SupIRBuck™

USER GUIDE FOR IR3448 EVALUATION BOARD

DESCRIPTION

The IR3448 is a synchronous buck converter, providing a compact, high performance and flexible solution in a small 5mmx6mm QFN package.

Key features offered by the IR3448 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, external frequency synchronization with smooth clocking, internal LDO, true differential remote sensing and pre-bias start-up.

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

This user guide contains the schematic and bill of materials for the IR3448 evaluation board. The guide describes operation and use of the evaluation board itself. Detailed application information for IR3448 is available in the IR3448 data sheet.

BOARD FEATURES

- V_{in} = +12V (+ 13.2V Max), ***No Vcc required.***
- V_{out} = +1.2V @ 0-16A
- F_s = 600kHz
- L = 0.400uH
- C_{in} = 5x22uF (ceramic 1206) + 1x330uF (electrolytic)
- C_{out} = 6x47uF (ceramic 0805)

CONNECTIONS and OPERATING INSTRUCTIONS

A well regulated +12V input supply should be connected to VIN+ and VIN-. A maximum of 16A load should be connected to VOUT+ and VOUT-. The inputs and output connections of the board are listed in Table I.

IR3448 needs only one input supply and internal LDO generates Vcc from Vin. If operation with external Vcc is required, then R33 should be removed and external Vcc can be applied between Vcc+ and Vcc- pins. Vin pin and Vcc pins should be shorted together for external Vcc operation by installing R35.

The board is configured for remote sensing. If local sense is desired, R8 should be uninstalled and R16 should be installed instead.

External Enable signal can be applied to the board via exposed Enable pad and *R18 should be removed for this purpose.*

Table I. Connections

Connection	Signal Name
VIN+	Vin (+12V)
VIN-	Ground of Vin
Vout+	Vout(+1.2V)
Vout-	Ground for Vout
Vcc+	Vcc Pin
Vcc-	Ground for Vcc input
Enable	Enable
PGood	Power Good Signal
AGnd	Analog ground

LAYOUT

The PCB is a 6-layer board. All of layers are 2 Oz. copper. The IR3448 and most of the passive components are mounted on the top side of the board.

Power supply decoupling capacitors and feedback components are located close to IR3448. The feedback resistors are connected to the output of the remote sense amplifier of the IR3448 and are located close to the IR3448. To improve efficiency, the circuit board is designed to minimize the length of the on-board power ground current path. Separate power ground and analog ground are used and may be connected together using a 0 ohm resistor at one of three possible locations. It is preferred to use one of R43 or R44.

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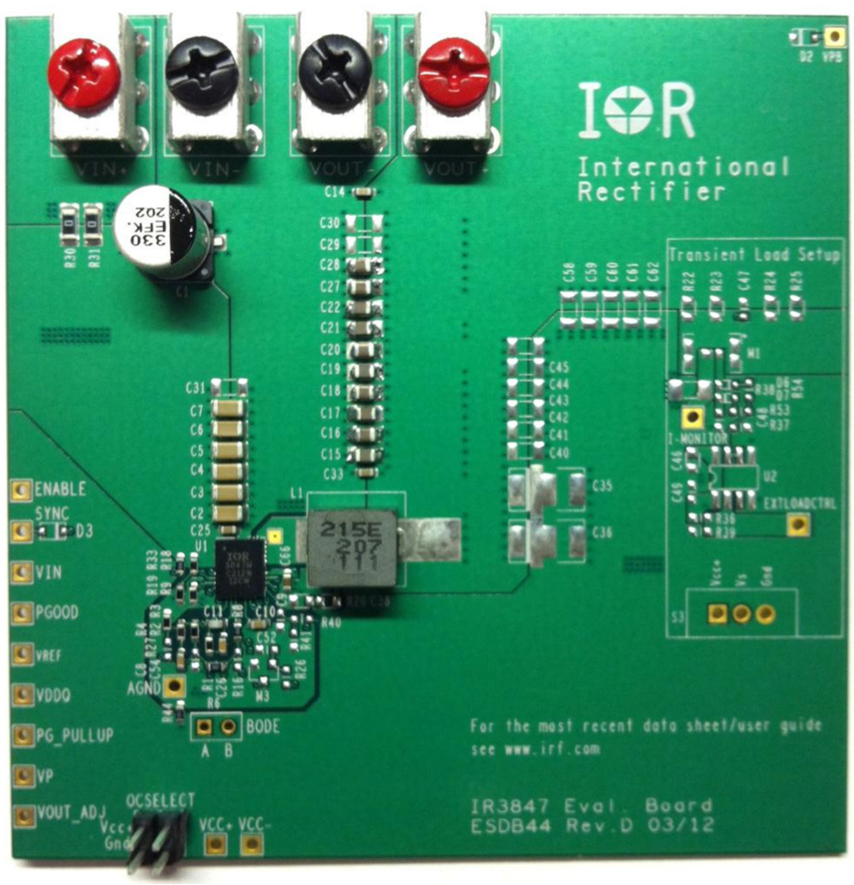
Vin Gnd Gnd Vo



