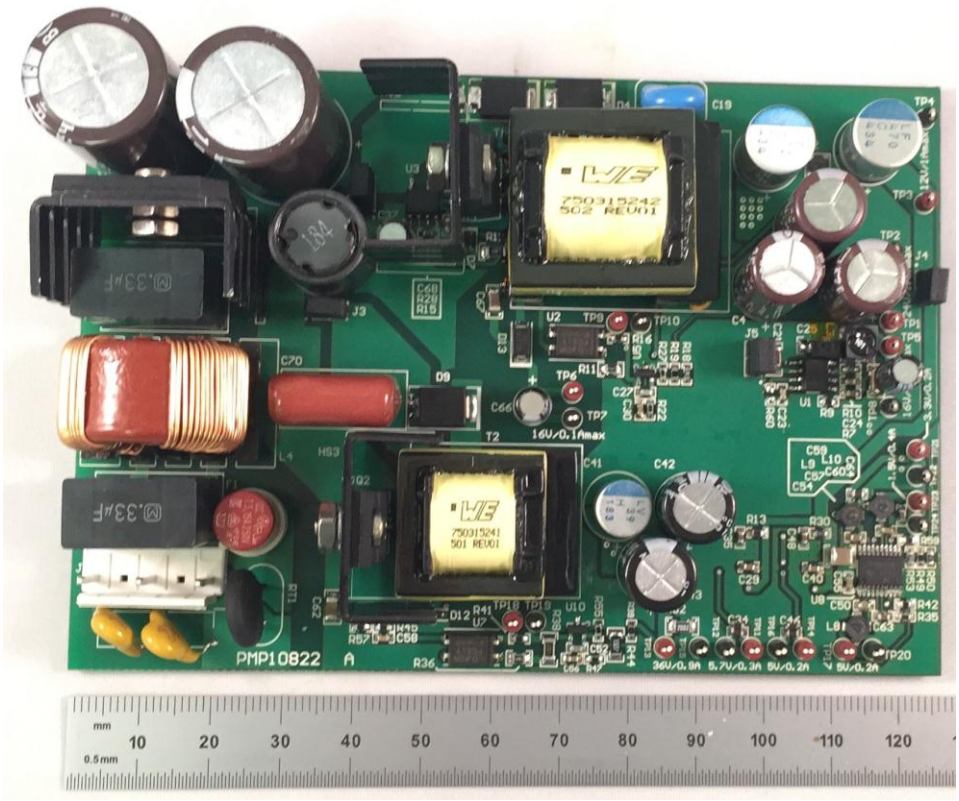
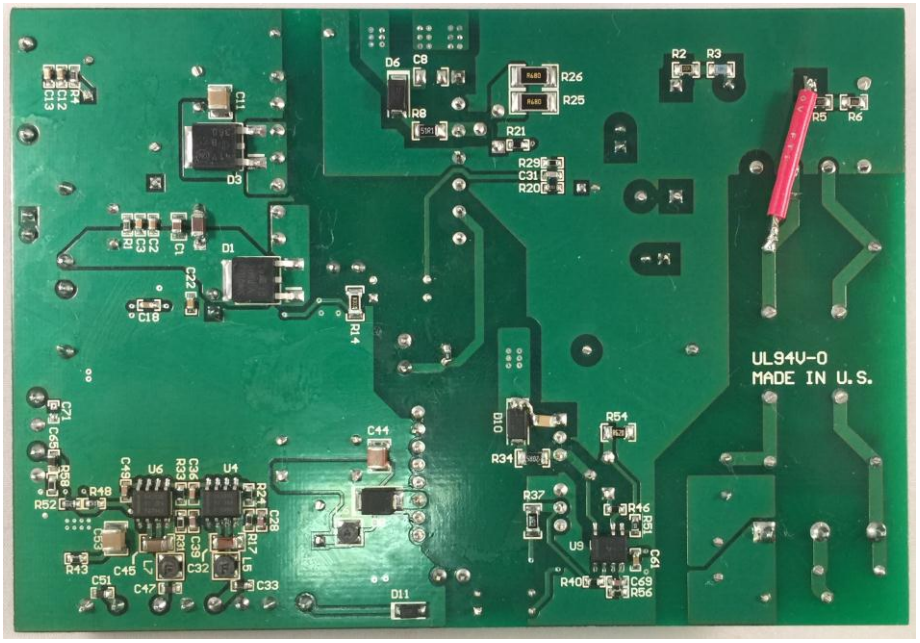
1 Photo

The photographs below show the PMP10822 Rev A assembly. This circuit was built on a PMP10822 Rev A PCB.

Top side



Bottom side

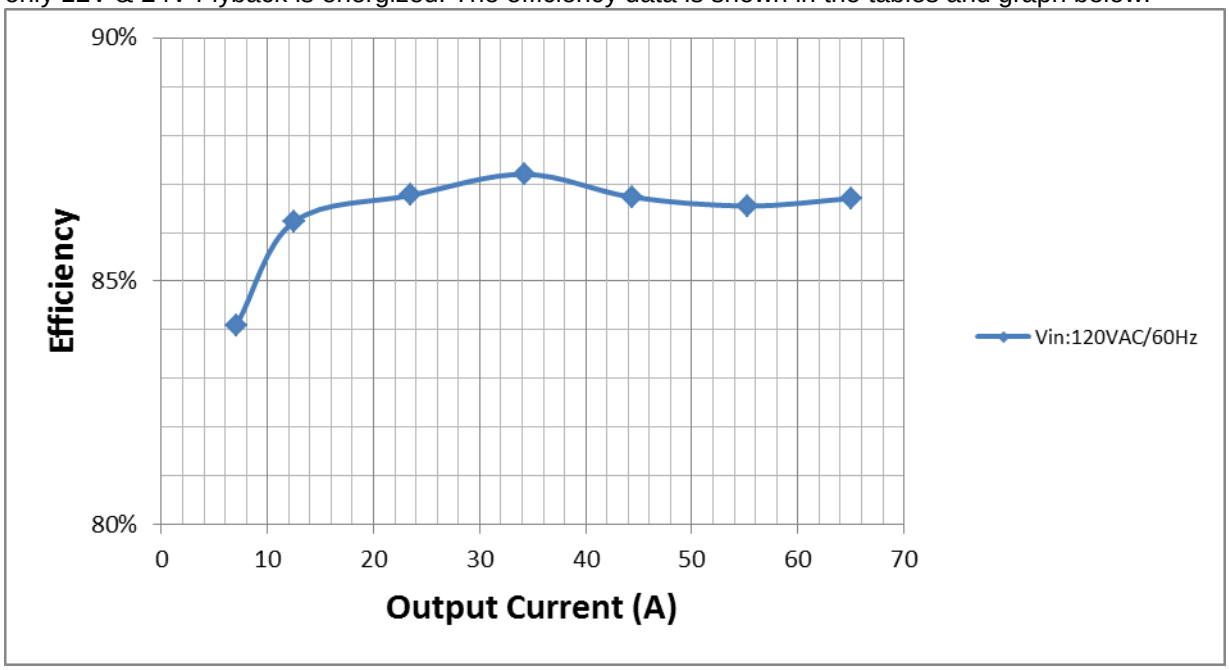


2 Converter Efficiency

The efficiency data of PMP10822Rev A was tested stage by stage.

