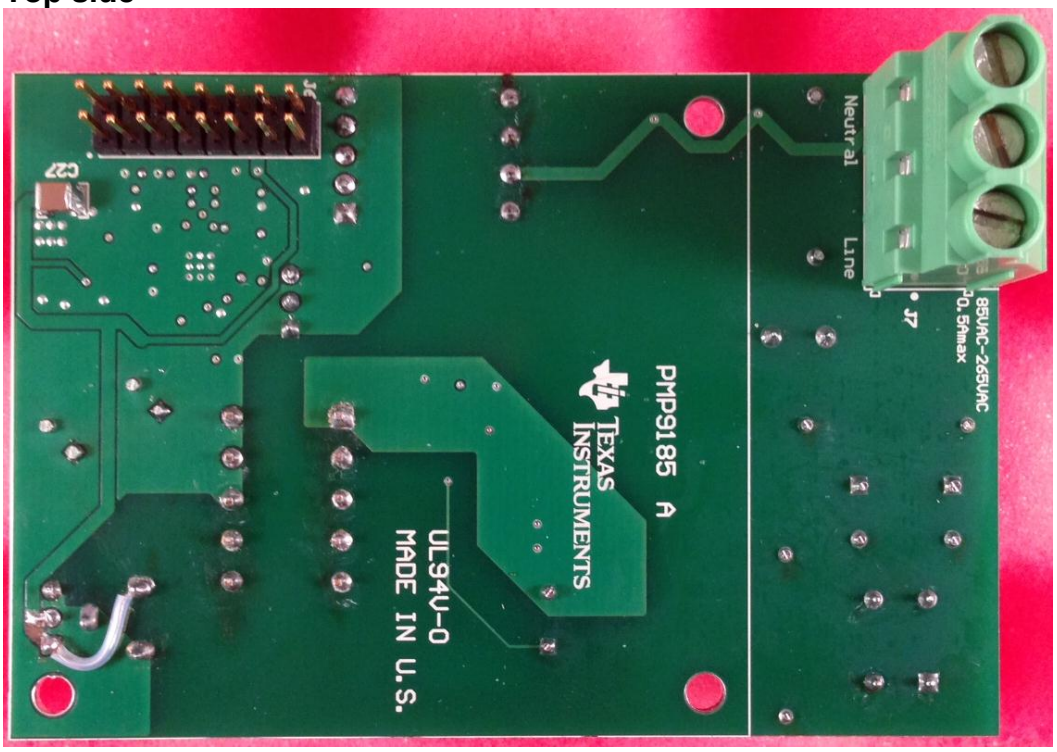
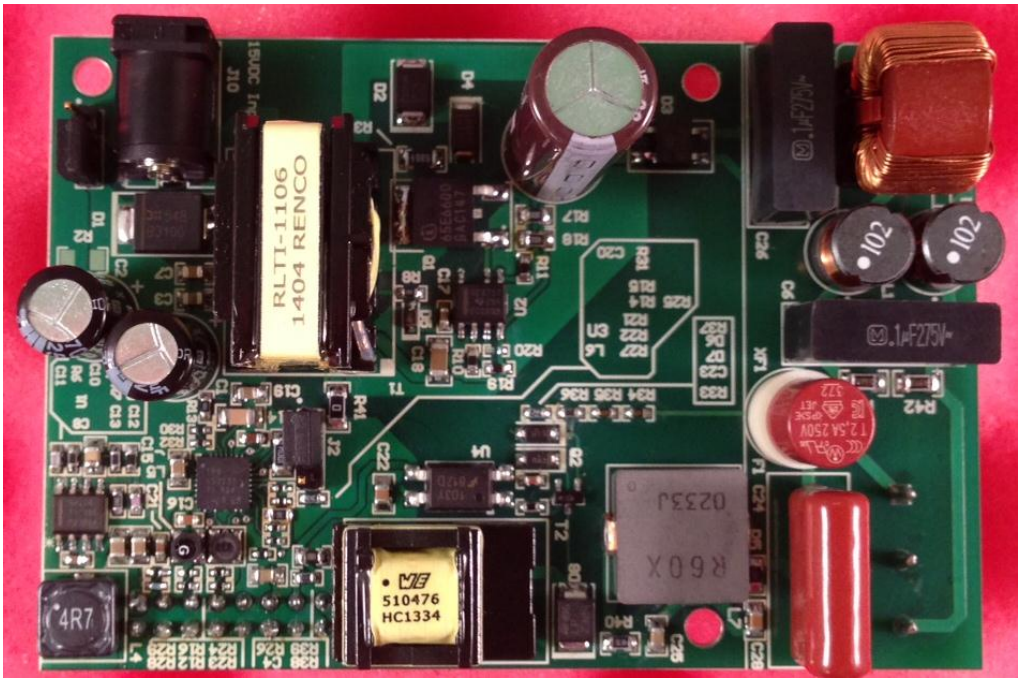
1 Photo

The photographs below show the PMP9185 Rev A assembly. This circuit was built on a PMP9185 Rev A PCB.