Top View

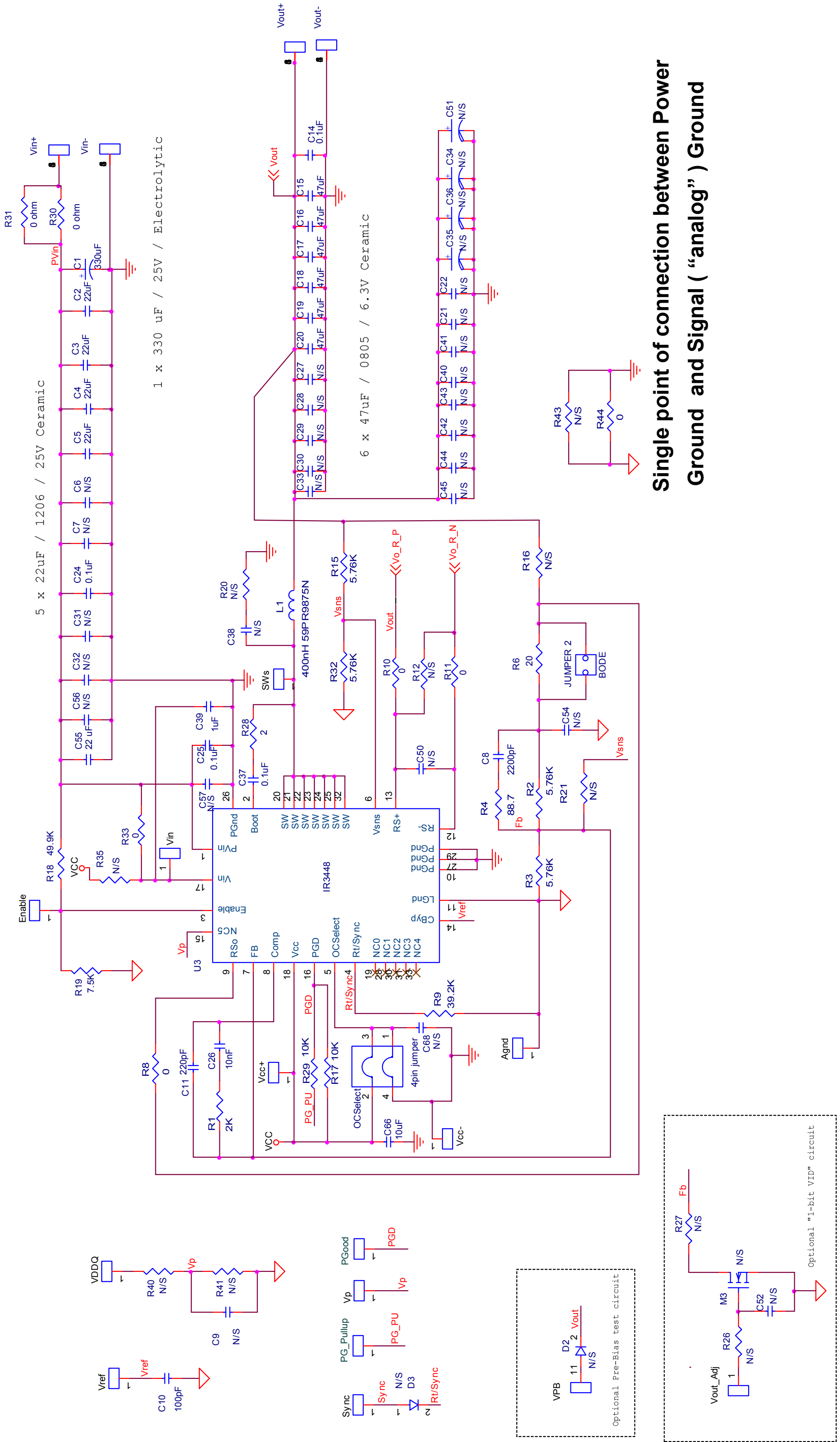
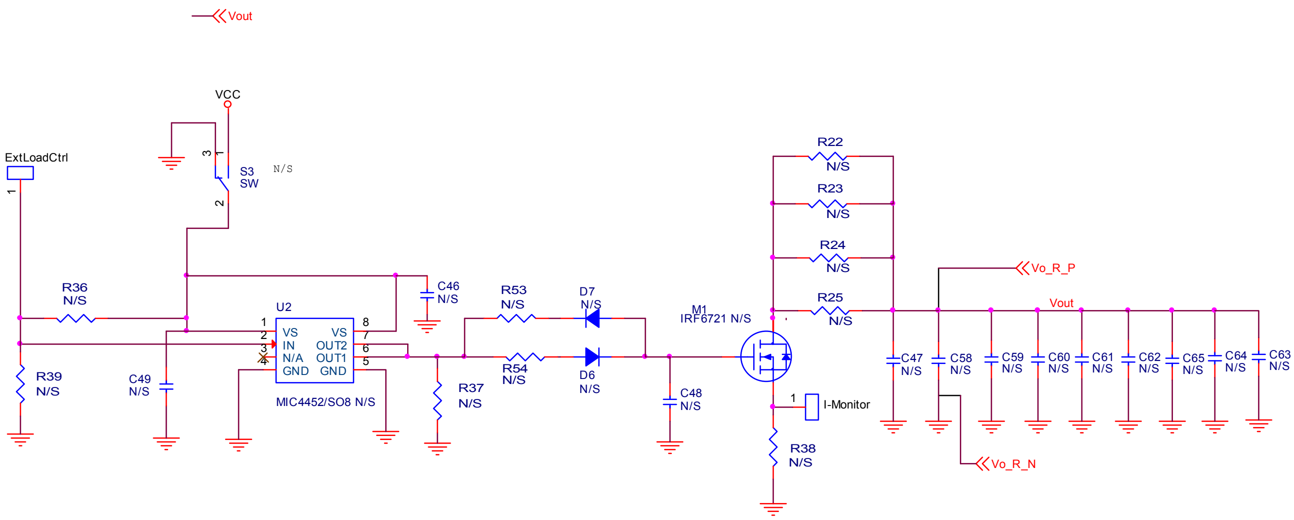


