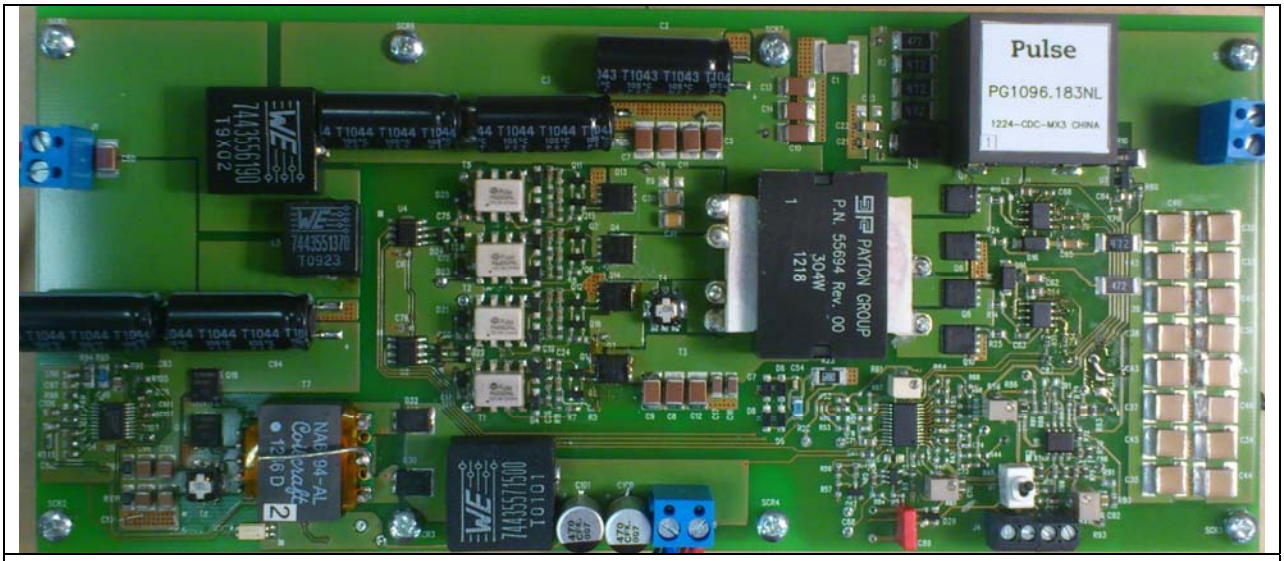
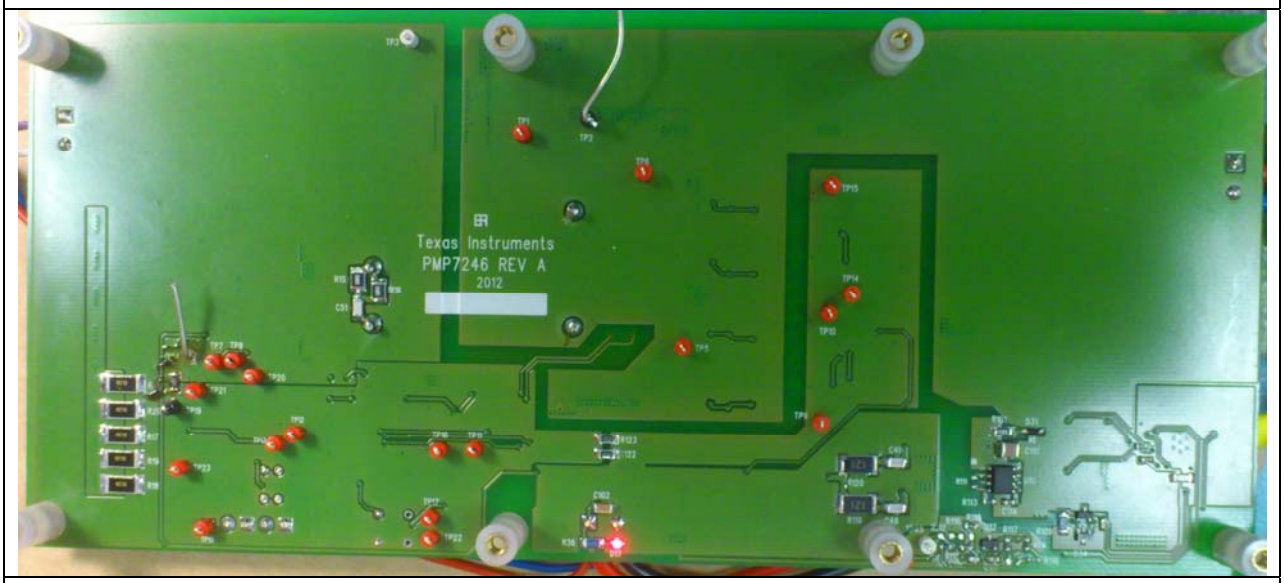
PMP7246 Rev.B Test Results

The PMP7246 is 350W **High Speed_Full Bridge Phase Shift ZVT – Galvanic Isolated_Full Bridge Synchronous Rectification** DC/DC reference design. It is built for telecom applications to supply a RF PA stage. On board is additional 12V/5A power stage made in half bridge topology.

The main converter is two quadrant converter, working forward in voltage mode control and working backward in average current mode limitation. This limitation is adjustable. Control input has a slope limitation, adjustable as well.