2.1 12V & 24V Flyback converter efficiency:

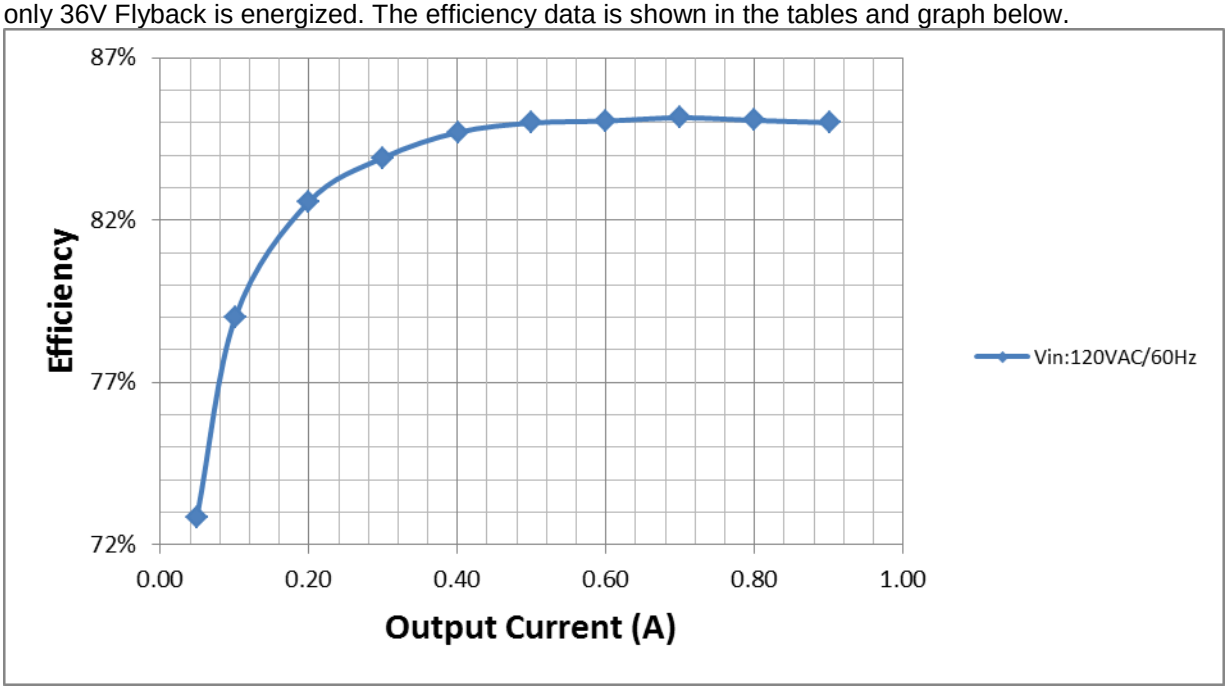
During this test, AC source is applied to connector J1 with J2 shorted and J3, J4, J5 opened. In other words, only 12V & 24V Flyback is energized. The efficiency data is shown in the tables and graph below.



Vin(ac)	Iin(A)	Pin(W)	Vo1(V)	Io1(A)	Vo2(V)	Io2(A)	Vo3(V)	Io3(A)	Pout(W)	Eff. (%)
120.00	1.00000	75.010	24.210	1.90	11.840	1.45	17.42	0.1073	65.03617	86.70%
120.17	0.86100	63.830	24.260	1.50	11.820	1.45	17.02	0.1049	55.24286	86.55%
120.38	0.70100	51.120	24.250	1.20	11.860	1.14	16.57	0.1021	44.33645	86.73%
120.55	0.55050	39.300	24.240	0.90	11.890	0.90	16.32	0.1073	34.2686	87.20%
120.22	0.39340	27.140	24.230	0.60	11.920	0.62	16.1	0.0992	23.54897	86.77%
120.48	0.22590	14.474	24.210	0.30	11.960	0.31	15.77	0.0972	12.47952	86.22%
120.19	0.13983	8.372	24.200	0.15	11.980	0.15	15.37	0.1018	7.039586	84.08%
120.39	0.02700	0.209	24.190	0.00	11.990	0.00	15.79	0	0	0.00%

2.2 36V Flyback converter efficiency:

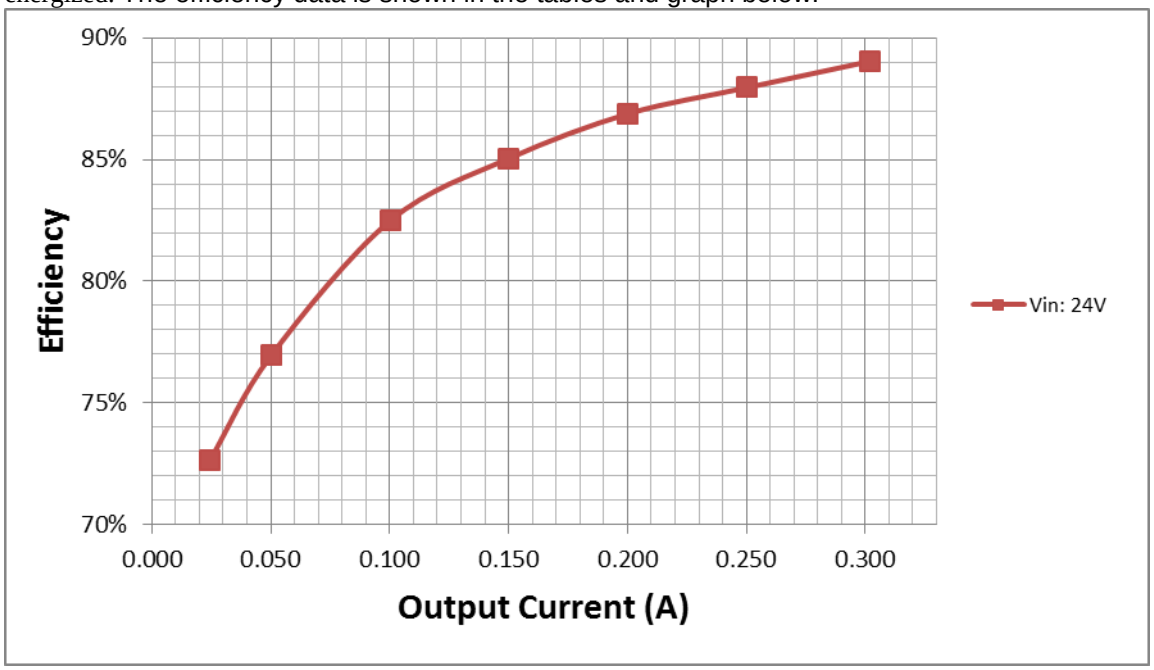
During this test, AC source is applied to connector J1 with J3 shorted and J2, J4, J5 opened. In other words, only 36V Flyback is energized. The efficiency data is shown in the tables and graph below.



Vin(ac)	Iin(A)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Eff. (%)
119.99	0.53400	38.170	36.010	0.90	32.445	85.00%
120.07	0.47990	33.830	36.020	0.80	28.780	85.07%
120.15	0.42600	29.610	36.020	0.70	25.214	85.15%
120.23	0.37150	25.410	36.020	0.60	21.612	85.05%
120.31	0.31640	21.190	36.020	0.50	18.010	84.99%
120.37	0.26110	17.052	36.020	0.40	14.444	84.71%
120.03	0.20410	12.876	36.020	0.30	10.806	83.92%
120.11	0.14588	8.684	36.020	0.20	7.168	82.54%
120.20	0.08675	4.604	36.020	0.10	3.638	79.02%
120.25	0.05407	2.423	36.020	0.05	1.765	72.84%
120.30	0.02713	0.214	36.020	0.00	0.000	0.00%

2.3 16V Buck converter efficiency:

During this test, DC source is applied to the input of U1 with J5 opened. In other words, only the 16V Buck converter is energized. The efficiency data is shown in the tables and graph below.



