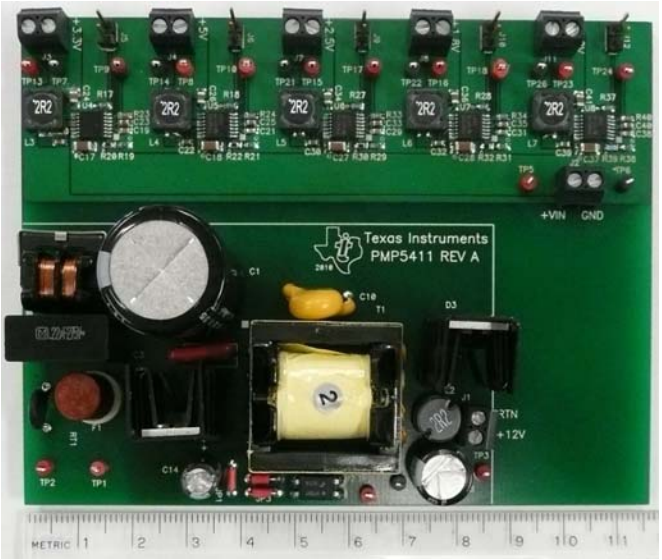
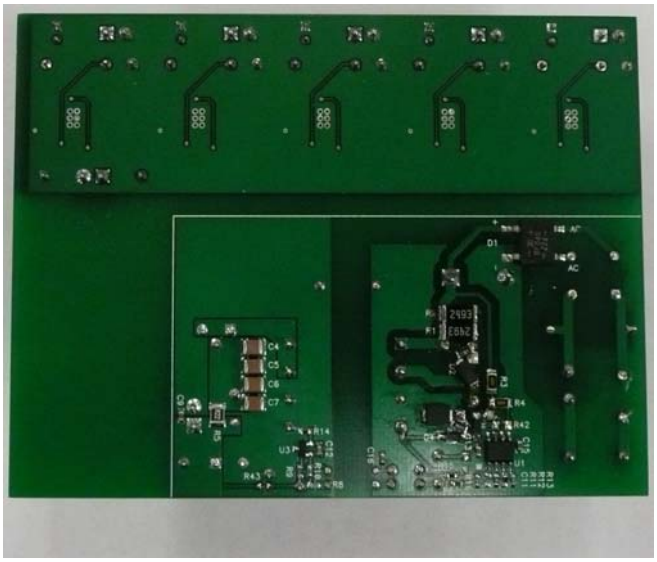
1 Photo

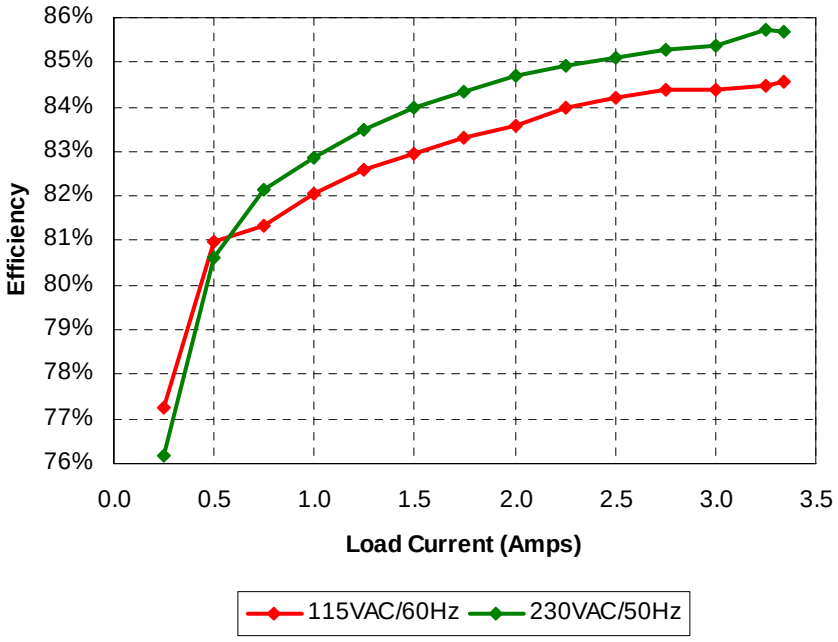
The photographs below show the top and bottom views of the PMP5411 Rev B demo board. The circuit is built on a PMP5411 Rev A PWB.





2 Active Mode Efficiency – Flyback Supply

The efficiency of the 12V flyback supply is shown in the tables and graph below.



115VAC/60Hz

Iout	Vout	Vin	Iin	Pin	PF	Pout	Losses	Efficiency
0.250	12.08	115.3	0.076	3.91	0.45	3.02	0.89	77.2%
0.500	12.08	115.3	0.132	7.46	0.49	6.04	1.42	81.0%
0.750	12.08	115.2	0.188	11.14	0.52	9.06	2.08	81.3%
1.000	12.08	115.1	0.240	14.72	0.53	12.08	2.64	82.1%
1.250	12.08	114.9	0.289	18.28	0.55	15.10	3.18	82.6%
1.500	12.08	114.9	0.340	21.84	0.56	18.12	3.72	83.0%
1.749	12.08	115.1	0.389	25.36	0.57	21.13	4.23	83.3%
2.000	12.08	115.0	0.438	28.90	0.58	24.16	4.74	83.6%
2.250	12.09	114.9	0.486	32.39	0.58	27.20	5.19	84.0%
2.500	12.09	114.8	0.534	35.89	0.59	30.23	5.67	84.2%
2.750	12.09	115.1	0.581	39.40	0.59	33.25	6.15	84.4%
3.000	12.09	115.0	0.631	42.98	0.59	36.27	6.71	84.4%
3.250	12.09	115.0	0.680	46.51	0.60	39.29	7.22	84.5%
3.338	12.09	114.9	0.686	47.72	0.60	40.36	7.36	84.6%

230VAC/50Hz

Iout	Vout	Vin	Iin	Pin	PF	Pout	Losses	Efficiency
0.250	12.10	230.0	0.047	3.97	0.36	3.03	0.95	76.2%
0.500	12.09	229.9	0.080	7.50	0.41	6.05	1.46	80.6%
0.750	12.09	229.9	0.112	11.04	0.43	9.07	1.97	82.1%
1.000	12.09	229.8	0.143	14.59	0.45	12.09	2.50	82.9%
1.250	12.09	229.8	0.173	18.10	0.46	15.11	2.99	83.5%
1.500	12.09	229.8	0.201	21.59	0.47	18.14	3.46	84.0%
1.749	12.09	229.8	0.229	25.07	0.48	21.15	3.92	84.3%
2.001	12.09	229.7	0.257	28.56	0.48	24.19	4.37	84.7%
2.250	12.09	229.7	0.285	32.04	0.49	27.20	4.84	84.9%
2.500	12.09	229.6	0.312	35.52	0.50	30.23	5.30	85.1%
2.750	12.09	229.6	0.340	38.99	0.50	33.25	5.74	85.3%
3.000	12.09	229.5	0.367	42.48	0.51	36.27	6.21	85.4%
3.250	12.09	229.5	0.394	45.84	0.51	39.29	6.55	85.7%
3.338	12.09	229.5	0.404	47.09	0.51	40.36	6.73	85.7%

3 Active Mode Energy Star Compliance – Flyback Supply

The table below shows the calculations and compliance for "ENERGY STAR® Program Requirements for Single Voltage External Ac-Dc and Ac-Ac Power Supplies" version 2 based on the measured efficiency.

	Measured Efficiency						
Name Plate Power Rating	25% Load	50% Load	75% Load	100% Load	**Avg. Eff.**	**Energy Star Req.**	**Compliant**
30	0.81	0.83	0.83	0.84	**0.83**	**0.83**	**YES**
35	0.81	0.83	0.84	0.84	**0.83**	**0.84**	**NO**
40	0.82	0.83	0.84	0.85	**0.84**	**0.85**	**NO**

4 Light Load Power Consumption – Flyback Supply

The tables below show the input power and efficiency during light load operation of the 12V flyback supply. The No-Load mode requirements of "ENERGY STAR® Program Requirements for Single Voltage External Ac-Dc and Ac-Ac Power Supplies" version 2 require less than 300mW of power dissipation during no load operation.

