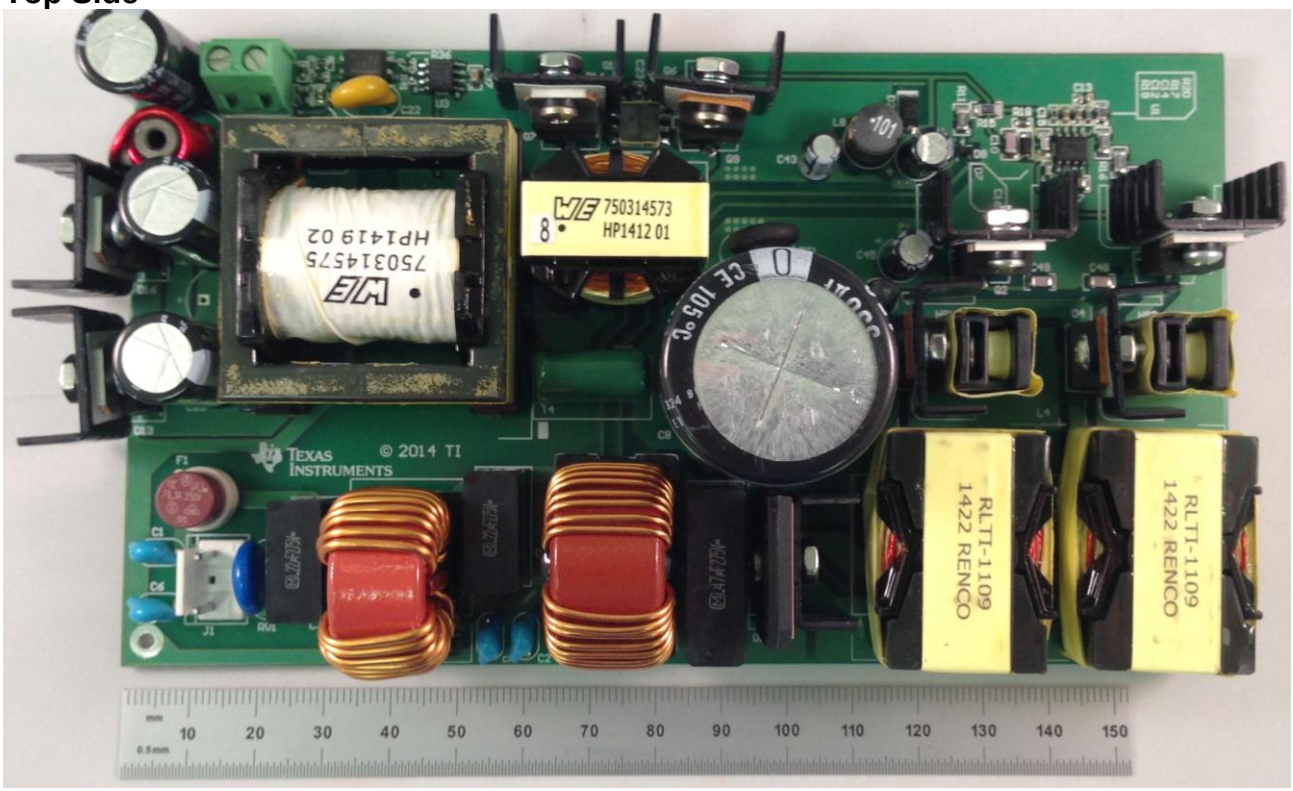
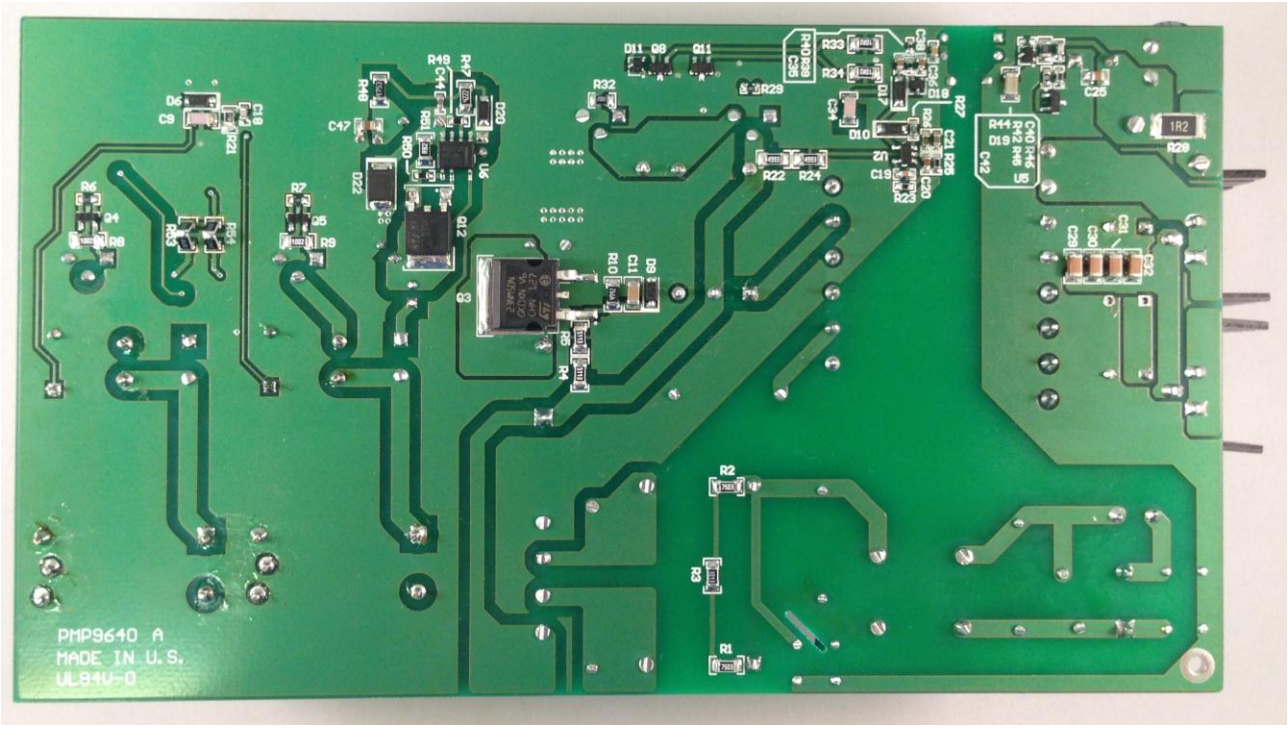
1 Photo

The photographs below show the top and bottom views of the PMP9640 Rev A board, which is built on PMP9640 Rev A PCB.