Top side



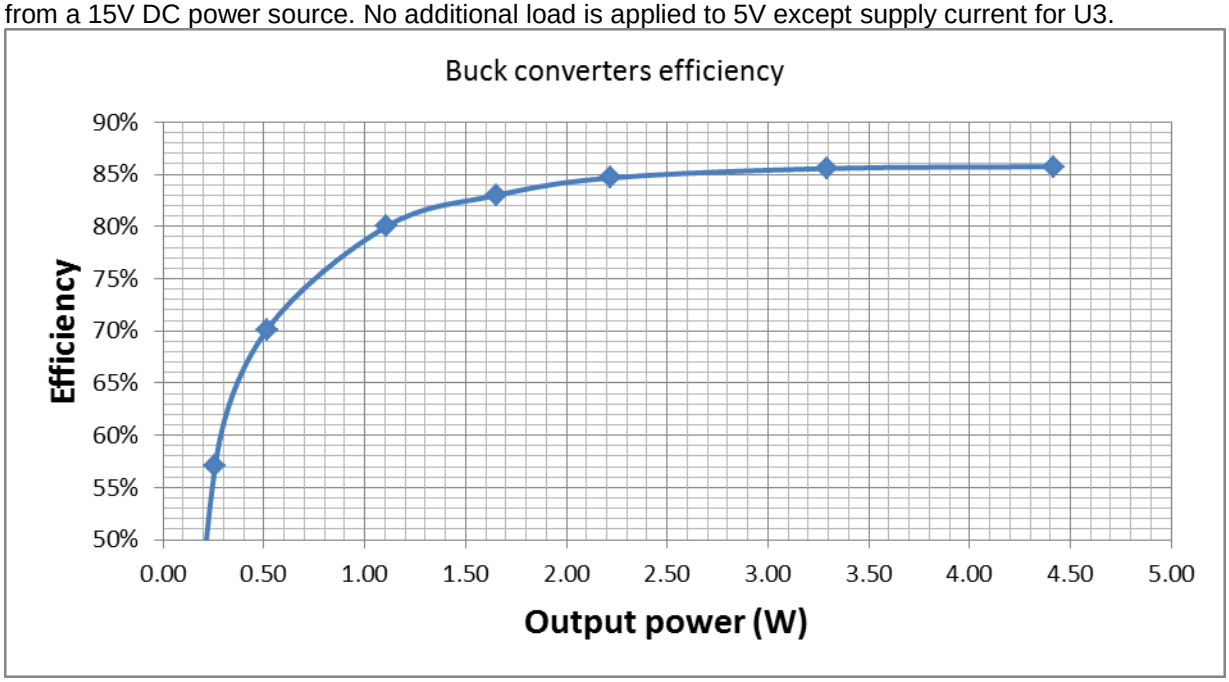
Bottom side



*. All tests are performed with J2 pin 1 and 2 shorted.

2 Buck Converters Efficiency

The efficiency data is shown in the tables and graph below. The buck converter controller U1 is supplied from a 15V DC power source. No additional load is applied to 5V except supply current for U3.

