Test Data
For PMP10559
12/15/2014

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1. Design Specifications

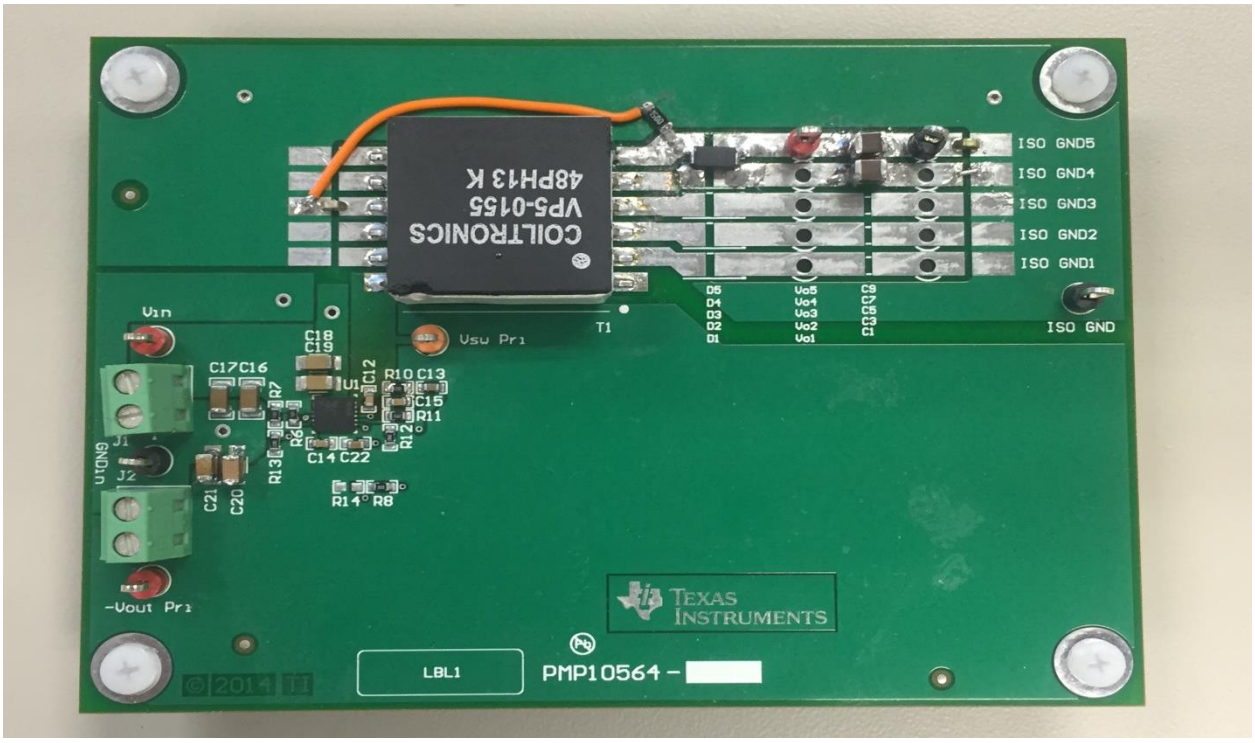
Vin Minimum	**18VDC**
Vin Maximum	**30VDC**
Vout	**+30VDC @ 670mA**
Nominal Switching Frequency	**≈ 200KHz**

