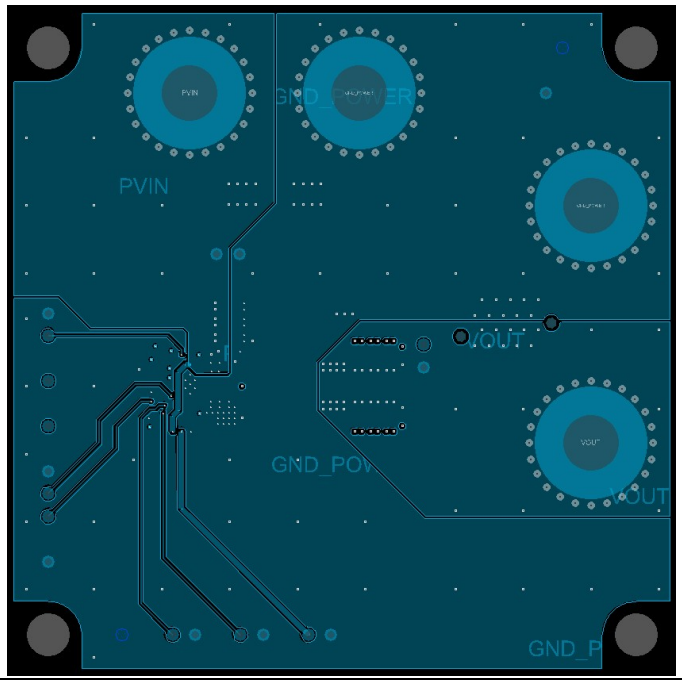

Figure 6 Mid layer 3

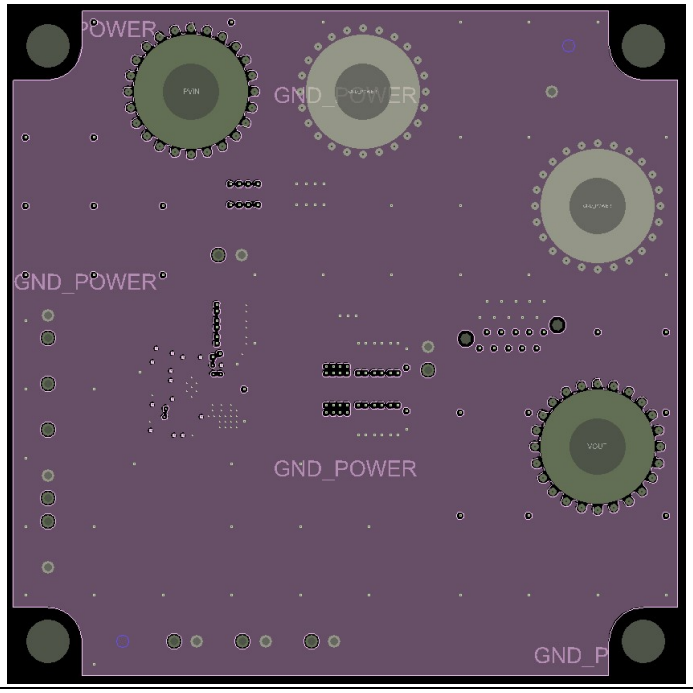

Figure 7 Mid layer 4

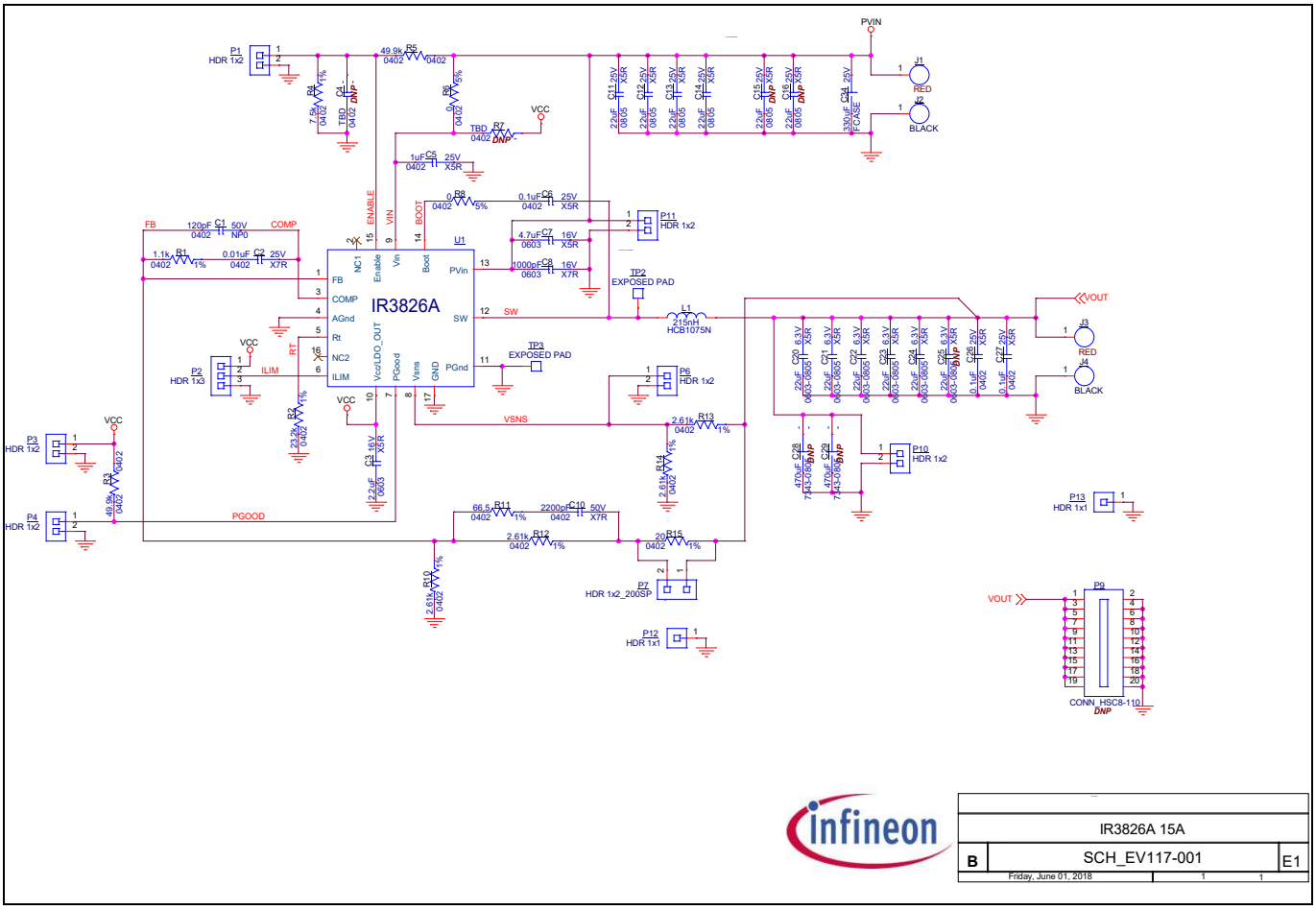

Figure 8 Schematic of the EVAL_3826A evaluation board V_{in} = 12 V, V_O = 1.2 V, $I_O$max = 16 A

1.5 Bill of materials

Table 2 Bill of materials

Item	Quantity	Part Reference	Value	Description	Part Number	Manufacture
1	1	C1	120 pF	CAP CER 120 pF 50 V 5% NP0 0402	GRM1555C1H121JA01D	Murata
2	1	C2	0.01 µF	CAP CER 10000 pF 25 V 10% X7R 0402	04023C103KAT2A	AVX
3	1	C3	2.2 µF	CAP CER 2.2 µF 16 V 10% X5R 0603	GRM188R61C225KE15D	Murata
4	1	C5	1 µF	CAP CER 1 µF 25 V 10% X5R 0402	GRM155R61E105KA12D	Murata
5	3	C6,C26,C27	0.1 µF	CAP CER 0.1 µF 25 V 10% X7R 0402	04023C104KAT2A	AVX
6	1	C7	4.7 µF	CAP CER 4.7 µF 16 V 10% X5R 0603	GRM188R61C475KAAJD	Murata
7	1	C8	1000 pF	CAP CER 1000 pF 16 V 10% X7R 0603	GRM188R71C102KA01D	Murata
8	1	C10	2200 pF	CAP CER 2200 pF 50 V 10% X7R 0402	GRM155R71H222KA01D	Murata