Fig. 1: Schematic of the IR3448 evaluation board

Schematic for Transient Load set up



Optional transient load circuit

This evaluation board is a preliminary version meant for the engineering evaluation of the IR3448. Based on the results of the continuing evaluation, this board can evolve and change without notice

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Bill of Materials

Item	Qty	Part Reference	Value	Description	Manufacturer	Part Number
1	5	C2 C3 C4 C5 C55	22uF	1206, 25V, X5R, 10%	Murata	GRM31CR61E226KE15L
2	1	C1	330uF	SMD Elecrolytic, Fsize, 25V, 20%	Panasonic	EEE-FK1E331P
3	1	C10	100pF	0603, 50V, C0G, 5%	Murata	GRM1885C1H101JA01D
4	3	C14 C25 C37	0.1uF	0603, 25V, X7R, 10%	Murata	GRM188R71E104KA01D
5	1	C8	2200pF	0603, 50V, X7R, 10%	Murata	GRM188R71H222KA01D
6	1	C11	220pF	50V, 0603, NP0, 5%	Murata	GRM1885C1H221JA01D
7	6	C15 C16 C17 C18 C19 C20	47uF	0805, 6.3V, X5R, 20%	TDK	C2012X5R0J476M
8	1	C26	10nF	0603, 50V, X7R, 10%	Murata	GRM188R71H103KA01D
9	1	L1	0.4uH	0.4uH, DCR=0.29mohm	Vitec	59PR9875N
10	1	R1	2K	0603,1/10 W,1%	Panasonic	ERJ-3EKF2001V
11	1	R2	5.76K	0603,1/10 W,1%	Panasonic	ERJ-3EKF5761V
12	1	R3	5.76K	0603,1/10 W,1%	Panasonic	ERJ-3EKF5761V
13	1	R4	88.7	0603,1/10 W,1%	Panasonic	ERJ-3EKF88R7V
14	1	R6	20	0603,1/10 W,1%	Vishay/Dale	CRCW060320R0FKEA
15	1	R9	39.2K	0603,1/10 W,1%	Panasonic	ERJ-3EKF3922V
16	5	R8 R10 R11 R33 R44	0	0603,1/10 W,5%	Vishay/Dale	CRCW06030000Z0EA
17	1	C39	1uF	0603, X5R, 25V	TDK	C1608X5R1E105M
18	1	C66	10uF	0603, X5R, 10V	TDK	C1608X5R1A106M
19	1	R28	2	0603,1/10 W,1%	Yageo	RC0603FR-072RL
20	2	R15 R32	5.76K	0603,1/10 W,1%	Panasonic	ERJ-3EKF5761V
21	2	R30 R31	0	1206,1/4 W,5%	Yageo	RC1206JR-070RL
22	1	R18	49.9K	0603,1/10 W,1%	Panasonic	ERJ-3EKF4992V
23	1	R19	7.5K	0603,1/10 W,1%	Panasonic	ERJ-3EKF7501V
24	2	R17 R29	10K	0603,1/10 W,1%	Panasonic	ERJ-3EKF1002V
25	1	Jumper		PLUG 40 POS DBL ROW STR	Omron Electronics Inc	XG8W-4041-ND
26	2	Vin+ Vout+	RED	SCREW TERMINAL	Keystone Electronics	8199-2
27	2	Vin- Vout-	BLACK	SCREW TERMINAL	Keystone Electronics	8199-3
28	1	U1	IR3448	IR3448 5mm X6mm	International Rectifier	IR3448MPBF