Picture of the board – Top side



Picture of the board – Bottom side

Dimensions: 217mm × 96mm

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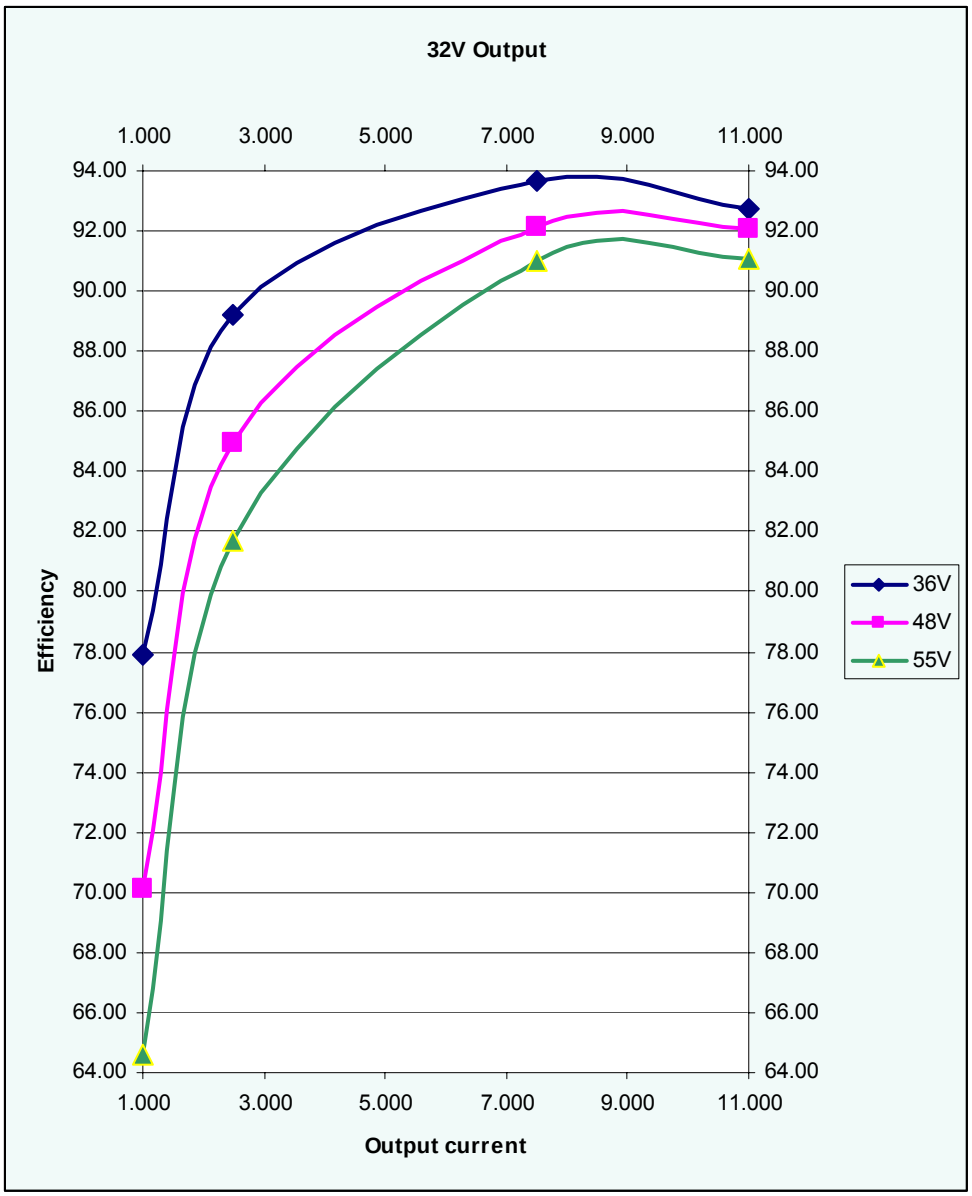
This board has been tested, according to the test report, @ 36V, 48V, 55Vin, full load, with a cooling fan with 32 cfm placed at 10cm distance. Connected load described in the specification document (100nH + 20×10uF X7R ceramic capacitors).

1 Power supply description

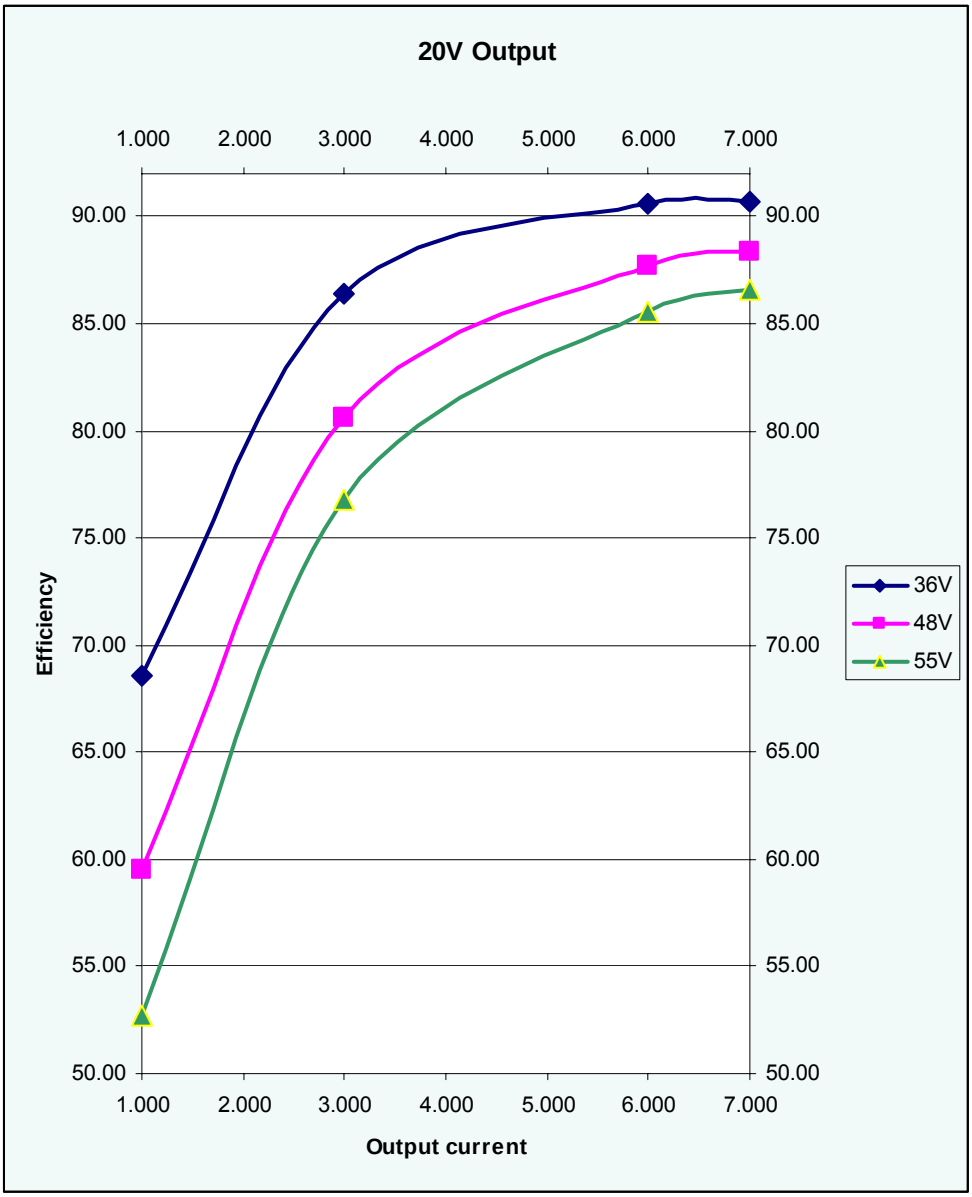
Nr.	Description	Capability	Remarks	Comments
1	Minimum Input voltage	36V		
2	Maximum Input voltage	60V		
3	Output voltage	20V to 32V		Adjustable
4	Isolation Primary - secondary	500Vdc		
5	DC accuracy/tolerance for the output voltage	+/- 2%.		
6	Output voltage ripple	100mVpp	(20MHz BW)	**see the measurements**
7	Maximum continuous output current	12A		Transformer need an other isolation for higher temperatures
8	Efficiency	>90%	for currents 6A -11A	**see the measurements**
9	Efficiency	>85%	for currents 1A -2A	**see the measurements**
10	Transient performance			**see the measurements**
11	Overshoot	<1.5V	output current 0A-11A	**see the measurements**
12	Undershoot	<1.5V	output current 0A-11A	**see the measurements**
13	Settling time of the output voltage to +/-2%	<200us	@ constant output current 1A	**see the measurements**
14	Analog control input	≥10k Ohm input impedance	3.3Vpp maximum	
15	Output voltage overshoot or undershoot when tuning the output voltage	<1.5%		**see the measurements**
16	ON/OFF function	active low/active high		
17	Power good (PGOOD)	No function available		
18	Board size	217mm x 96mm		
19	Absolute maximum components height - top side	15mm		
20	Absolute maximum components height - bottom side	3mm		
21	Component placement	Top & Bottom side		
22	Power MOSFETs package	PowerPAK SO8		
23	Operating temperature range	-40 to +90 deg C.		