9	4	C11,C12,C13, C14	22 µF	CAP CER 22 µF 25 V 20% X5R 0805	GRM21BR61E226ME44L	Murata
10	5	C20,C21,C22, C23,C24,	22 µF	CAP CER 22 µF 6.3 V 20% X5R 0805	C2012X5R0J226M125AC	TDK
11	1	C34	330 µF	CAP ALUM 330 µF 20% 25 V SMD	EEV-FK1E331P	Panasonic
12	1	L1	215 nH	INDUCTOR ,215 nH,10.4x8.0 x7.5 mm, 0.29 mohm,SMD	HCB1075N-211	Delta
13	1	R1	1.1 k	RES 1.1 kΩ 1/16 W 1% 0402 SMD	RC0402FR-071K1L	Yageo
14	1	R2	23.2 k	RES 23.2 kΩ 1/10 W 1% 0402 SMD	ERJ-2RKF2322X	Panasonic
15	2	R3,R5	49.9 k	RES 49.9 kΩ 1/10 W 1% 0402 SMD	ERJ-2RKF4992X	Panasonic
16	1	R4	7.5 k	RES 7.50 kΩ 1/10 W 1% 0402 SMD	ERJ-2RKF7501X	Panasonic
17	2	R6,R8	0	RES 0.0 Ω 1/10 W 0402 SMD	ERJ-2GE0R00X	Panasonic
18	4	R10,R12,R13, R14	2.61 k	RES 2.61 kΩ 1/10 W 1% 0402 SMD	ERJ-2RKF2611X	Panasonic
19	1	R11	66.5	RES 66.5 Ω 1/10 W 1% 0402 SMD	ERJ-2RKF66R5X	Panasonic
20	1	R15	20	RES 20.0 Ω 1/16 W 1% 0402 SMD	CRCW040220R0FKED	Vishay Dale
21	1	U1	IR3826A	Integrated buck regulator PQFN 5x6 mm	IR3826A	Infineon