Top Side



Bottom Side

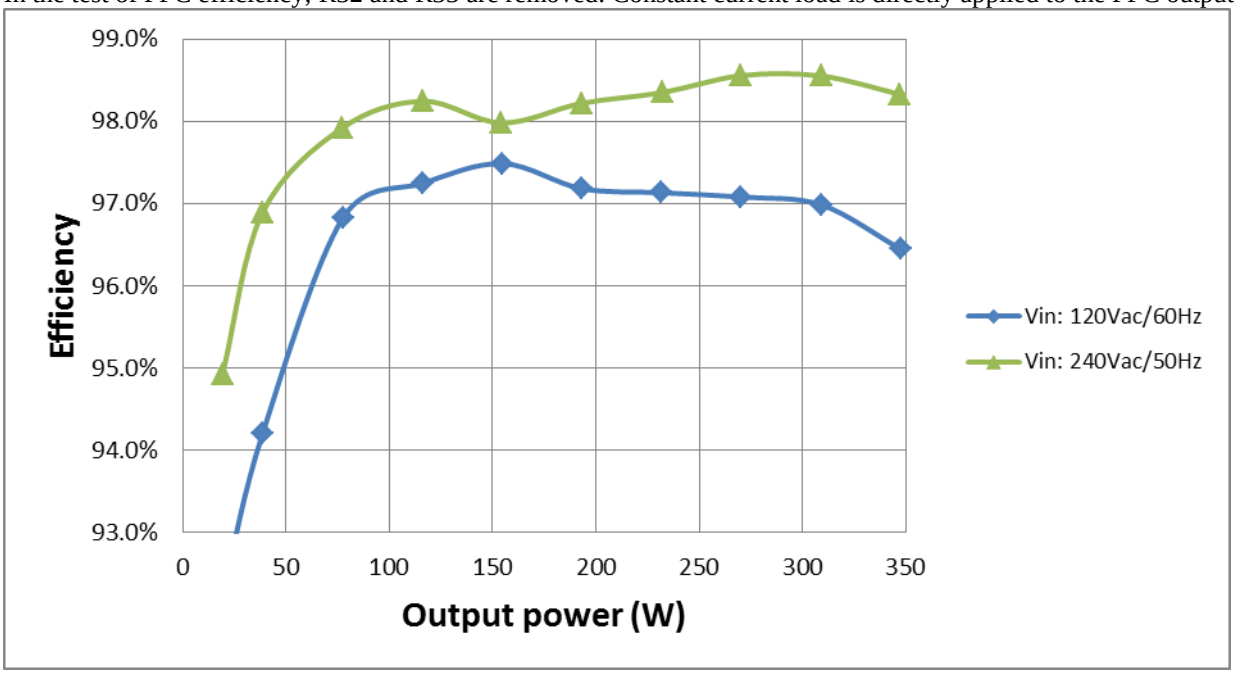


2 Efficiency

The efficiency curves of total supply are shown in the tables and graph below.

2.1 PFC Efficiency

In the test of PFC efficiency, R32 and R33 are removed. Constant current load is directly applied to the PFC output.



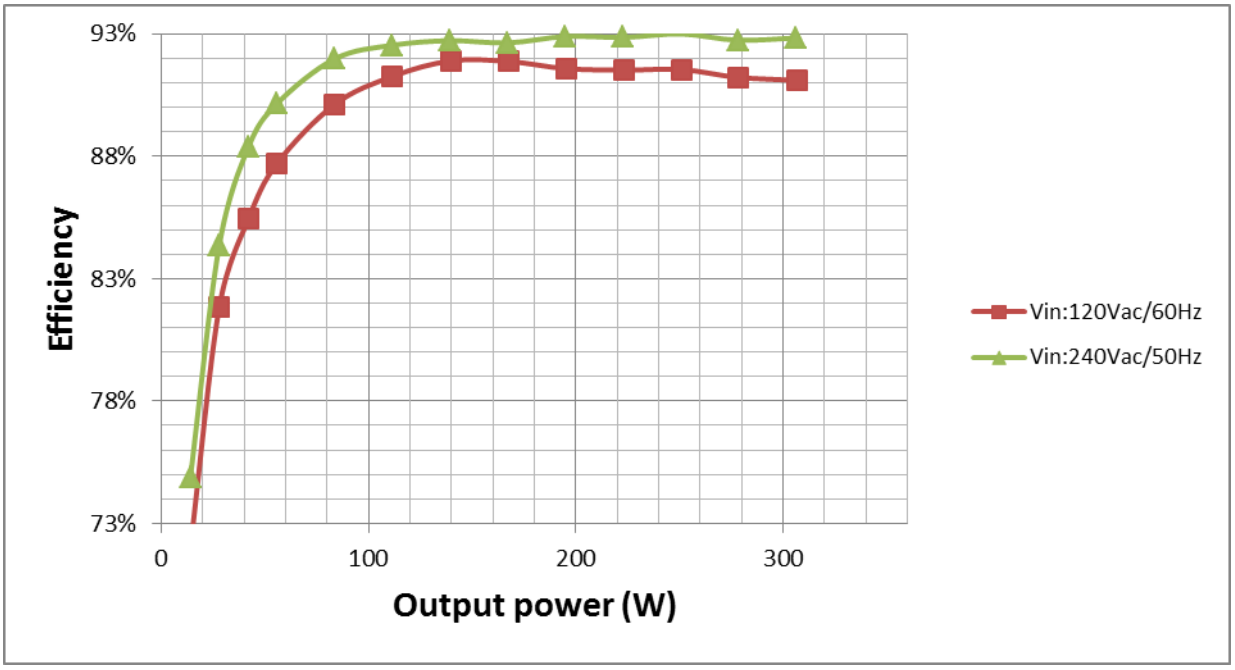
120V$_{AC}$/60Hz

Vin(ac)	Iin(A)	Pin(W)	PF	V_B+(V)	I_B+(A)	Pout(W)	Losses(W)	Eff. (%)
120.5	3.181	381.3	0.995	386	0.951	367.086	14.214	96.27%
120.42	3.006	360.6	0.996	386	0.901	347.786	12.814	96.45%
119.78	2.668	318.8	0.998	386	0.801	309.186	9.614	96.98%
120.5	2.316	278.4	0.998	386.1	0.7	270.27	8.13	97.08%
120.56	1.984	238.5	0.997	386.1	0.6	231.66	6.84	97.13%
119.92	1.664	198.7	0.997	386.2	0.5	193.1	5.6	97.18%
120.07	1.329	158.9	0.996	386.3	0.401	154.9063	3.9937	97.49%
119.85	1.006	119.6	0.992	386.4	0.301	116.3064	3.2936	97.25%
120.12	0.6783	80.23	0.985	386.5	0.201	77.6865	2.5435	96.83%
119.85	0.3635	41.02	0.942	386.4	0.1	38.64	2.38	94.20%
119.99	0.2364	20.93	0.738	386.2	0.05	19.31	1.62	92.26%

