LM3478

Boost Converter

TI reference design number: PMP9382 Rev A

Input: 3.5 - 6V

Operational down to 2V

Output: 10V @ 3A

DC – DC Test Results

Table of Contents

1. Circuit Description

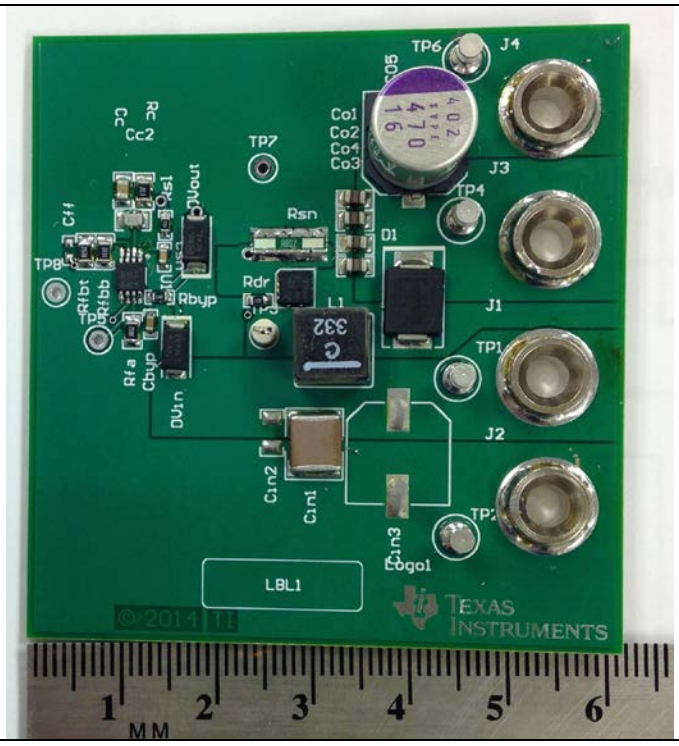
PMP9382 is a boost converter utilizing the LM3478Q-Q1. This design starts at a diode drop above the minimum input voltage of 2.97V (~3.4V) to a maximum of 6V in. Once the power supply is enabled and output is present, this design will work down to 2V input minimum, supplying an output voltage of 10V at 3A. The Switching frequency is set to 400 kHz

1.1. Absolute Maximum Design Specifications

Start Up Vin	**3.5VDC**
Vin Min.	**2VDC**
Vin Max.	**6VDC**
Vout	**10VDC**
Iout	**3A**
Target Switching Frequency	**400 kHz**