2 Typical operating waveforms

V_{in} = 12.0 V, V_o = 1.2 V, I_o = 0 – 16 A, room temperature, no airflow

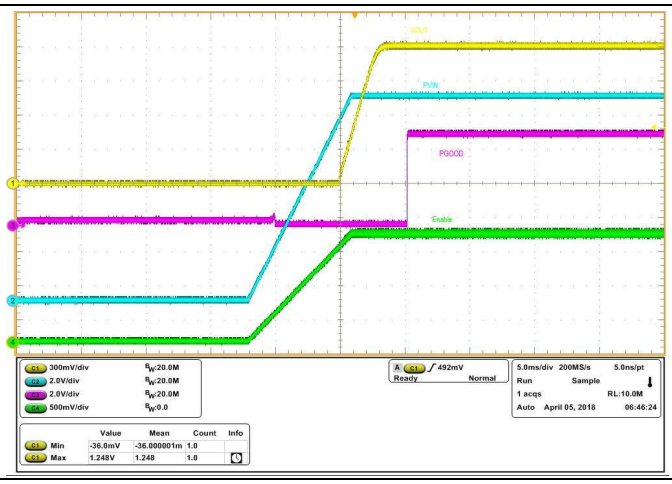

Figure 9 Start up at 16 A load, (Ch_1: V_o, Ch_2: PV_{in}, Ch_3:P_{Good} ,Ch_4:Enable)

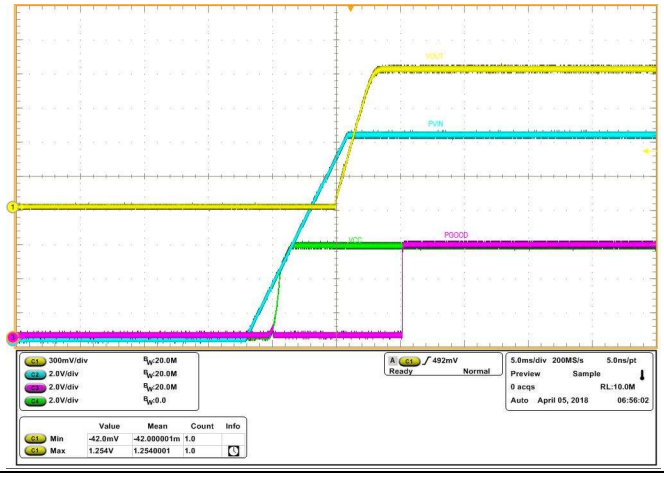

Figure 10 Start up at 16 A load, (Ch_1: V_o, Ch_2: PV_{in}, Ch_3:P_{Good} , Ch_4:V_{cc})

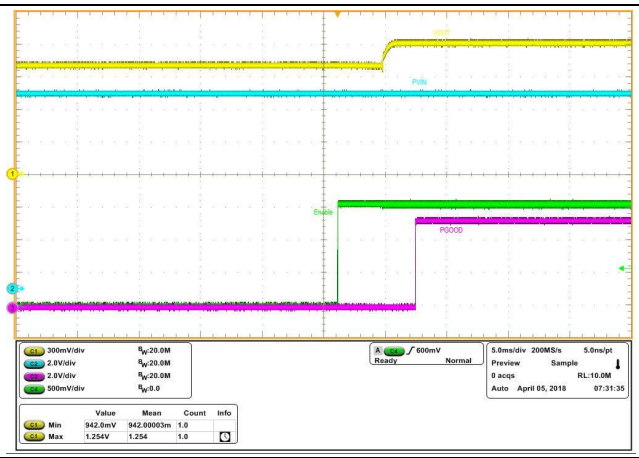

Figure 11 Pre-bias start up at 0 A Load, (Ch_1: V_o , Ch_2: PV_{in} , Ch_3:P_{Good} ,Ch_4:Enable)