2 Efficiency

The efficiency data are shown in the graph below.
The load consisted of an electronic load, manually adjusted; the power supply is able to deliver a maximum current of 55A.
Efficiency curve measured at 36V, 48Vin, 55Vin and 32Vout; the graph shows the efficiency versus output current (maximum 32V*11A)

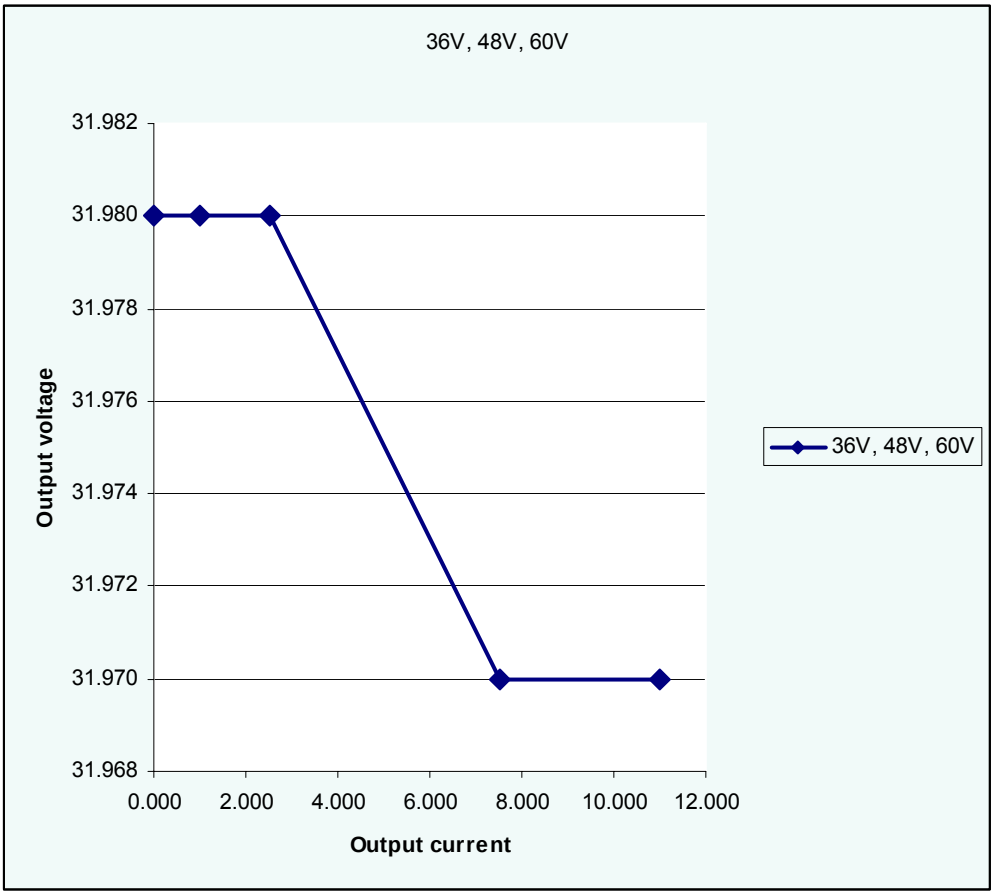


Efficiency curve measured at 36V, 48V, 55Vin and 20V out; the graph shows the efficiency versus output current (maximum 20V * 7A).