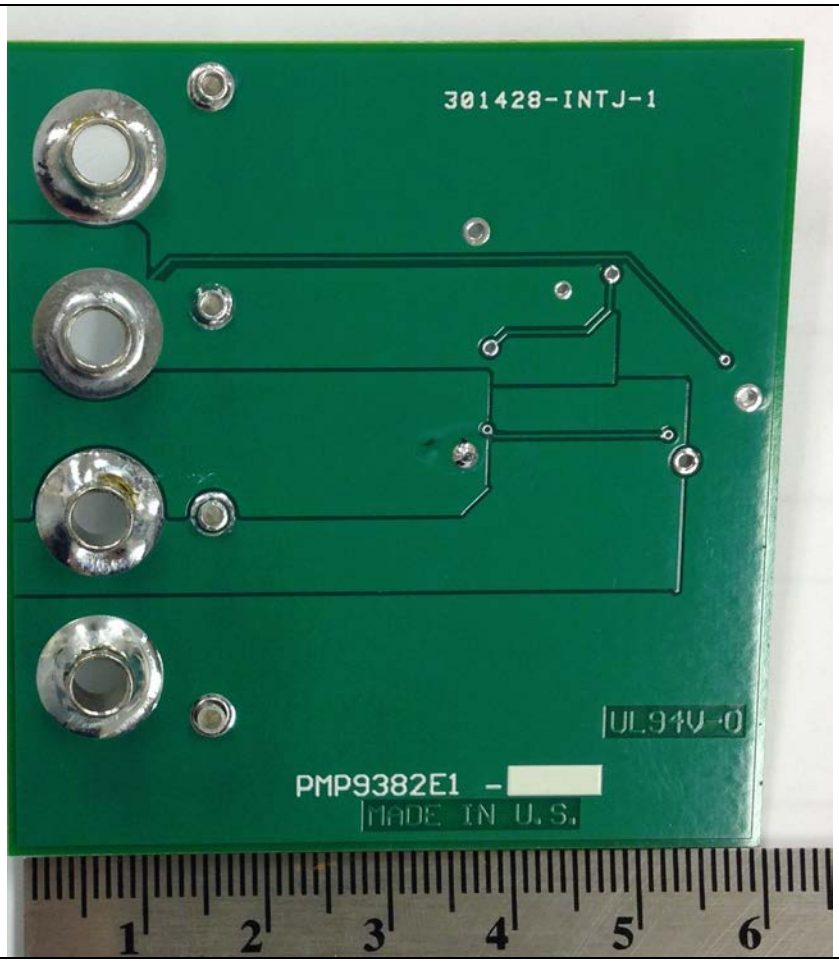
2. Fabrication

The PMP9382 is a two layer board with overall dimensions of 2.4” (60.mm) x 2.5” (63mm). The copper weight is 1oz.



Top Layer

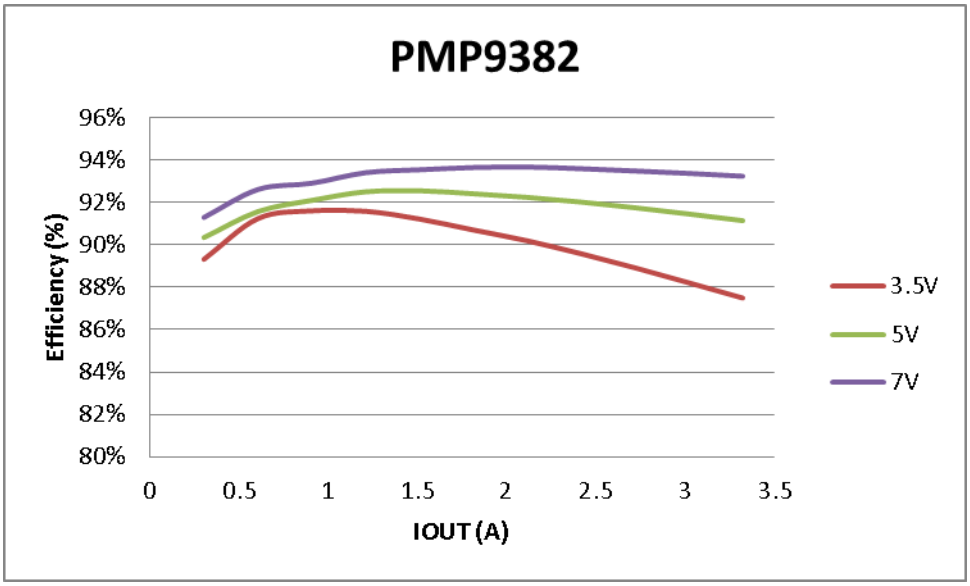
Boost Converter



Bottom Layer

Boost Converter

3. Efficiency



3.1 3V Efficiency Data

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Efficiency (%)	Pin (W)	Pout (W)	Losses (W)
2.998	1.204	10.500	0.306	88.83%	3.611	3.208	0.403
2.998	2.341	10.497	0.607	90.86%	7.018	6.376	0.642
2.998	3.502	10.495	0.908	90.80%	10.499	9.533	0.966
2.998	4.695	10.493	1.210	90.19%	14.075	12.694	1.380
2.998	5.921	10.491	1.512	89.38%	17.751	15.866	1.885
2.998	7.177	10.488	1.814	88.41%	21.515	19.022	2.493
2.998	8.472	10.486	2.115	87.34%	25.396	22.182	3.214
2.997	9.810	10.484	2.417	86.19%	29.404	25.343	4.061
2.997	11.192	10.481	2.719	84.94%	33.547	28.495	5.052
2.997	12.629	10.478	3.020	83.61%	37.849	31.646	6.203