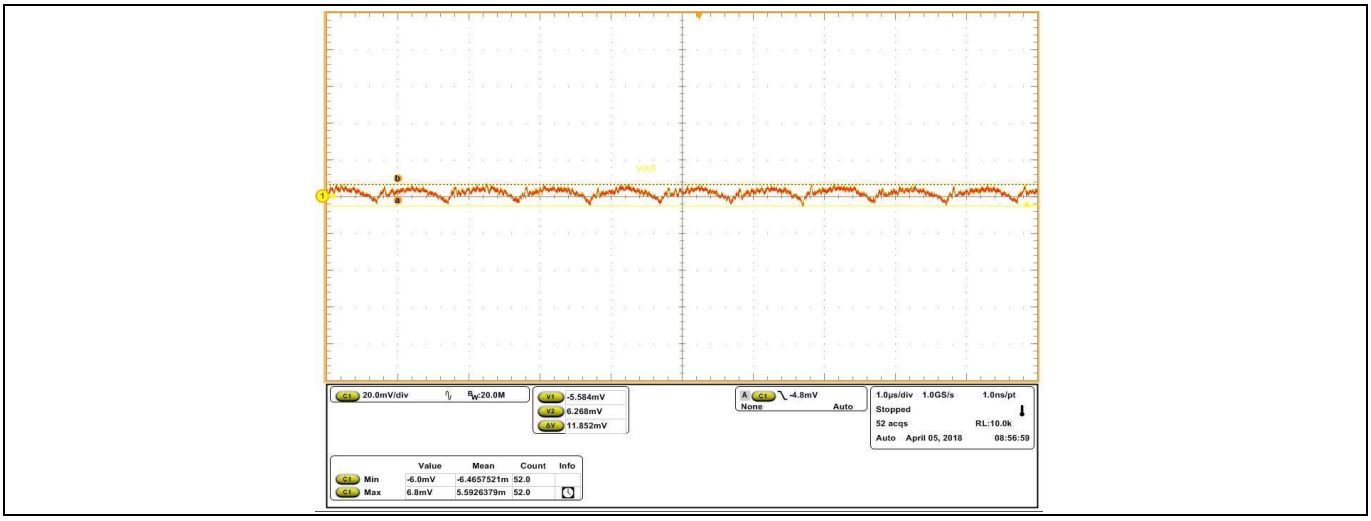

Figure 12 Vout ripple at 16 A load, (Ch_1: V_o)

