PMP10979 4-Phase Synchronous Buck Converter
Test Report
3/23/15

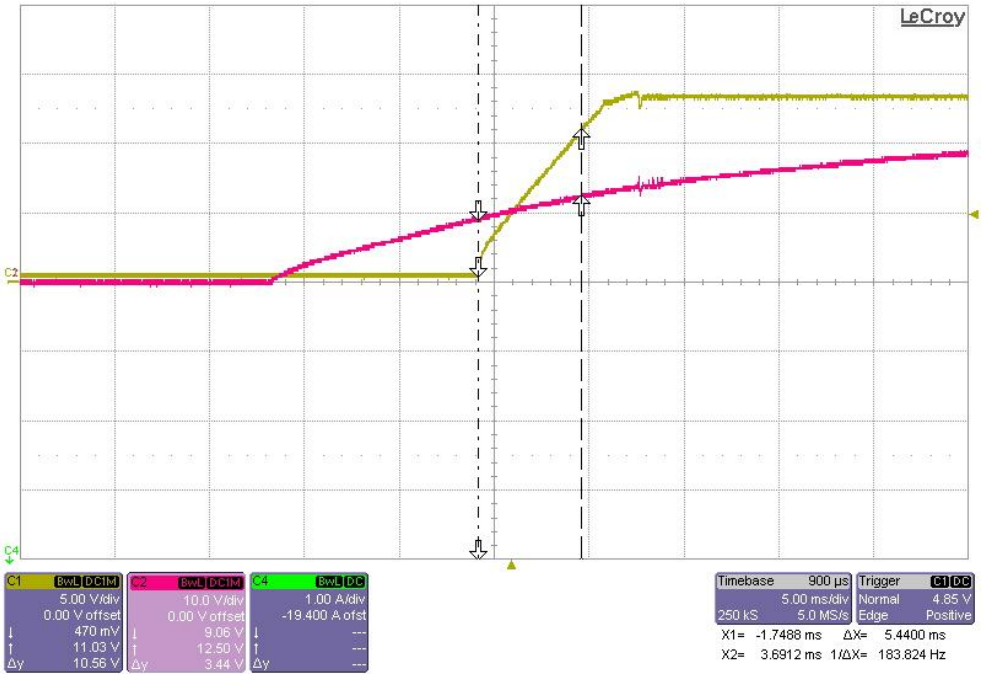
The tests performed were as follows:

A. LM5119(x2)
   1. Startup
   2. Shutdown
   3. Switch
   4. Output Voltage Ripple (No Load and Full Load)
   5. Transient Response (0A to 50A Load Step)
   6. Efficiency
   7. Load Regulation
   8. Board Photos
   9. Thermal Images

PMP10979 Test Results Rev. A

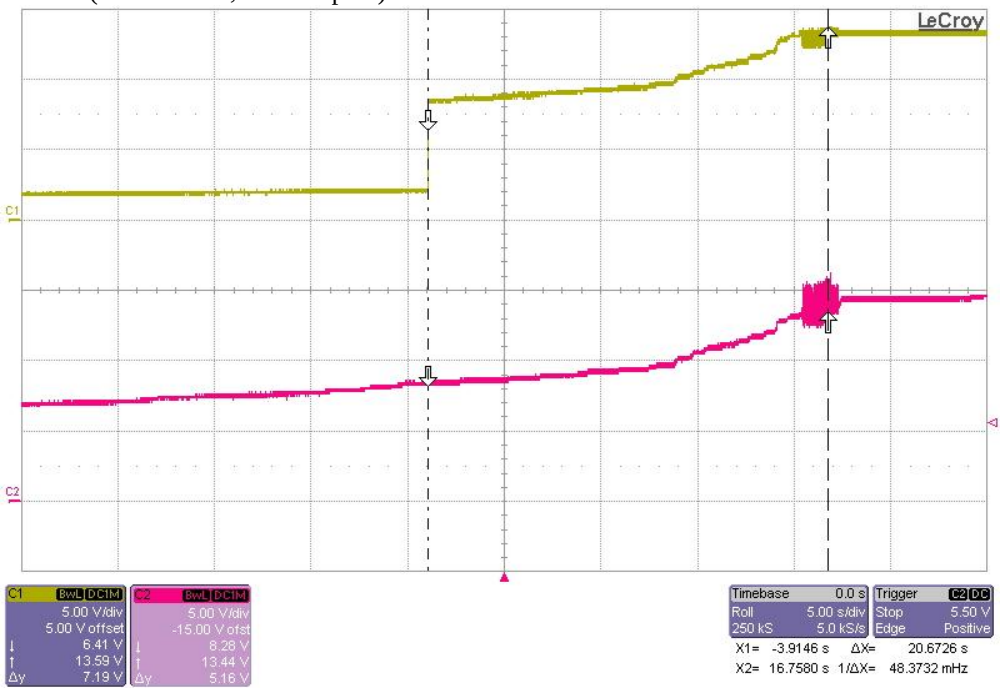
1 Startup

The photos below show the startup waveforms. The input voltage is varied from 0-19V and the output is not loaded.
Channel 1 – Yellow: Vout (13.5V) – (5V/Division; DC Coupled) (5msec/div)
Channel 2 – Pink: Vin–(5V/Division; DC Coupled)