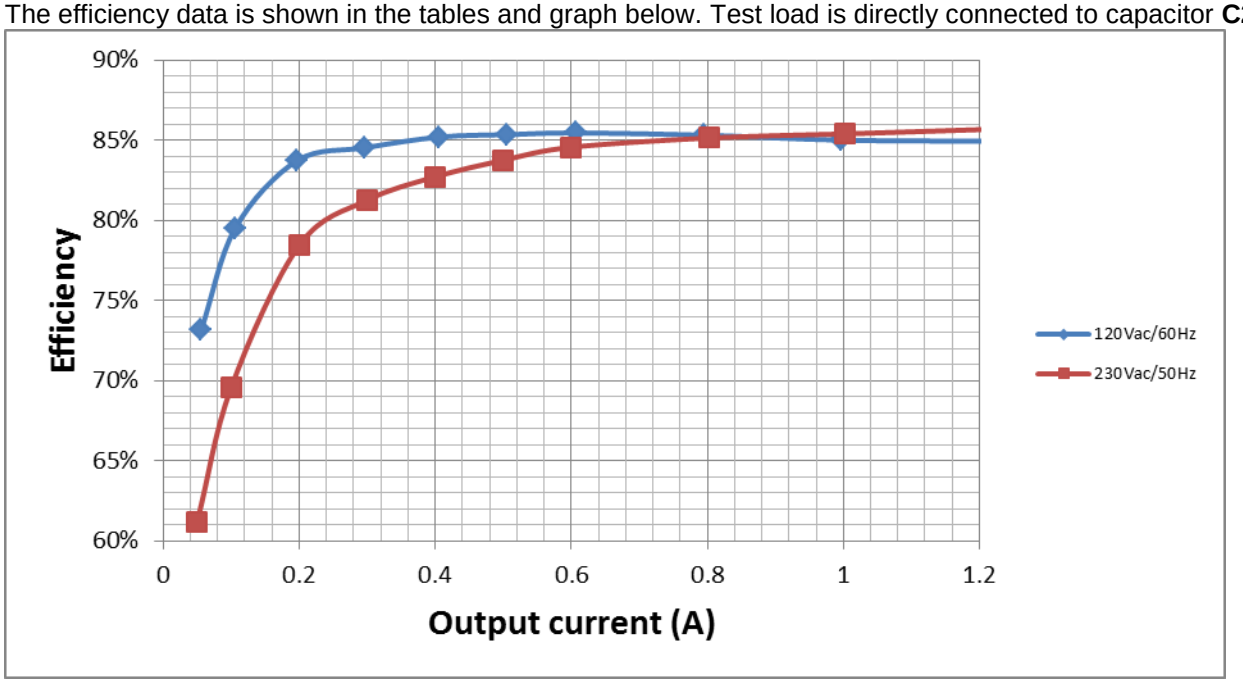


Vin(V)	Iin(mA)	Pin(W)	Vo1(V)	Io1(A)	Vo2(V)	Io2(mA)	Vo3(V)	Io3(A)	Vo4(V)	Io4(A)	Pout(W)	Eff.(%)
14.99	0.34	5.15	1.20	0.80	1.81	50.12	3.29	0.20	4.97	0.55	4.42	85.75%
15.06	0.26	3.85	1.20	0.60	1.81	37.50	3.28	0.15	4.97	0.40	3.29	85.57%
15.00	0.17	2.62	1.20	0.40	1.81	24.91	3.28	0.10	4.97	0.27	2.22	84.66%
15.09	0.13	1.99	1.20	0.30	1.81	19.97	3.30	0.07	4.97	0.20	1.65	82.99%
15.05	0.09	1.38	1.20	0.20	1.80	12.47	3.31	0.05	4.97	0.14	1.11	80.03%
15.03	0.05	0.73	1.21	0.10	1.80	6.01	3.33	0.03	4.97	0.06	0.51	70.10%
15.08	0.03	0.45	1.22	0.05	1.80	3.01	3.33	0.01	4.97	0.03	0.26	57.02%
15.11	0.01	0.17	1.22	0.00	1.80	0.00	3.31	0.00	4.97	0.00	0.00	0.00%

*. All tests are performed with J2 pin 1 and 2 shorted.

3 Flyback Converter Efficiency

The efficiency data is shown in the tables and graph below. Test load is directly connected to capacitor **C2**.



V_{in}=120V_{AC}/60Hz

Vin(V)	Iin(mA)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Losses(W)	Efficiency (%)
120.04	328.6	21.44	15.1	1.206	18.2106	3.2294	84.94%
120.11	275.5	17.657	15.07	0.996	15.00972	2.64728	85.01%
120.16	222.9	14.042	15.05	0.796	11.9798	2.0622	85.31%
120.2	172.04	10.659	15.03	0.606	9.10818	1.55082	85.45%
120.23	145.71	8.911	15.03	0.506	7.60518	1.30582	85.35%
120.27	119.72	7.153	15.01	0.406	6.09406	1.05894	85.20%
120.31	92.45	5.27	15	0.297	4.455	0.815	84.54%
120.34	67.18	3.527	14.99	0.197	2.95303	0.57397	83.73%
120.38	46.56	1.998	14.99	0.106	1.58894	0.40906	79.53%
120.38	36.13	1.147	14.99	0.056	0.83944	0.30756	73.19%
120.41	29.04	0.08716	17.28	0	0	0.08716	0.00%

*. All tests are performed with J2 pin 1 and 2 shorted.

V_{in}=230V_{AC}/50Hz

Vin(V)	Iin(mA)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Losses(W)	Efficiency (%)
230	202.5	21.16	15.08	1.202	18.12616	3.03384	85.66%
230	171.79	17.671	15.06	1.002	15.09012	2.58088	85.39%
230	141.25	14.177	15.05	0.802	12.0701	2.1069	85.14%
230.1	111.86	10.657	15.02	0.6	9.012	1.645	84.56%
230.1	98.27	8.961	15.01	0.5	7.505	1.456	83.75%
230.1	84.89	7.253	15	0.4	6	1.253	82.72%
230.1	71.85	5.534	14.99	0.3	4.497	1.037	81.26%
230.1	60.9	3.819	14.98	0.2	2.996	0.823	78.45%
230.2	51.4	2.151	14.97	0.1	1.497	0.654	69.60%
230.2	47.83	1.223	14.97	0.05	0.7485	0.4745	61.20%
230.2	46.21	0.3034	17.23	0	0	0.3034	0.00%

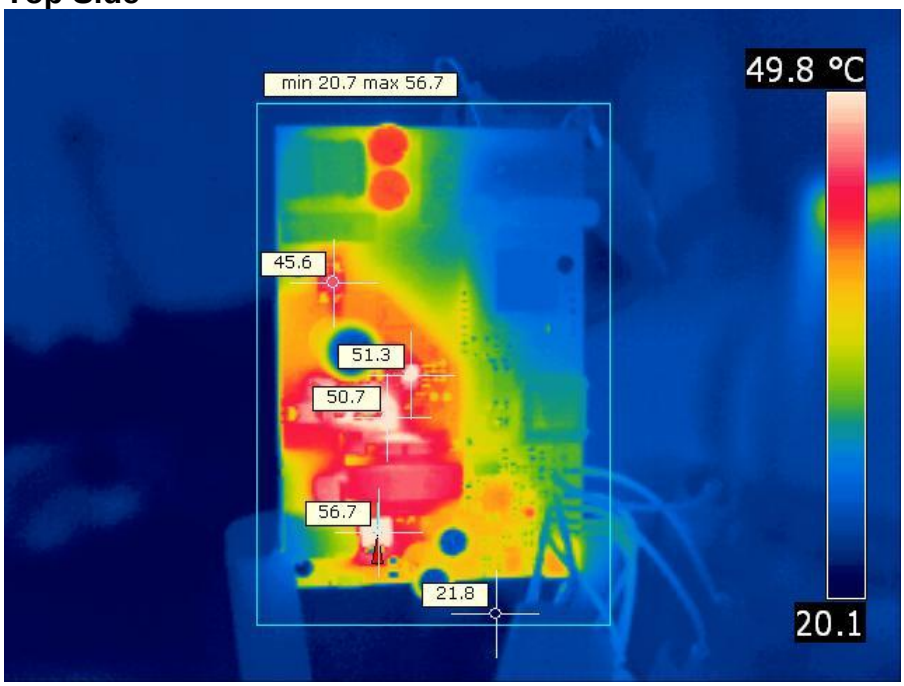
*. All tests are performed with J2 pin 1 and 2 shorted.