Vin(DC)	Iin(A)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Eff. (%)
24.14	0.22460	5.422	15.990	0.302	4.827	89.04%
24.21	0.18800	4.551	16.000	0.250	4.003	87.95%
24.04	0.15320	3.683	15.990	0.200	3.200	86.88%
24.12	0.11700	2.822	15.990	0.150	2.400	85.05%
23.95	0.08110	1.942	15.990	0.100	1.602	82.49%
24.02	0.04340	1.042	15.990	0.050	0.802	76.95%
24.06	0.02234	0.538	15.980	0.024	0.391	72.66%
24.10	0.00036	0.009	15.970	0.000	0.000	0.00%

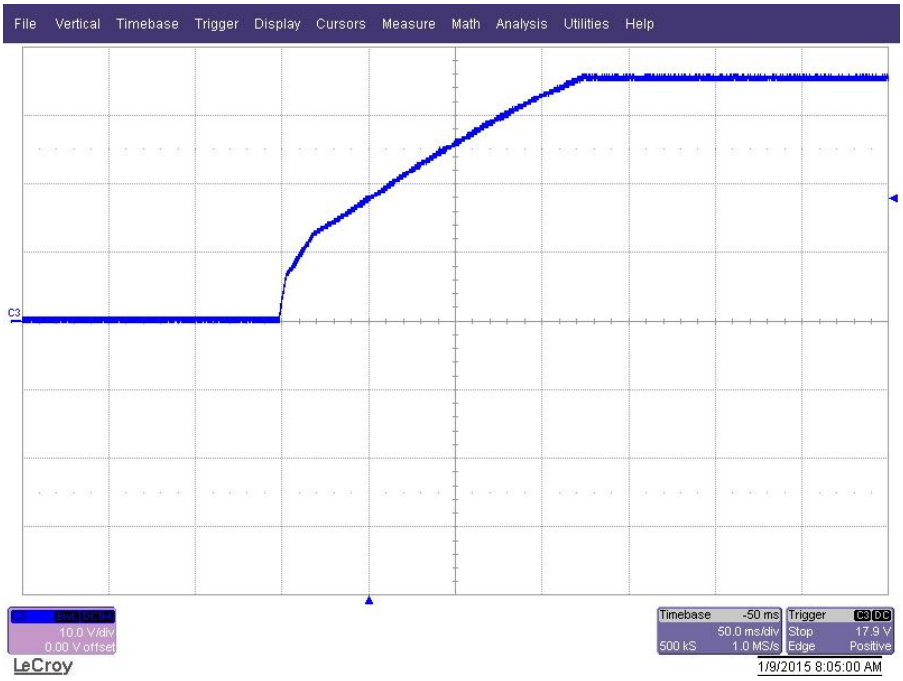
3 Startup

The output voltages at startup are shown in the images below.

3.1 24V, 16V_{pri}, and 12V startup @ 120V_{AC}: 120V_{AC}/60Hz: 24V/1.9A, 12V/1.45A, 16V_{PRI}/0.1A outputs.

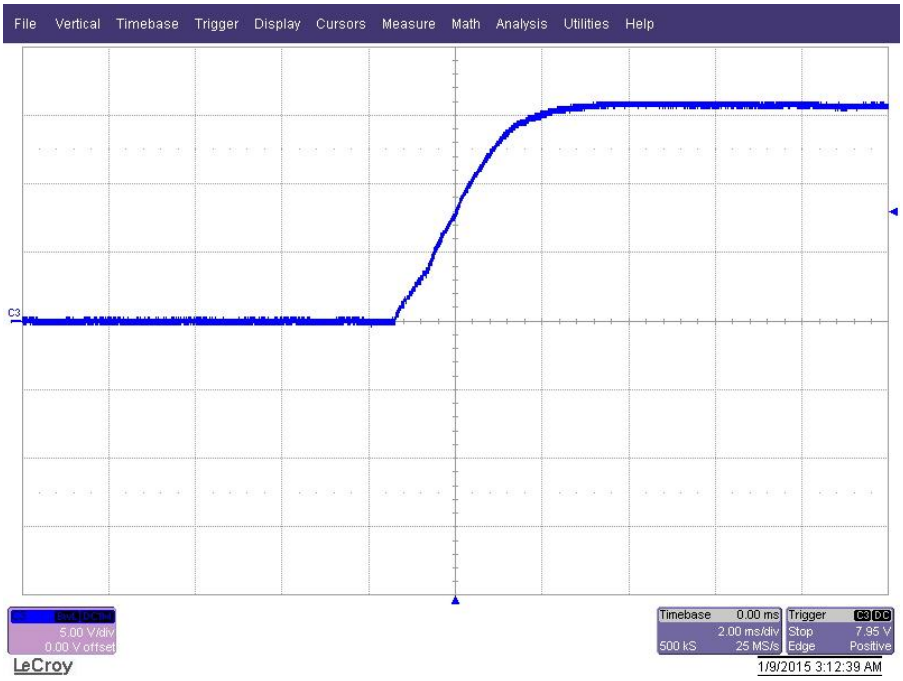
3.2 24V, 16V_{pri}, and 12V startup @ 120V_{AC}: no load.

3.3 36V startup @ 120V_{AC}: full load.

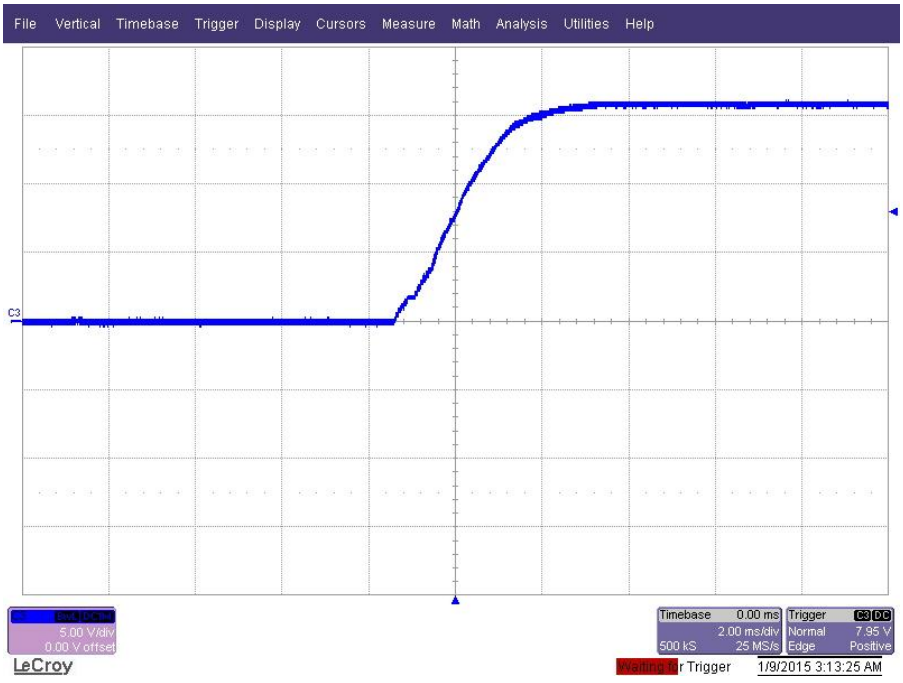


3.4 36V startup @ 120V_{AC}: no load.