13.5V Output showing rise time from 0V-11V is less than 20msec

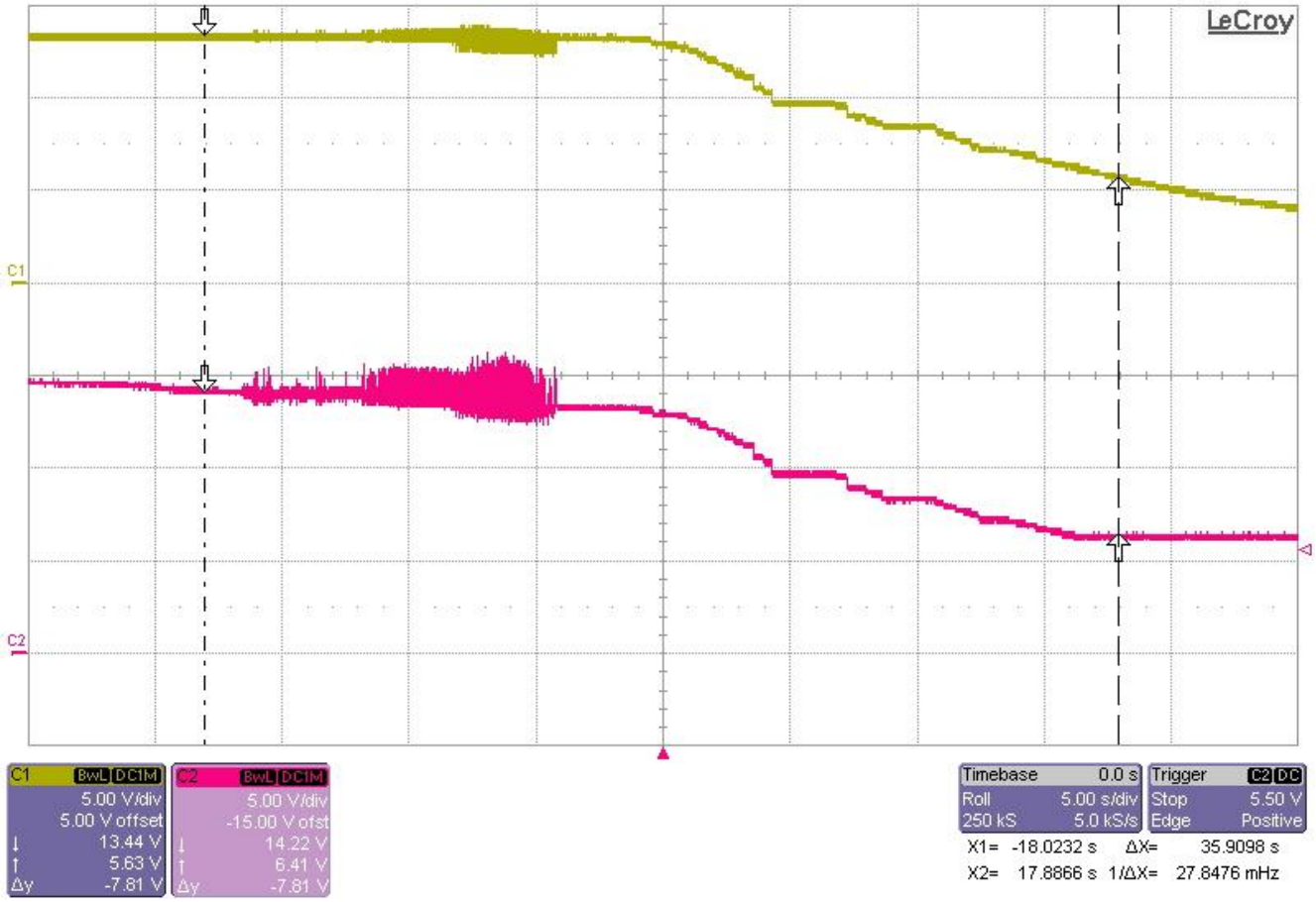
Channel 1 – Yellow: Vout (13.5V) – (5V/Division; DC Coupled) (5msec/div)
Channel 2 – Pink: Vin–(5V/Division; DC Coupled)



13.5V Output showing Vout rising with Vin.

2 Shutdown

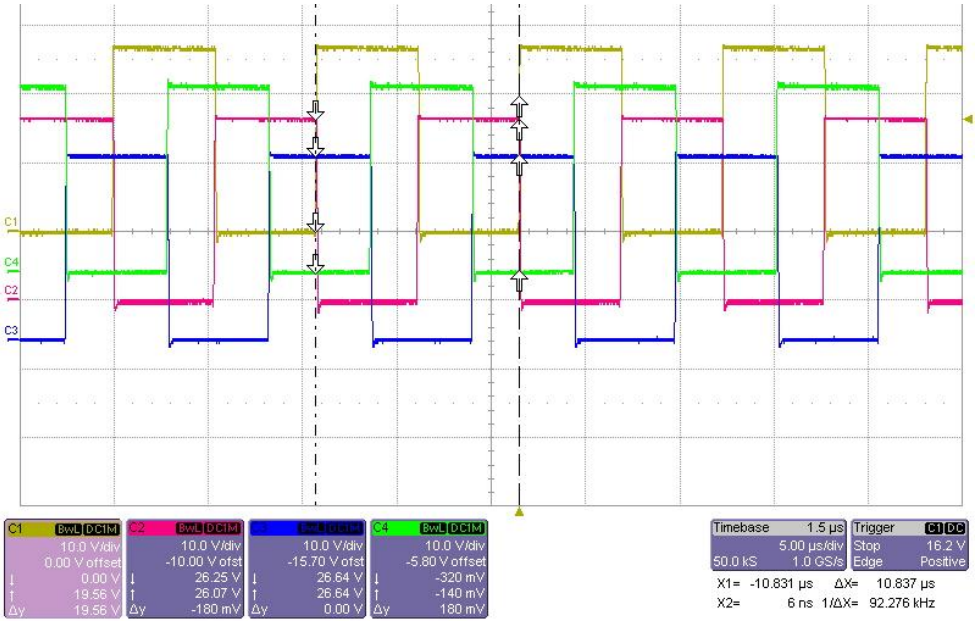
The photos below show the Shutdown waveforms. The input voltage is decreased from 15V to 0V and the output is not loaded.
Channel 1 – Yellow: Vout (13.5V) – (5V/Division; DC Coupled) (5sec/div)
Channel 2 – Pink: Vin–(5V/Division; DC Coupled)



13.5V Output showing Vout decreasing with Vin.