2. Circuit Description

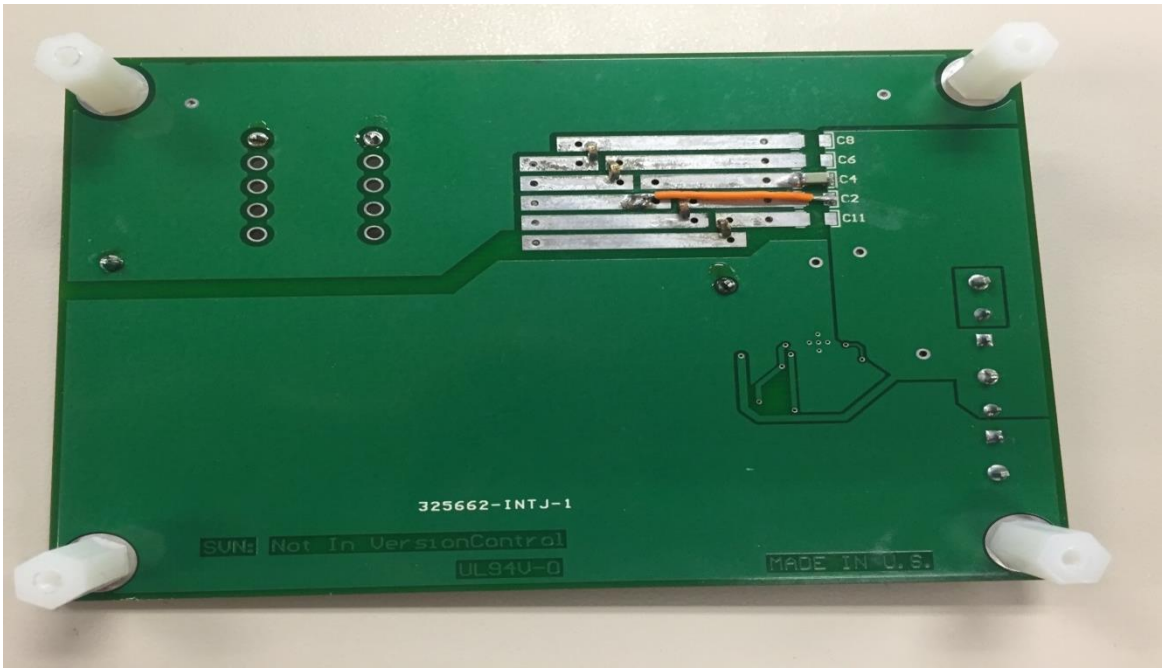
PMP10559 is an Isolated Flyback Converter with the primary configured as a buck-boost inverter, using the LM5160 regulator IC. The design accepts an input voltage of 18Vin to 30Vin and provides one isolated outputs of +30Vout, capable of supplying 670mA current. The nominal switching frequency of the design is 200KHz. The board is a 2-layer PCB with 1oz copper on both the top and bottom layer. All tests for oscilloscope waveform captures were performed on Vout at 18Vin and 30Vin. Efficiency testing was performed at 18Vin, 24Vin, and 30Vin. The design uses an easily available off-the-shelf transformer, making it a more cost effective design solution. 3 identical windings in series forms the primary, and other 3 identical windings in series forms the secondary winding, making the transformer of a 1:1 turns ratio. The selected transformer is capable of 500V isolation. The board is assembled on PMP10564 breakout board.