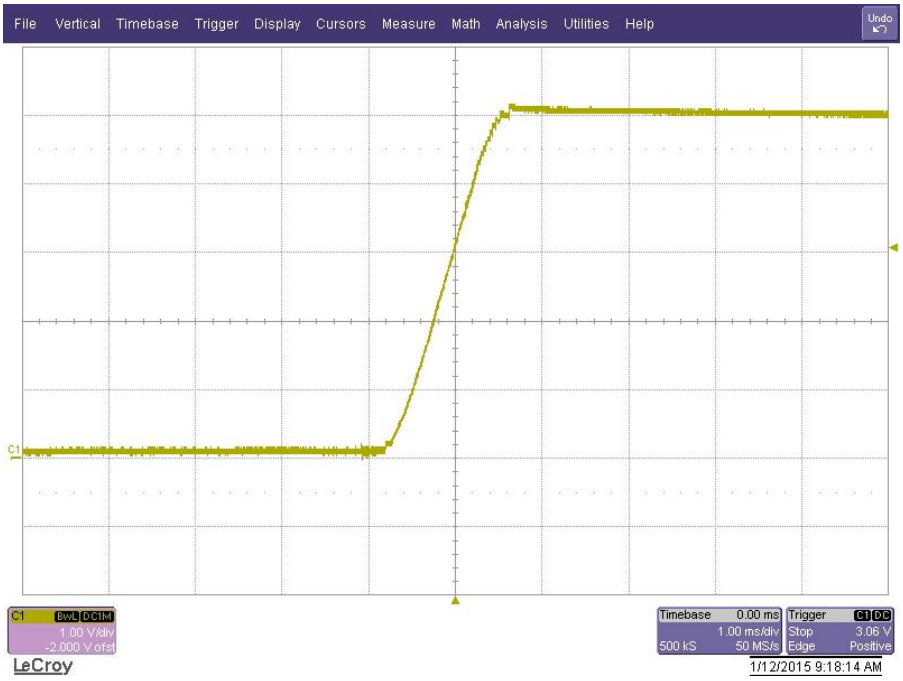
3.5 16V startup @ 24V_{DC} on U1 input: full load.



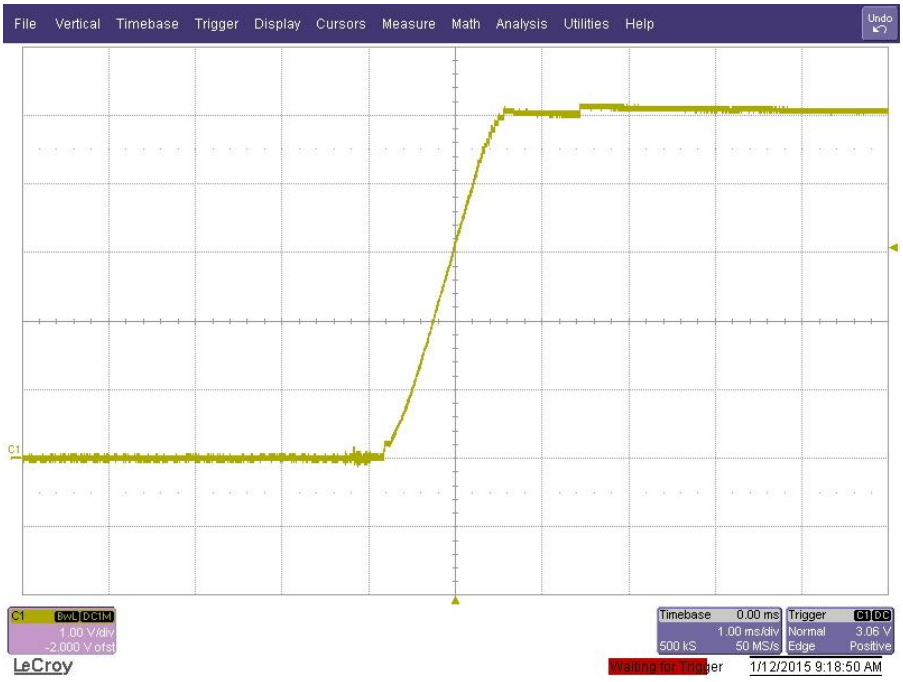
3.6 16V startup @ 24V_{DC} on U1 input: no load.



3.7 5.7V startup @ 12V_{DC} input: full load.

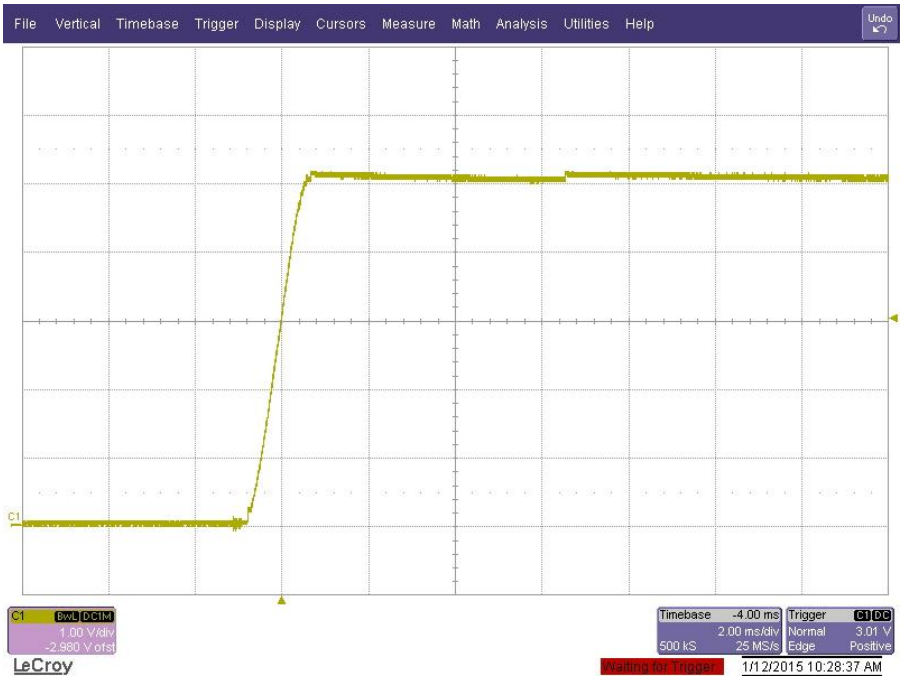


3.8 5.7V startup @ 12V_{DC} input: no load.



3.9 5.1V startup @ 12V_{DC} input: full load.

3.10 5.1V startup @ 12V_{DC} input: no load.



4 Cross regulation

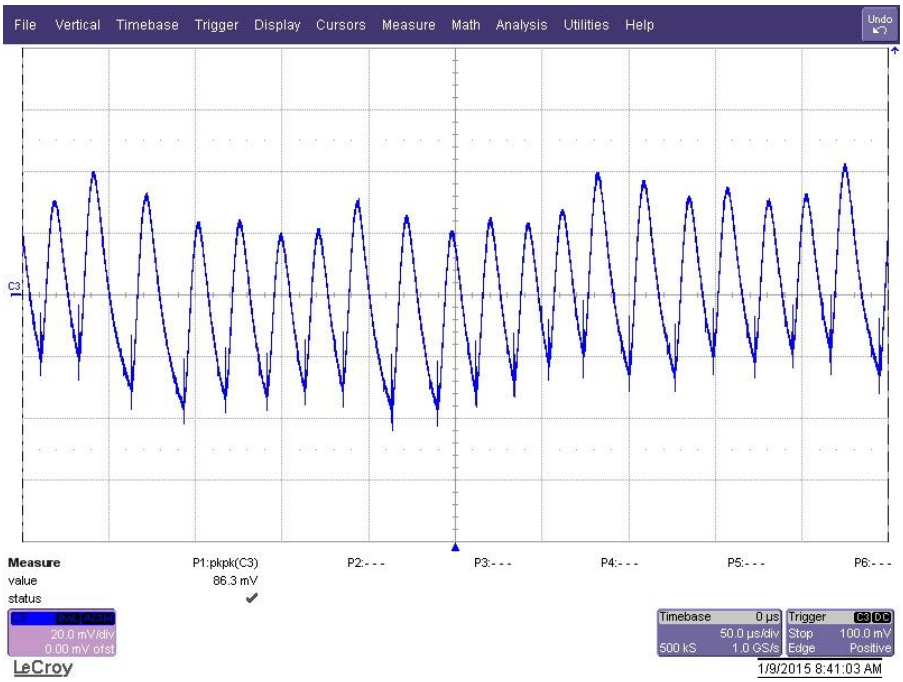
Output voltage cross regulation is tested at $120V_{AC}$/60Hz input with J4 and J5 open.