4 Thermal Images

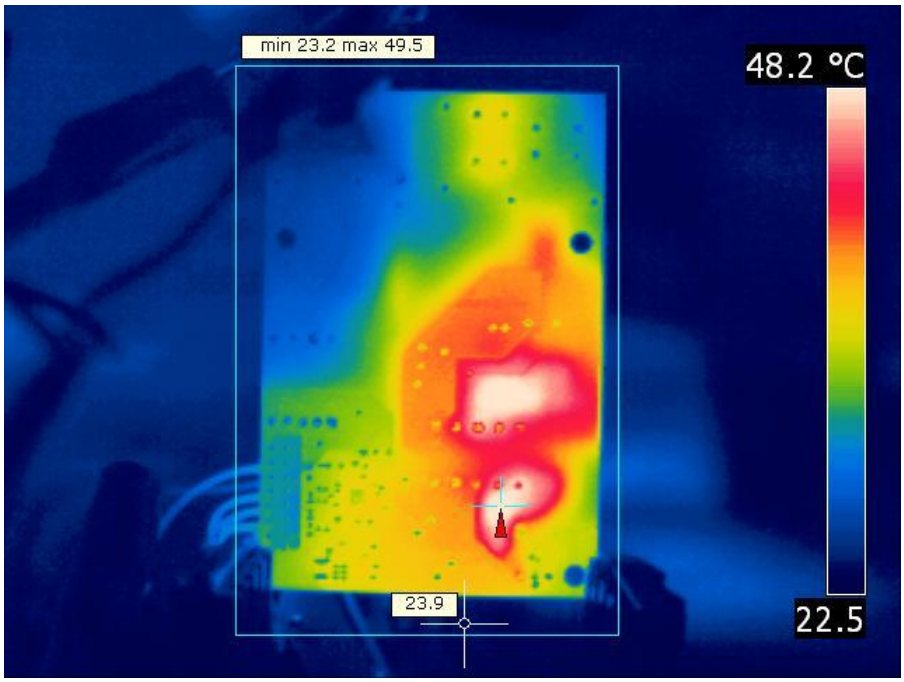
The thermal images below show a top view and bottom view of the board. The ambient temperature was 20ºC with no forced air flow. The outputs were at full load: 15V/0.6A, 5V/0.55A, 3.3V/0.2A, 1.8V/0.05A, 1.2V/0.8A.