TYPICAL OPERATING WAVEFORMS

Vin=12.0V, Vo=1.2V, Io=0A-16A, 600kHz, Room Temperature, No air flow

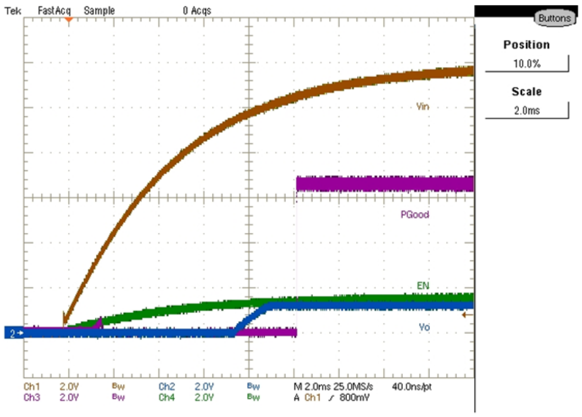

Fig. 2: Start up at 16A Load
Ch_1:V_{in}, Ch_2:V_o, Ch_3:PGood, Ch_4:Enable

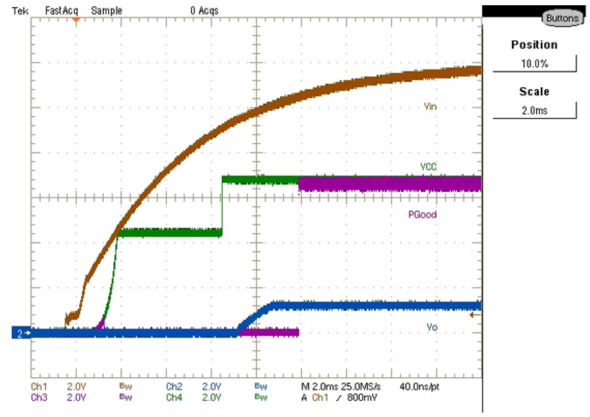

Fig. 3: Start up at 16A Load,
Ch_1:V_{in}, Ch_2:V_o, Ch_3:PGood,Ch_4:V_{cc}

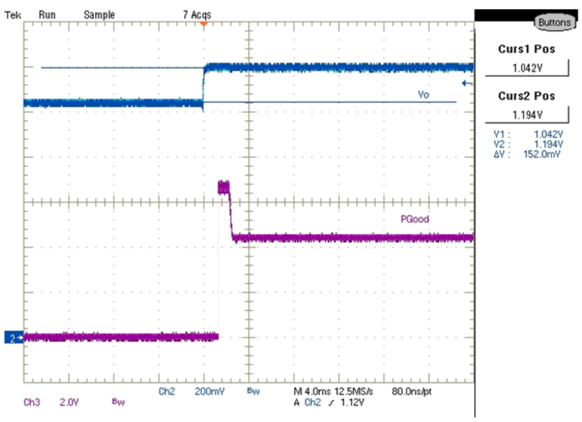

Fig. 4: Start up with 1.05V Pre Bias , 0A Load, Ch_2:V_o,

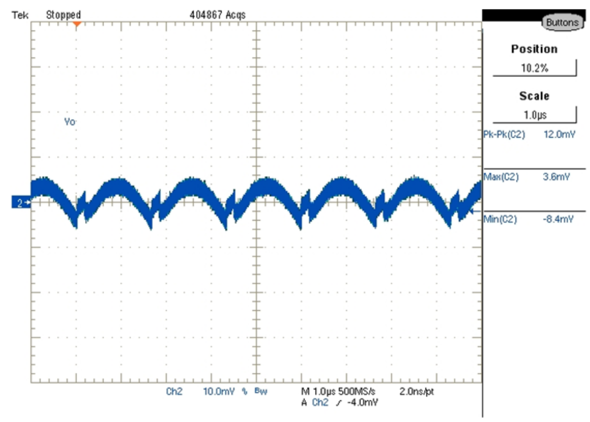

Fig. 5: Output Voltage Ripple, 16A load Ch_2: V_o

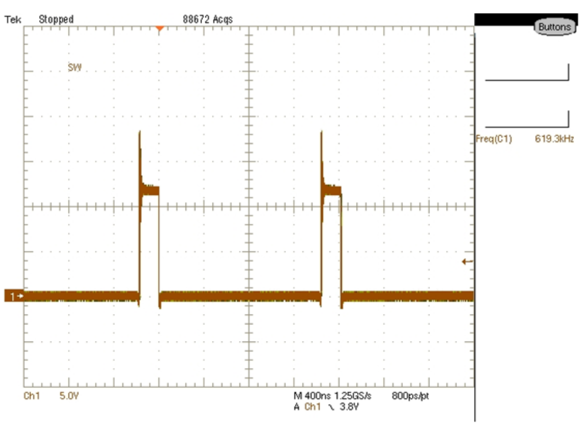

Fig. 6: Inductor node at 16A load
Ch_1:LX

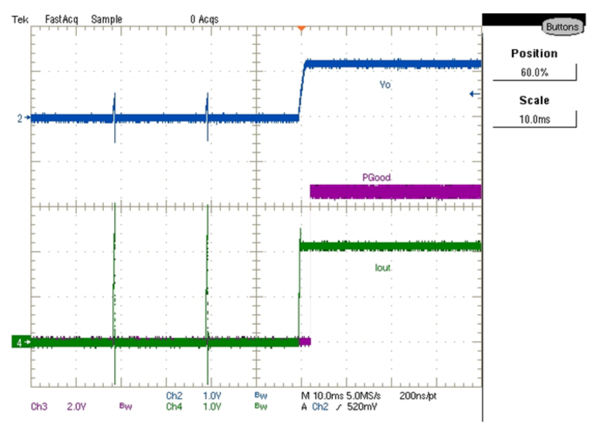

Fig. 7: Short (Hiccup) Recovery
Ch_2:V_o, Ch_3:PGood, Ch_4=Io

TYPICAL OPERATING WAVEFORMS
Vin=12.0V, Vo=1.2V, Io=1.6A-6.4A, 600kHz, Room Temperature, No air flow