240V_{AC}/50Hz

Vin(ac)	Iin(A)	Pin(W)	PF	V_B+(V)	I_B+(A)	Pout(W)	Losses(W)	Eff. (%)
240	1.569	373.3	0.991	386	0.95	366.7	6.6	98.23%
240.1	1.484	353	0.991	386.1	0.899	347.1039	5.8961	98.33%
240.3	1.316	313.5	0.991	386.2	0.8	308.96	4.54	98.55%
240.2	1.155	274.3	0.989	386.2	0.7	270.34	3.96	98.56%
240	1.001	236	0.983	386.2	0.601	232.1062	3.8938	98.35%
240.5	0.857	196.55	0.953	386.1	0.5	193.05	3.5	98.22%
239.9	0.7477	157.54	0.878	385.9	0.4	154.36	3.18	97.98%
240	0.6378	118.2	0.772	385.8	0.301	116.1258	2.0742	98.25%
240	0.5141	78.76	0.638	385.6	0.2	77.12	1.64	97.92%
239.9	0.3525	39.8	0.471	385.6	0.1	38.56	1.24	96.88%
240.1	0.2445	20.3	0.346	385.4	0.05	19.27	1.03	94.93%

2.2 Converter Efficiency



120V$_{AC}$/60Hz

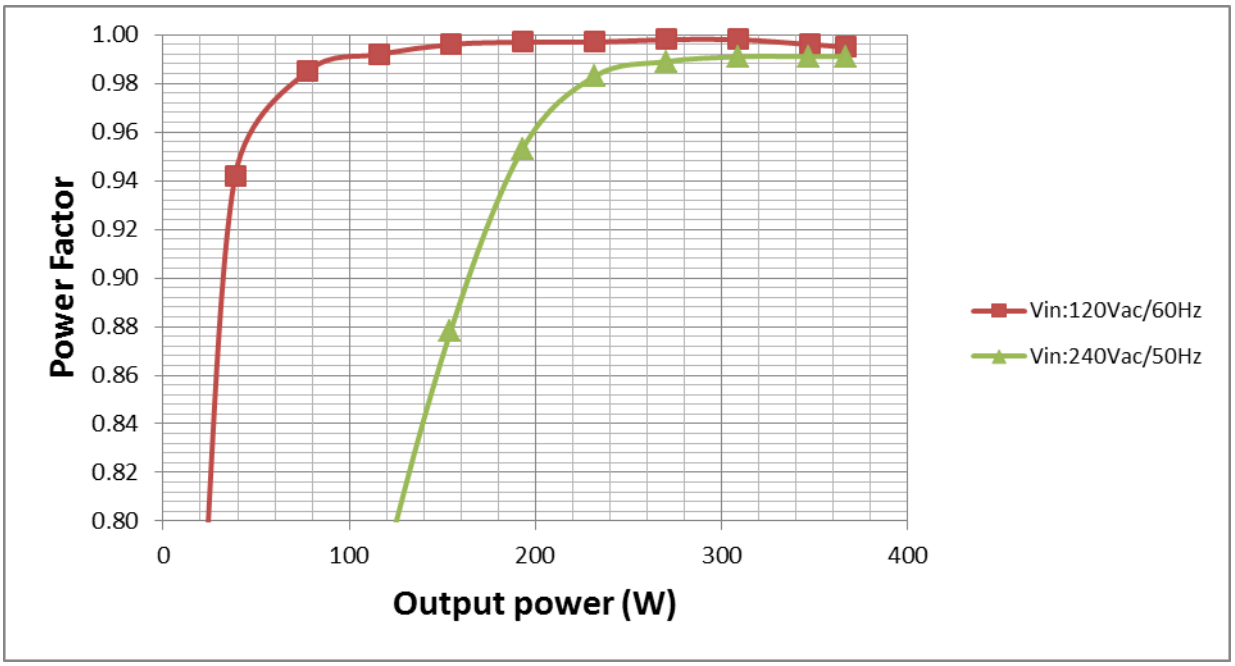
Vin(ac)	Iin(A)	Pin(W)	PF	Vout(V)	Iout(A)	Pout(W)	Losses(W)	Eff. (%)
120.11	2.809	336.5	0.997	27.87	11	306.57	29.93	91.11%
120	2.547	305	0.998	27.88	9.98	278.2424	26.7576	91.23%
120.01	2.291	274.4	0.998	27.88	9.01	251.1988	23.2012	91.54%
120.08	2.037	244	0.997	27.88	8.01	223.3188	20.6812	91.52%
119.82	1.787	213.4	0.997	27.88	7.01	195.4388	17.9612	91.58%
120.21	1.522	182.37	0.996	27.88	6.01	167.5588	14.8112	91.88%
119.85	1.276	152.22	0.995	27.89	5.016	139.8962	12.32376	91.90%
119.84	1.029	122.38	0.993	27.89	4.005	111.6995	10.68055	91.27%
120	0.7835	92.87	0.988	27.9	3	83.7	9.17	90.13%
120.31	0.5407	63.65	0.978	27.9	2.001	55.8279	7.8221	87.71%
120.14	0.4243	49.17	0.965	27.91	1.505	42.00455	7.16545	85.43%
120.18	0.3178	34.18	0.895	27.91	1.002	27.96582	6.21418	81.82%
119.95	0.2255	19.469	0.72	27.92	0.502	14.01584	5.45316	71.99%
120.48	0.05401	1.478	0.227	28.22	0	0	1.478	0.00%

240V_{AC}/50Hz

Vin(ac)	Iin(A)	Pin(W)	PF	Vout(V)	Iout(A)	Pout(W)	Losses(W)	Eff. (%)
240	1.388	330.1	0.991	27.86	11	306.46	23.64	92.84%
240	1.262	299.9	0.99	27.87	9.98	278.1426	21.7574	92.75%
240	1.137	269.7	0.988	27.87	9	250.83	18.87	93.00%
239.7	1.018	240.1	0.984	27.87	8	222.96	17.14	92.86%
240	0.902	210	0.97	27.87	7	195.09	14.91	92.90%
239.7	0.808	180.51	0.932	27.87	6	167.22	13.29	92.64%
239.9	0.7258	150.45	0.864	27.88	5.004	139.5115	10.93848	92.73%
240.3	0.6438	120.33	0.778	27.88	3.994	111.3527	8.97728	92.54%
239.9	0.5578	91.02	0.68	27.89	3.002	83.72578	7.29422	91.99%
240.2	0.4608	62.05	0.561	27.89	2.006	55.94734	6.10266	90.16%
240.2	0.4028	47.49	0.491	27.9	1.504	41.9616	5.5284	88.36%
240	0.3318	33.14	0.416	27.9	1.002	27.9558	5.1842	84.36%
239.9	0.2409	18.712	0.326	27.91	0.502	14.01082	4.70118	74.88%
240.1	0.081	1.39	0.071	28.13	0	0	1.39	0.00%