V_{in}=120V_{AC}/60Hz

Top Side

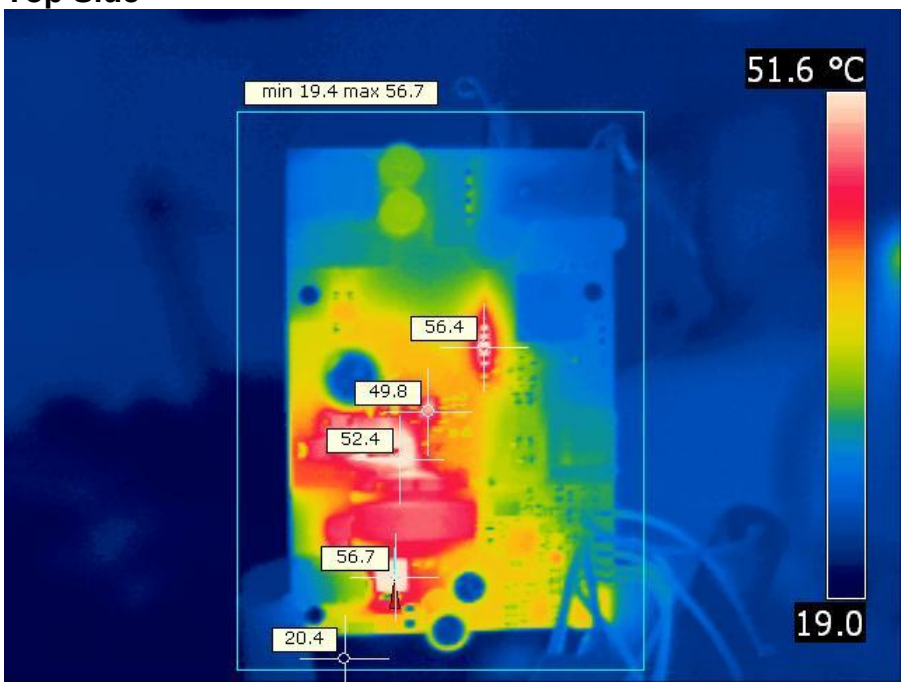


Bottom Side

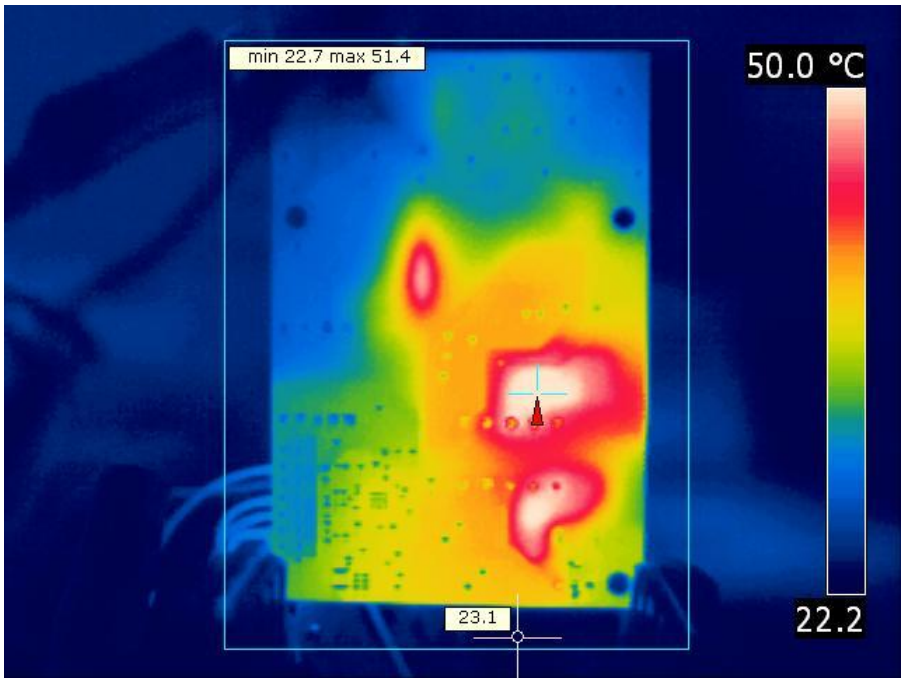


*. All tests are performed with J2 pin 1 and 2 shorted.

V_{in}=230V_{AC}/50Hz
Top Side



Bottom Side



*. All tests are performed with J2 pin 1 and 2 shorted.

5 Startup

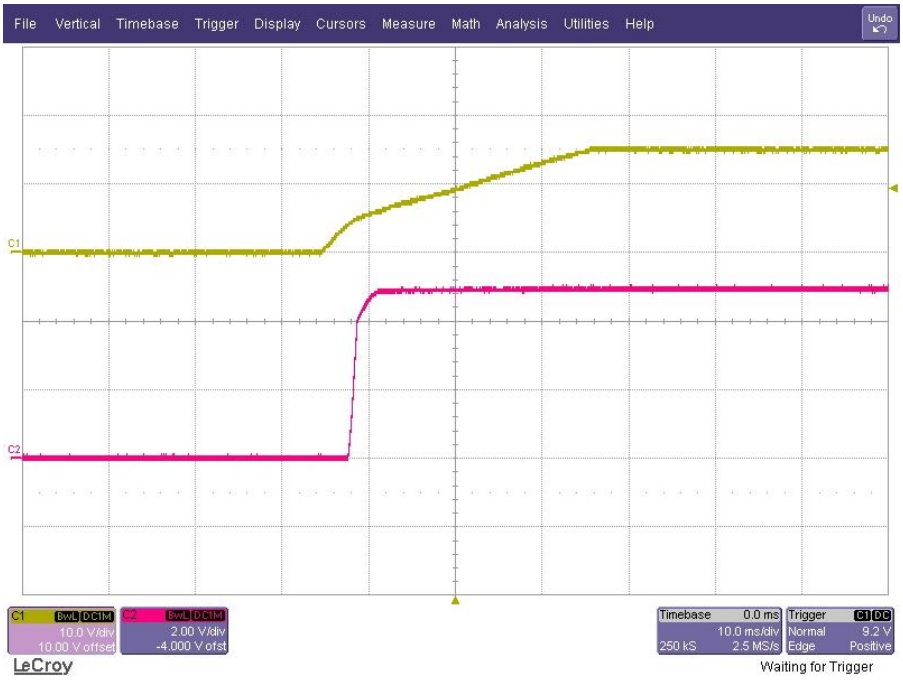
The output voltages at startup are shown in the images below with 15V/0.6A, 5V/0.55A, 3.3V/0.2A, 1.8V/0.05A, 1.2V/0.8A loads.

5.1 120V_{ac}/60Hz: CH1: 15V output, CH2: 5V output

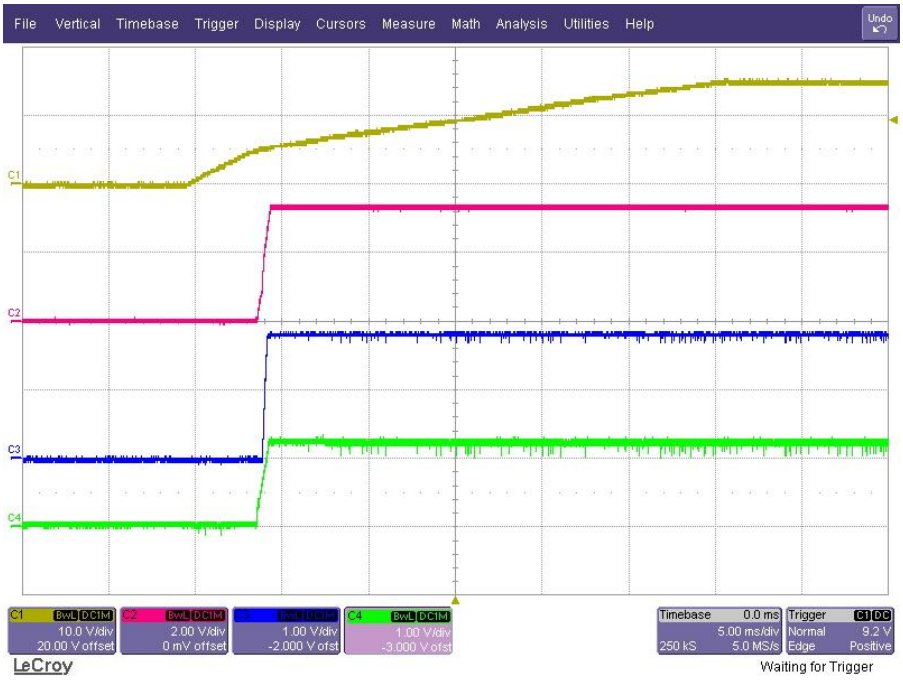
5.2 120V_{ac}/60Hz: CH1: 15V_{out}, CH2: 3.3V_{out}, CH3: 1.8V_{out}, CH4: 1.2V_{out}

*. All tests are performed with J2 pin 1 and 2 shorted.