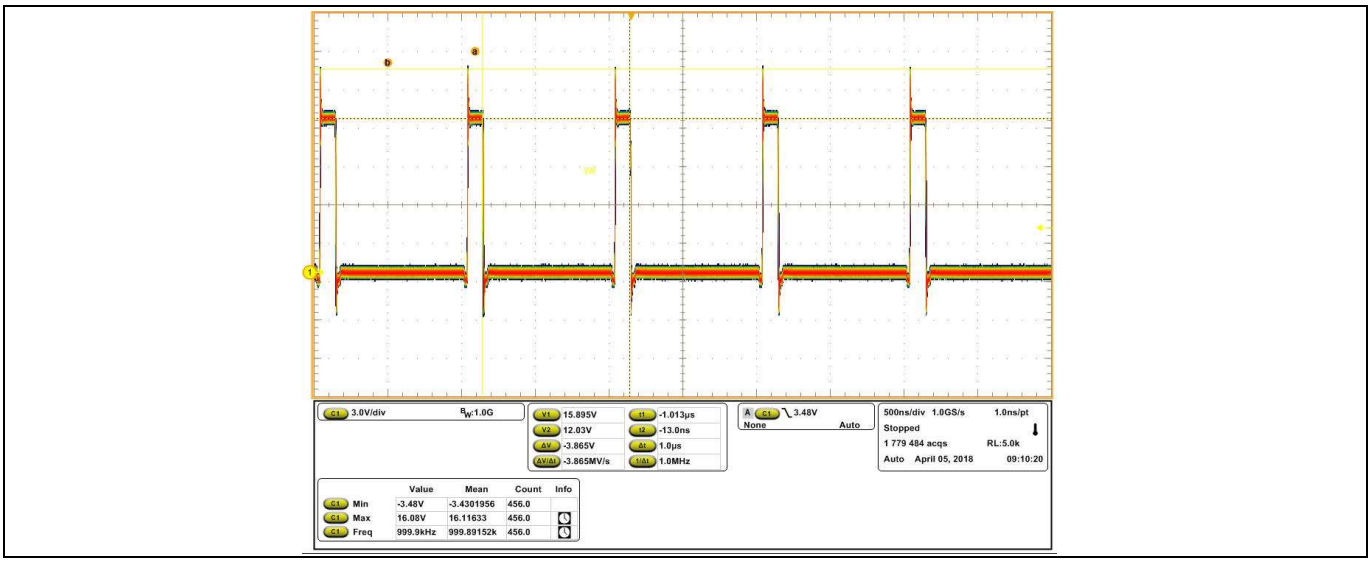

Figure 13 SW node, 16 A load

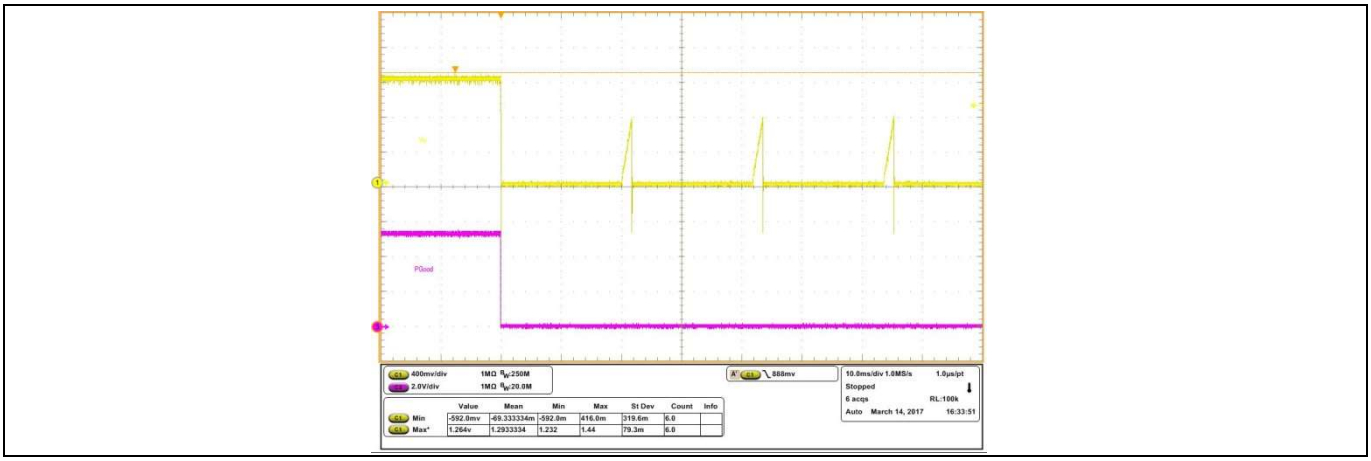

Figure 14 Short circuit (hiccup), (Ch_1: V_o , Ch_3:P_{Good})