3 Power Factor

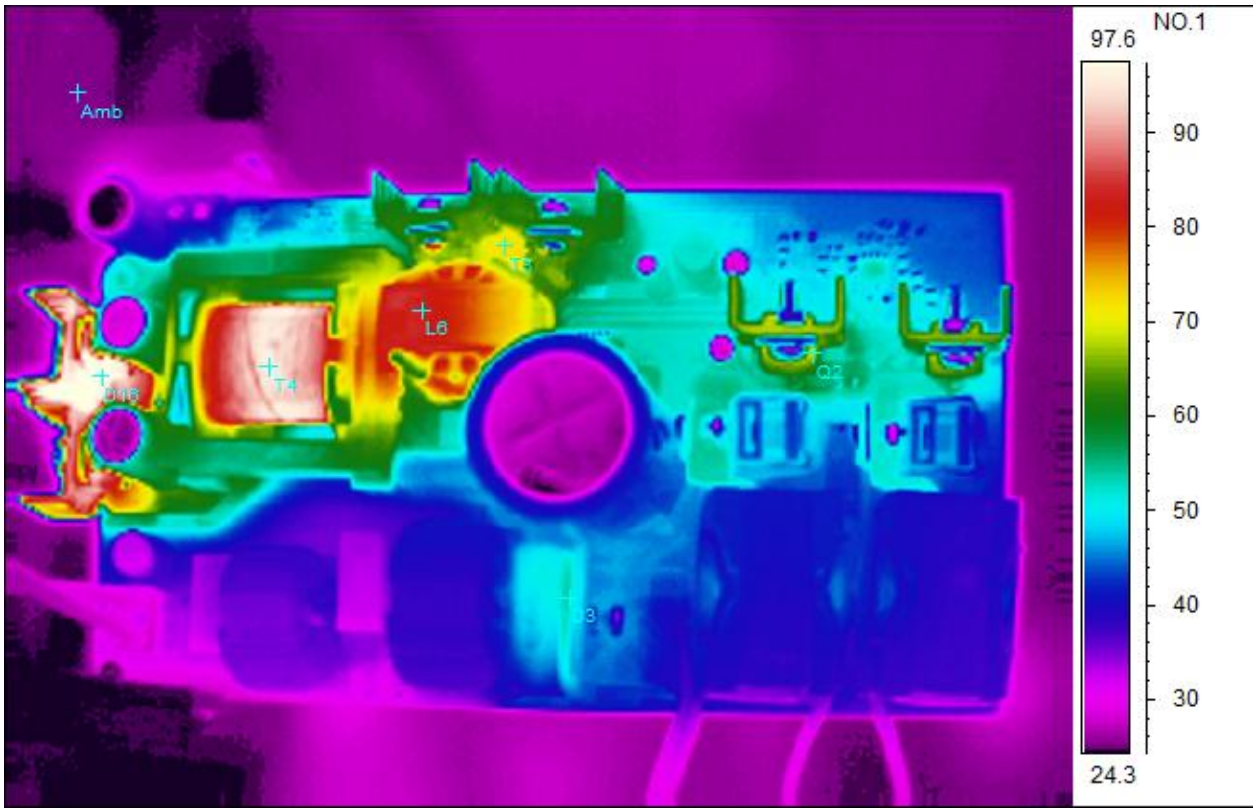
The power factor is shown in the plot below.



4 Thermal Images

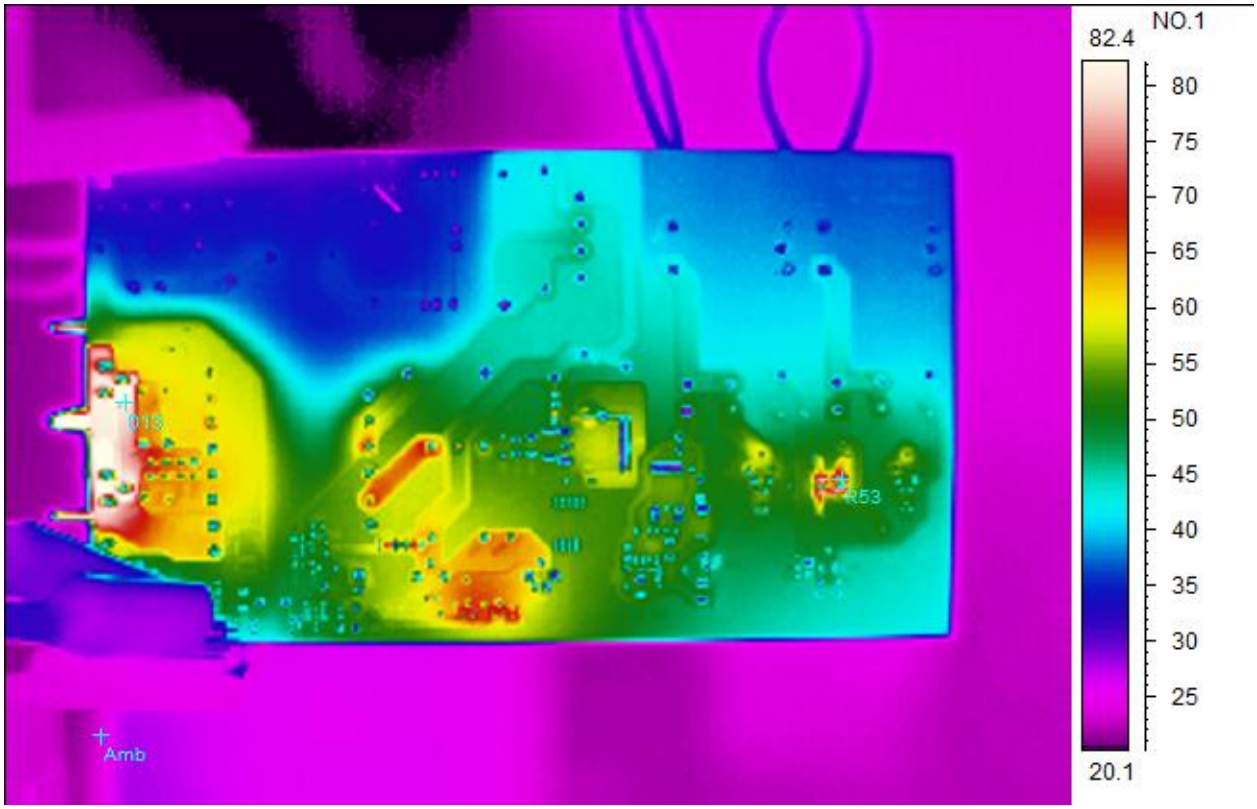
The thermal images below show a top view and bottom view of the board. The board is placed vertically during the test, where the input and output connecters are at the bottom side. The ambient temperature was 25ºC with no air flow. The output was loaded with 28V/11A. Notice that Aavid 530614B00000G was applied as the heatsink of D3 during the thermal tests.