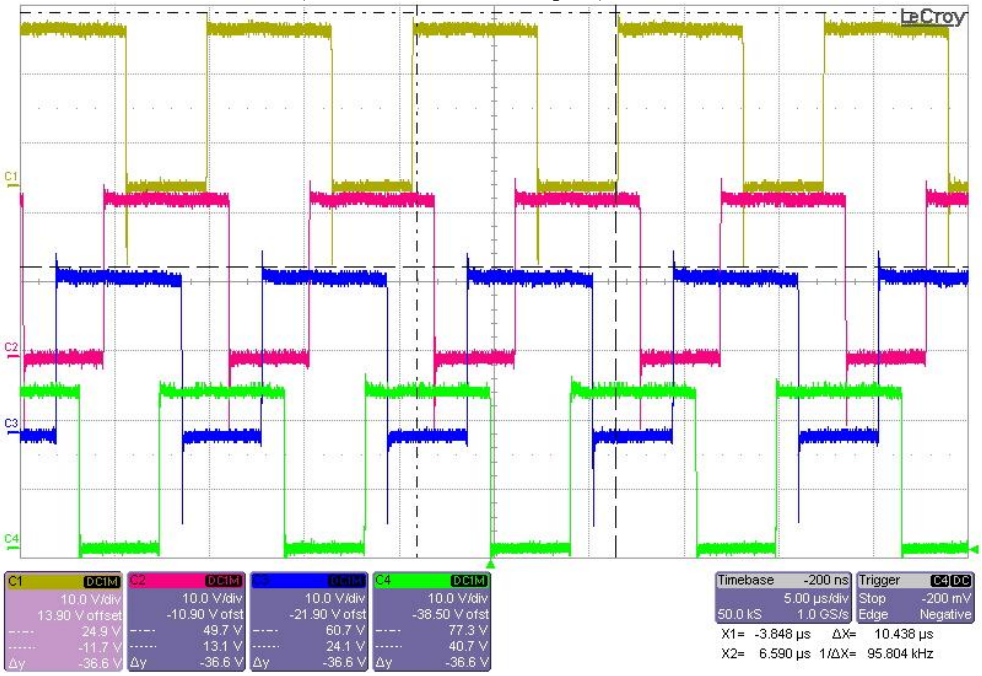
3 Switch Node

The pictures below show the switching waveform for the converter at full load. The input voltage is 26V.
Channel 1 – Yellow: Switch Node Phase 1 – (10V/Division; DC Coupled) (5usec/div)
Channel 2 – Pink: Switch Node Phase 2 – (10V/Division; DC Coupled)
Channel 3 – Blue: Switch Node Phase 3 – (10V/Division; DC Coupled)
Channel 4 – Green: Switch Node Phase 4 – (10V/Division; DC Coupled)



4Phase operation; 90 deg phase shift at 50% DC; F_{sw} = ~100KHz

Channel 1 – Yellow: Switch Node Phase 1 – (10V/Division; DC Coupled) (5usec/div)
Channel 2 – Pink: Switch Node Phase 2 – (10V/Division; DC Coupled)
Channel 3 – Blue: Switch Node Phase 3 – (10V/Division; DC Coupled)
Channel 4 – Green: Switch Node Phase 4 – (10V/Division; DC Coupled)