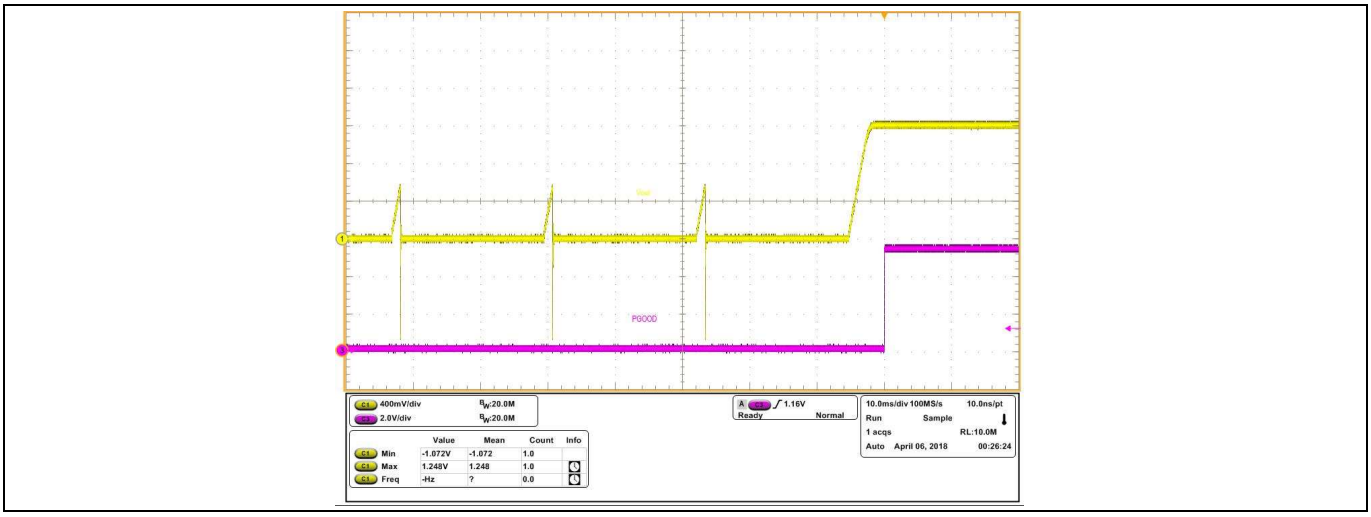

Figure 15 **Short circuit (hiccup) recover, (Ch_1: V_o , Ch_3:P_{Good})**

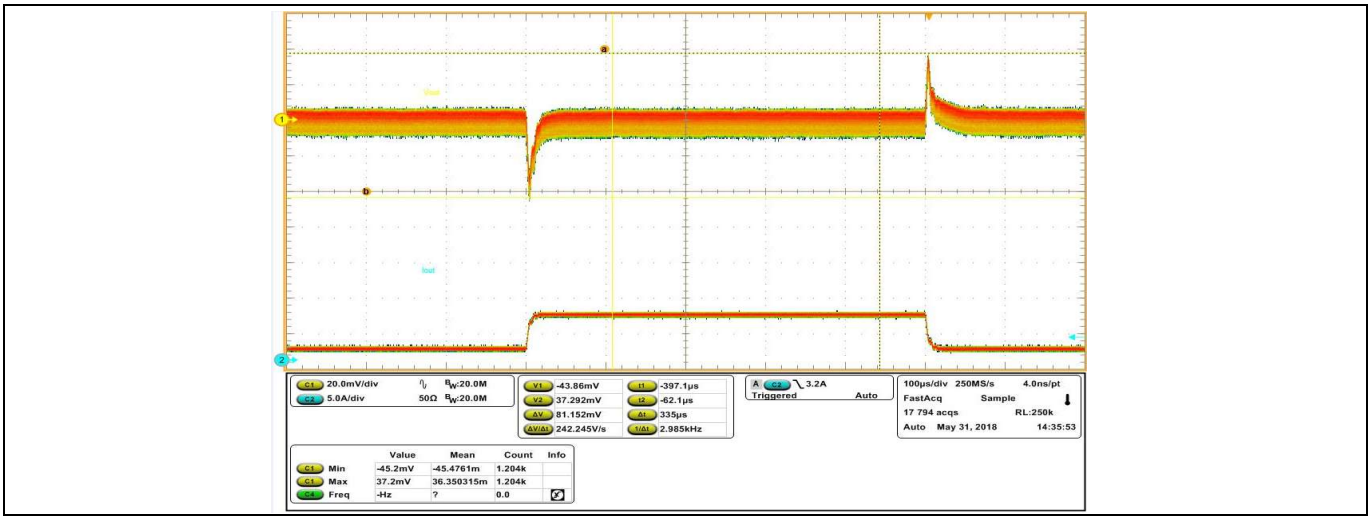

Figure 16 **Transient response of 4.8 A step load current at 2.5 A/µs slew rate: I_o= 1.6 A – 6.4 A, (Ch_1: V_o , Ch_4: I_o) undershoot: -45.2 mV, overshoot: 37.2 mV**

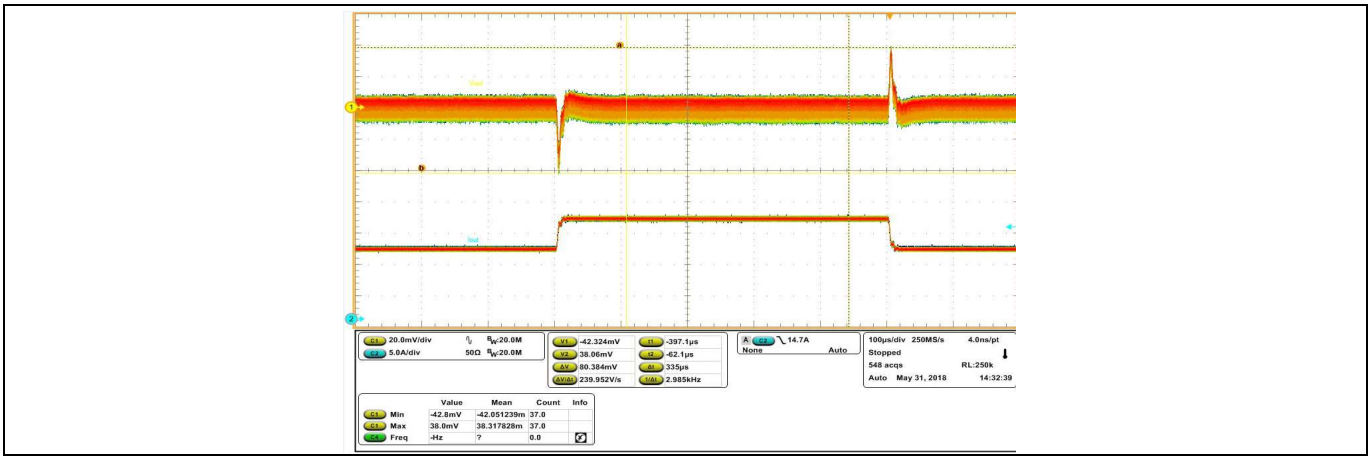

Figure 17 **Transient response of 4.8 Astep load current at 2.5 A/µs slew rate: I_o= 11.2 A – 16 A, (Ch_1: V_o , Ch_4: I_o), undershoot: -42.8 mV, overshoot: 38 mV**