3.2 3.5V Efficiency Data

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Efficiency (%)	Pin (W)	Pout (W)	Losses (W)
3.496	1.030	10.487	0.307	89.32%	3.600	3.215	0.384
3.496	2.000	10.483	0.609	91.24%	6.992	6.380	0.612
3.496	2.975	10.482	0.909	91.61%	10.402	9.529	0.873
3.496	3.967	10.481	1.212	91.59%	13.868	12.702	1.167
3.496	4.974	10.480	1.513	91.22%	17.387	15.861	1.526
3.496	5.995	10.478	1.814	90.71%	20.957	19.009	1.948
3.496	7.034	10.478	2.117	90.20%	24.588	22.177	2.411
3.496	8.090	10.476	2.418	89.58%	28.280	25.335	2.946
3.495	9.166	10.475	2.720	88.92%	32.037	28.487	3.550
3.495	10.262	10.474	3.021	88.21%	35.866	31.639	4.228

3.3 5V Efficiency Data

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Efficiency (%)	Pin (W)	Pout (W)	Losses (W)
4.997	0.711	10.495	0.306	90.35%	3.555	3.212	0.343
4.997	1.393	10.490	0.608	91.58%	6.960	6.374	0.586
4.997	2.071	10.488	0.909	92.10%	10.349	9.531	0.817
4.997	2.748	10.487	1.211	92.51%	13.731	12.702	1.029
4.997	3.430	10.486	1.513	92.56%	17.141	15.865	1.276
4.997	4.119	10.486	1.814	92.41%	20.579	19.018	1.561
4.997	4.814	10.485	2.116	92.24%	24.052	22.187	1.865
4.996	5.513	10.484	2.418	92.02%	27.547	25.350	2.197
4.996	6.218	10.484	2.719	91.75%	31.069	28.507	2.562
4.996	6.931	10.483	3.021	91.46%	34.628	31.671	2.957

3.4 7V Efficiency Data

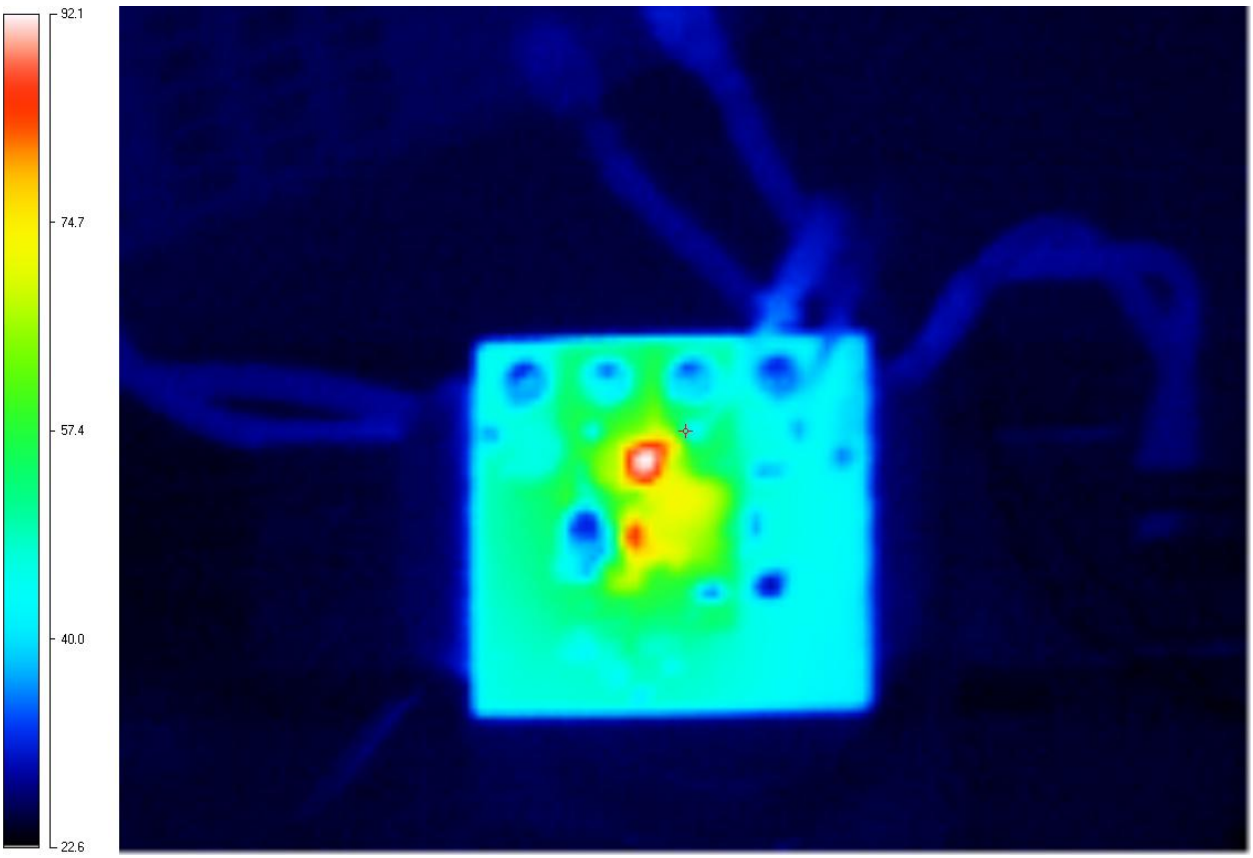
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Efficiency (%)	Pin (W)	Pout (W)	Losses (W)
6.996	0.505	10.517	0.306	91.30%	3.530	3.223	0.307
6.996	0.986	10.497	0.608	92.62%	6.896	6.387	0.509
6.996	1.467	10.495	0.909	92.91%	10.264	9.537	0.728
6.996	1.945	10.494	1.211	93.41%	13.609	12.713	0.897
6.996	2.425	10.494	1.512	93.55%	16.965	15.870	1.095
6.996	2.907	10.494	1.815	93.65%	20.336	19.045	1.291
6.996	3.389	10.493	2.117	93.68%	23.710	22.210	1.500
6.996	3.875	10.493	2.418	93.60%	27.111	25.374	1.736
6.996	4.362	10.492	2.719	93.49%	30.518	28.532	1.987
6.996	4.852	10.492	3.021	93.38%	33.945	31.697	2.248