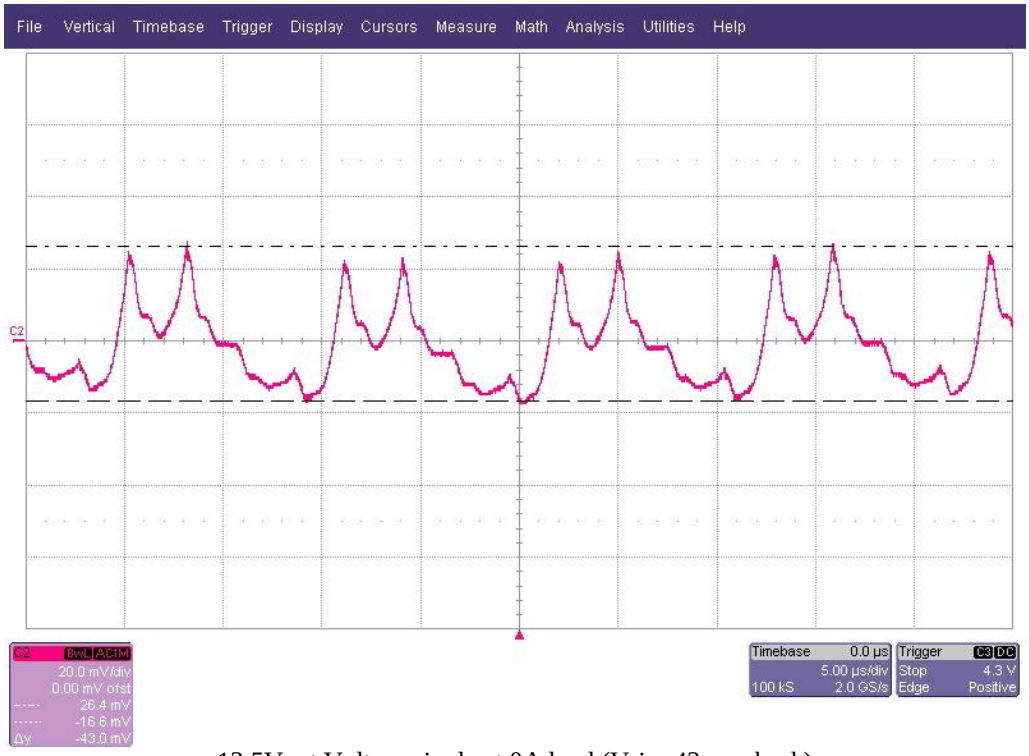


Full BW showing 36.6V pk to pk Vsw. 24Vin

4 Output Voltage Ripple

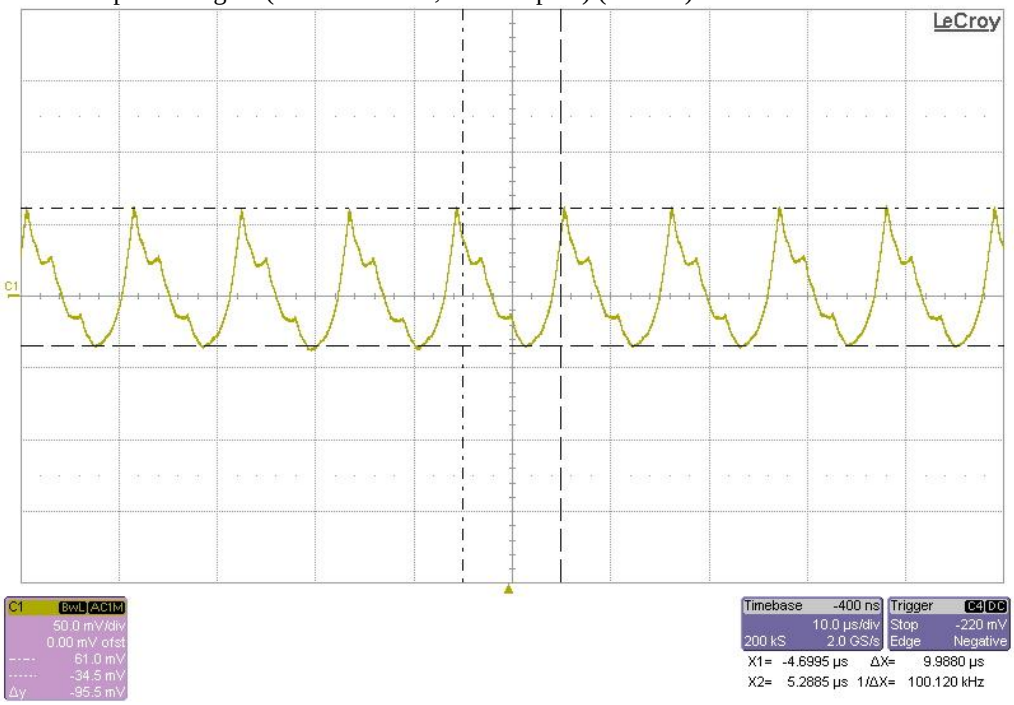
The output voltage ripple of the converter is shown in the figures below. The input voltage is 24V. The time-base is set to

Channel 2 – Pink: Output Voltage – (20mv/Division; AC Coupled) (5us/div)



13.5Vout Voltage ripple at 0A load (Vrip=43mv pk-pk)

Channel 1 – Yellow: Output Voltage – (50mv/Division; AC Coupled) (5us/div)



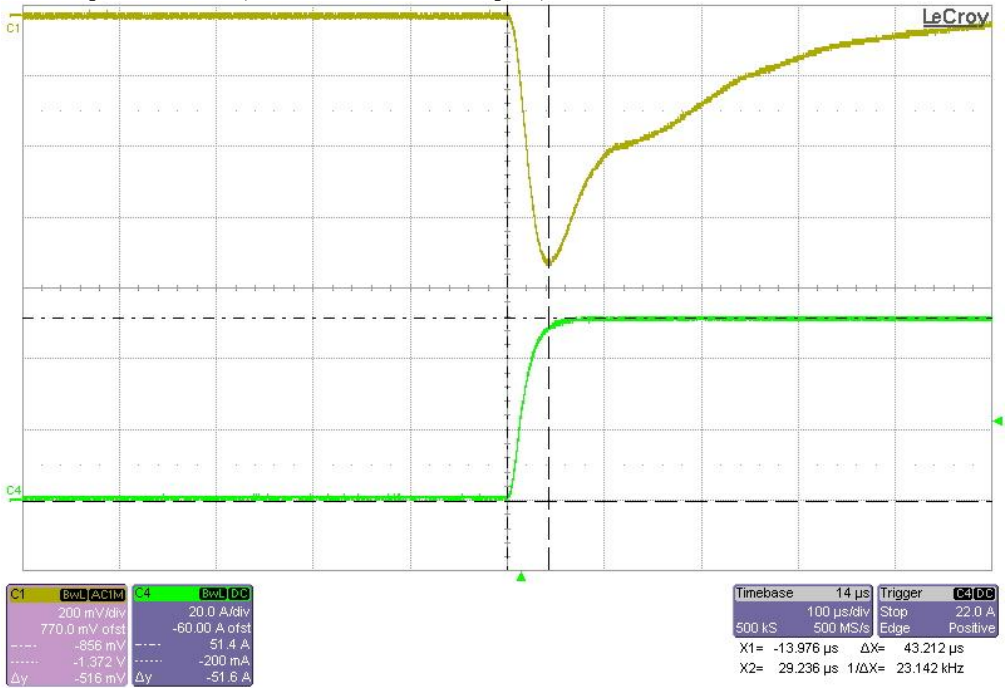
13.5Vout Voltage ripple at 95A load (Vrip=95.5mv pk-pk)