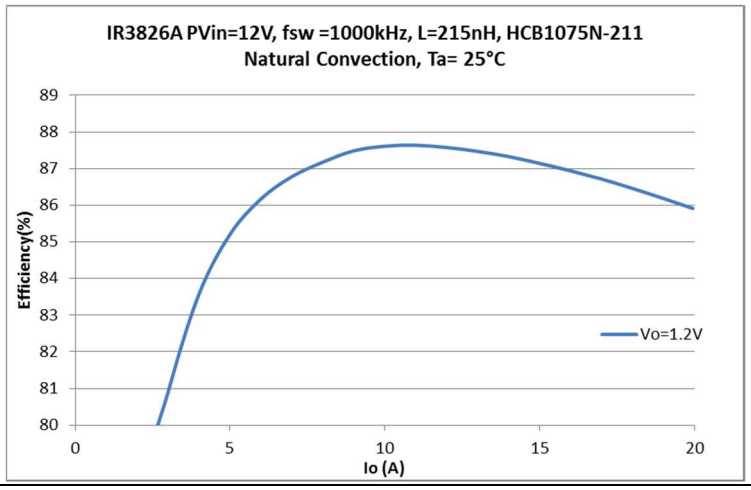

Figure 18 Efficiency versus load current with natural convection

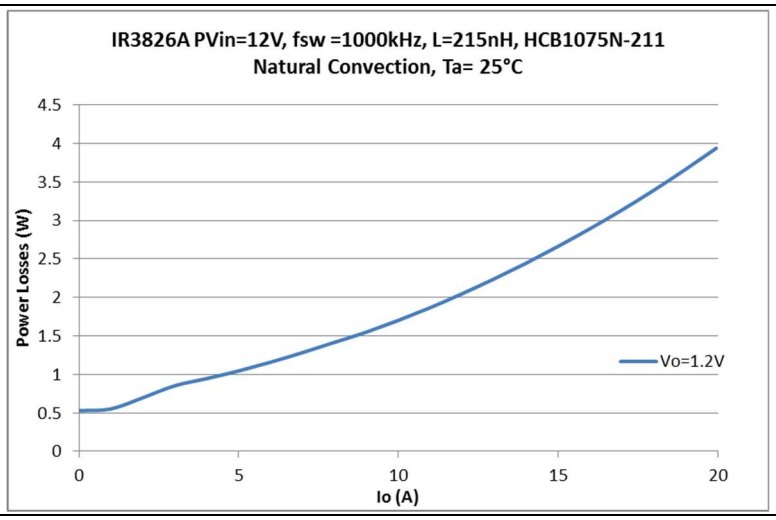

Figure 19 Power loss versus load current with natural convection

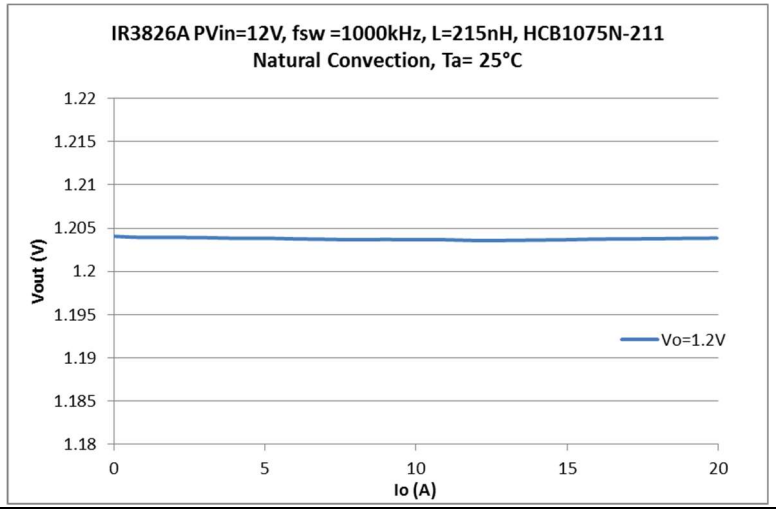

Figure 20 Load regulation with natural convection

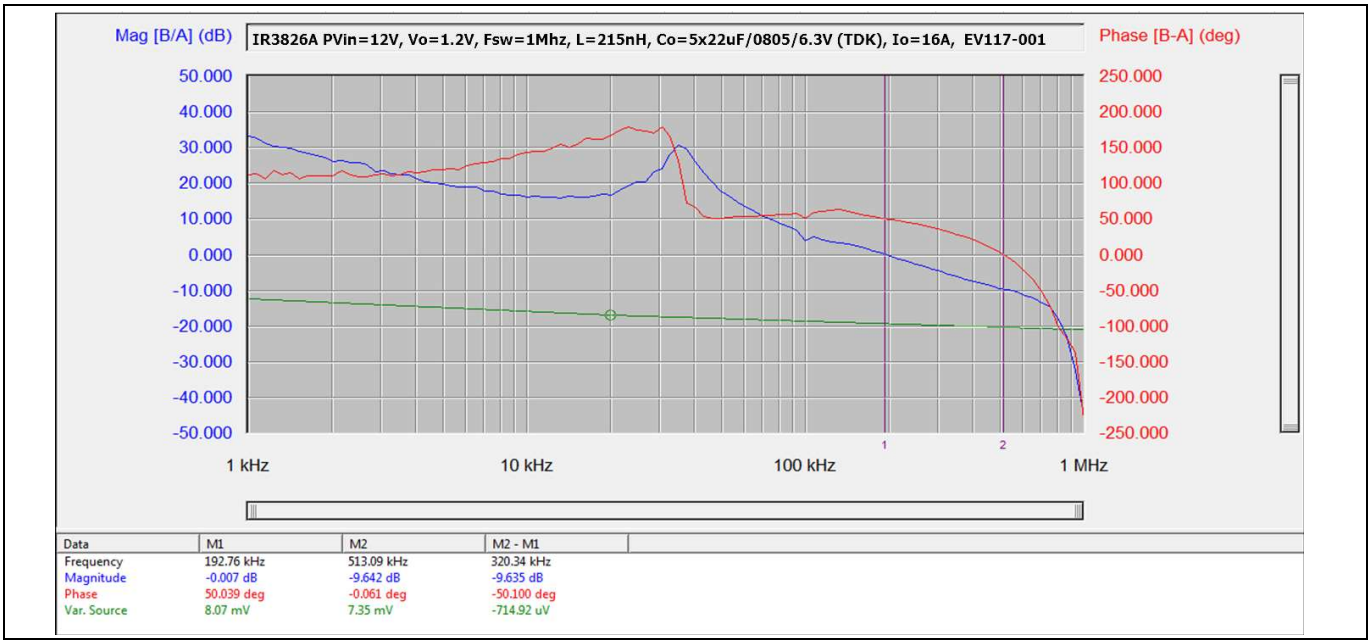