Cross Regulation: Change on 12V current				Cross Regulation: Change on 24V current			
Current (A)		Voltage(V)		Current (A)		Voltage(V)	
12V	24V	12V	24V	12V	24V	12V	24V
0.000	0.799	12.280	23.600	1.010	0.000	10.970	26.310
0.090	0.799	12.080	24.050	1.010	0.100	11.700	24.680
0.191	0.799	12.040	24.100	1.010	0.200	11.770	24.510
0.290	0.799	12.010	24.130	1.010	0.300	11.810	24.440
0.391	0.799	11.990	24.160	1.010	0.400	11.830	24.390
0.490	0.799	11.970	24.180	1.010	0.500	11.840	24.350
0.590	0.799	11.950	24.200	1.010	0.600	11.850	24.320
0.689	0.799	11.930	24.220	1.010	0.700	11.860	24.300
0.790	0.799	11.910	24.240	1.010	0.800	11.870	24.280
0.889	0.799	11.890	24.260	1.010	0.900	11.870	24.270
0.989	0.799	11.870	24.270	1.010	1.000	11.880	24.250
1.090	0.799	11.850	24.290	1.010	1.100	11.880	24.240
1.189	0.799	11.830	24.310	1.010	1.200	11.890	24.230
1.290	0.799	11.820	24.320	1.010	1.300	11.890	24.220
1.389	0.799	11.800	24.340	1.010	1.400	11.890	24.210
1.509	0.799	11.770	24.350	1.010	1.500	11.890	24.200
0.000	1.600	12.380	23.360	1.010	1.600	11.900	24.190
0.090	1.600	12.090	23.990	1.010	1.700	11.900	24.180
0.191	1.600	12.050	24.040	1.010	1.800	11.900	24.180
0.290	1.600	12.030	24.070	1.010	1.900	11.900	24.170
0.391	1.600	12.010	24.100	1.509	0.000	10.790	26.590
0.490	1.600	11.990	24.120	1.509	0.100	11.570	24.840
0.590	1.600	11.970	24.130	1.509	0.200	11.660	24.620
0.690	1.600	11.950	24.150	1.509	0.300	11.700	24.530
0.790	1.600	11.930	24.170	1.509	0.400	11.720	24.480
0.889	1.600	11.920	24.180	1.509	0.500	11.740	24.440
0.989	1.600	11.900	24.190	1.509	0.600	11.750	24.410
1.090	1.600	11.880	24.200	1.509	0.700	11.760	24.380
1.189	1.600	11.870	24.210	1.509	0.800	11.770	24.360
1.290	1.600	11.850	24.220	1.509	0.900	11.780	24.340
1.389	1.600	11.830	24.230	1.509	1.000	11.780	24.320
1.509	1.600	11.810	24.250	1.509	1.100	11.790	24.310
0.000	1.901	12.400	23.290	1.509	1.200	11.790	24.290
0.091	1.901	12.090	23.970	1.509	1.300	11.800	24.280
0.191	1.901	12.060	24.020	1.509	1.400	11.800	24.270
0.290	1.901	12.030	24.060	1.509	1.500	11.800	24.260
0.391	1.901	12.010	24.080	1.509	1.600	11.810	24.250
0.490	1.901	11.990	24.100	1.509	1.700	11.810	24.230
0.590	1.901	11.970	24.120	1.509	1.800	11.810	24.220
0.690	1.901	11.950	24.130	1.509	1.900	11.820	24.220
0.790	1.901	11.940	24.150				
0.889	1.901	11.920	24.160				
0.989	1.901	11.900	24.170		12V max	12.400	V
1.090	1.901	11.890	24.180		12Vmin	10.790	V
1.189	1.901	11.870	24.190		Δ12V	1.610	V
1.290	1.901	11.850	24.200		24V max	26.590	V
1.389	1.901	11.840	24.210		24Vmin	23.290	V
1.509	1.901	11.810	24.220		Δ24V	3.300	V

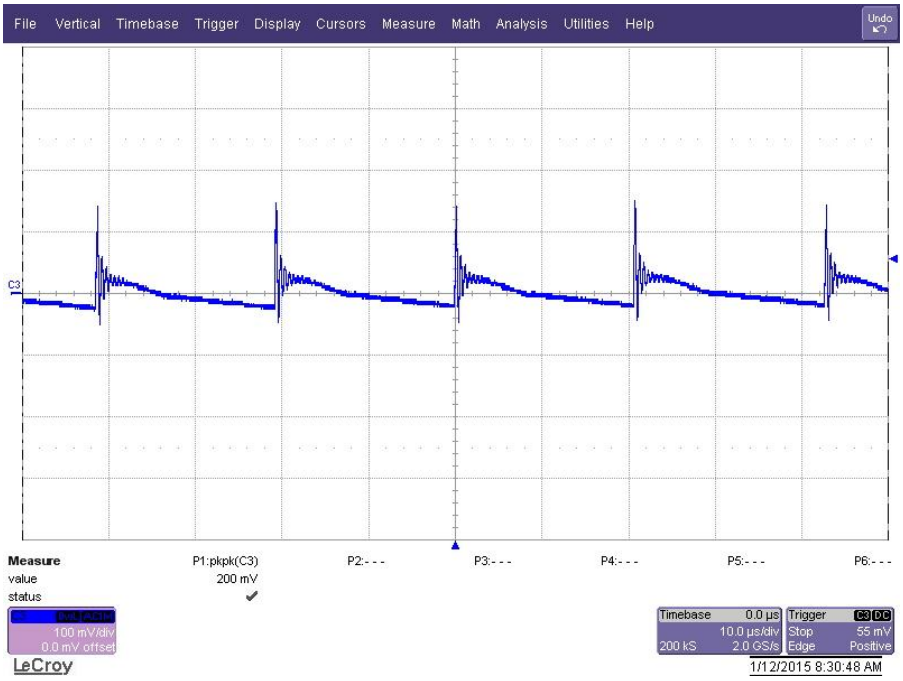
5 Output Ripple Voltages

The output ripple voltages are shown in the plots below with full load.