4.1 120V/60Hz –Top Side



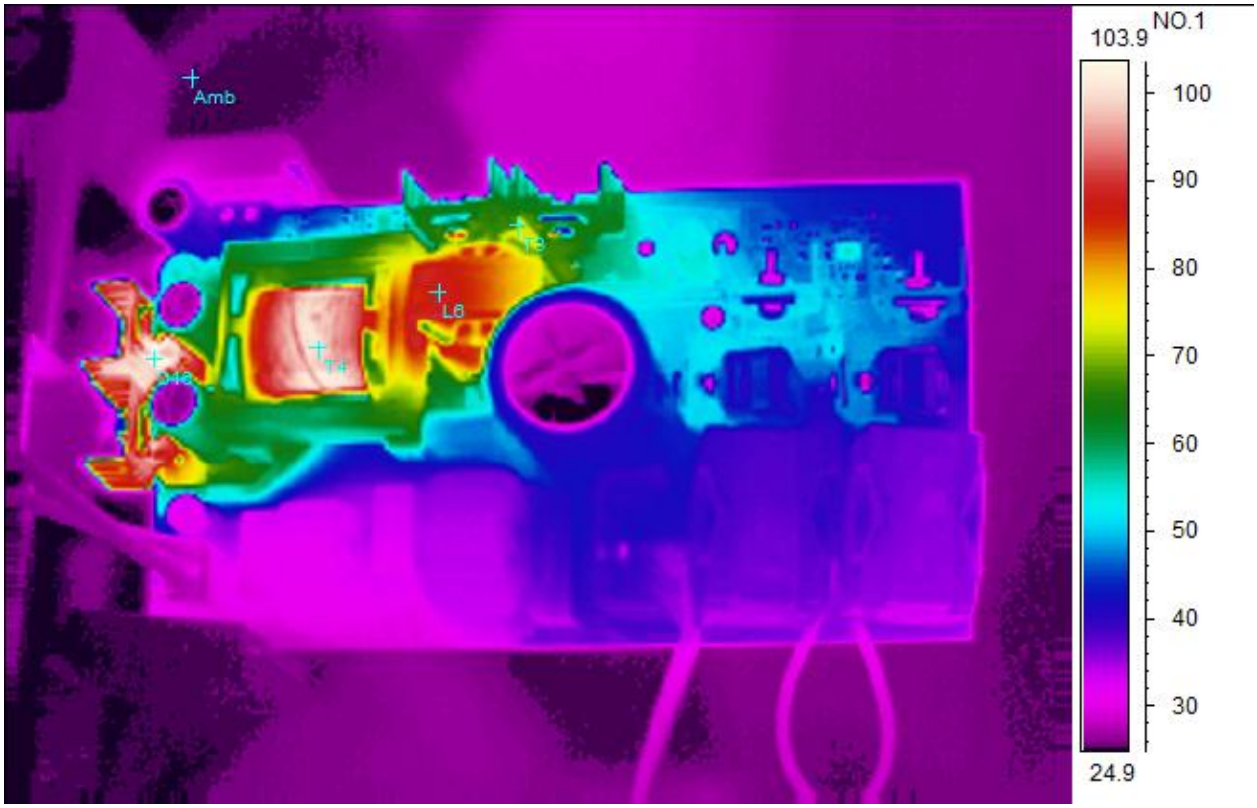
Spot analysis	Value
AmbTemperature	25.6°C
D16Temperature	101.6°C
T4Temperature	96.5°C
L6Temperature	86.4°C
Q2Temperature	72.6°C
D3Temperature	56.9°C
T3 Temperature	76.5°C

4.2 120V/60Hz –Bottom Side



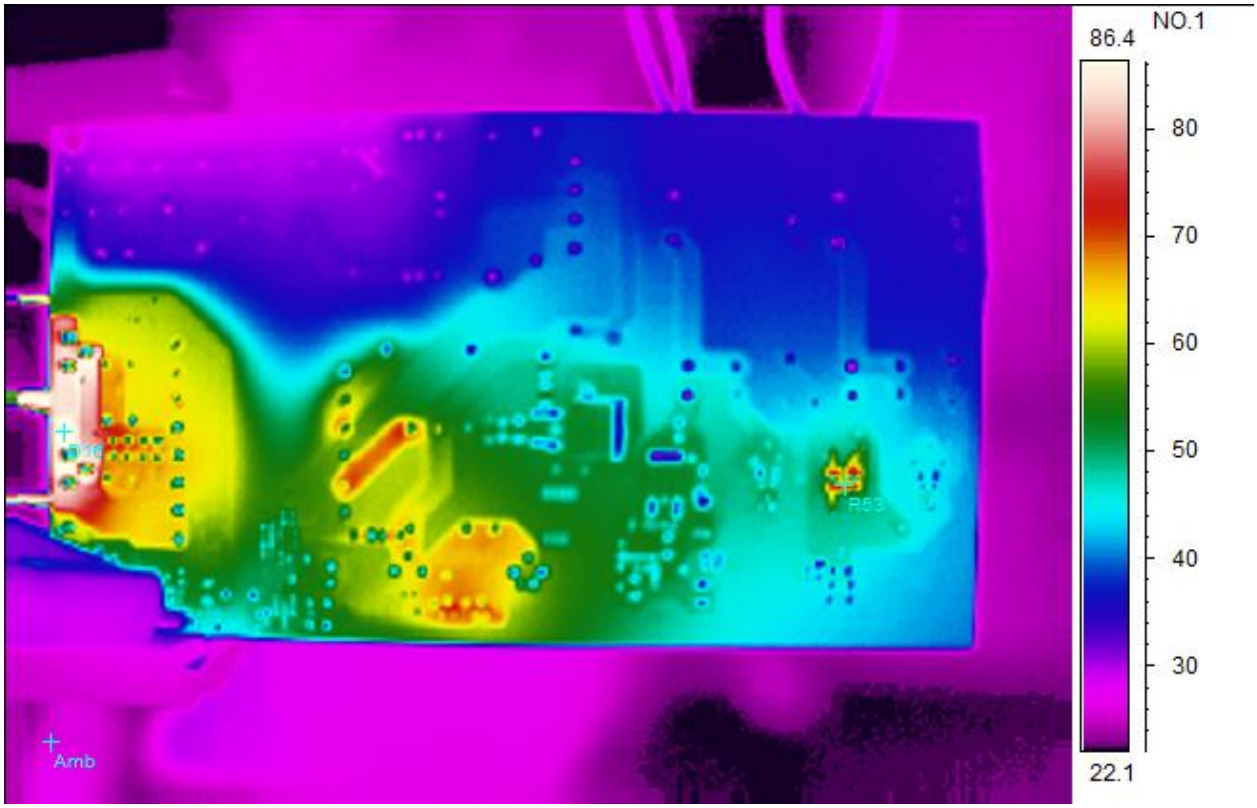
Spot analysis	Value
AmbTemperature	25.0°C
R53Temperature	80.3°C
D13 Temperature	82.0°C

4.3 240V/50Hz –Top Side



Spot analysis	Value
AmbTemperature	25.7°C
D16Temperature	105.7°C
T4Temperature	101.2°C
L6Temperature	92.3°C
T3 Temperature	77.3°C