5.3 230V_{ac}/50Hz: CH1: 15V output, CH2: 5V output



5.4 230V_{ac}/50Hz: CH1: 15V_{out}, CH2: 3.3V_{out}, CH3: 1.8V_{out}, CH4: 1.2V_{out}



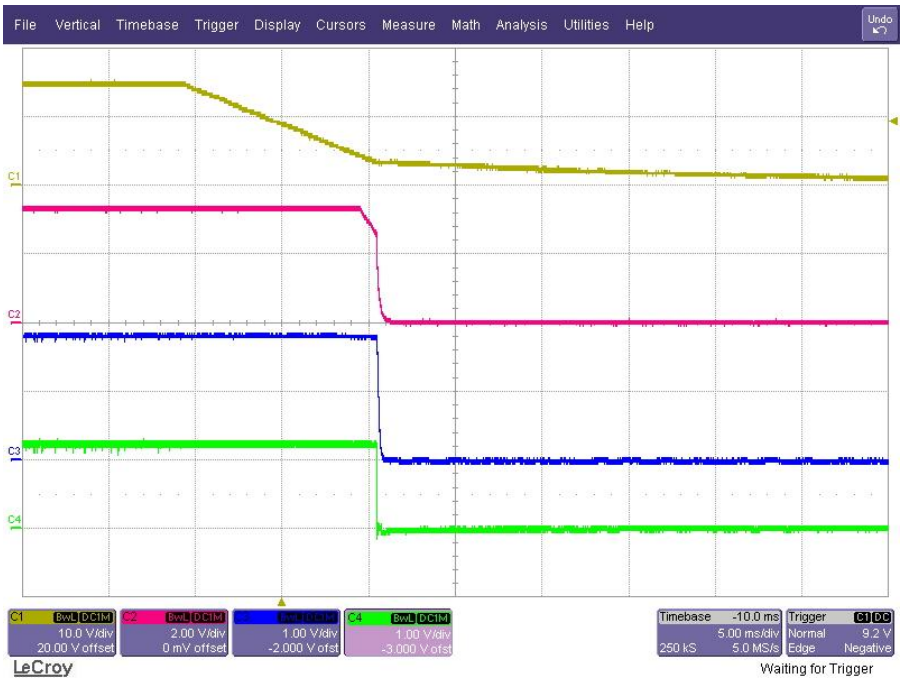
*. All tests are performed with J2 pin 1 and 2 shorted.

6 Turn off

The output voltages at turn off transient are shown in the images below with 15V/0.6A, 5V/0.55A, 3.3V/0.2A, 1.8V/0.05A, 1.2V/0.8A loads.

6.1 120V_{ac}/60Hz: CH1: 15V output, CH2: 5V output

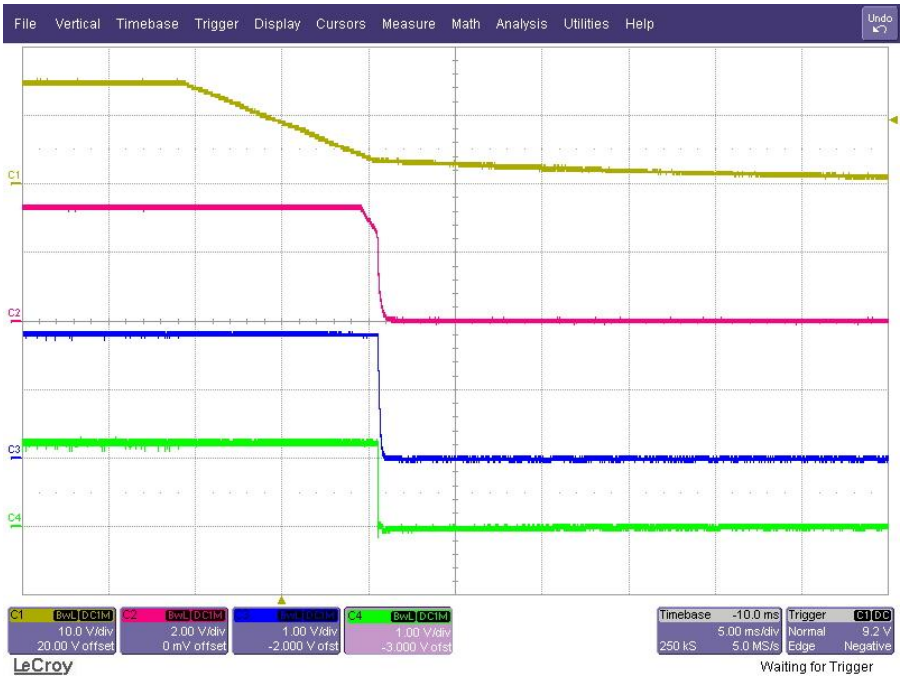
6.2 120V_{ac}/60Hz: CH1: 15V_{out}, CH2: 3.3V_{out}, CH3: 1.8V_{out}, CH4: 1.2V_{out}



*. All tests are performed with J2 pin 1 and 2 shorted.