3.5 Efficiency Data

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Efficiency (%)	Pin (W)	Pout (W)	Losses (W)
6.996	0.505	10.517	0.306	91.30%	3.530	3.223	0.307
6.996	0.986	10.497	0.608	92.62%	6.896	6.387	0.509
6.996	1.467	10.495	0.909	92.91%	10.264	9.537	0.728
6.996	1.945	10.494	1.211	93.41%	13.609	12.713	0.897
6.996	2.425	10.494	1.512	93.55%	16.965	15.870	1.095
6.996	2.907	10.494	1.815	93.65%	20.336	19.045	1.291
6.996	3.389	10.493	2.117	93.68%	23.710	22.210	1.500
6.996	3.875	10.493	2.418	93.60%	27.111	25.374	1.736
6.996	4.362	10.492	2.719	93.49%	30.518	28.532	1.987
6.996	4.852	10.492	3.021	93.38%	33.945	31.697	2.248

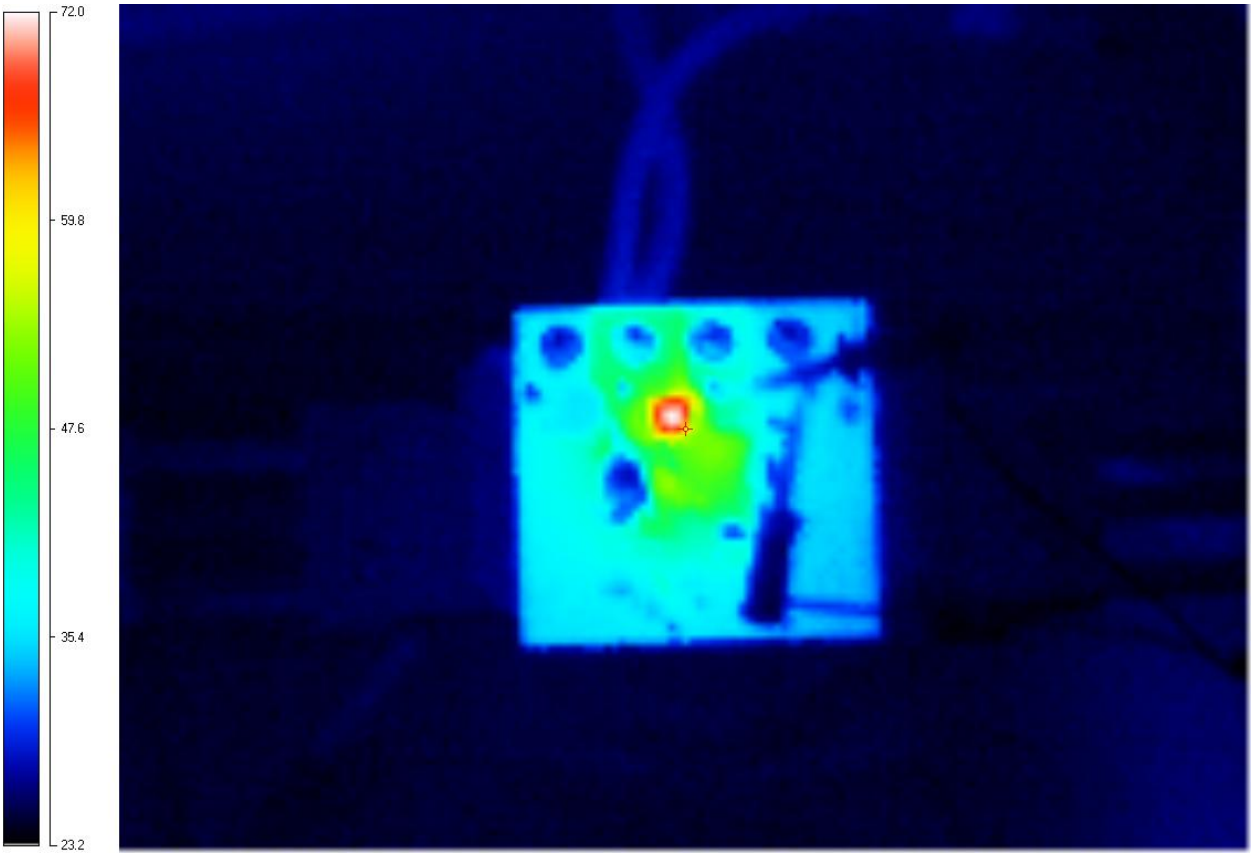
4. Thermal

4.1 Steady State Temperature 3.5V in, 10V out at a load of 3A.



The output diode (D1) is the warmest component on the PCB. The image displays a 70°C temperature rise.

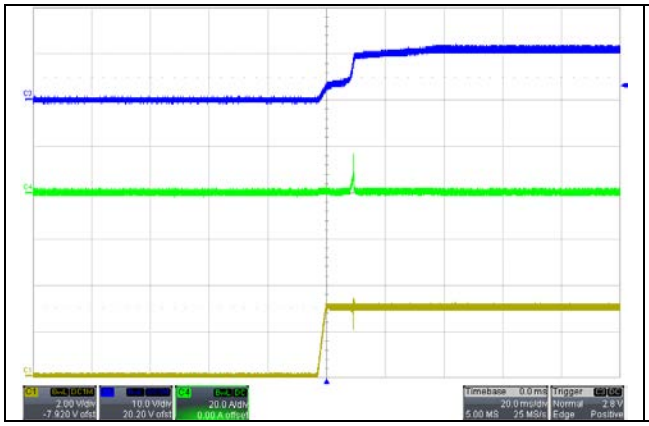
4.2 Steady State Temperature 6V in, 10V out at a load of 3A.



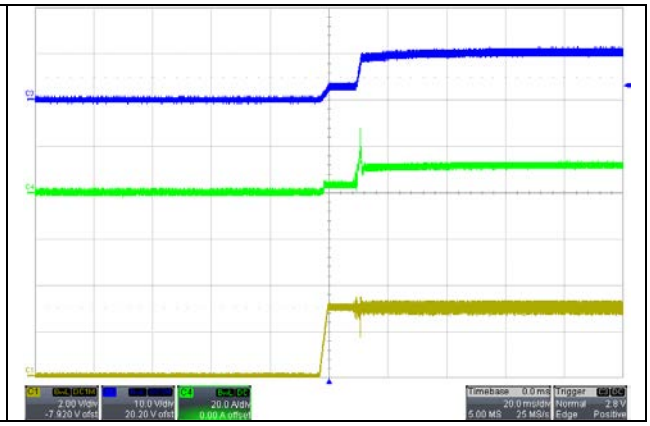
The output diode (D1) is the warmest component on the PCB The image displays a 49°C temperature rise.