115VAC/60Hz

Iout	Vout	Vin	Iin (mA)	Pin	PF	Pout	Losses	Efficiency
0.000	12.09	115.0	9.1	0.14	0.13	0.00	0.14	0.0%
0.050	12.08	115.0	24.7	1.06	0.37	0.60	0.46	57.0%
0.100	12.08	114.9	38.7	1.82	0.41	1.21	0.61	66.4%
0.150	12.08	114.9	50.7	2.51	0.43	1.81	0.70	72.2%
0.200	12.08	114.9	62.5	3.21	0.45	2.42	0.79	75.3%

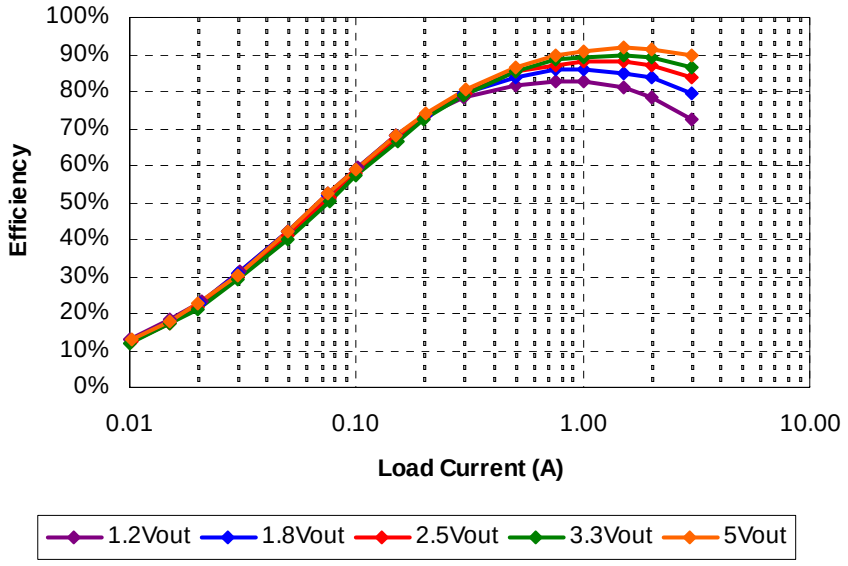
230VAC/50Hz

Iout	Vout	Vin	Iin (mA)	Pin	PF	Pout	Losses	Efficiency
0.000	12.10	230.2	14.1	0.19	0.06	0.00	0.19	0.0%
0.050	12.09	230.2	19.8	1.10	0.24	0.60	0.50	55.0%
0.100	12.09	230.1	27.7	1.94	0.30	1.21	0.73	62.3%
0.150	12.09	230.1	34.4	2.62	0.33	1.81	0.81	69.2%
0.200	12.08	230.1	41.1	3.32	0.31	2.42	0.90	72.8%

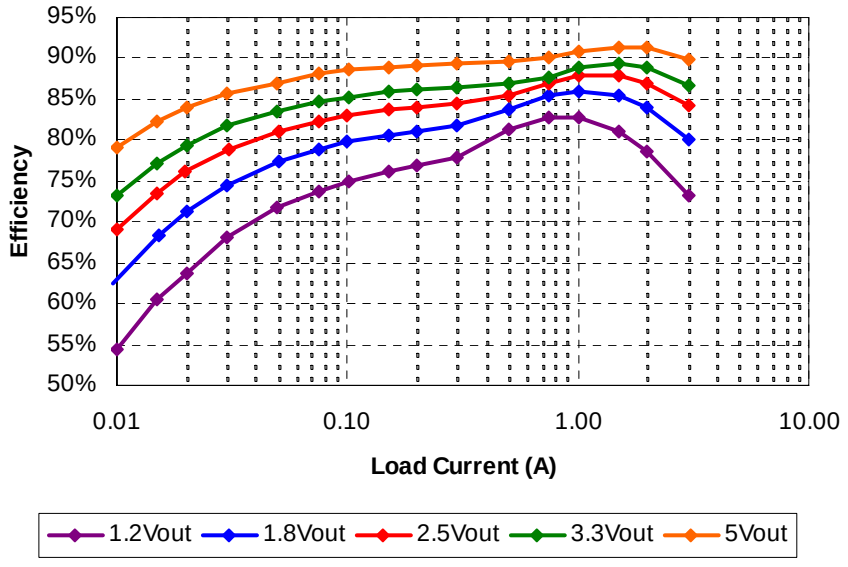
5 Efficiency – Point of Load Converters

The efficiency of the point of load converters is shown in the plots below. Efficiency was measured using the TPS54325 and TPS54326 (light load efficient).

TPS54325



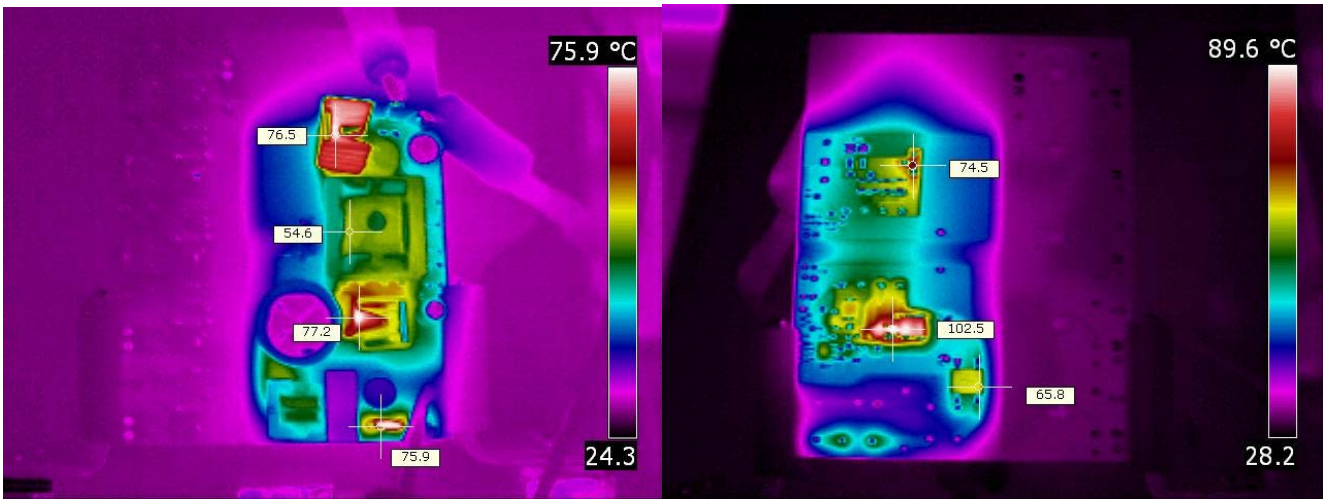
TPS54326



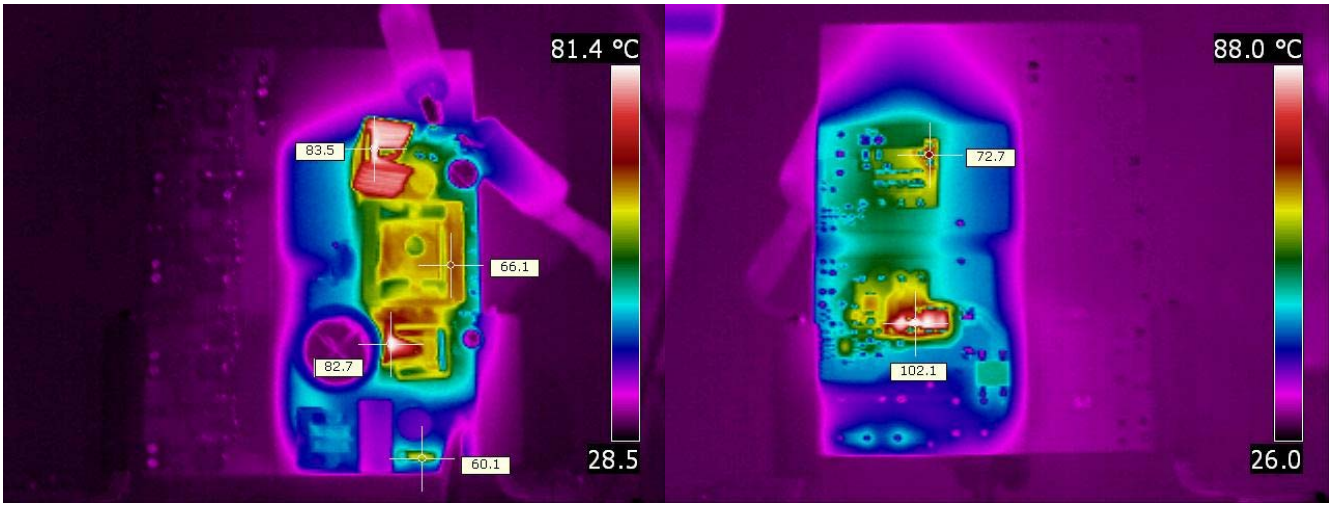
6 Thermal Images

The thermal images below show a top view (left) and bottom view (right) of the board. The ambient temperature was 26ºC with no forced air flow. Only the flyback supply was loaded with 3.4A. The point of load converters were not active.