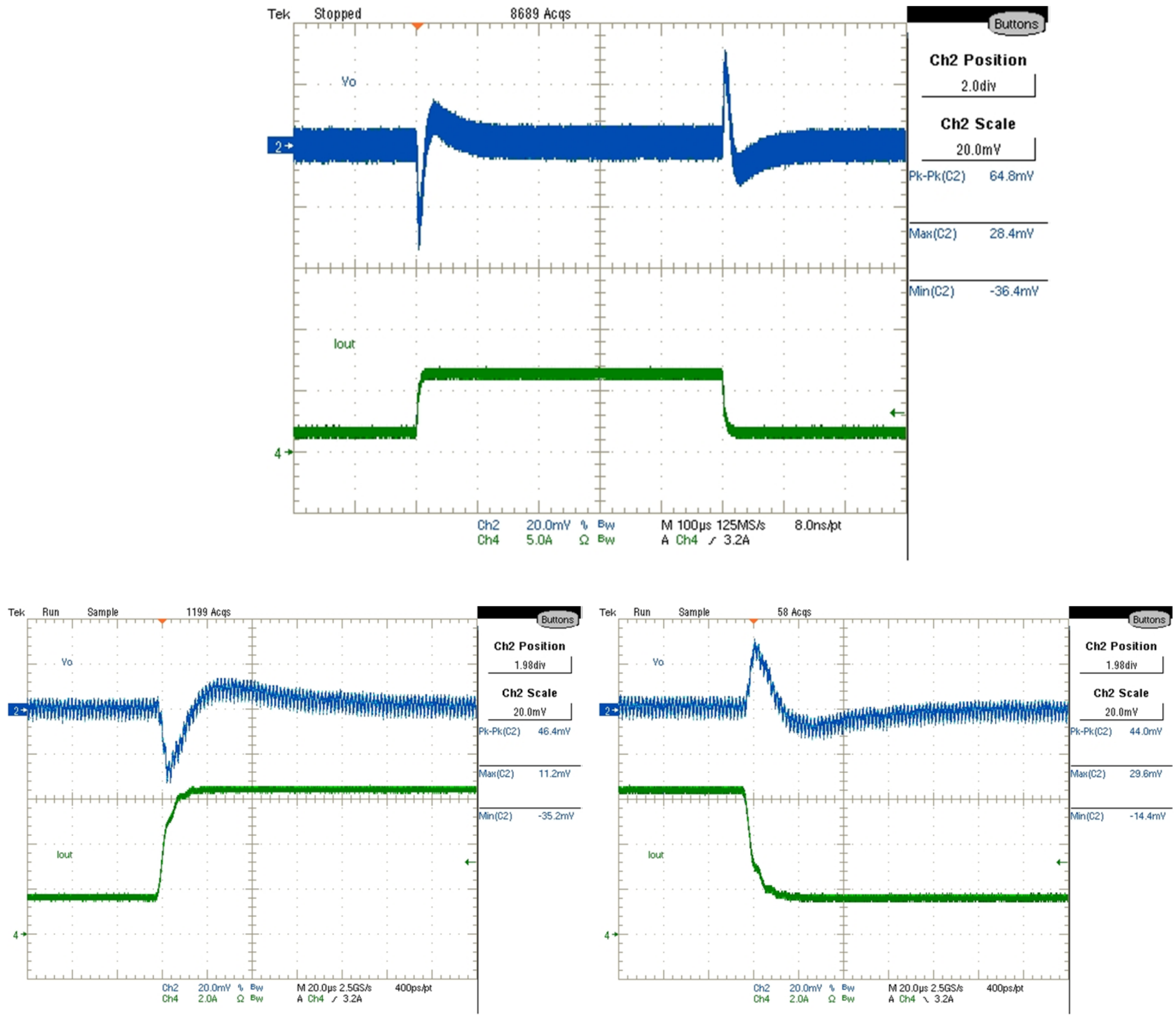

Fig. 8: Transient Response, 1.6A to 6.4A step (2.5A/us)
Ch_2:V_{out}

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TYPICAL OPERATING WAVEFORMS

Vin=12.0V, Vo=1.2V, Io=11.2A-16A, 600kHz, Room Temperature, No air flow