5. Power Up

5.1 Power Up at 3.5V Input – No Load

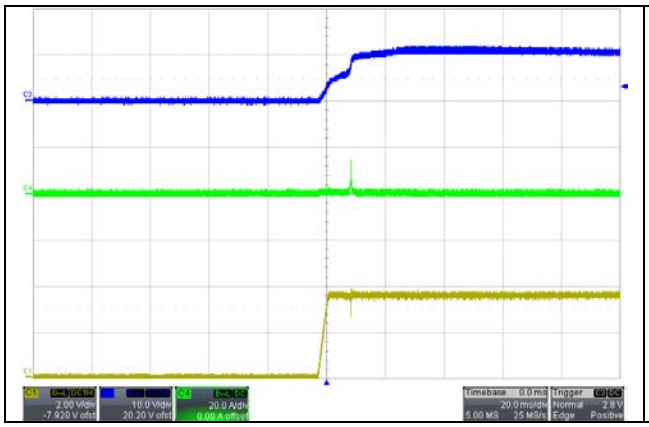


Power Up at 3.5V Input –3A Load

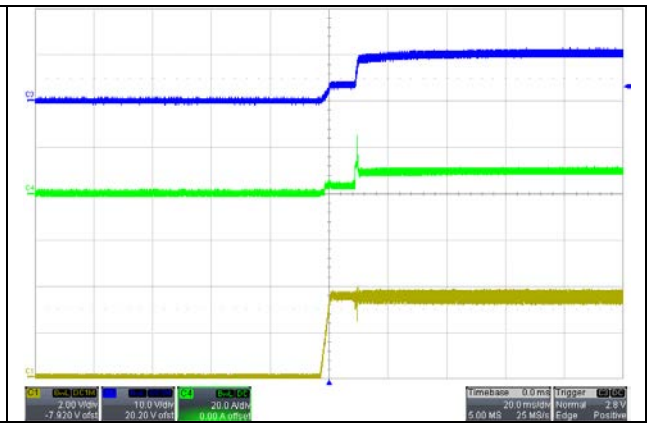


Channel 1 VIN
Channel 3 VOUT
Channel 4 IIN

5.2 Power Up at 4V Input – No Load



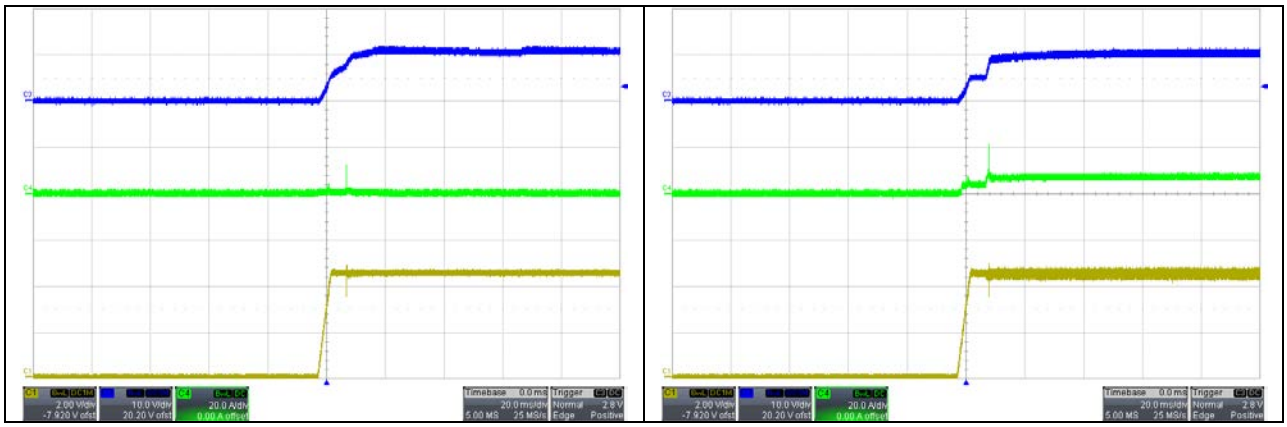
Power Up at 4V Input –3A Load



Channel 1 VIN
Channel 3 VOUT
Channel 4 IIN

5.3 Power Up at 4.5V Input – No Load

Power Up at 4.5V Input –3A Load



Channel 1 VIN
Channel 3 VOUT
Channel 4 IIN

6. Switching and Ripple