6.1 115VAC, 60Hz Input

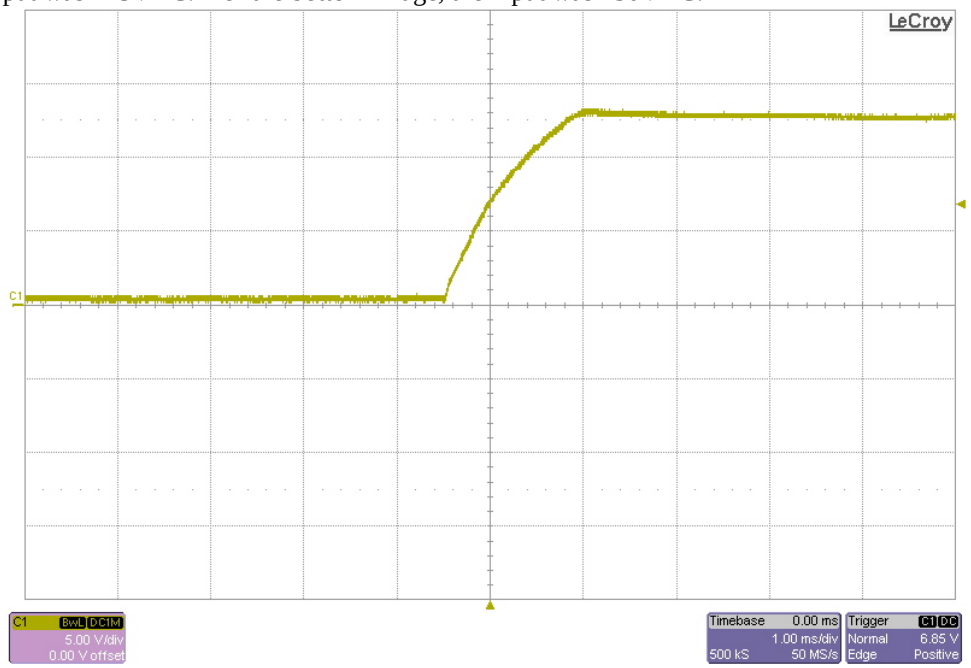


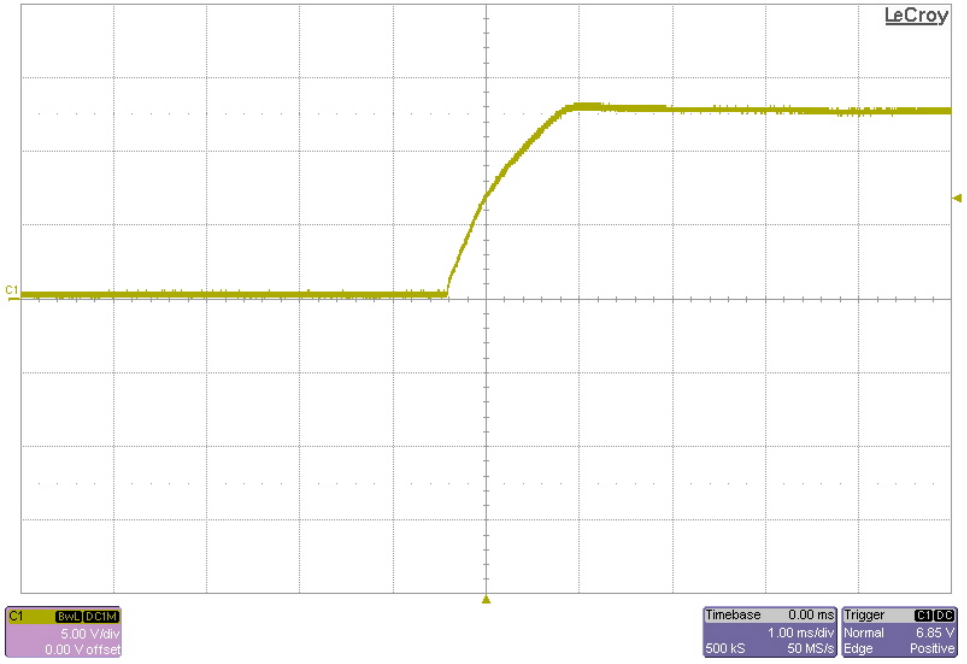
6.2 230VAC, 50Hz Input



7 Startup – Flyback Supply – No Load

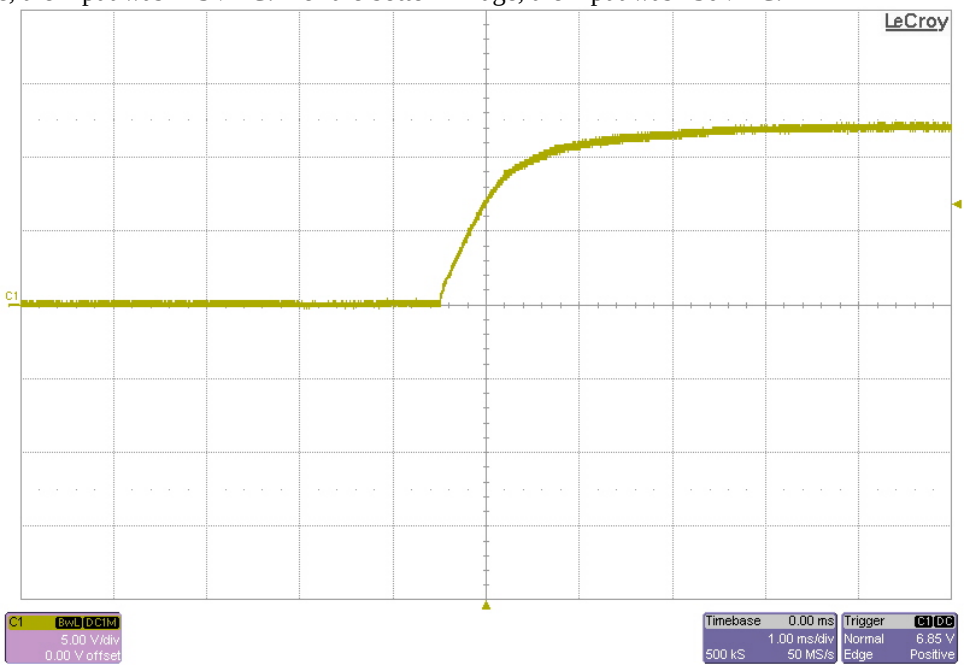
The output voltage of the 12V flyback supply at startup is shown in the images below. The output was unloaded. For the top image, the input was 115VAC. For the bottom image, the input was 230VAC.

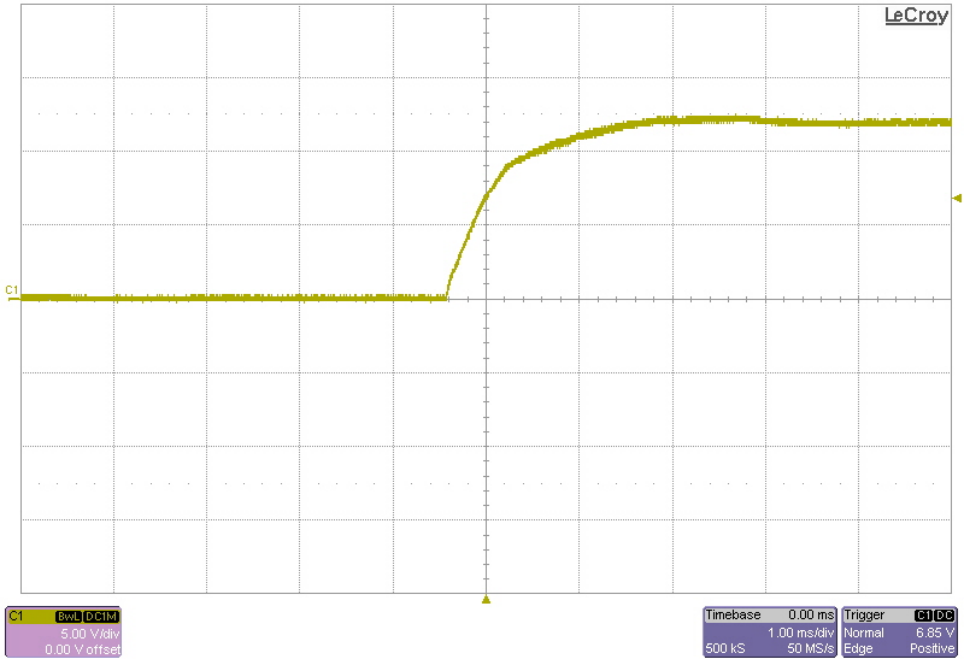




8 Startup – Flyback Supply – Full Load

The output voltage of the 12V flyback supply at startup is shown in the images below. The output was loaded with 3.4A. For the top image, the input was 115VAC. For the bottom image, the input was 230VAC.