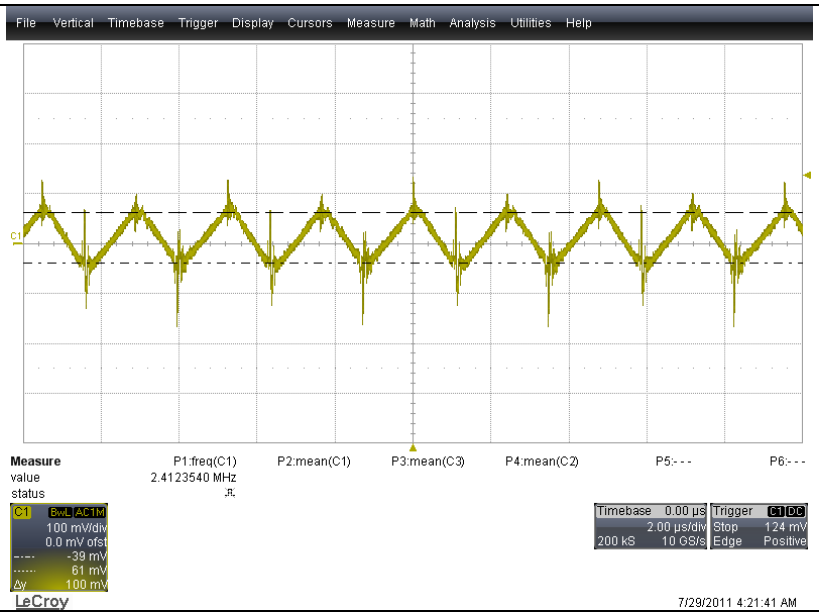


3 Output voltage regulation

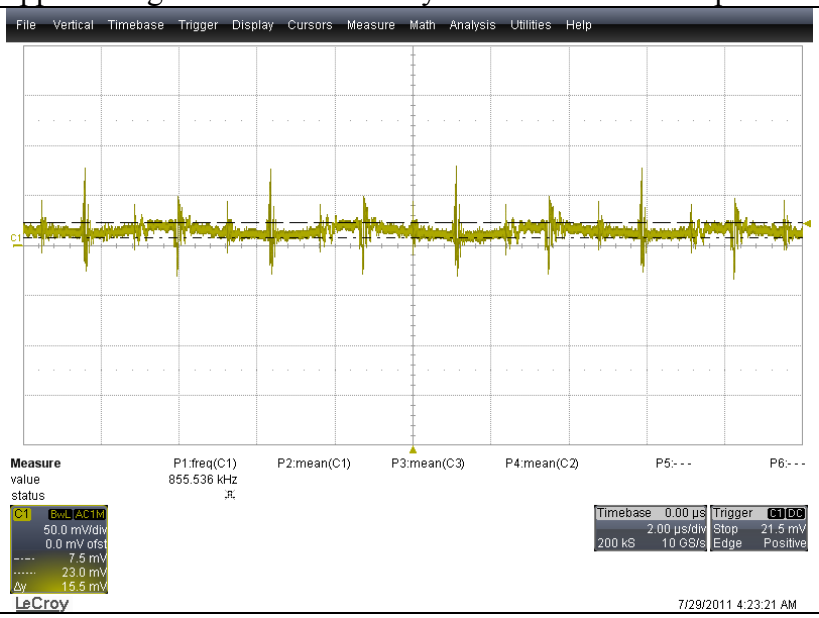
The output voltage regulation versus output current



4 Output ripple voltage



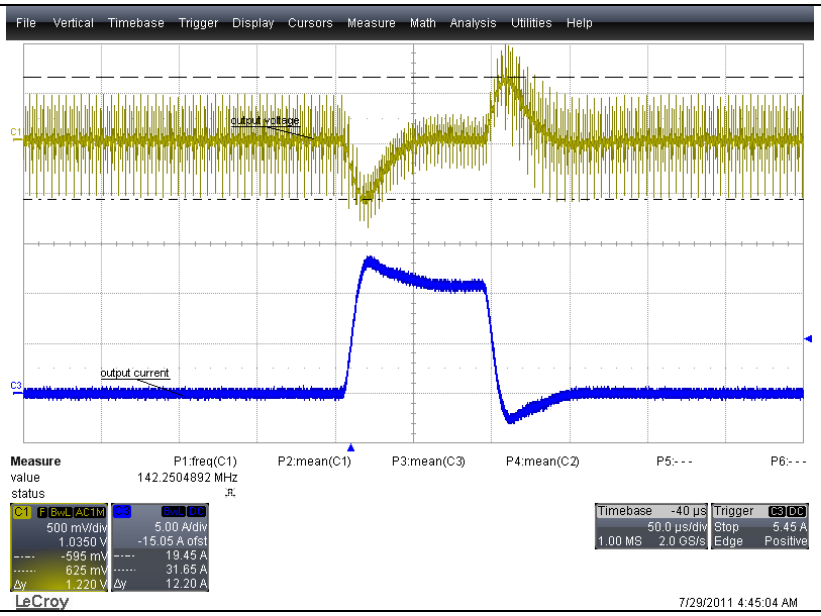
Output ripple voltage – measured directly on the converters output – 100mVpp



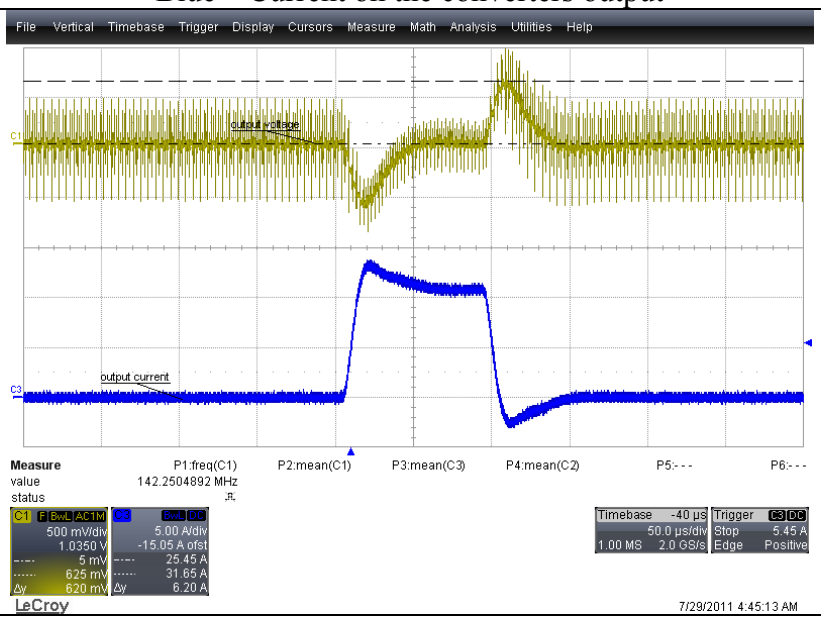
Output ripple voltage – measured directly on the 200uF (RF Amplifier) – 15mVpp