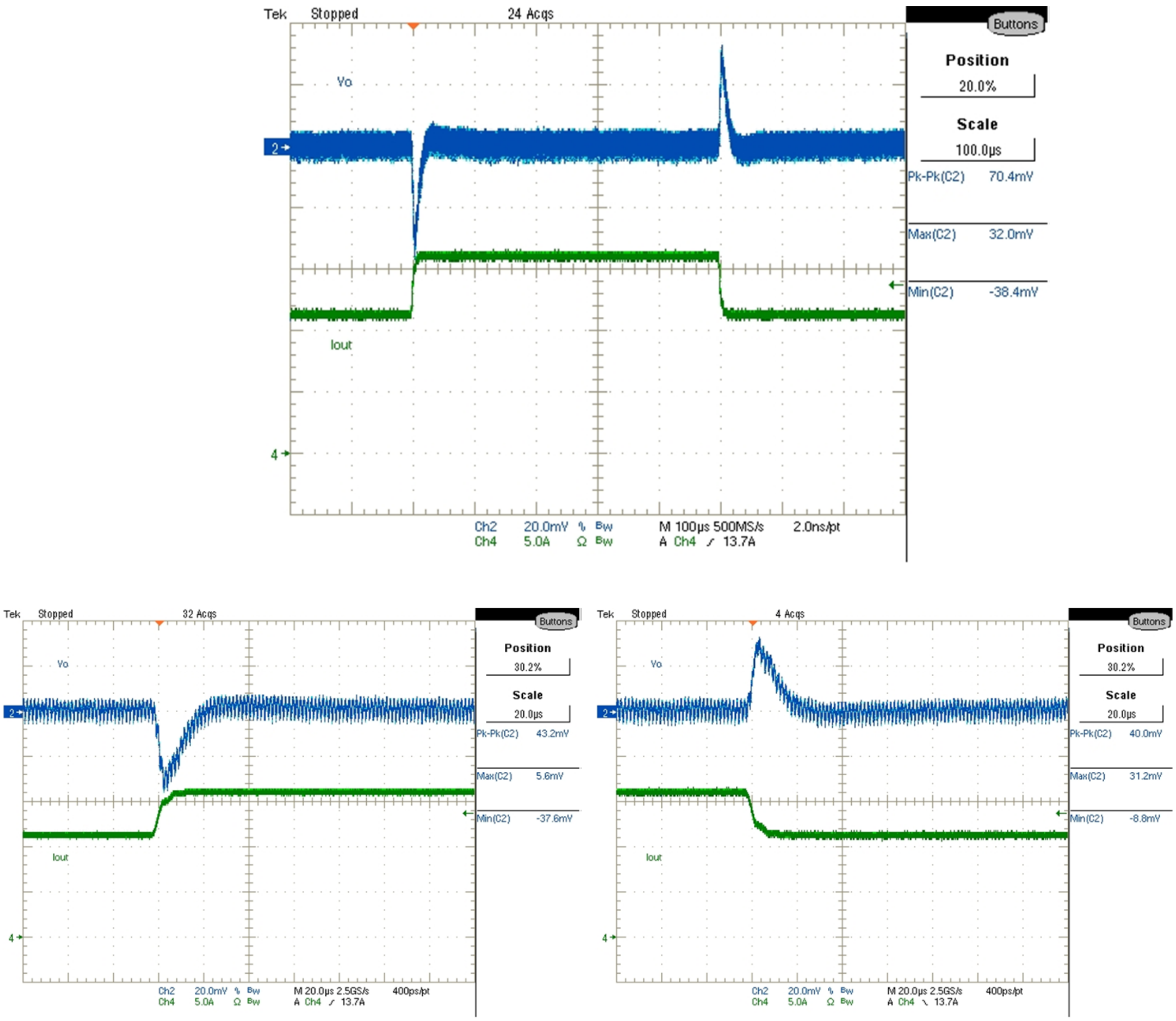

Fig. 9: Transient Response, 11.2A to 16A step (2.5A/us)
Ch_2:V_{out}

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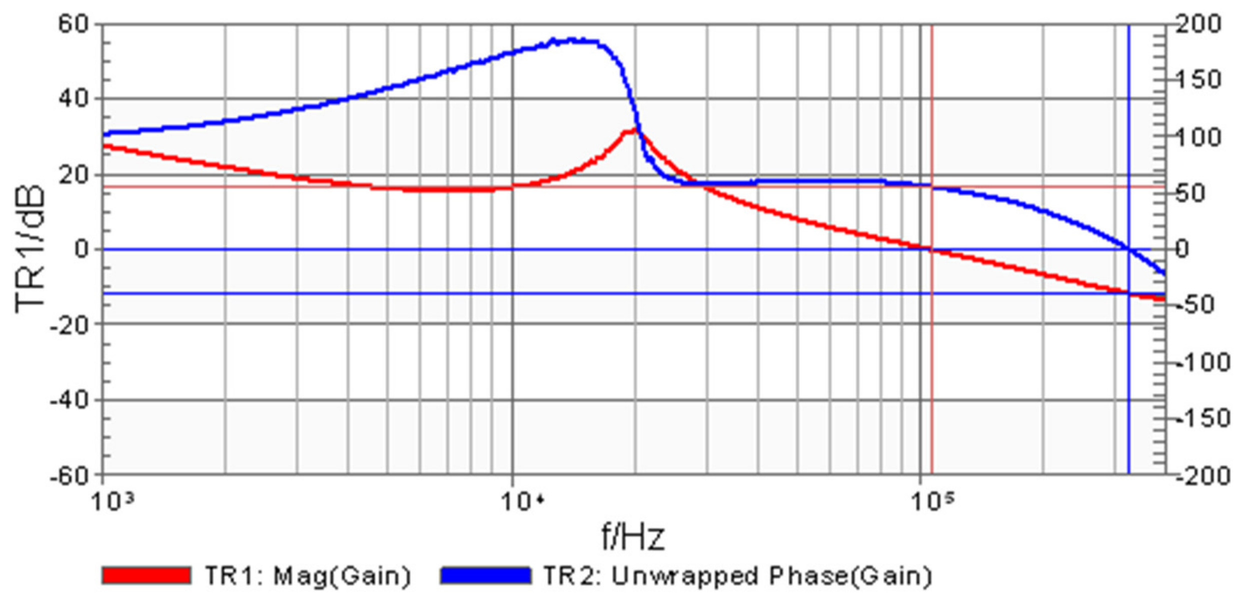
TYPICAL OPERATING WAVEFORMS
Vin=12.0V, Vo=1.2V, Io=16A, 600kHz, Room Temperature, No air flow