4.4 240V/50Hz –Bottom Side



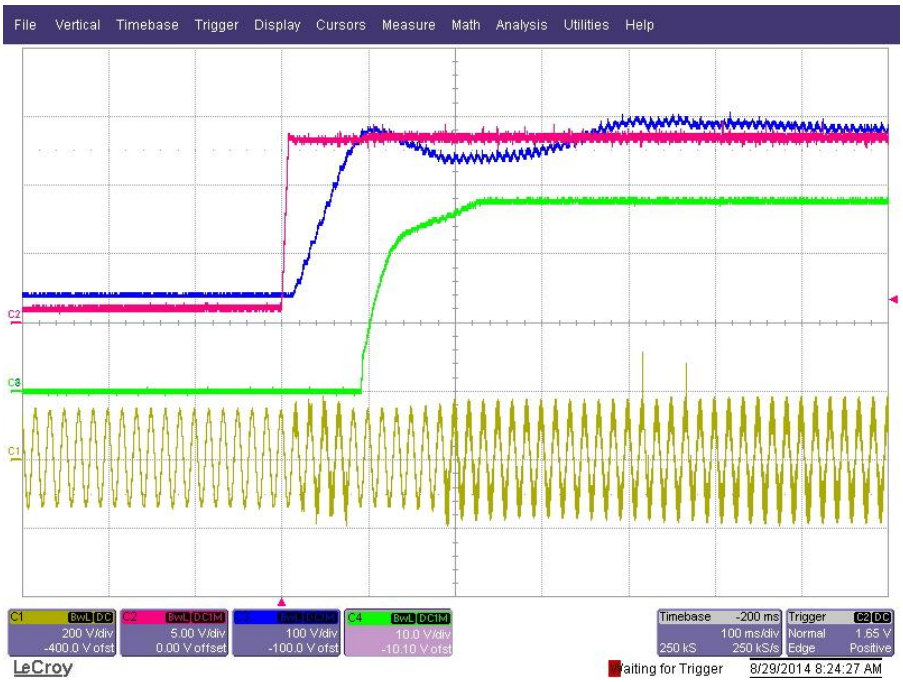
Spot analysis	Value
AmbTemperature	26.5°C
D16Temperature	87.6°C
R53 Temperature	75.0°C

5 Startup

The voltages at startup are shown in the images below, where CH1 is the input voltage, CH2 is the Bias voltage, CH3 is the PFC output voltage, and CH4 is the 28V output voltage.

5.1 90VAC/60Hz – Full Load (28V/11A)

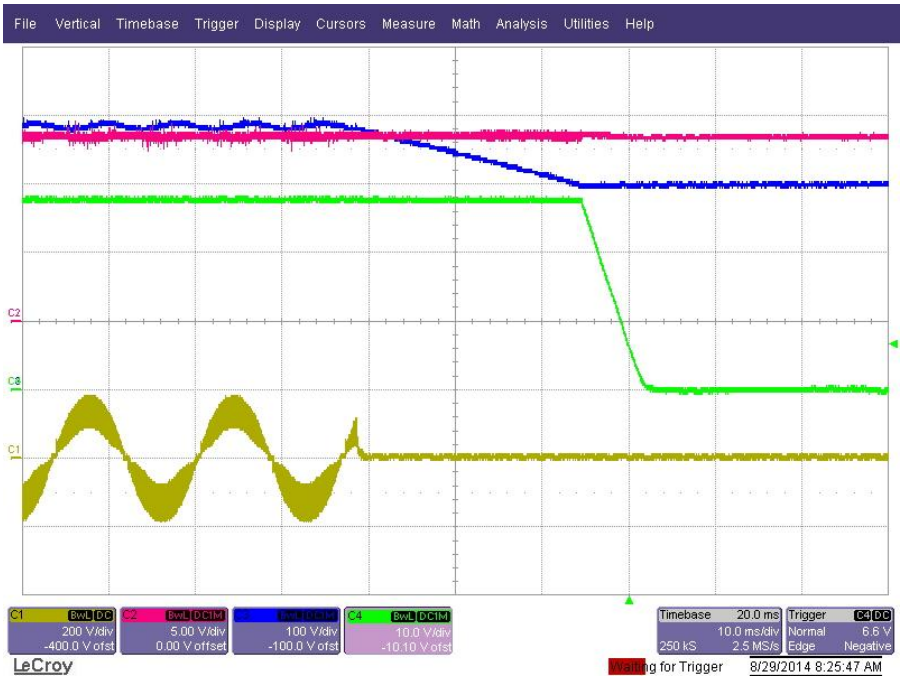
5.2 240VAC/50Hz – Full Load (28V/11A)



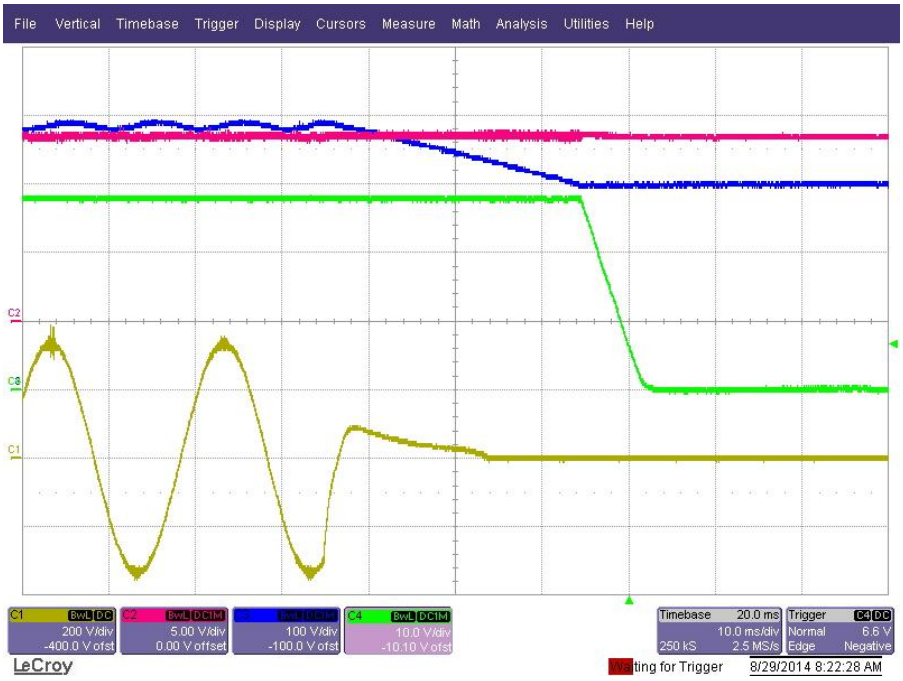
6 Turn-off

The voltages at turn-off are shown in the images below, where CH1 is the input voltage, CH2 is the Bias voltage, CH3 is the PFC output voltage, and CH4 is the 28V output voltage.