5 Transient response (load current switched)

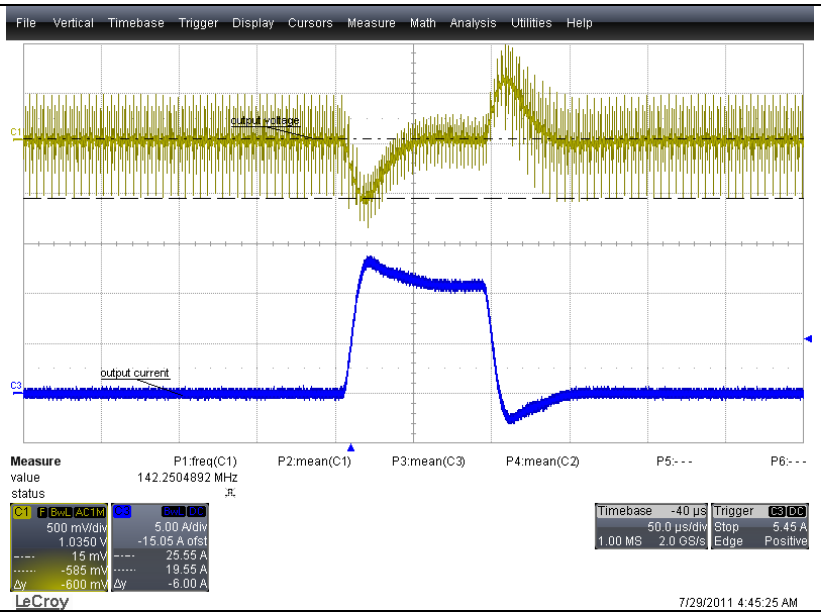
The fast transient load step current was produced with a 2.9Ohm. Switching time ON & OFF is in the **range of 100ns**.



Yellow – Output voltage AC coupled 200MHz band with – 1.2V
Blue – Current on the converters output



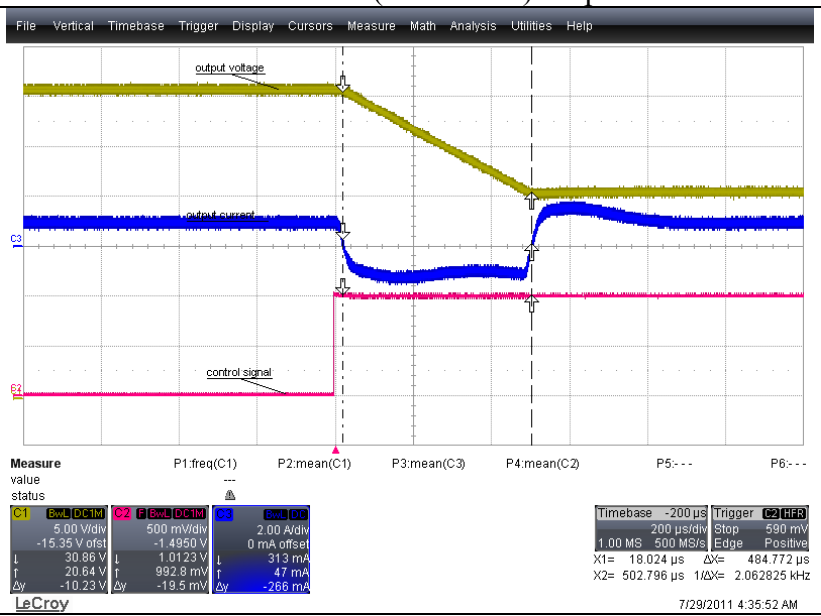
The same with markers for overshoot – 620mV



The same with markers for undershoot – 600mV

6 Slow Drain Modulation (SDM)

For this test, a waveform function generator was set to provide the rectangular waveform, shown in the graphs below. The input voltage was set to 48V and the output swings between 20V and 32V. The load was set to 1A constant current (worse case). Repetition rate 50Hz.



Load = 1A, 32Vout to 20Vout (maximal down slope limited internally to 500us)
Channel 1: Output Voltage, 5V/div, DC coupled, 200usec/div
Channel 2: Control Voltage, 500mV/div
Channel 3: Current on the converters output 2A/div

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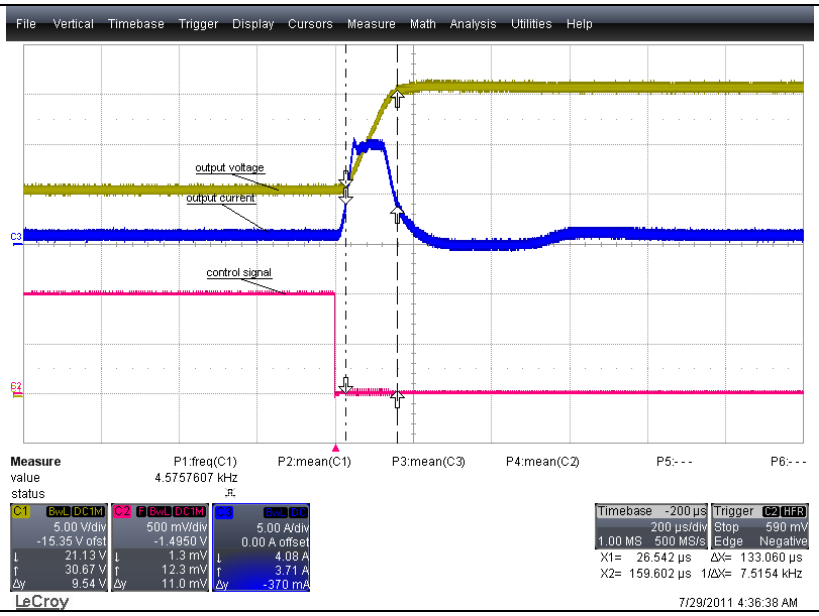
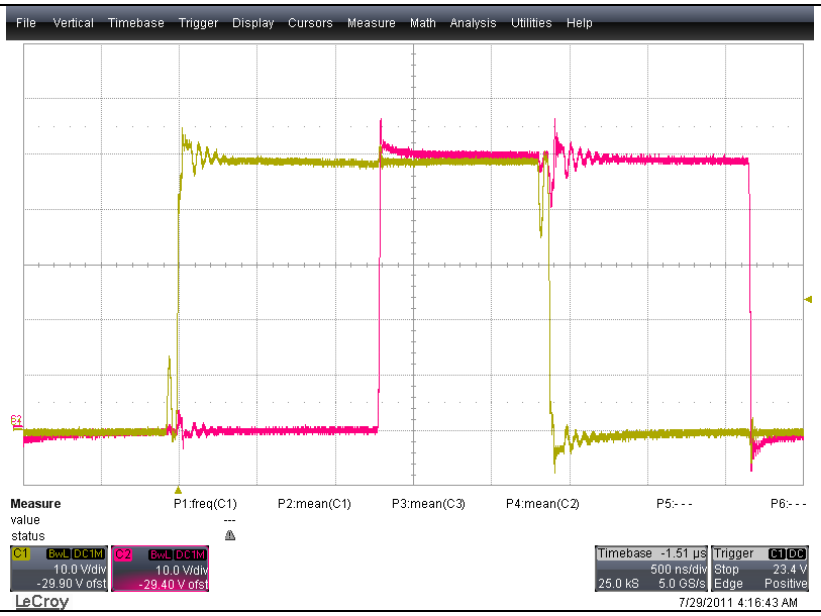