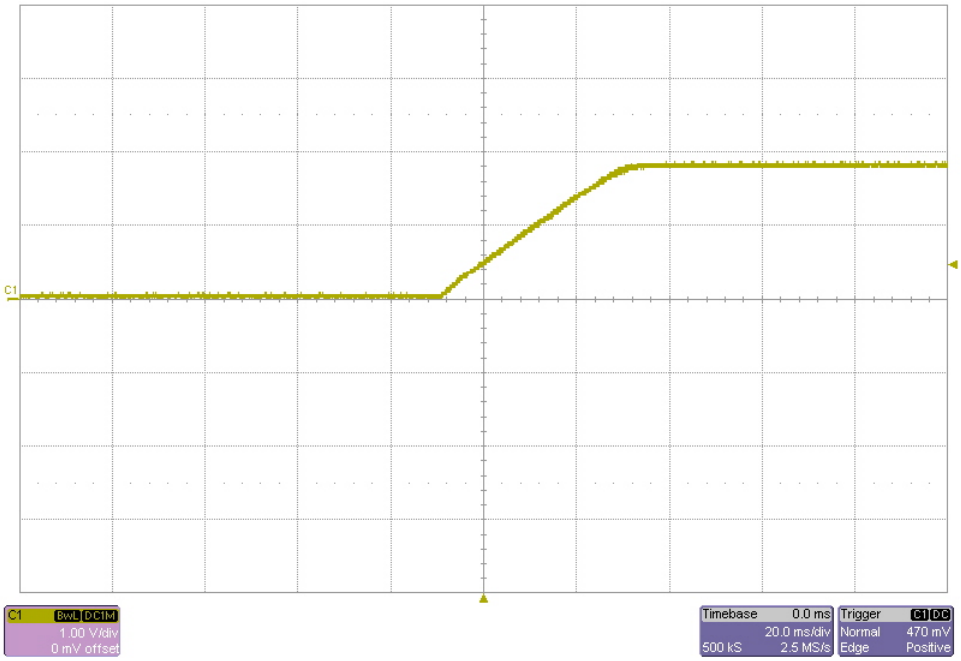




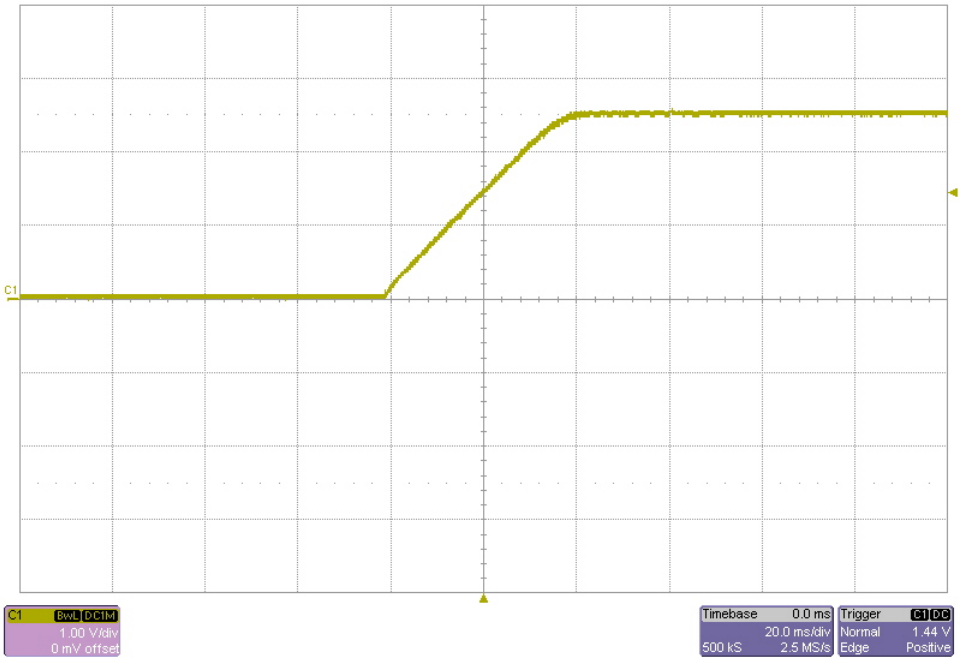
9 Startup – Point of Load Converters

The output voltage at startup is shown in the images below. The input was 12VDC. The startup waveform is not dependent on load current.