6.1 90VAC/60Hz – Full Load (28V/11A)

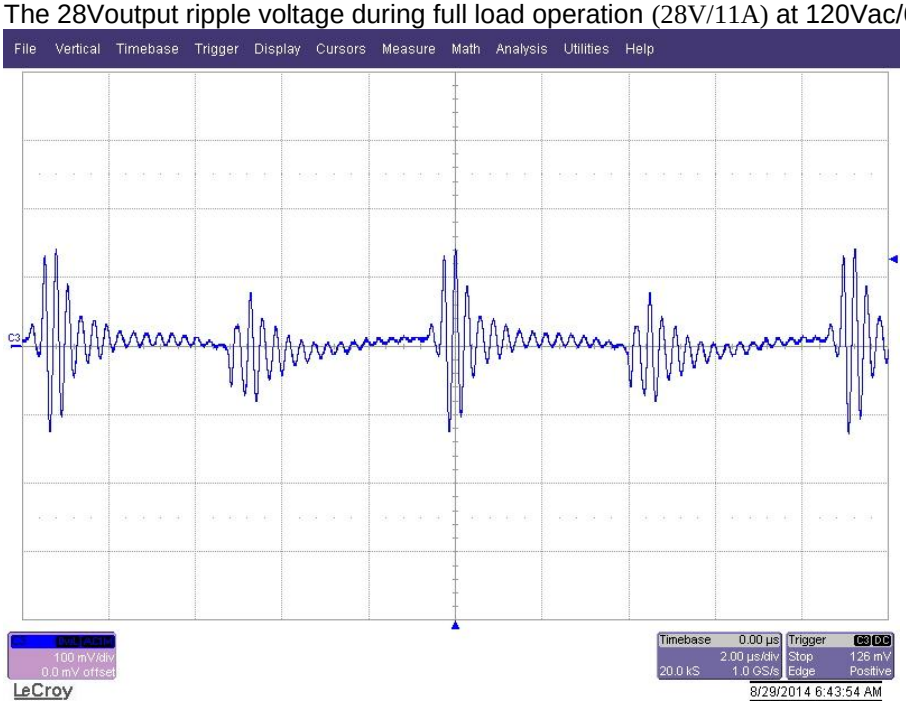


6.2 240VAC/50Hz – Full Load (28V/11A)



7 28V Output Ripple Voltage

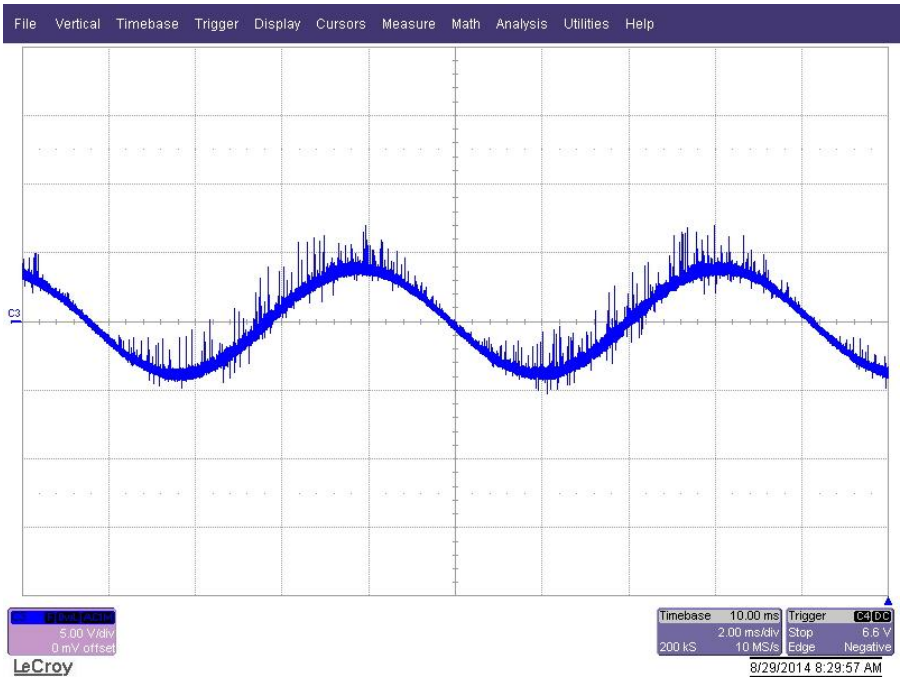
The 28Voutput ripple voltage during full load operation (28V/11A) at 120Vac/60Hz is shown in the plot below.



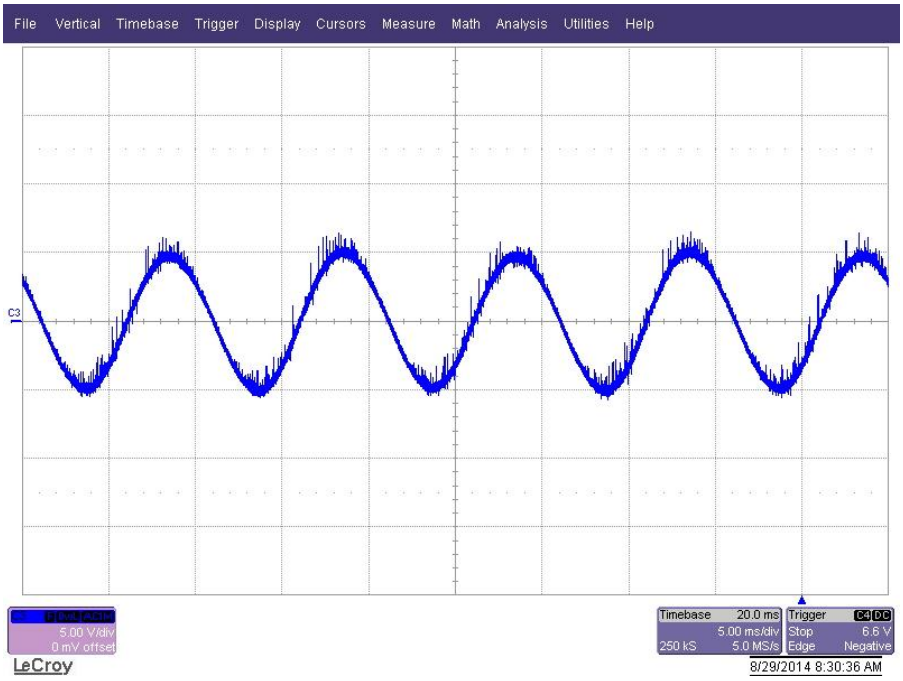
8 PFC Output Ripple Voltage

The PFC output ripple voltage during full load operation (28V/11A) is shown in the plots below.