	Frequency	Trace1	Trace2
Cursor 1	106.348 kHz	-0.059 dB	55.472 °
Cursor 2	323.989 kHz	-11.712 dB	-74.808 m°

Fig. 10: Bode Plot at 16A load shows: Fc = 106.35kHz, Phase Margin = 55.47º, Gain Margin = -11.71dB

TYPICAL OPERATING WAVEFORMS
Vin=12.0V, Vo=1.2V, Io=0-16A, 600kHz, Room Temperature, No air flow

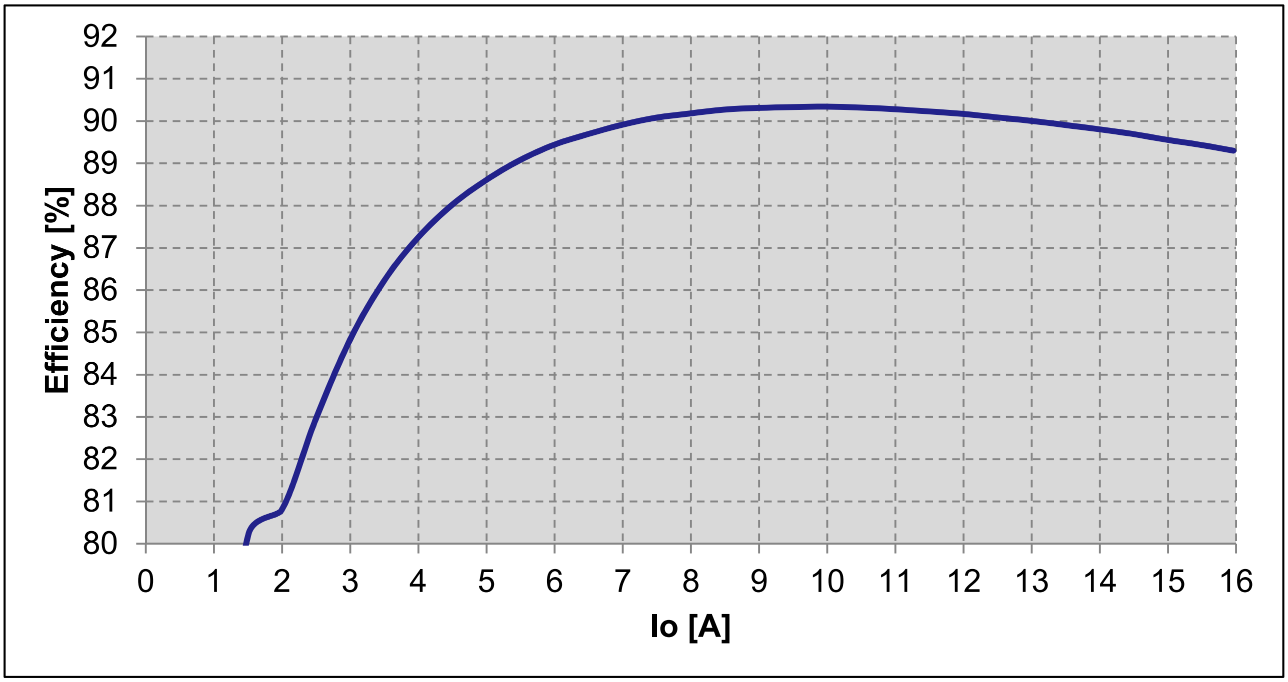