6.3 230V_{ac}/50Hz: CH1: 15V output, CH2: 5V output

6.4 230V_{ac}/50Hz: CH1: 15V_{out}, CH2: 3.3V_{out}, CH3: 1.8V_{out}, CH4: 1.2V_{out}

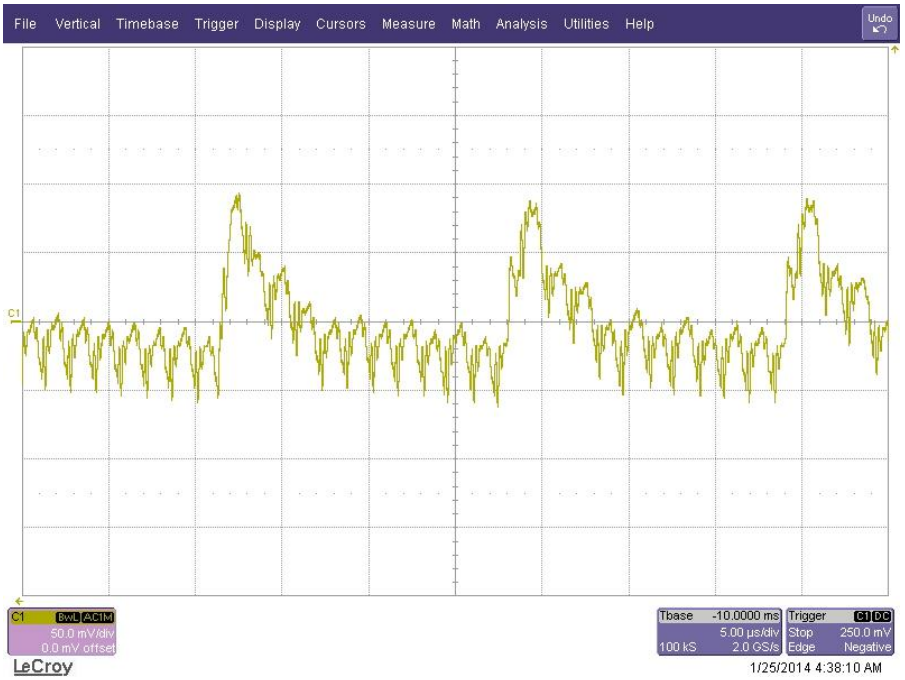


*. All tests are performed with J2 pin 1 and 2 shorted.

7 Output Ripple Voltages

The output ripple voltages are shown in the plots below with 15V/0.6A, 5V/0.55A, 3.3V/0.2A, 1.8V/0.05A, 1.2V/0.8A loads and $120V_{ac}$/60Hz input.

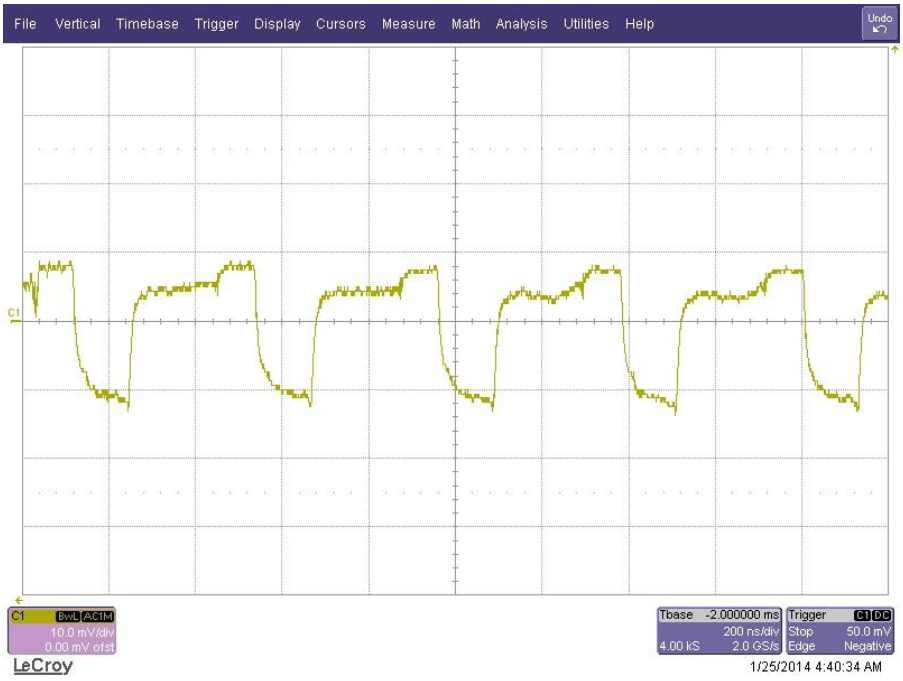
7.1 15V$_{out}$



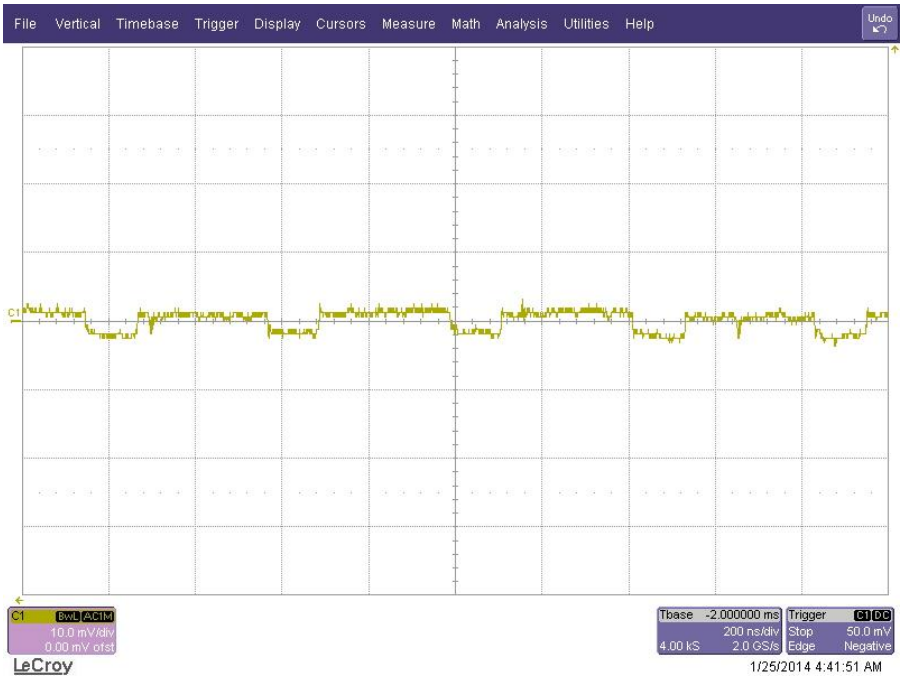
7.2 5V$_{out}$

*. All tests are performed with J2 pin 1 and 2 shorted.