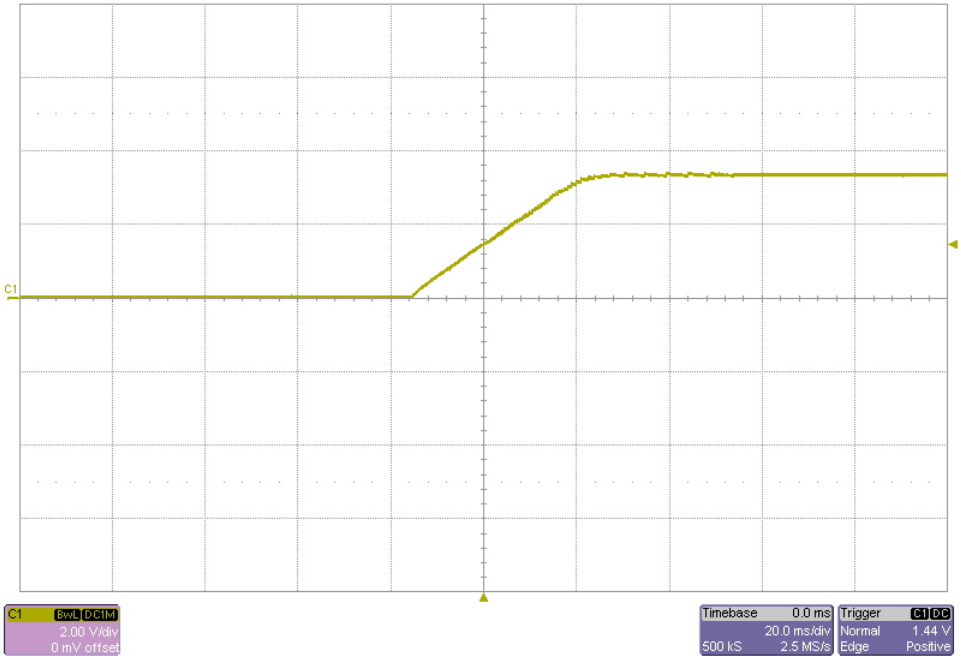
9.1 1.8Vout



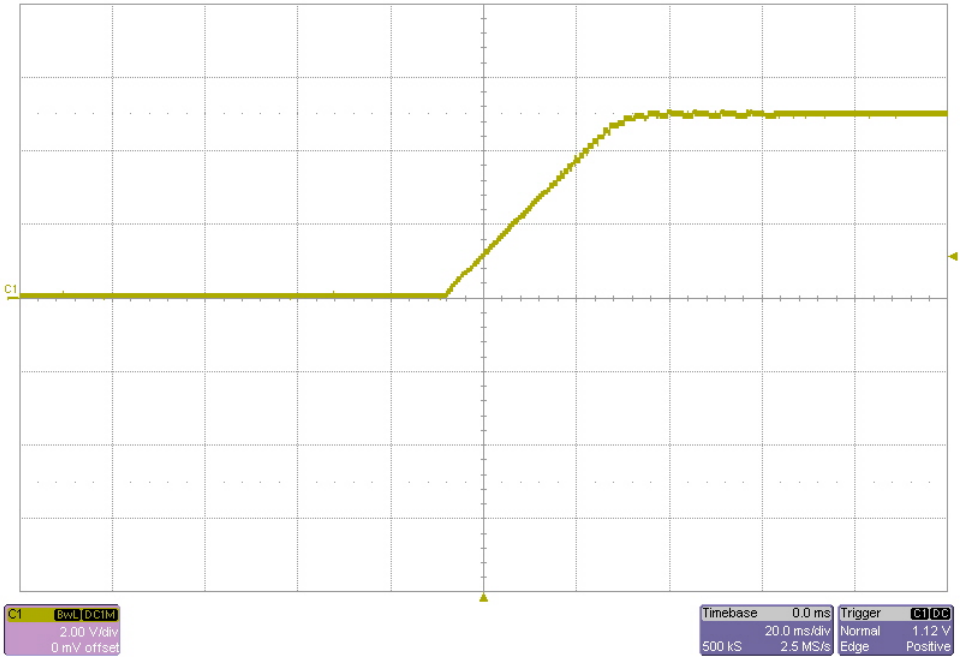
9.2 2.5Vout



9.3 3.3Vout

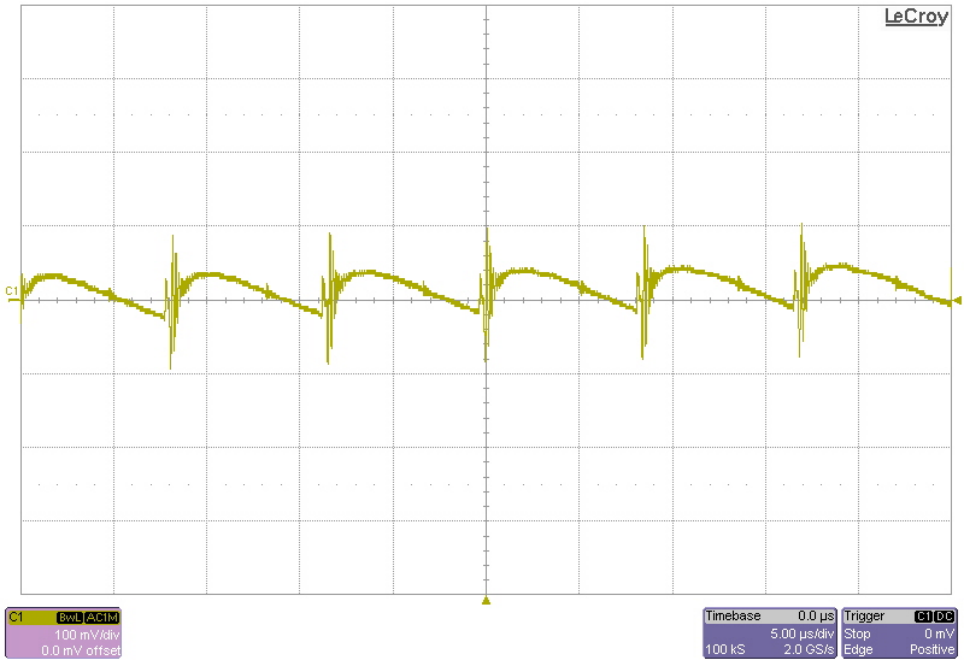


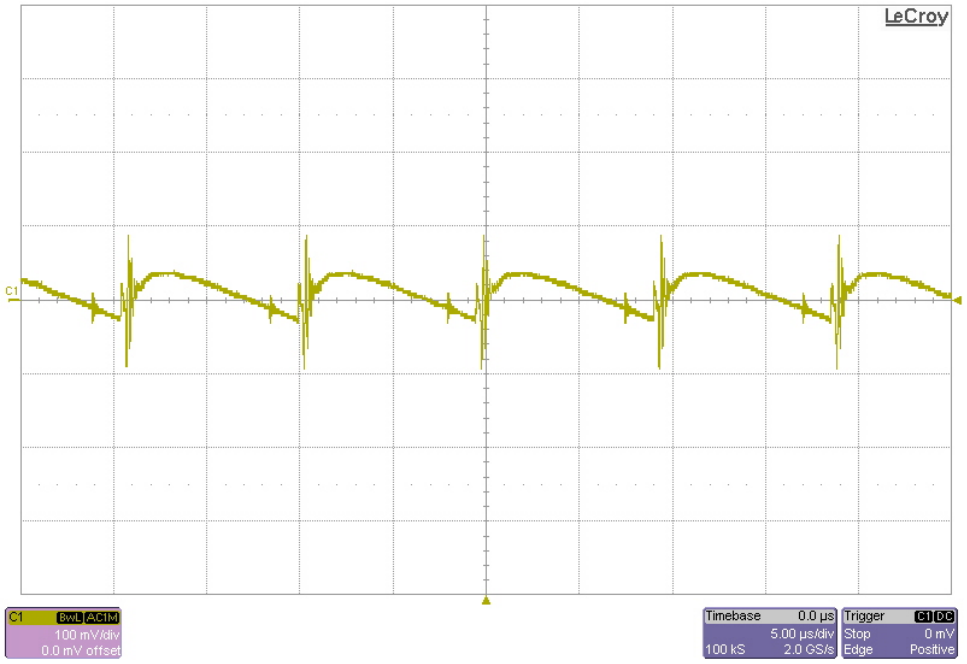
9.4 5Vout



10 Output Ripple Voltage – Flyback Supply – Full Load

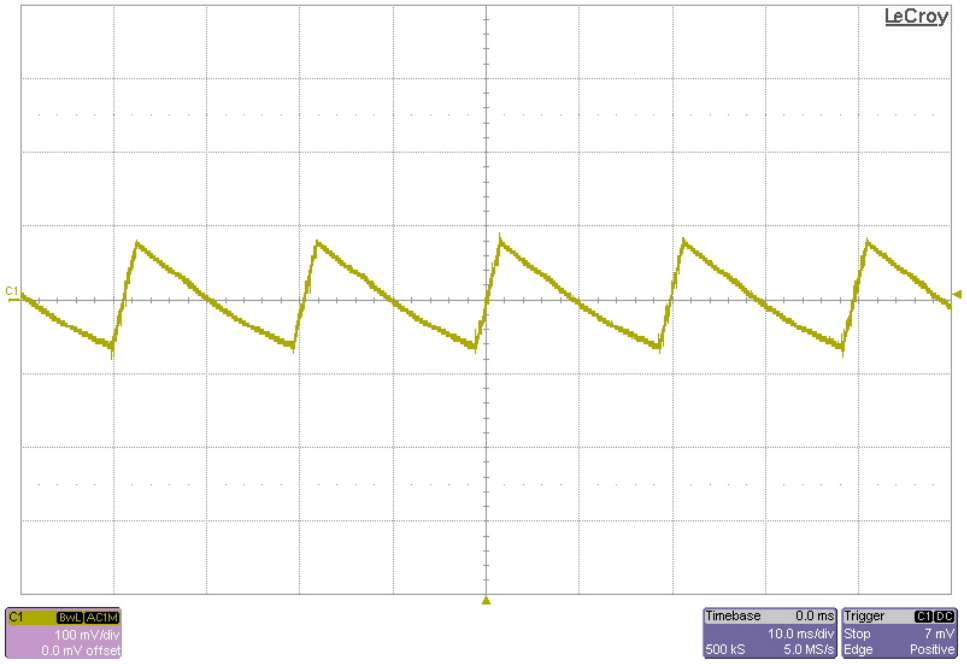
The output ripple voltage of the 12V flyback supply during full load (3.4A) operation is shown in the plots below. The top image shows the ripple with an 115VAC input. The bottom image shows the ripple with a 230VAC.