5 Transient Response

The transient response of the converter is shown in the figures below. The input voltage is 24V. The load is stepped from 0A to 50A.

Channel 1 – Yellow: Output Voltage (AC Coupled) (100us/div)

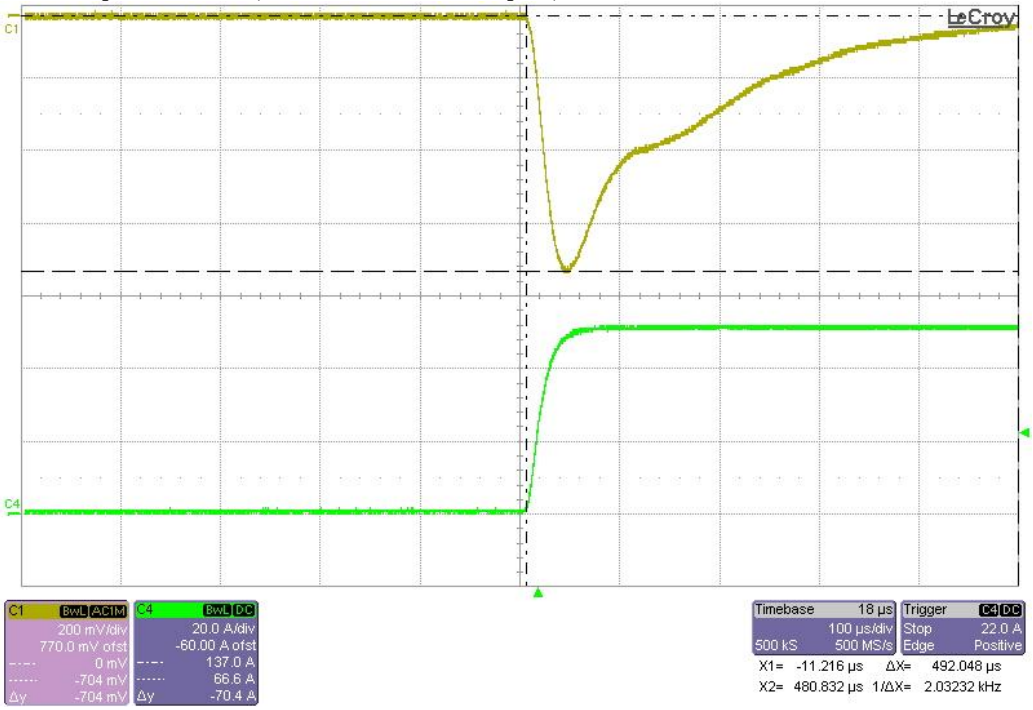
Channel 4 – green: Output Current – (20A/Division; DC Coupled)



13.5Vout transient response showing 0A-50A load step

Channel 1 – Yellow: Output Voltage (AC Coupled) (100us/div)

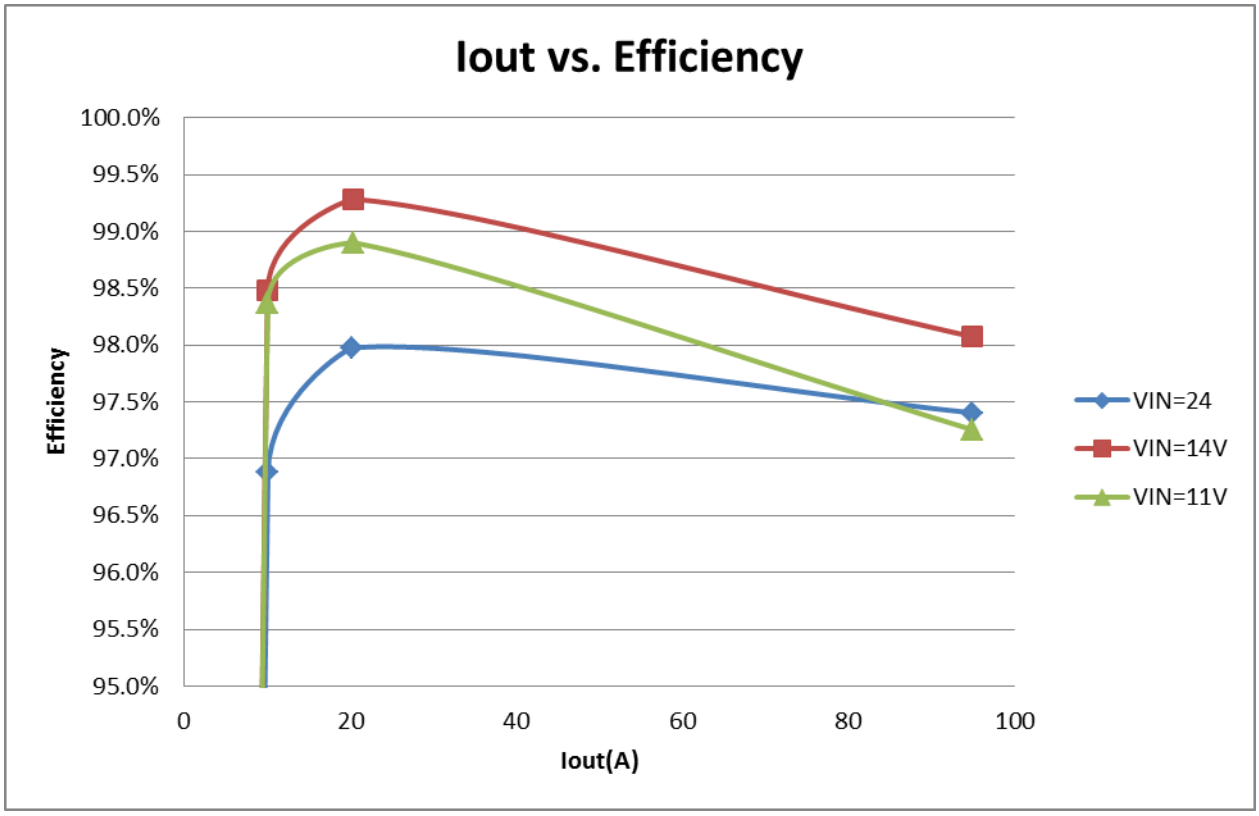
Channel 4 – green: Output Current – (20A/Division; DC Coupled)