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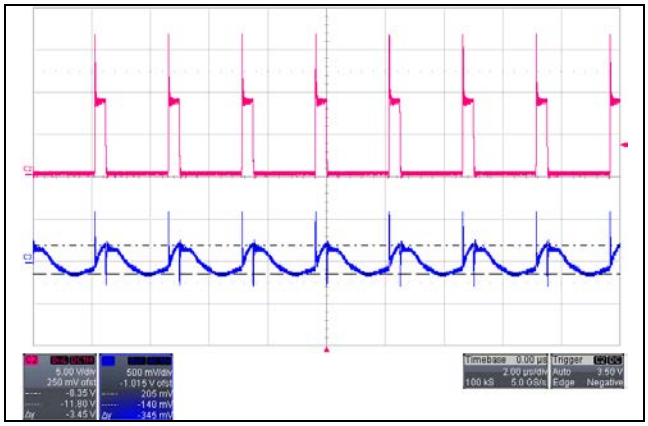
If need be more ceramics can be added to reduce output ripple

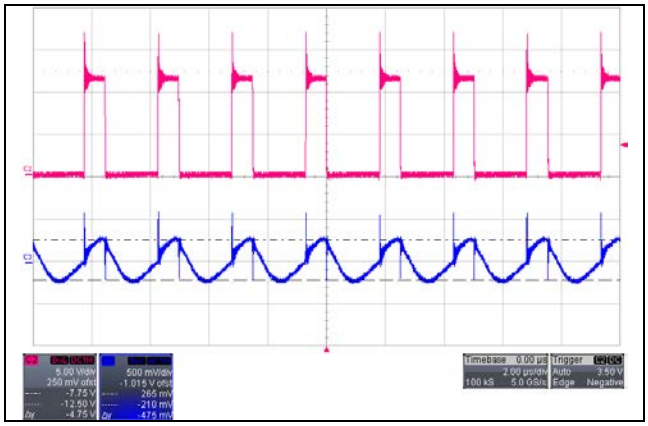
6.1 2 VIN @ 3A



The cursors indicate less than 345mV ripple.

Channel 2 VSW
Channel 3 $Vout_{Ripple}$

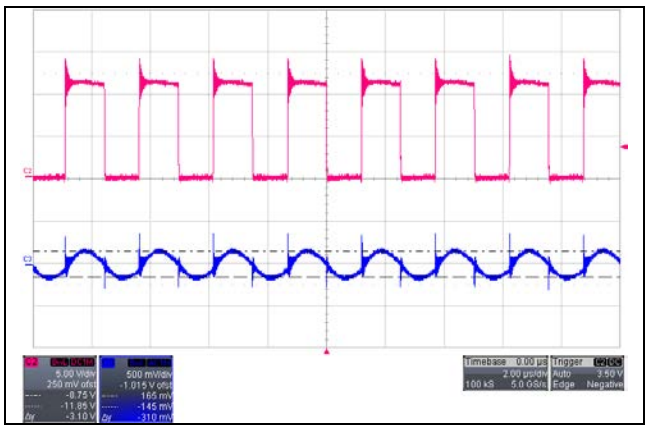
6.2 3.5VIN @ 3A



The cursors indicate less than 475mV ripple.

Channel 2 VSW
Channel 3 $Vout_{Ripple}$

6.3 6VIN @ 3A

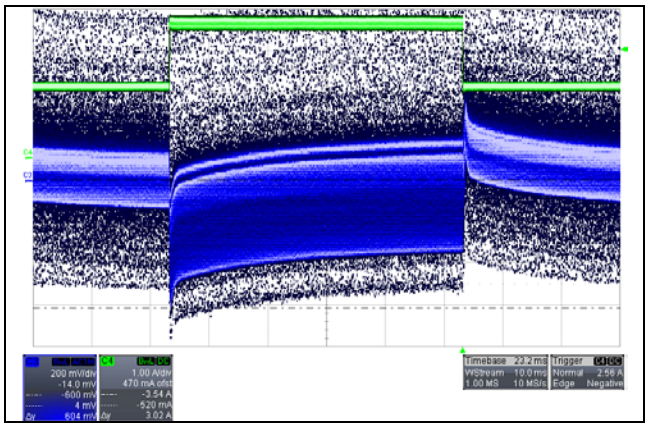


The cursors indicate less than 310mV ripple.