Load = 1A, 20Vout to 32Vout (maximal up slope limited internally ~ 100us)
Channel 1: Output Voltage, 5V/div, DC coupled, 200usec/div
Channel 2: Control Voltage, 500mV/div
Channel 3: Current on the converters output 5A/div

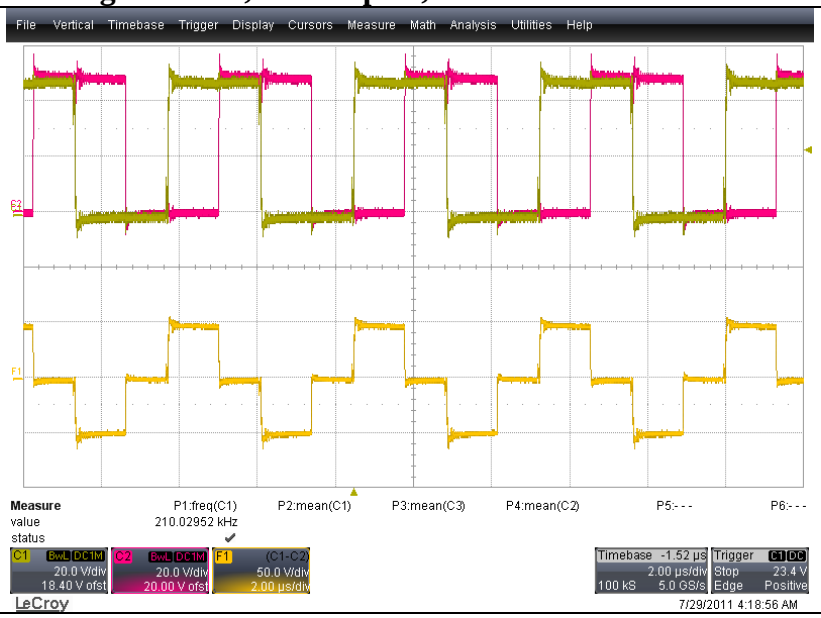
Settling time – no settling time issues. Negligible over shoot/undershoot.

7 Switching Node Waveform

The images below show the voltages behavior of the right (TP6) and left (TP7) full bridge legs, the 48Vin operation, full load conditions.



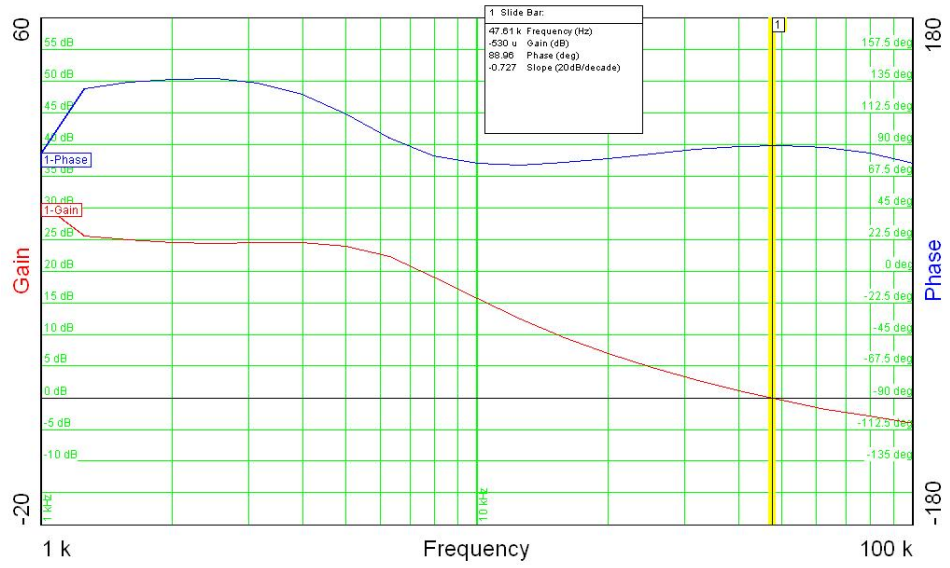
Load = 11A, 32Vout
Channel 1: Drain voltage 10V/div, DC coupled, 500nsec/div
Channel 2: Drain voltage 10V/div, DC coupled, 500nsec/div



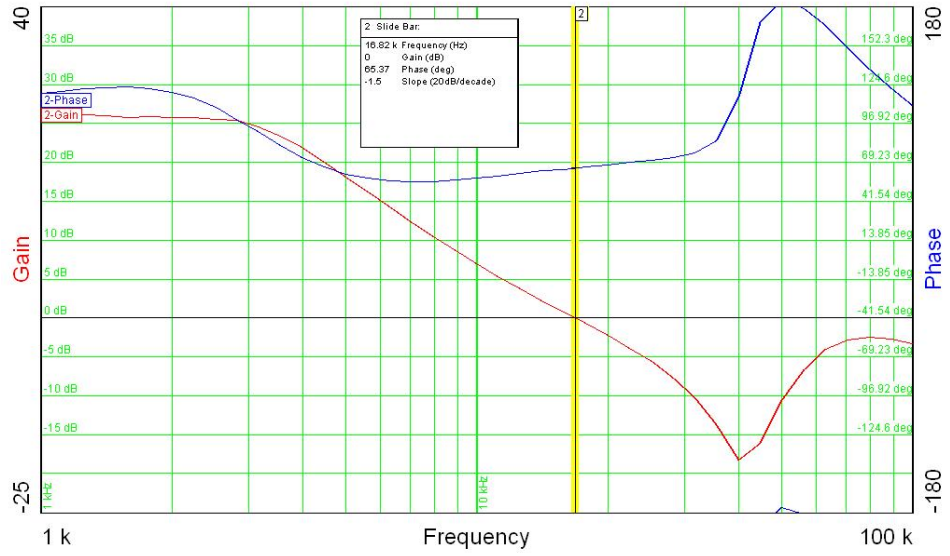
The same, in addition CH1-CH2 (Voltage across the transformer)

8 Loop response

Vin = 48V, Vout = 32V, load = 6.8A.