8.1 120VAC/60Hz



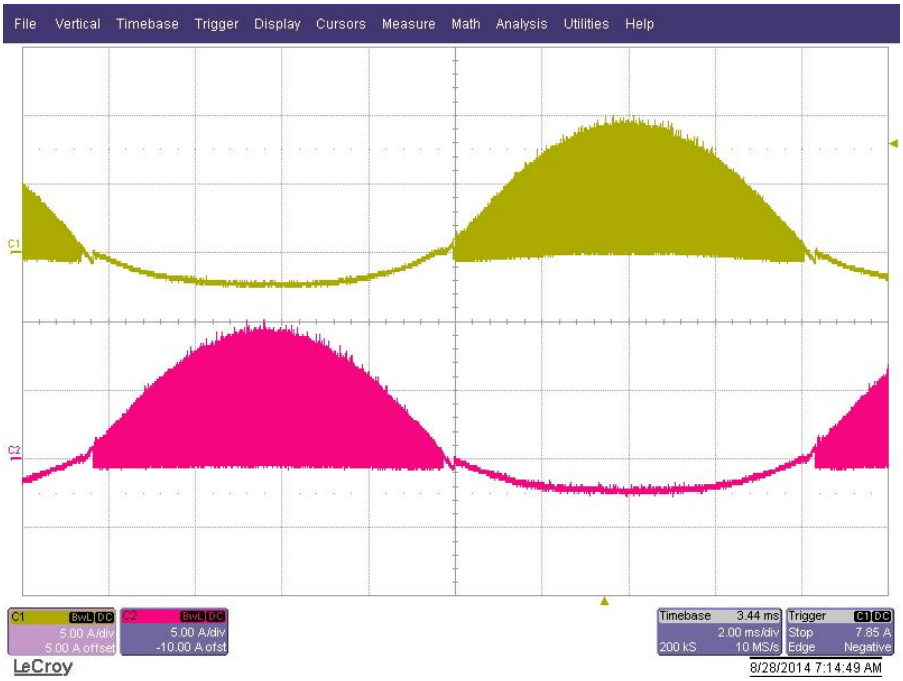
8.2 240VAC/50Hz



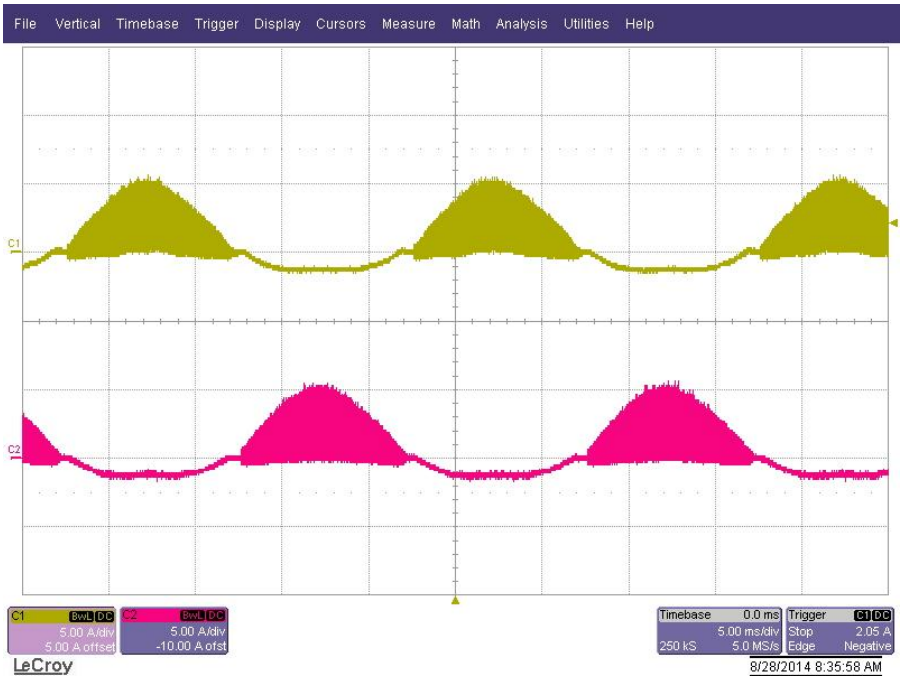
9 PFC Inductor Currents

The PFC inductor currents with 385V/0.95A at PFC output (pin B+) is shown in the plots below.

9.1 120VAC/60Hz

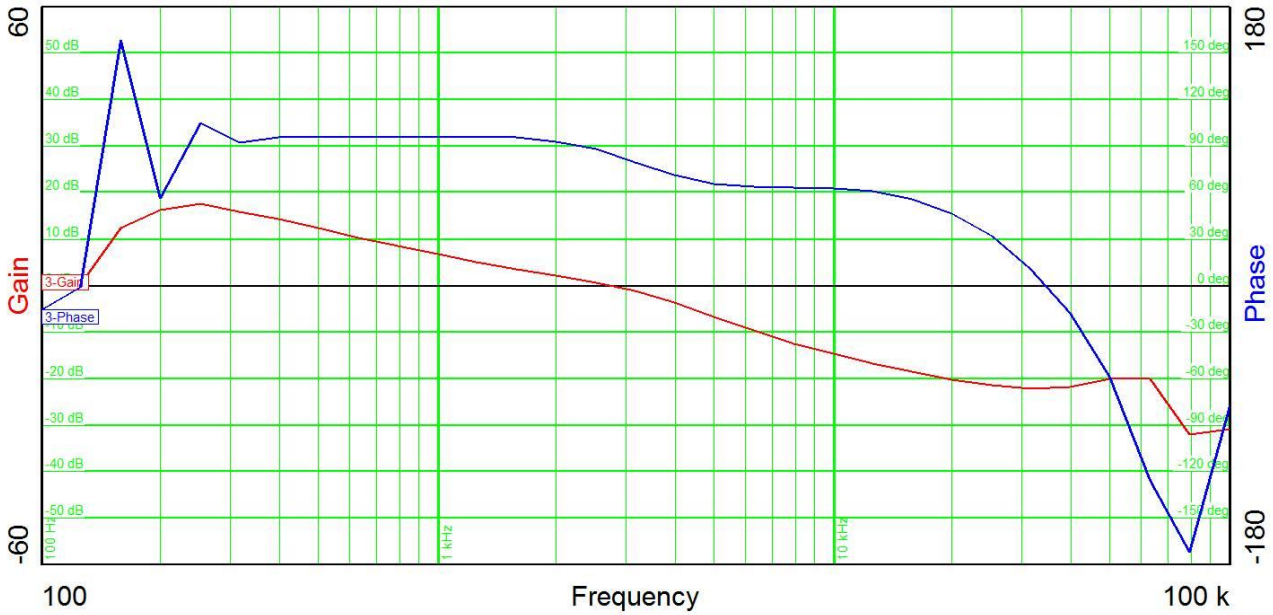


9.2 220VAC/50Hz



10 LLC Half Bridge Frequency Response

The frequency response of the feedback loop is shown in the plot below, where AC signal is injected at R37. The output was loaded with 28V/11A at $120V_{AC}$/60Hz input.



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