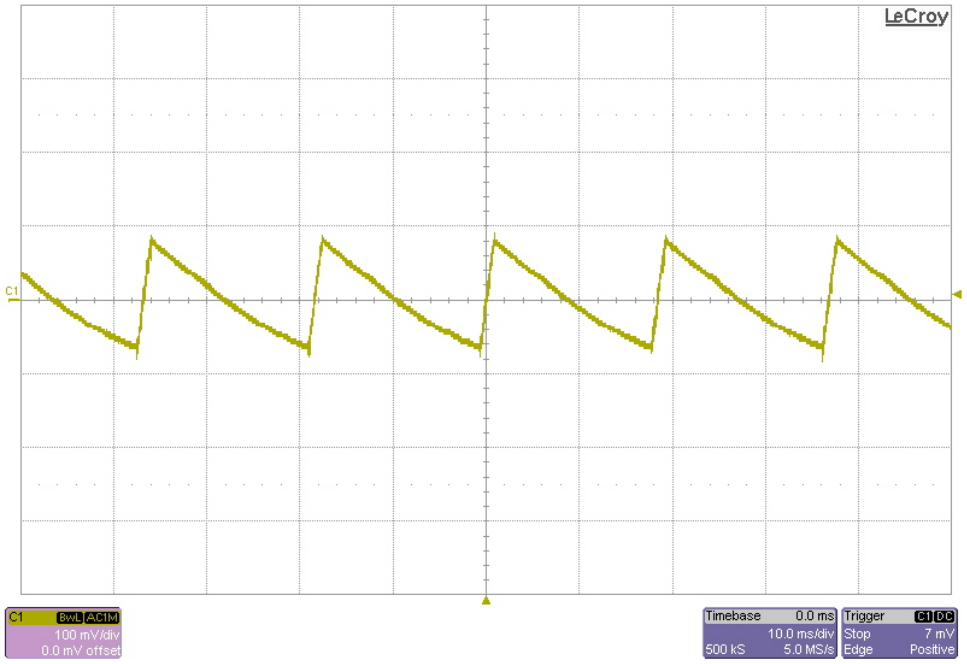




11 Output Ripple Voltage – Flyback Supply – No Load

The output ripple voltage of the 12V flyback supply during no load operation is shown in the plots below. The top image shows the ripple with a 115VAC input. The bottom image shows the ripple with a 230VAC.

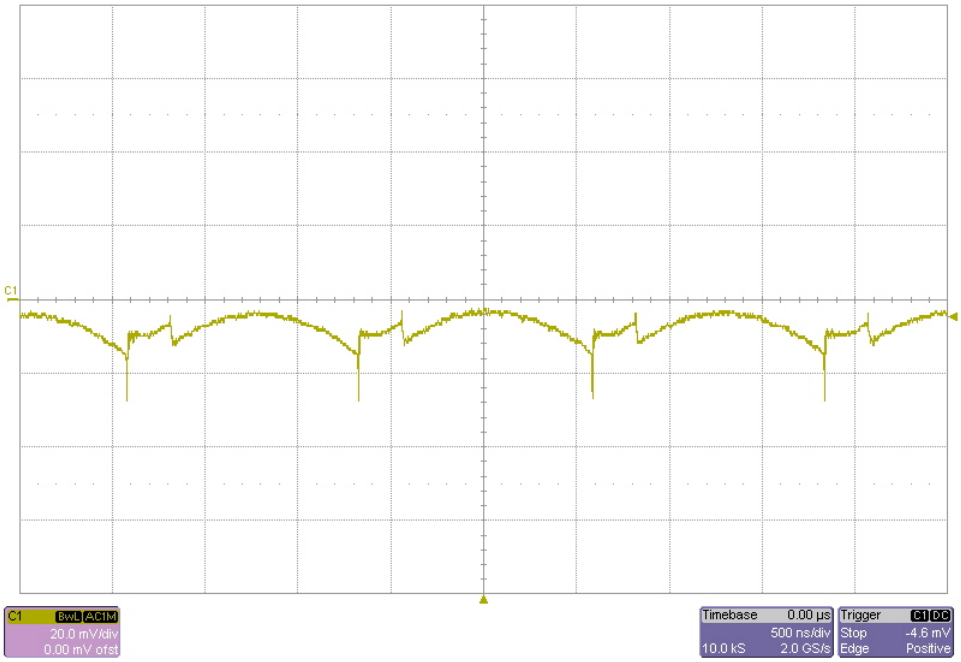




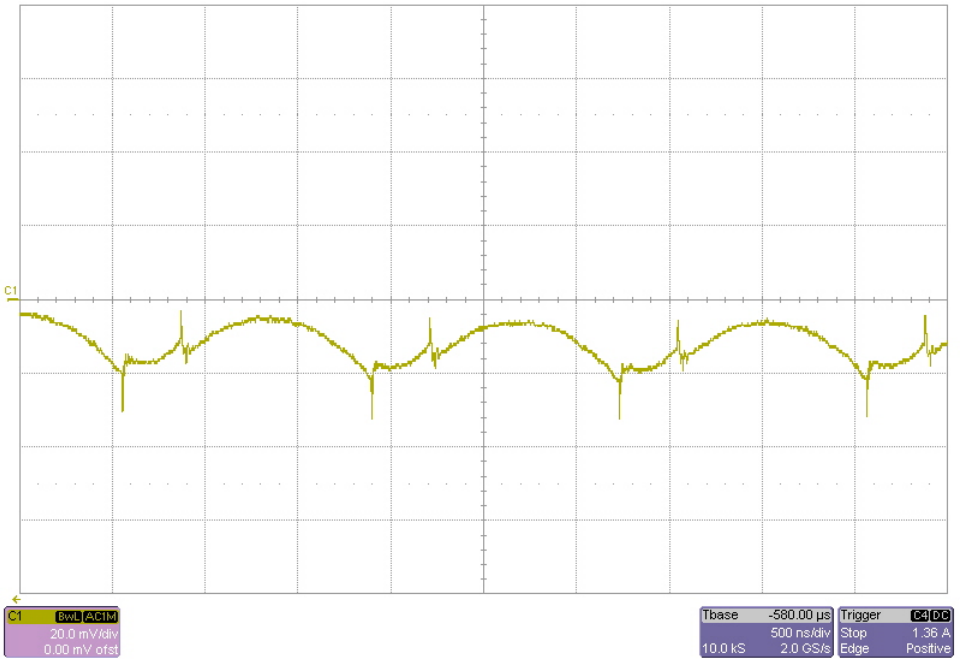
12 Output Ripple Voltage – Point of Load Converters

The output ripple voltage is shown in the plots below. The input voltage was 12V, and the output was loaded with 3A.