13.5Vout transient response showing 704 mV spike for a 50A load step.

6 Efficiency

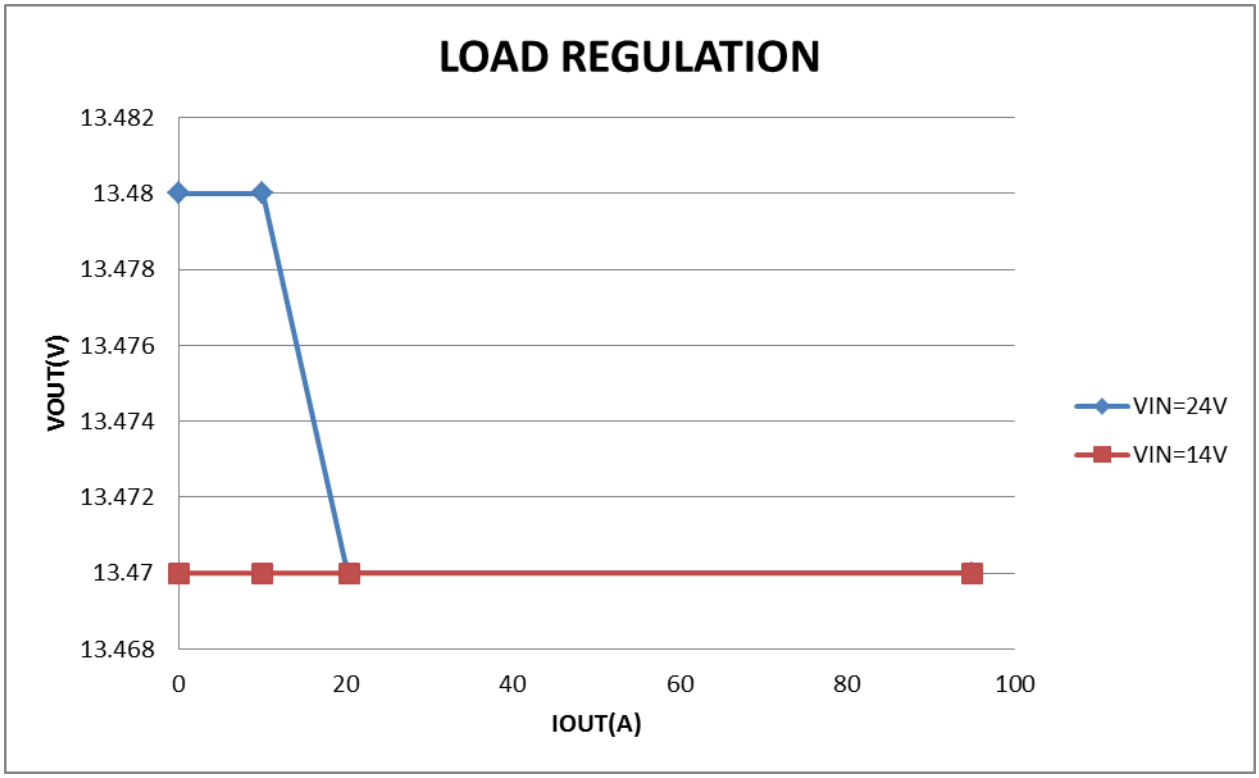
The efficiency of the board at its two outputs is shown in the figures below.