Fig.11: Efficiency versus load current

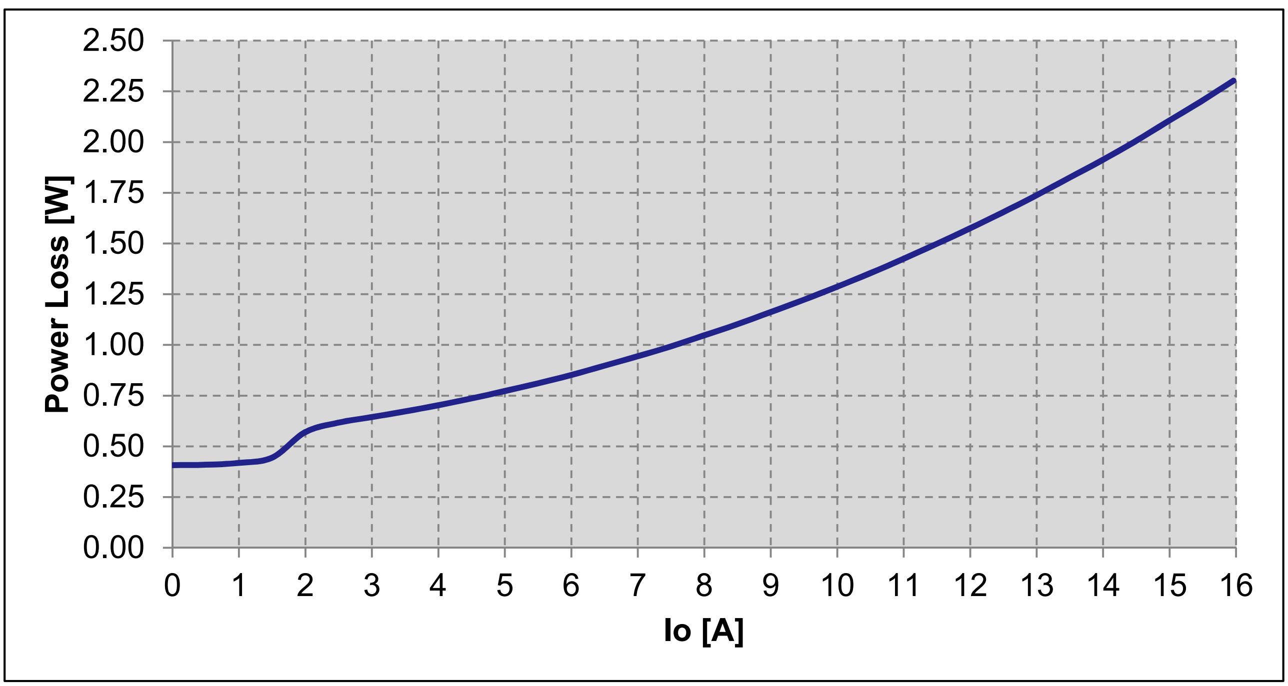


Fig.12: Power loss versus load current

THERMAL IMAGES

Vin=12.0V, Vo=1.2V, Io=16A, 600kHz, Room Temperature, No air flow

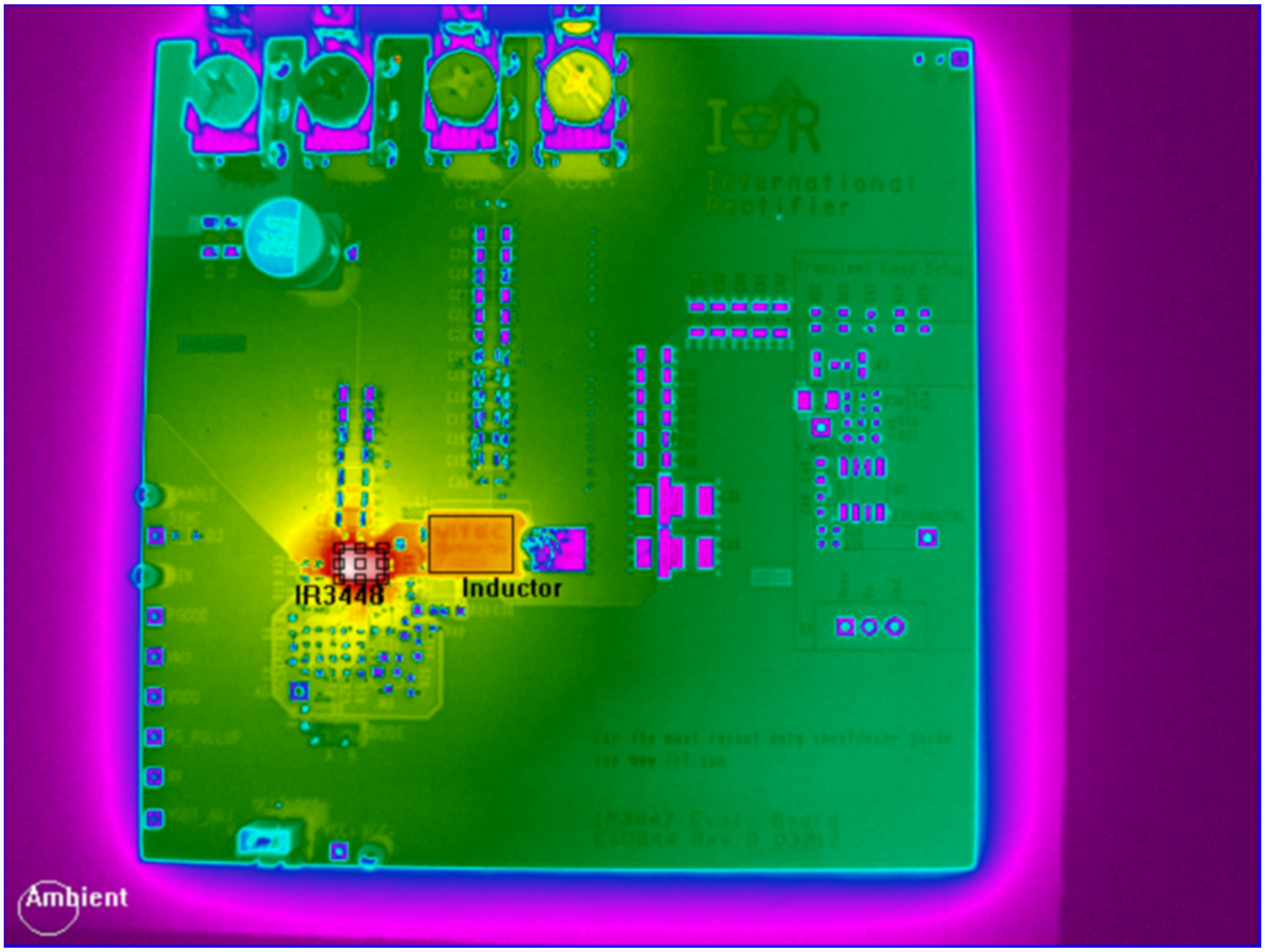


Fig. 13: Thermal Image of the board at 16A load
Test point 1 is IR3448: 56^{0}C
Test point 2 is inductor: 49.5^{0}C