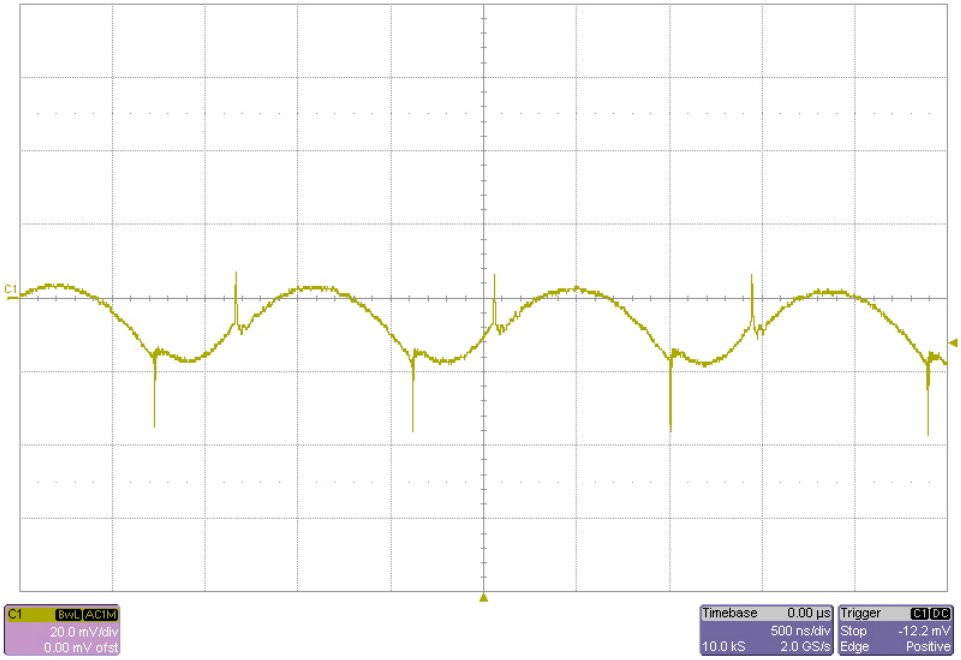
12.1 1.8Vout



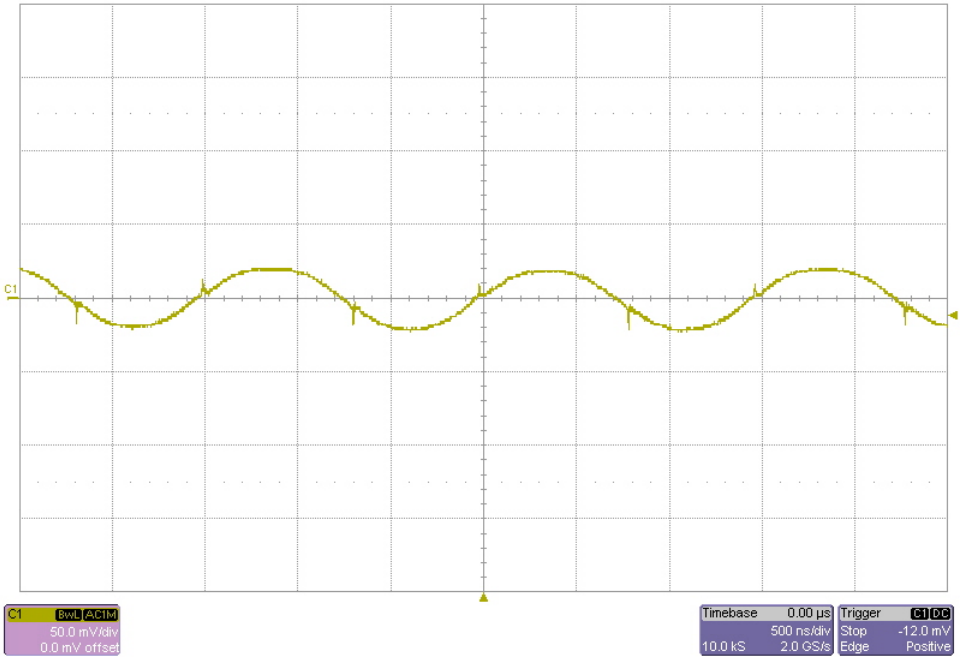
12.2 2.5Vout



12.3 3.3Vout



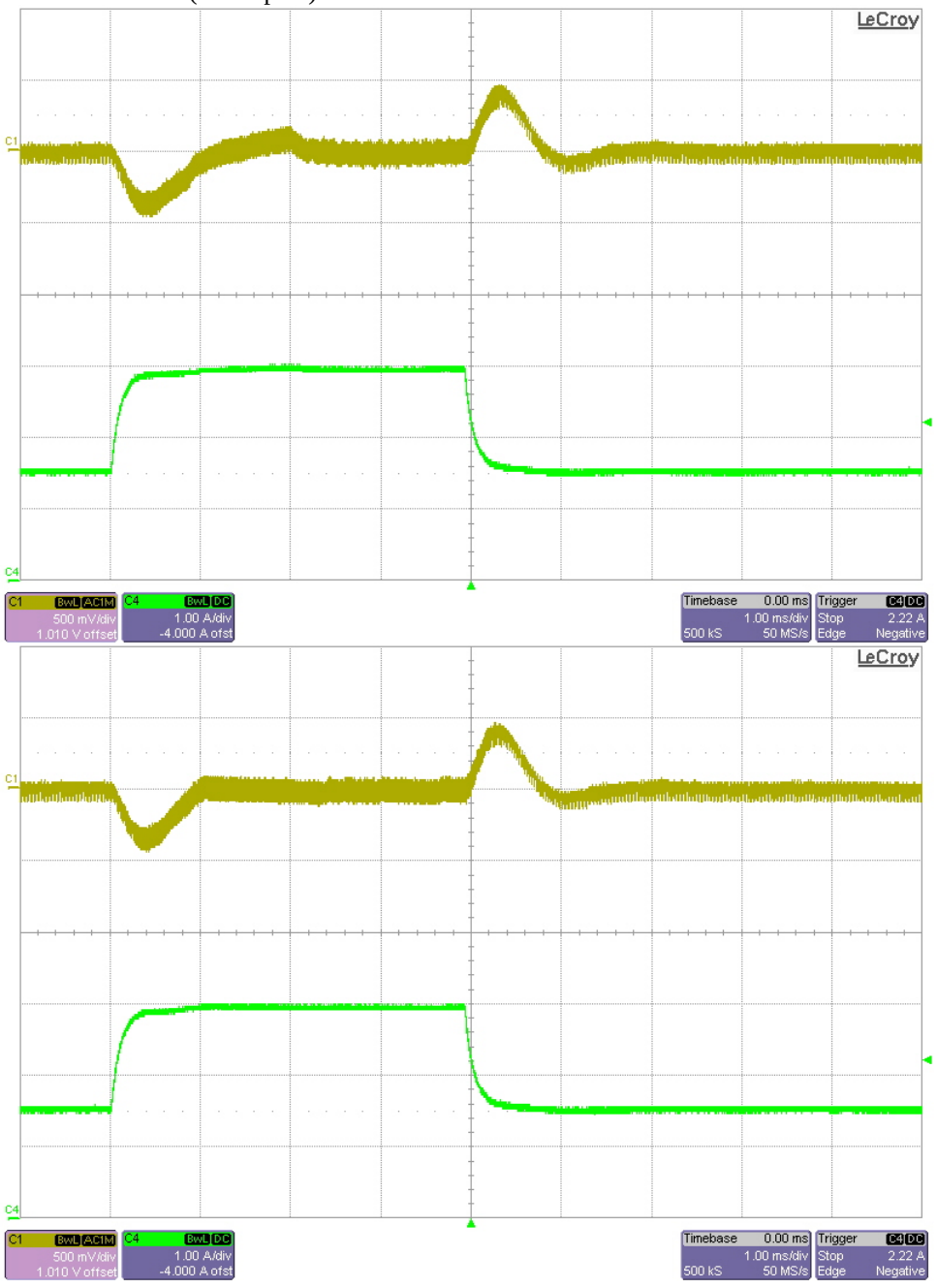
12.4 5Vout



13 Load Transients – Flyback Supply

The images below show the response to a 1.5A to 3A load transient on the 12V flyback supply. For the top image, the input voltage was set to 115VAC. For the bottom image, the input was set to 230VAC.

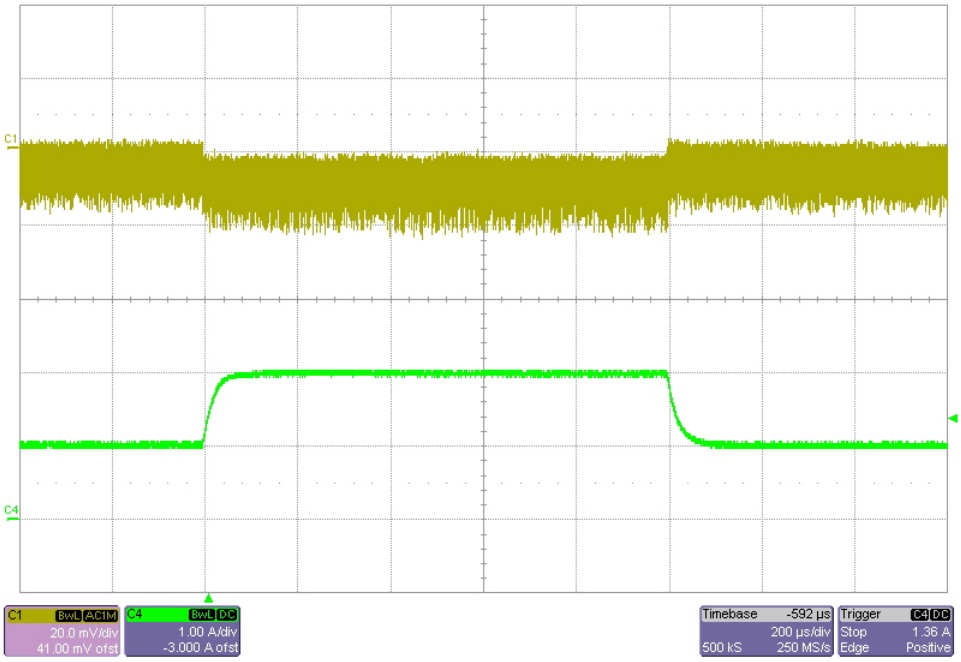
Channel 1: Vout (ac coupled) 500mV/div Channel 4: Iout 1A/div