3. PMP10559 Board Photos

Board Dimensions: 79mm x 107mm



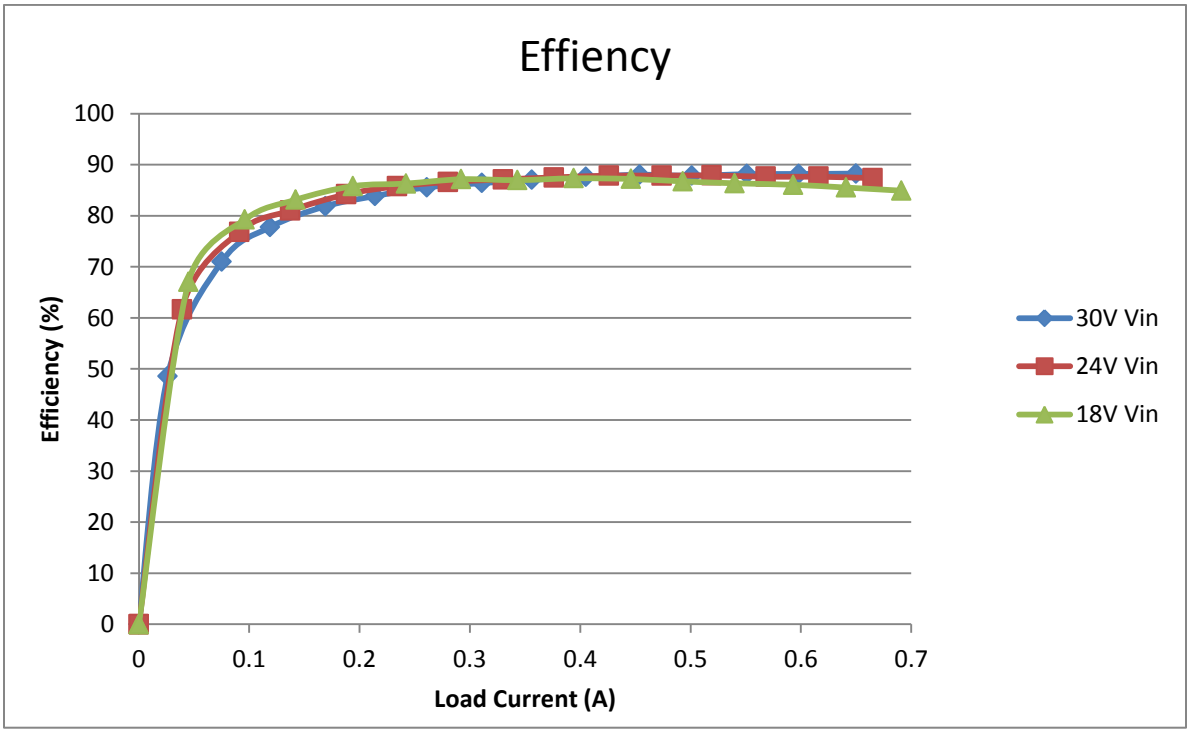
Board Photo (Top)



Board Photo (Bottom)