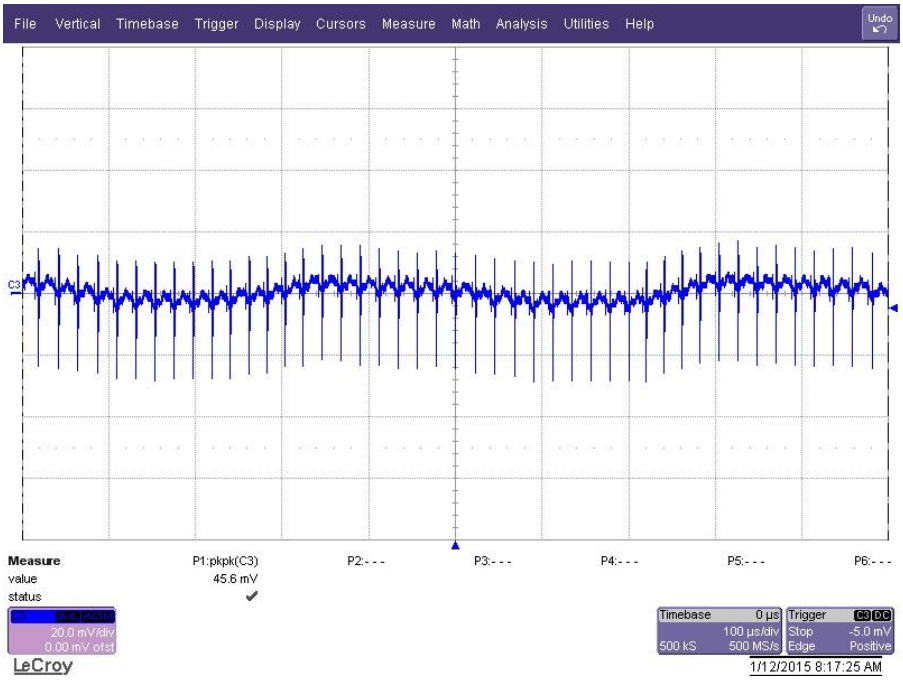
5.1 $36V_{ripple}$ @ 0.9A



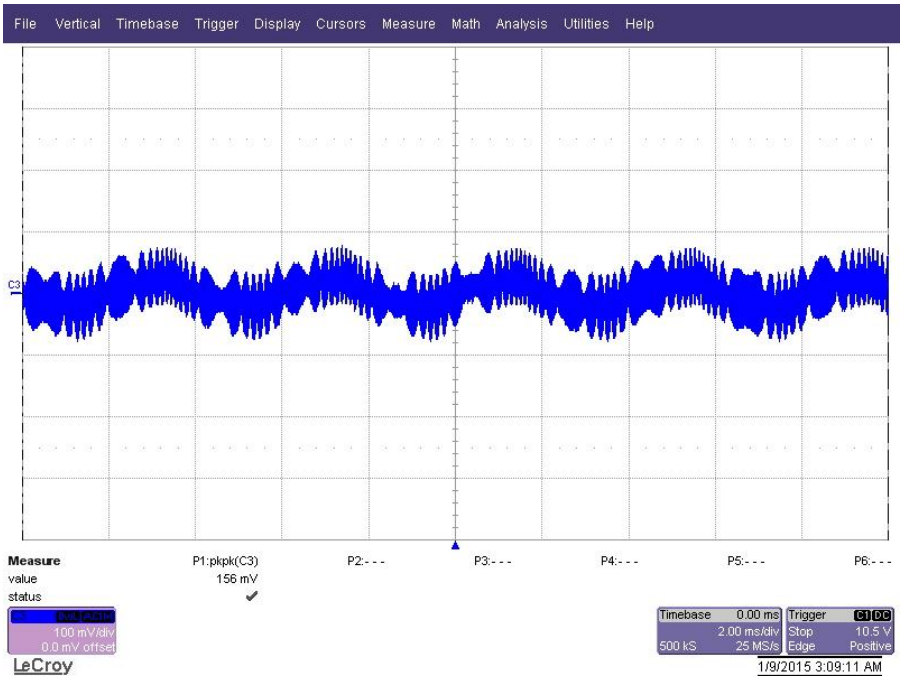
5.2 $24V_{ripple}$ @ $120V_{AC}$/60Hz: 24V/1.9A, 12V/1.45A, $16V_{PRI}$/0.1A outputs.



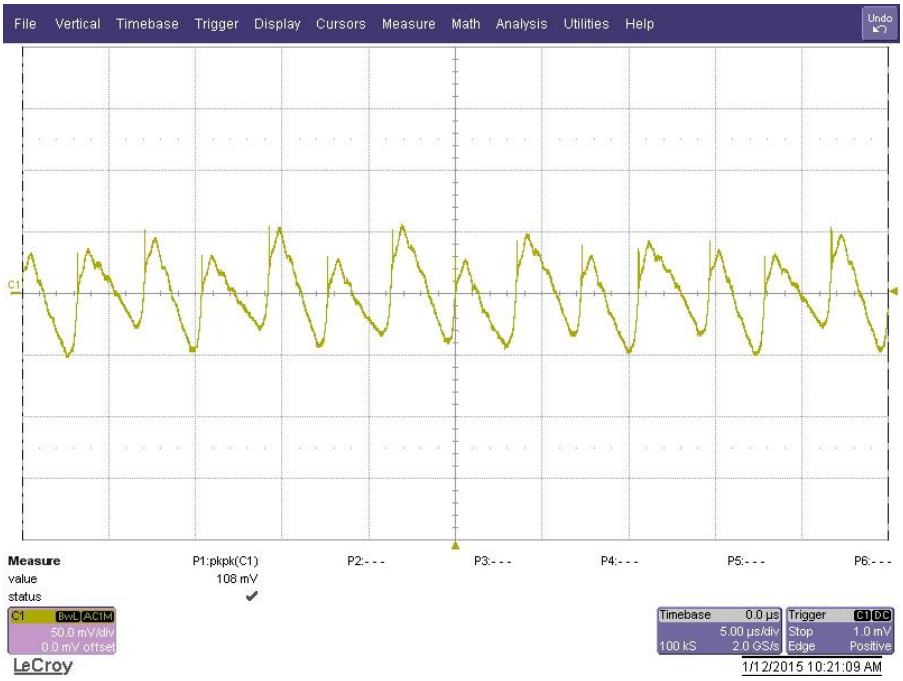
5.3 $12V_{ripple}$ @ $120V_{AC}$/60Hz: 24V/1.9A, 12V/1.45A, $16V_{PRI}$/0.1A outputs.