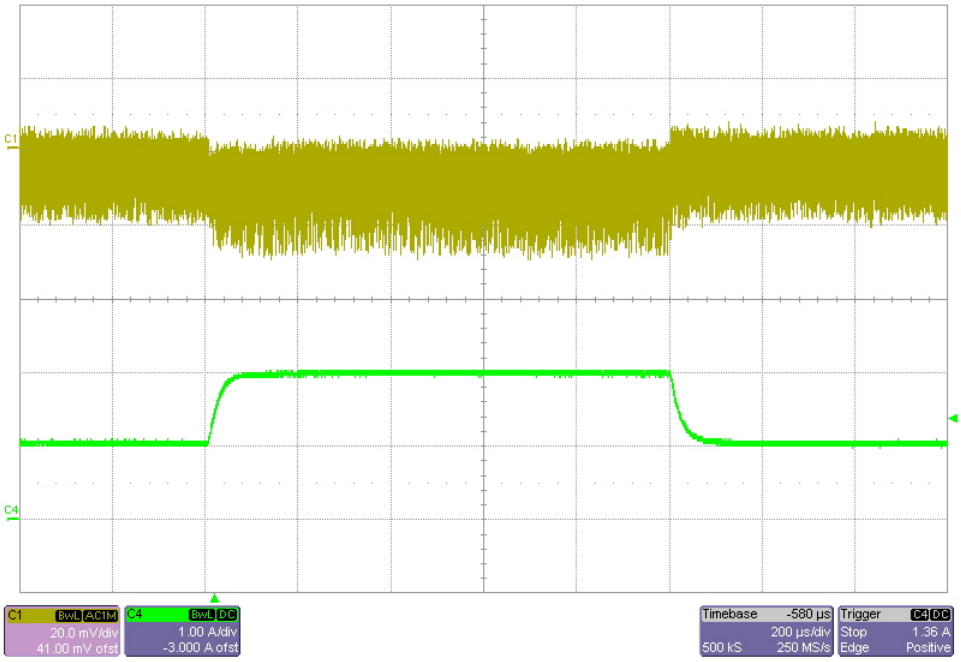
14 Load Transients – Point of Load Converters

The image below shows the response to a 1A to 2A pulsed load. Channel 1 is the AC-coupled output voltage, and channel 4 is the load current. The input voltage was 12V.

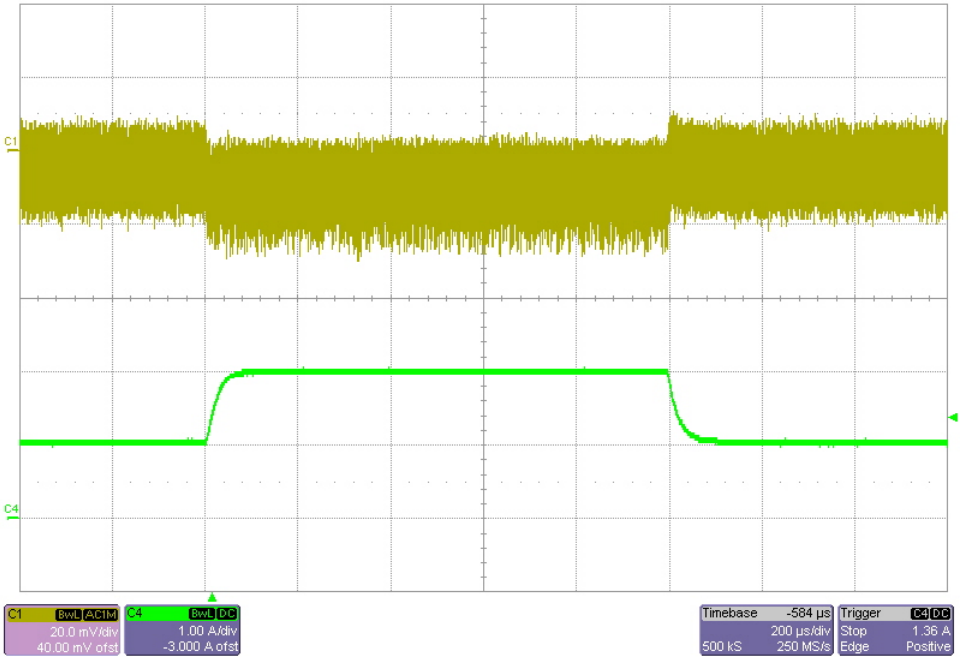
14.1 1.8Vout



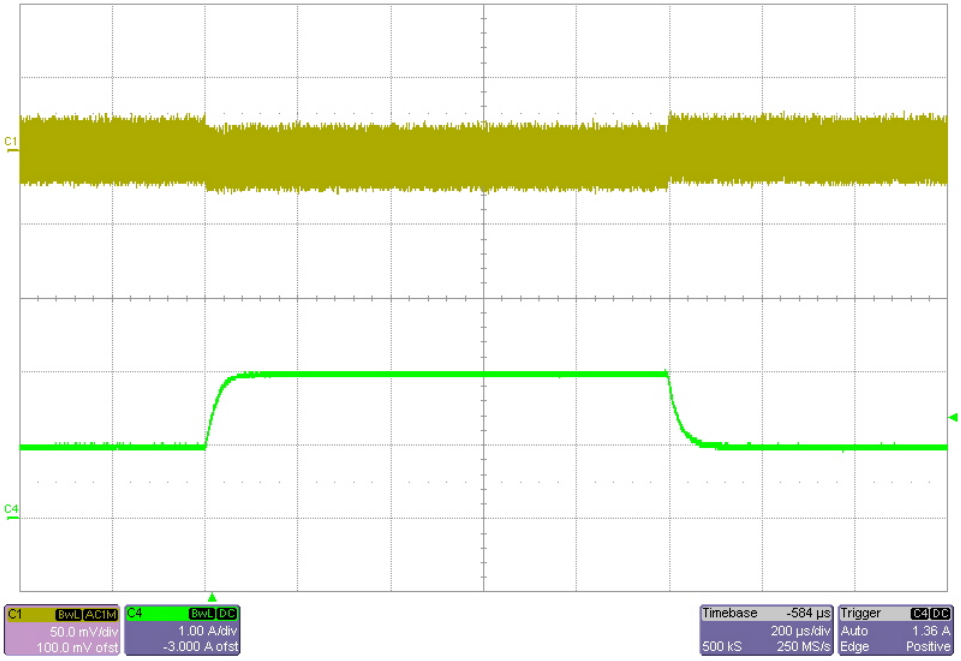
14.2 2.5Vout



14.3 3.3Vout

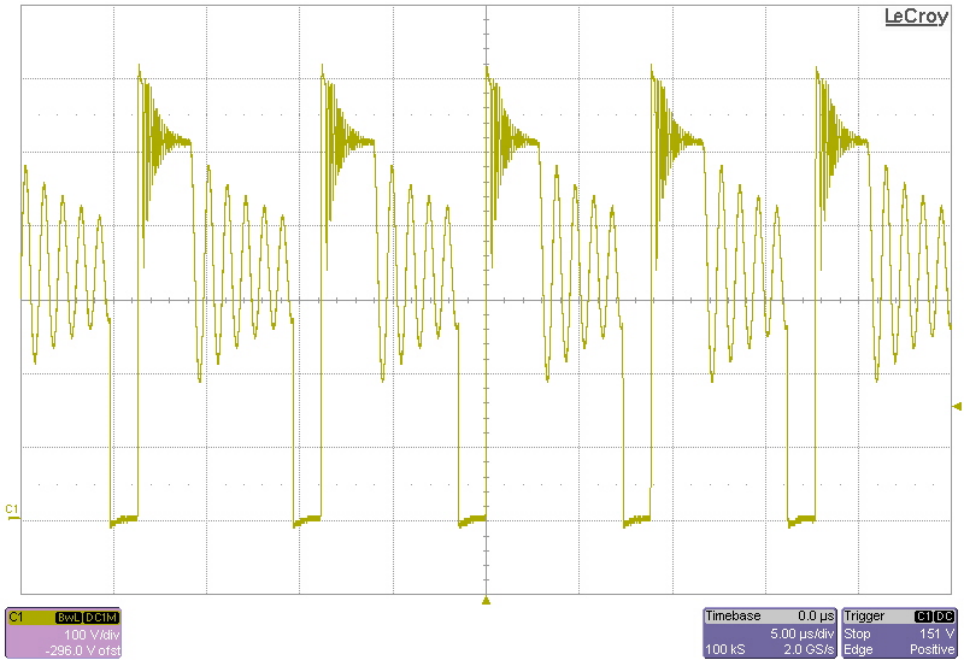


14.4 5Vout



15 Switching Waveforms – Flyback Supply

The image below shows the drain-to-source voltage waveform on the primary MOSFET (Q1) of the 12V flyback supply. The load was 3.4A. The input was 230VAC.



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