7.3 $3.3V_{out}$



7.4 $1.8V_{out}$



*. All tests are performed with J2 pin 1 and 2 shorted.

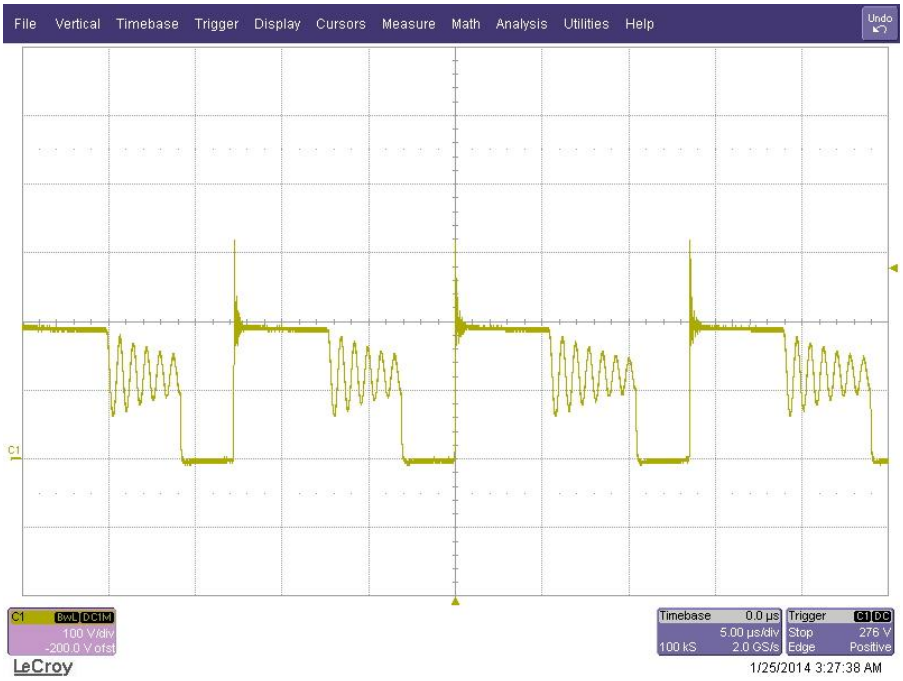
7.5 1.2V_{out}

*. All tests are performed with J2 pin 1 and 2 shorted.

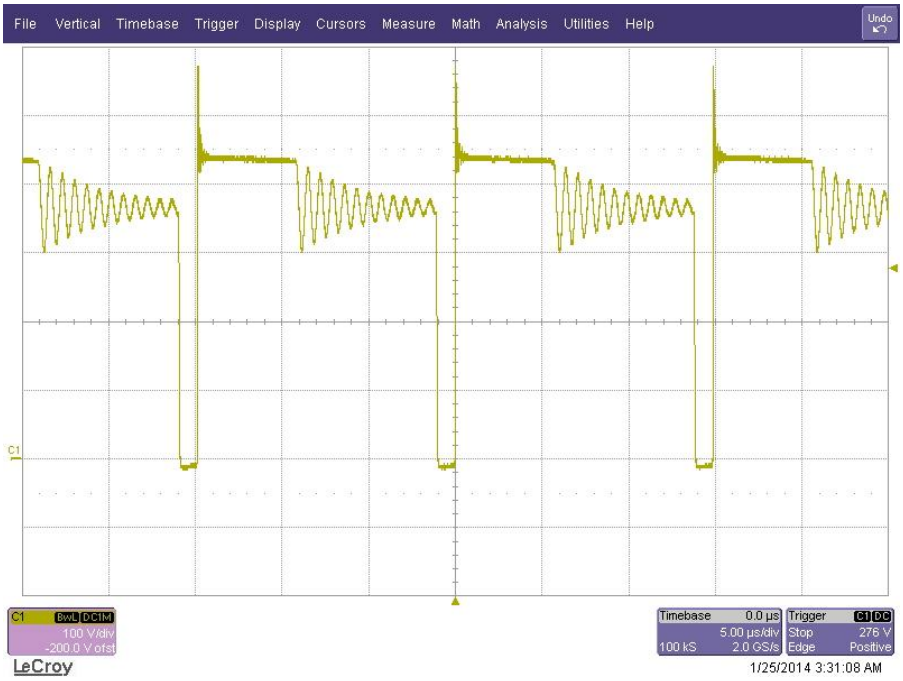
8 Switching Waveforms

The images below show key switching waveforms of PMP9185RevA. The waveforms are measured with 15V/1.2A load.

8.1 V_{DS} of MOSFET Q_1 @ 85V_{AC}/60Hz



8.2 V_{DS} of MOSFET Q_1 @ 265V_{AC}/50Hz



*. All tests are performed with J2 pin 1 and 2 shorted.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (https:www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265