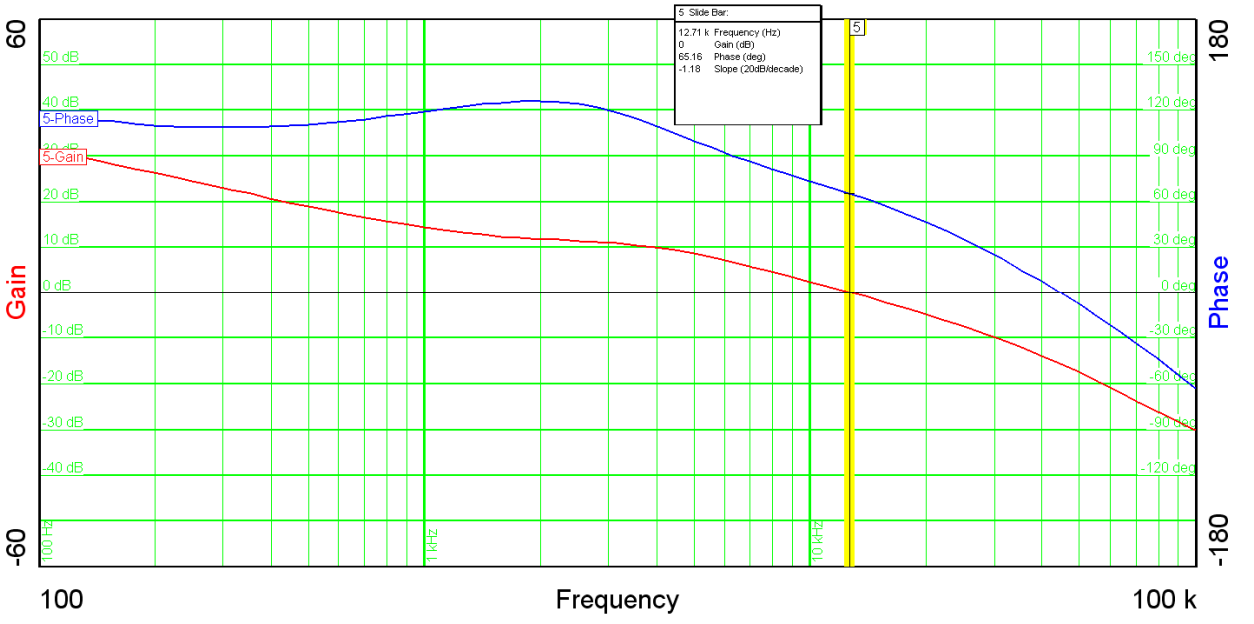
Frequency loop response of the converter – no capacitive load
The measured crossover frequency was around 47 KHz with a phase margin 88deg.



Frequency loop response of the converter – 200uF capacitive load
The measured crossover frequency was around 17 KHz with a phase margin 66deg.

9 AUX Power supply

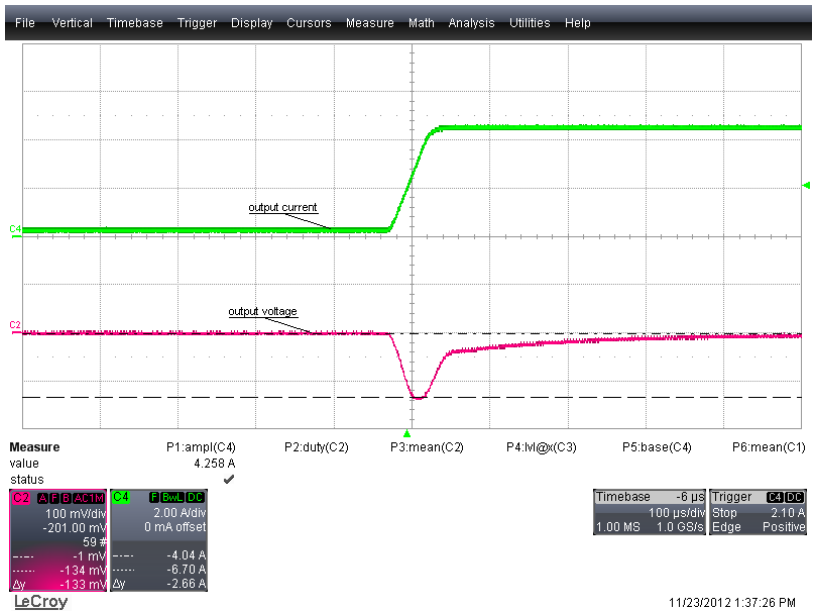
9.1 Loop response



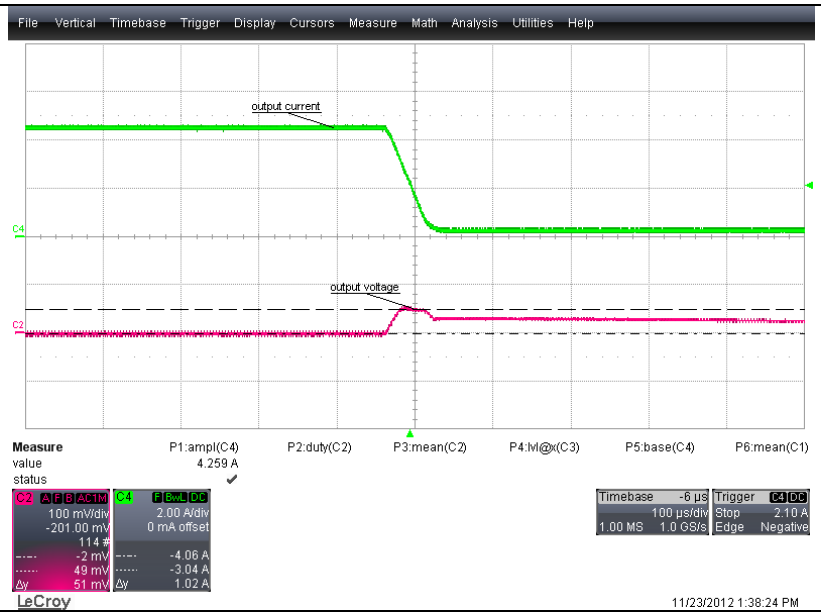
Frequency loop response resistive load

Cross over frequency: >12kHz
Phase margin: >60Deg
Gain margin: >15dB
Measured @ 48Vin and 5Ohm resistive load

9.2 Load step response:



Load step response rising age
CH2 (red): Output AC voltage 100mV/div, ΔU=133mV
CH4 (green): Output load current 2A/div, ΔI=4.25A