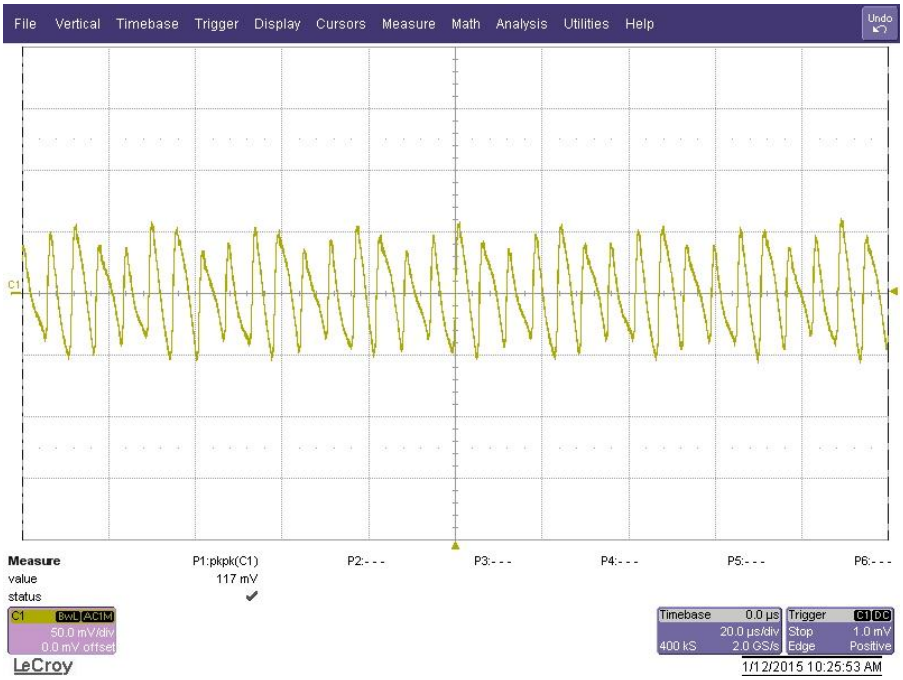
5.4 $16V_{ripple}$ @ 0.3A



5.5 $5.7V_{ripple}$ @ 0.3A



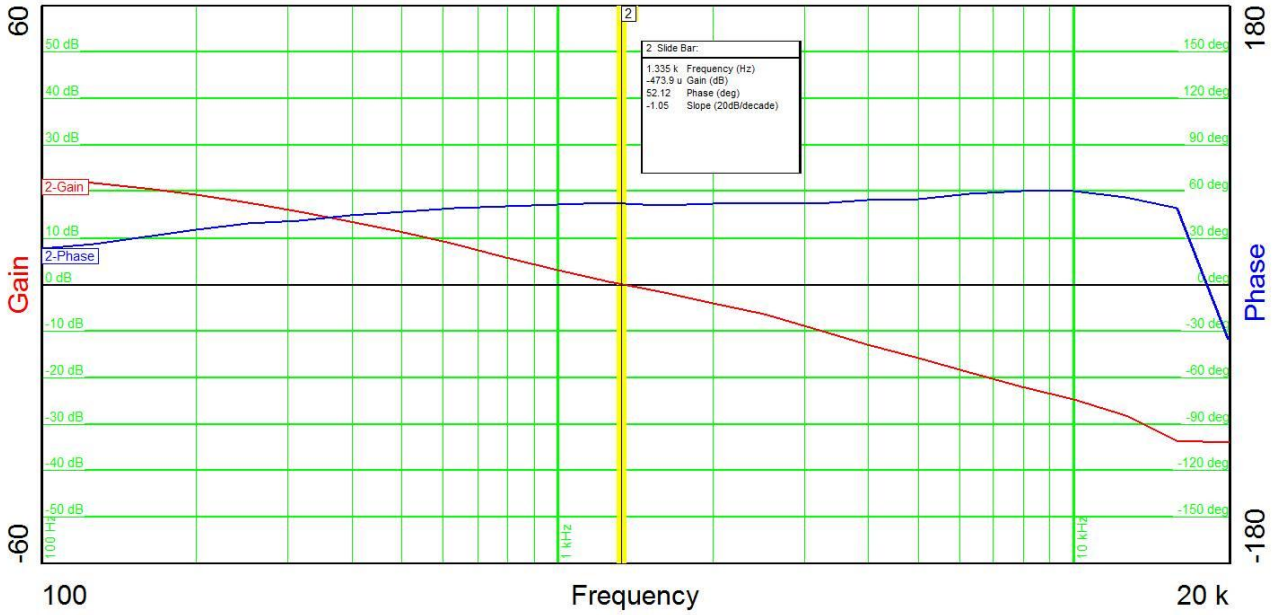
5.6 $5V1_{ripple}$ @ 0.2A



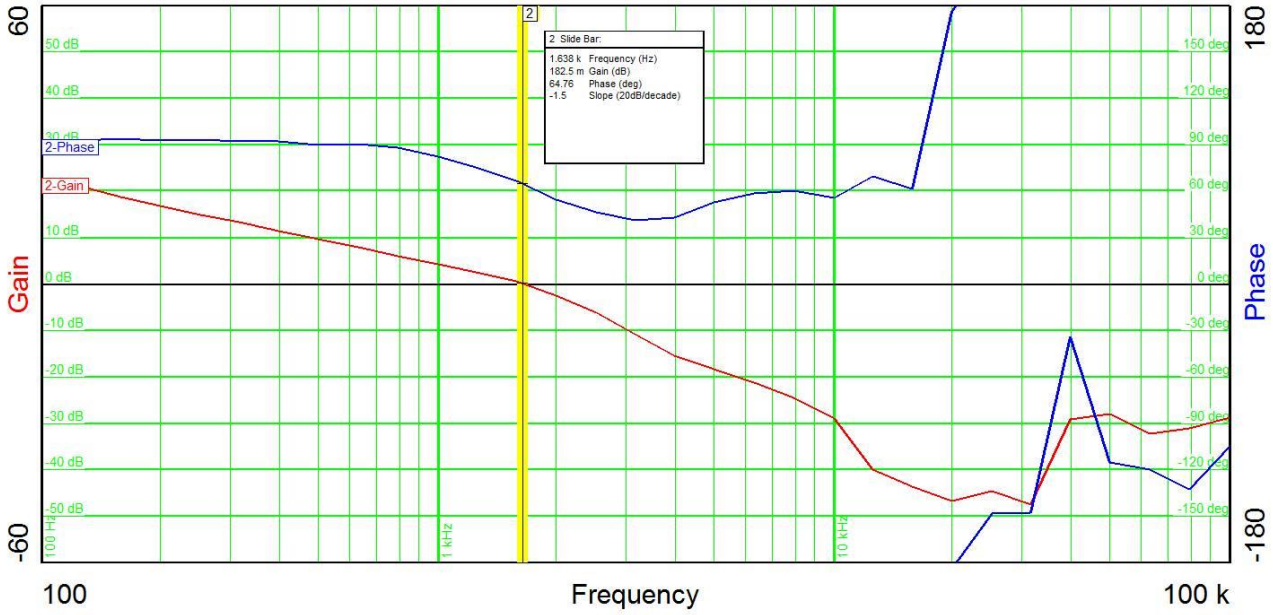
6 Loop Response

The frequency responses of Flyback and Buck converters are shown in the images below.

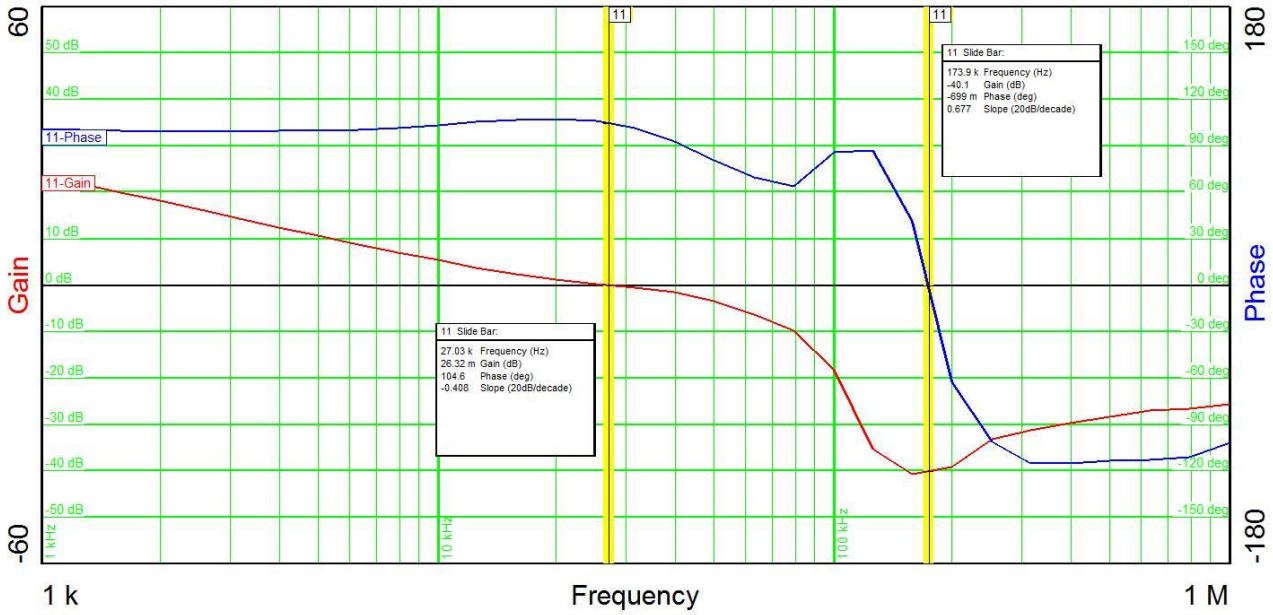
6.1 24V, 16V_{pri}, and 12V Flyback converter @ 120V_{AC}/60Hz: 24V/1.9A, 12V/1.45A, 16V_{PRI}/0.1A outputs.