Figure 21 **Bode plot of IR3826A at 16 A load, crossover frequency = 192.8 kHz, phase margin = 50°, gain margin = -9.6 dB**

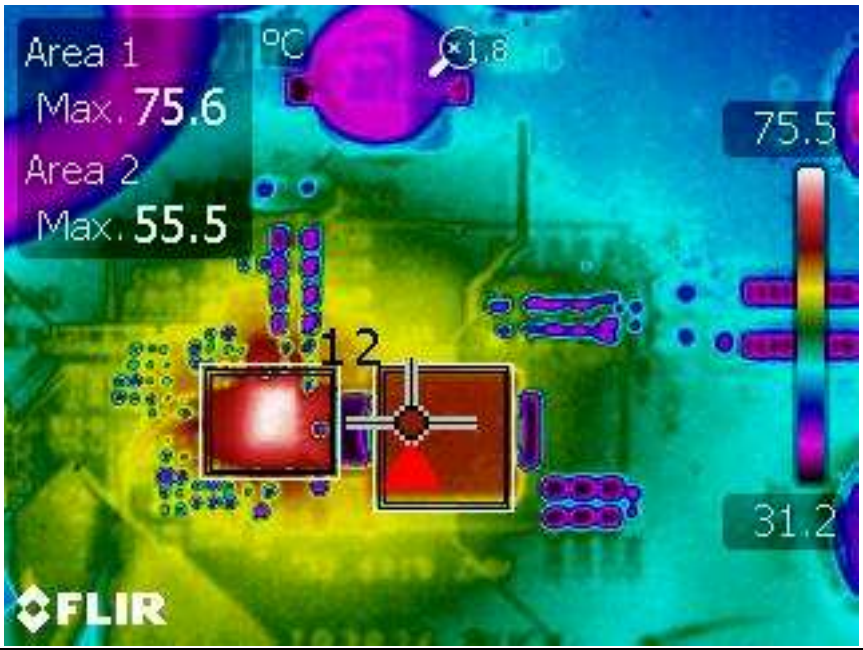

Figure 22 **Thermal image of the board at 16 A load IR3826A = 75.6°C, L= 55.5°C, amb = 25°C, natural convection**

Revision history

Major changes since the last revision

Page or Reference	Description of change

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