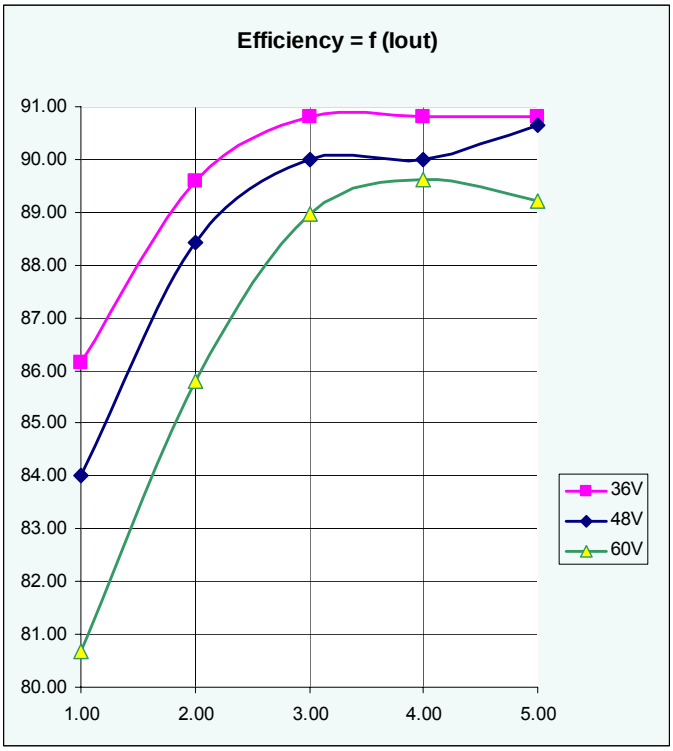


Load step response falling age
CH2 (red): Output AC voltage 100mV/div, ΔU=51mV
CH4 (green): Output load current 2A/div, ΔI=4.25A

9.3 Output ripple voltage

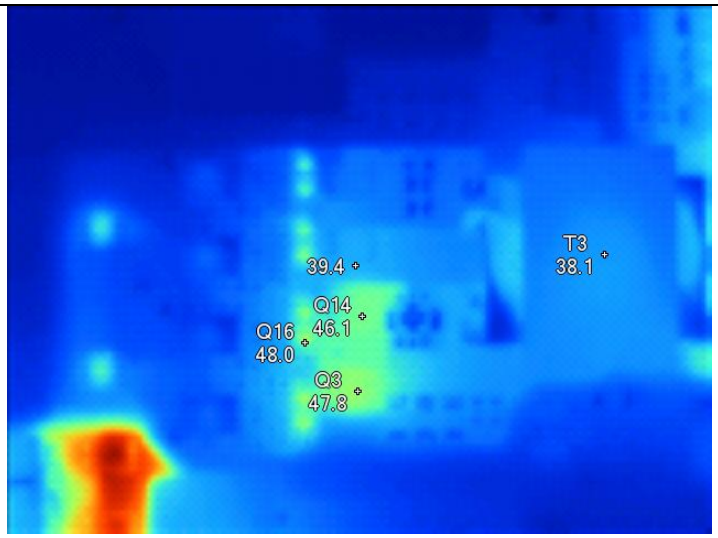
CH1 (yellow): switch node after diode rectifier
CH2 (red): Output voltage AC coupled, 100mV/div, ΔU<20mVpp
CH4 (green) : Output DC current 2A/div

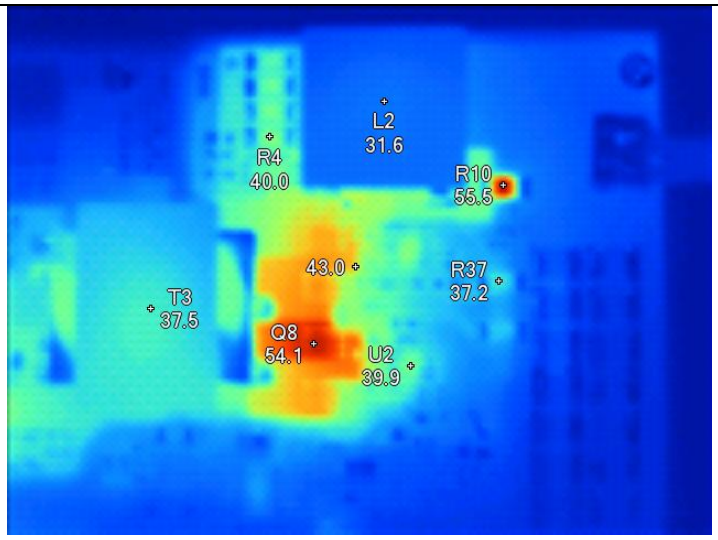
9.4 Efficiency



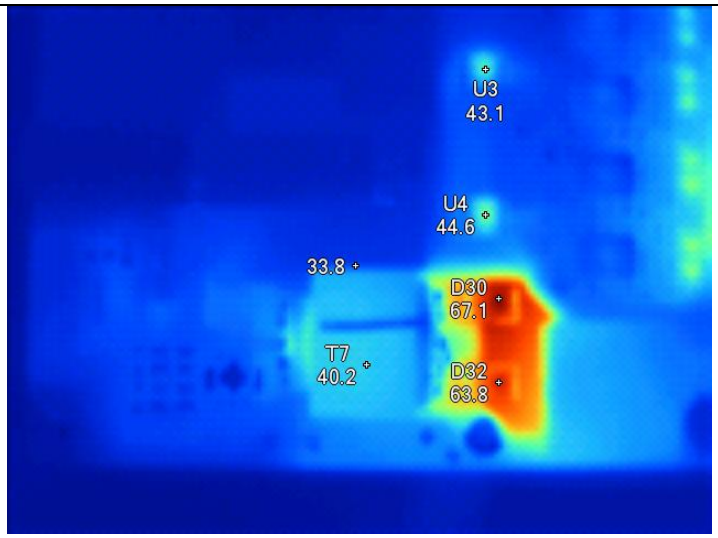
9.5 *Thermal analysis*

The thermal analysis has been accomplished by an infrared camera at the following conditions:
Vin = 48V, Vout = 32V @ 4A, Vaux = 12V @ 4A. Force air flow.





R10 – **need a bigger package or several connected in parallel**



U3, U4, gate driver ICs – **need to be in MSOP PowerPAD-8**

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