6.2 36V Flyback converter @ 120V_{AC}/60Hz: full load.



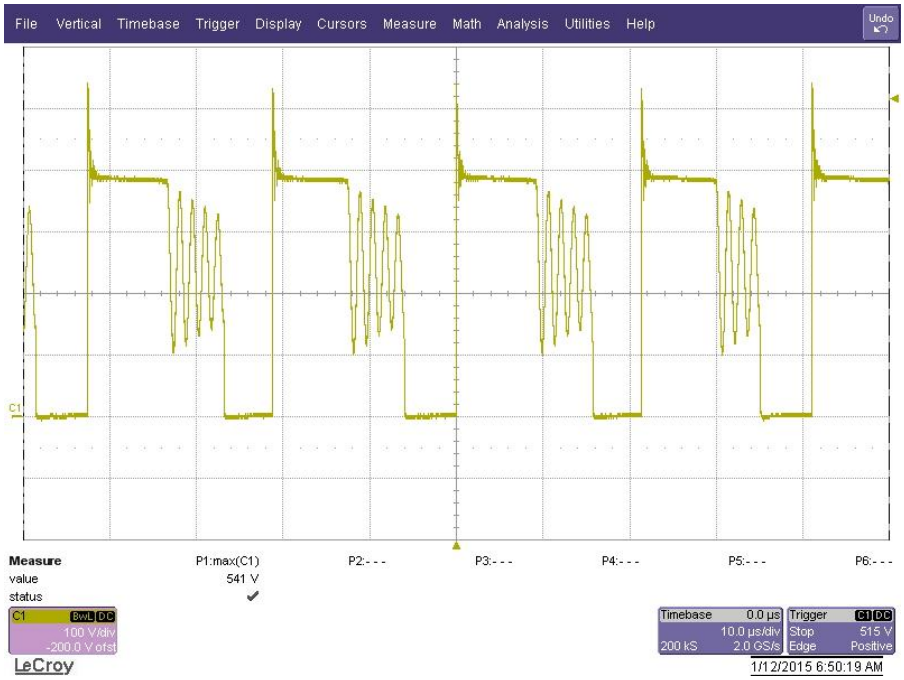
6.3 16V Buck converter @ 24V_{DC} on U1 input: full load.



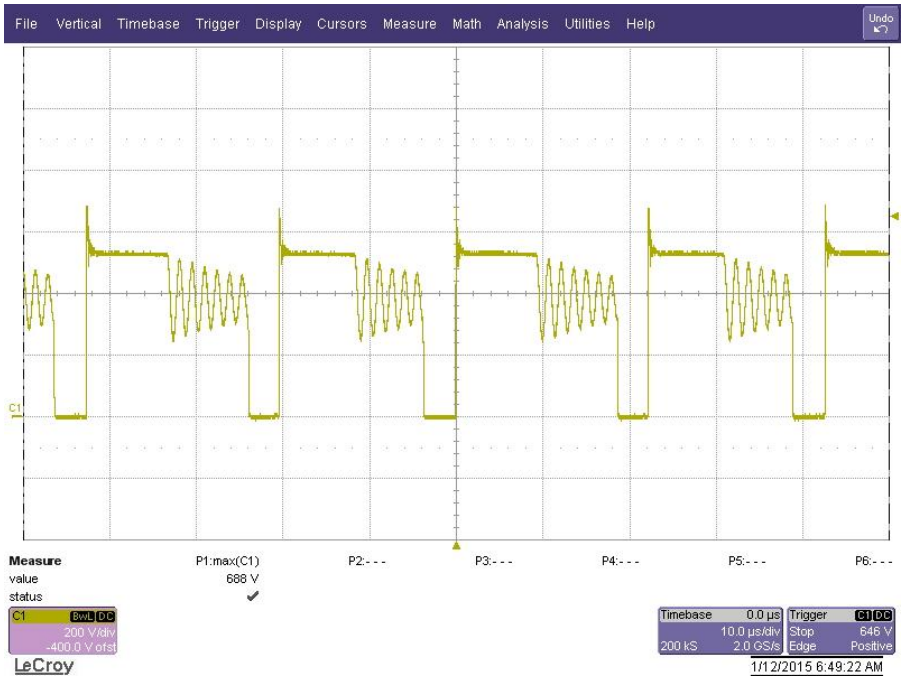
7 Switching Waveforms

The images below show key switching waveforms of PMP10822RevA. The waveforms are measured at full load.

7.1 Voltage at Q1 Drain @ 90V_{AC}/60Hz input and 24V/1.9A, 12V/1.45A, 16V_{PRI}/0.1A outputs



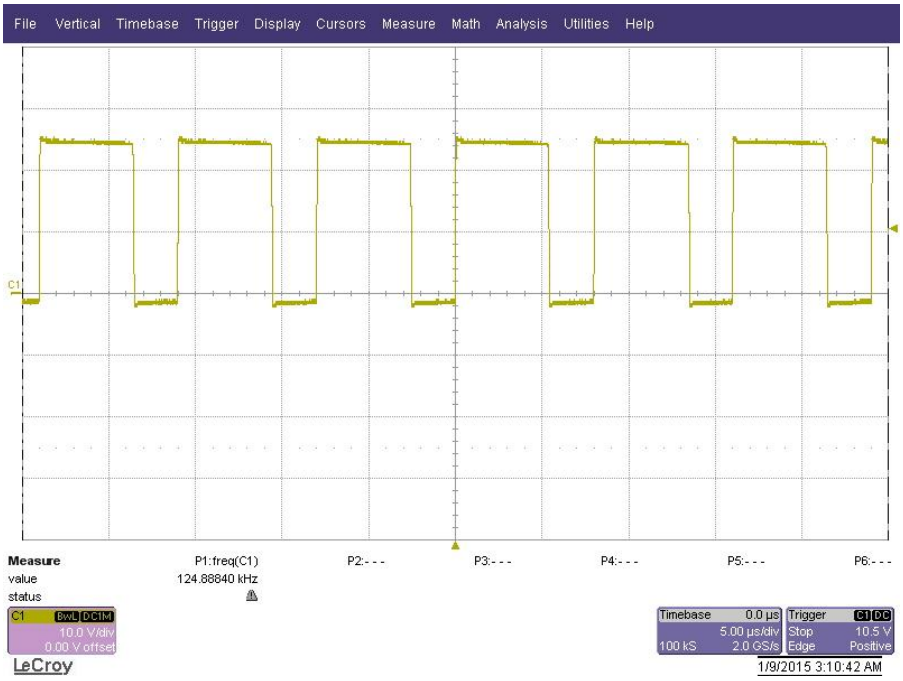
7.2 Voltage at Q1 Drain @ 140V_{AC}/60Hz and 24V/1.9A, 12V/1.45A, 16V_{PRI}/0.1A outputs



7.3 Voltage at Q2 Drain @ 90V_{AC}/60Hz

7.4 Voltage at Q2 Drain @ 140V_{AC}/60Hz

7.5 Voltage at U1 SW pin @ 24V_{DC} input on U1



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