Channel 2 VSW
Channel 3 $Vout_{Ripple}$

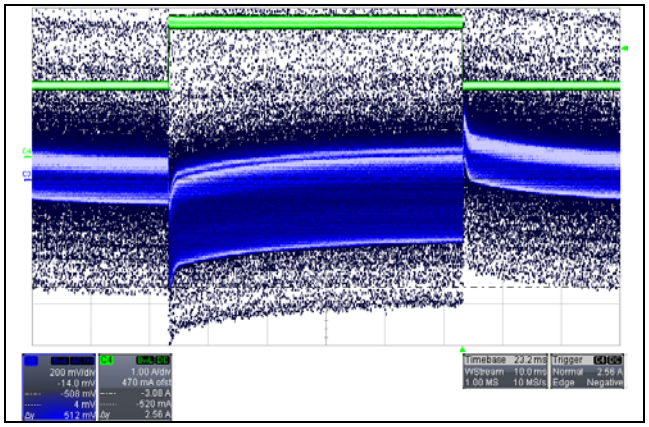
7. Transient Response

7.1 2V Input – 1.5A to 3A Step, 100mA/µs, 30 Hz



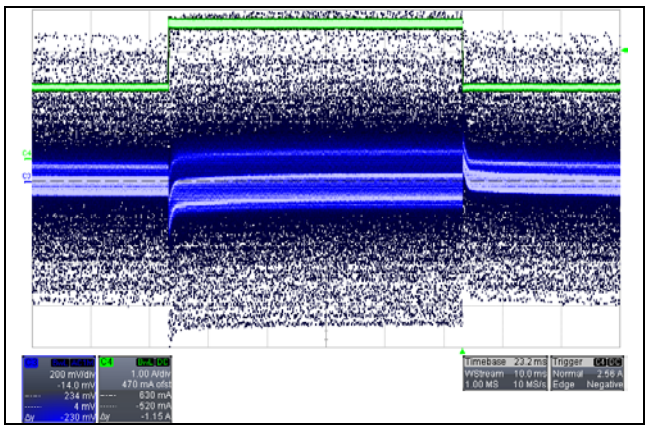
Cursors indicate ~604mV deviation across output capacitor.

7.2 3.5V Input – 1.5A to 3A Step, 100mA/µs, 30 Hz



Cursors indicate ~512mV deviation across output capacitor.

7.3 6V Input – 1.5A to 3A Step, 100mA/µs, 30 Hz

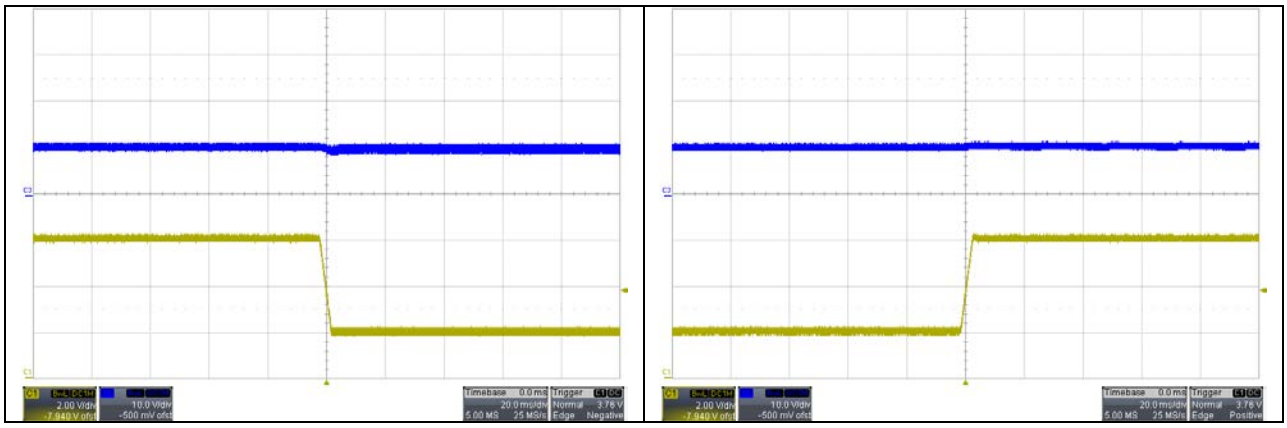


Cursors indicate ~230mV deviation across output capacitor.

8. Input Transient

An input step of 6V to 2V and back to 6V was applied to the input and the output was monitored.

8.1



Channel 1 VIN
Channel 3 VOUT

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