Vin(V)	Iin(A)	Vout(V)	Iout(A)	Eff(%)
23.99	0.15	13.48	0	0.00%
23.9	5.88	13.48	10.1	96.88%
23.76	11.70	13.47	20.22	97.97%
23.15	56.75	13.47	95	97.40%
14.5	0.1	13.47	0	0.00%
14.5	9.49	13.47	10.06	98.47%
14.1	19.61	13.47	20.38	99.28%
14.26	91.5	13.47	95	98.07%
11	0.1	10.82	0	0.00%
11	9.92	10.67	10.06	98.36%
10.65	19.91	10.29	20.38	98.90%
11.04	92.55	10.46	95	97.25%

7 Load Regulation – (LM5119)

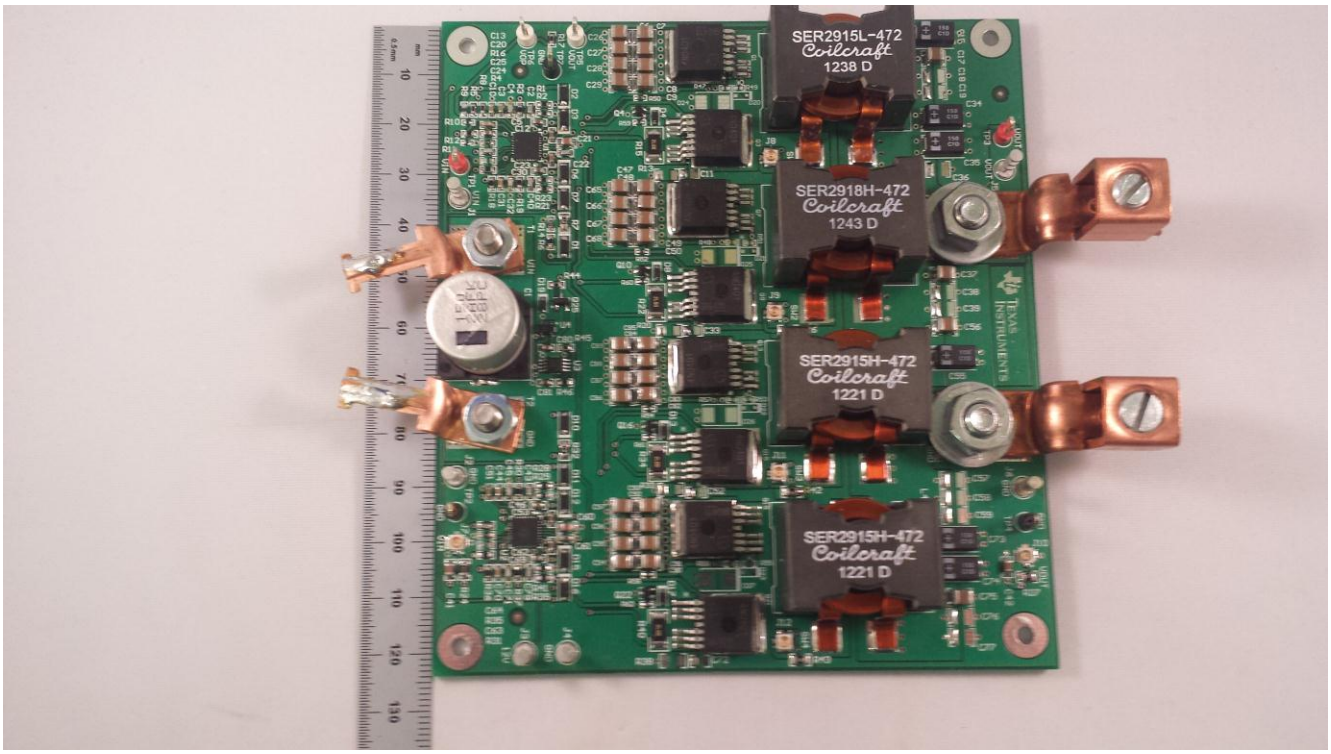
The load regulation of the board measured at both of the outputs with a 24V input is shown below.



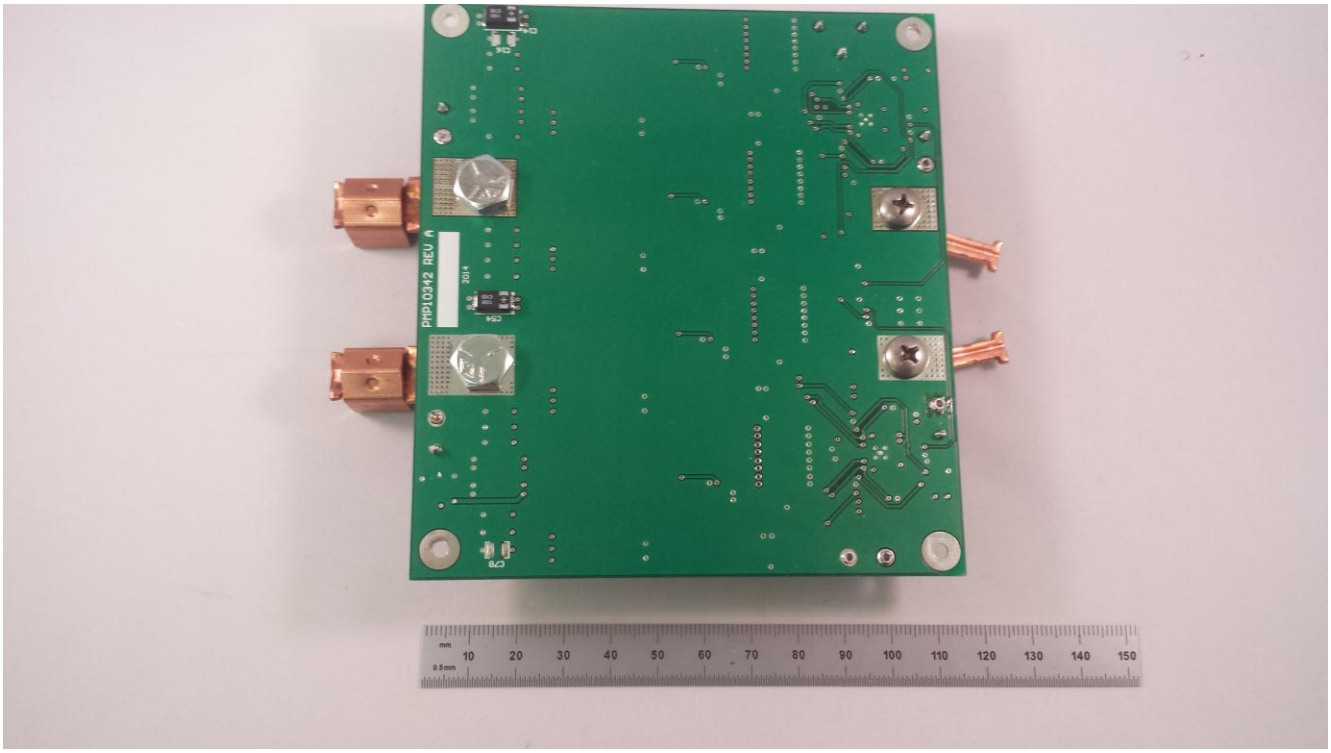
Vin	Vout	Iout
23.99	13.48	0
23.9	13.48	10.1
23.76	13.47	20.22
23.15	13.47	95
14.5	13.47	0
14.5	13.47	10.06
14.1	13.47	20.38
14.26	13.47	95

8 Board Photo

The photos below show the PMP10979 board that is used.



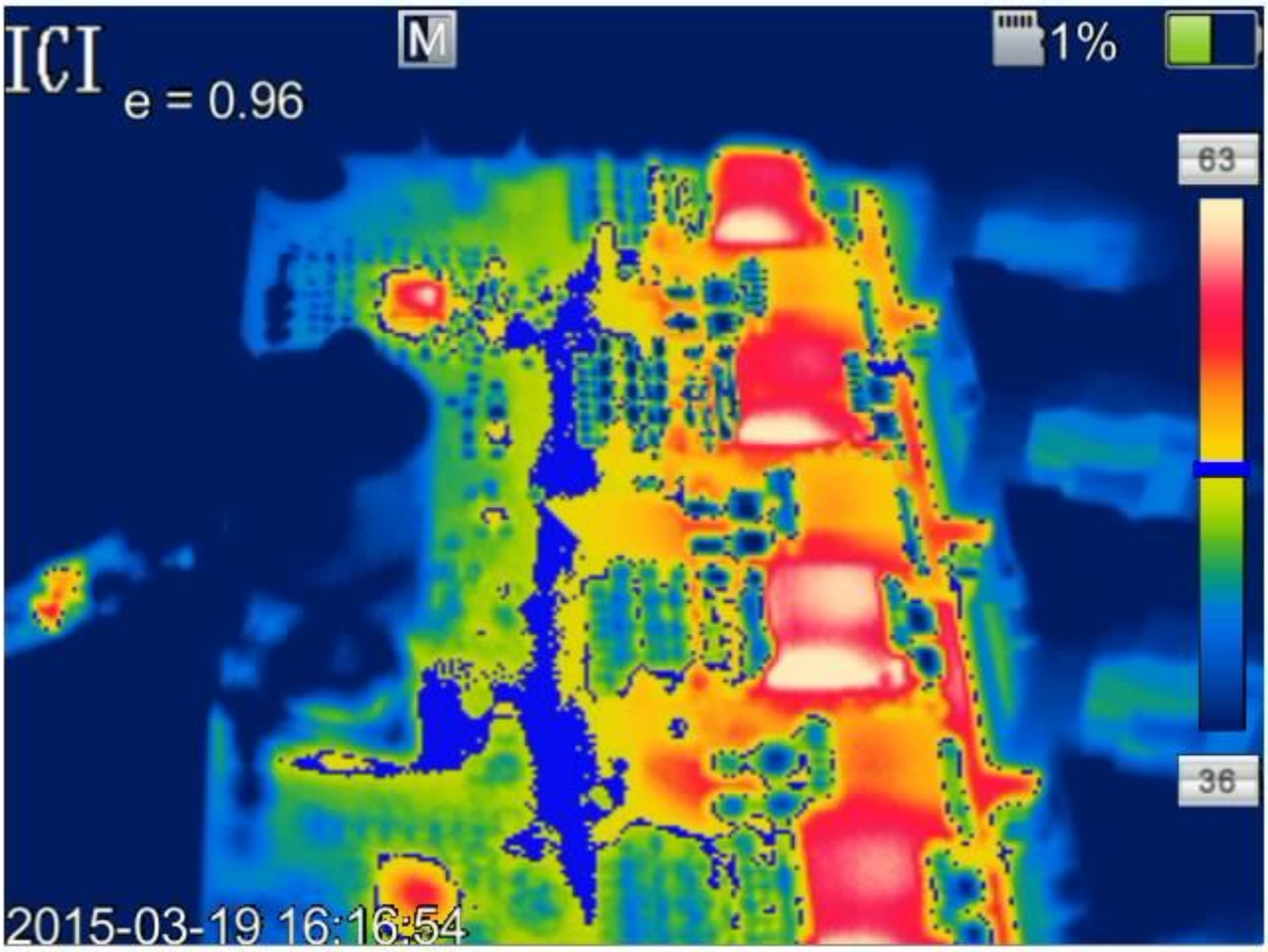
Top Side



Bottom Side

9 Thermal Images

The images below show the thermal performance of the design.



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