4. Efficiency

4.1 Efficiency Chart



4.2 Efficiency Data

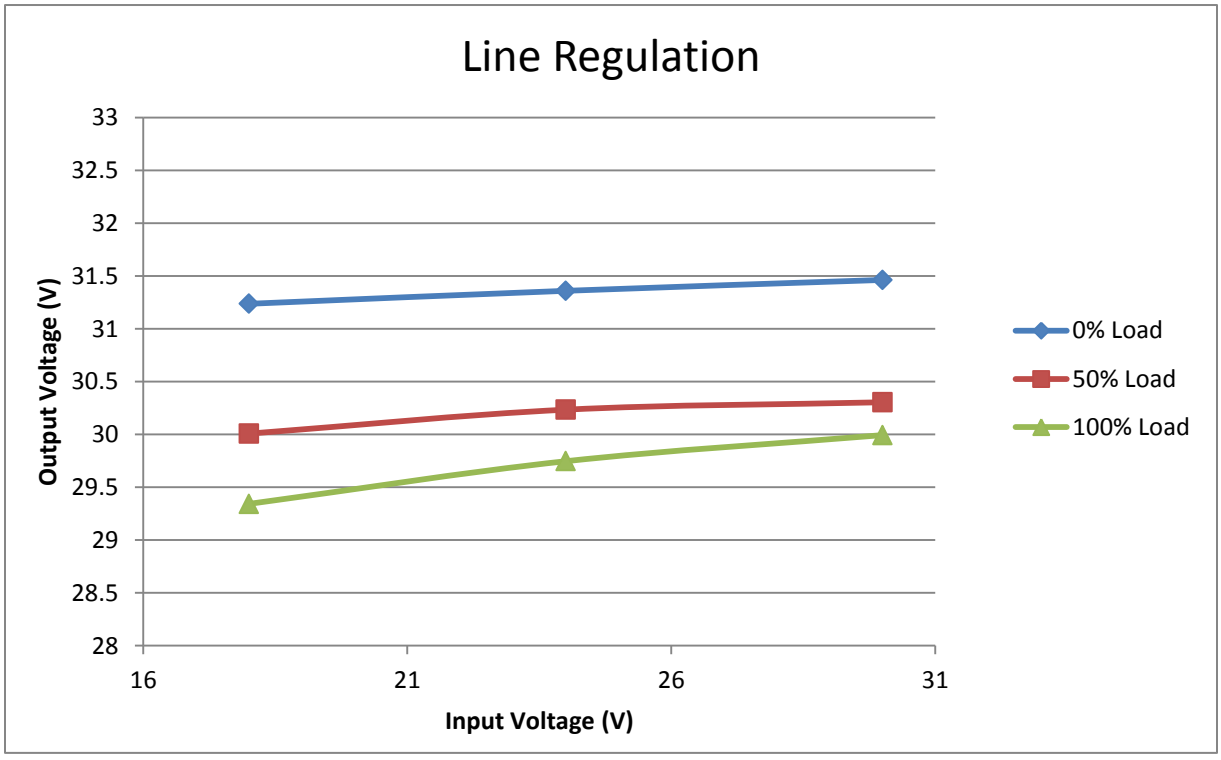
30Vin				
Vin	Iin	Vout	Iout	Eff
30.011	0.028	31.462	0	0
30.011	0.028	31.463	0	0
30.011	0.055	30.813	0.026	48.536
30.011	0.108	30.675	0.075	70.981
30.011	0.156	30.603	0.119	77.787
30.011	0.21	30.528	0.169	81.863
30.011	0.259	30.461	0.214	83.864
30.011	0.309	30.403	0.261	85.569
30.011	0.364	30.349	0.311	86.402
30.011	0.413	30.304	0.356	87.04
30.011	0.466	30.254	0.405	87.614
30.011	0.519	30.204	0.454	88.038
30.011	0.573	30.154	0.501	87.851
30.011	0.627	30.102	0.551	88.145
30.01	0.679	30.051	0.598	88.191
30.01	0.736	29.993	0.65	88.265

24Vin				
Vin	Iin	Vout	Iout	Eff
24.008	0.03	31.359	0	0
24.008	0.03	31.36	0	0
24.008	0.081	30.733	0.039	61.635
24.008	0.151	30.608	0.091	76.832
24.008	0.215	30.519	0.137	81.002
24.008	0.283	30.428	0.188	84.195
24.008	0.345	30.36	0.234	85.771
24.008	0.408	30.299	0.28	86.61
24.008	0.477	30.234	0.33	87.123
24.008	0.54	30.174	0.376	87.513
24.008	0.608	30.105	0.426	87.859
24.008	0.675	30.037	0.474	87.857
24.007	0.737	29.969	0.519	87.909
24.007	0.807	29.895	0.568	87.647
24.007	0.873	29.822	0.616	87.653
24.007	0.943	29.746	0.665	87.378

18Vin				
Vin	Iin	Vout	Iout	Eff
18.011	0.034	31.236	0	0
18.011	0.034	31.259	0	0
18.011	0.114	30.601	0.045	67.066
18.01	0.205	30.477	0.096	79.246
18.01	0.288	30.367	0.142	83.135
18.01	0.38	30.27	0.194	85.806
18.01	0.47	30.191	0.242	86.314
18.01	0.56	30.104	0.292	87.158
18.01	0.657	30.007	0.343	86.984
18.01	0.749	29.904	0.394	87.343
18.01	0.846	29.794	0.446	87.213
18.01	0.937	29.691	0.493	86.74
18.01	1.027	29.582	0.54	86.365
18.009	1.127	29.459	0.593	86.071
18.01	1.221	29.342	0.641	85.53
18.009	1.32	29.214	0.691	84.919

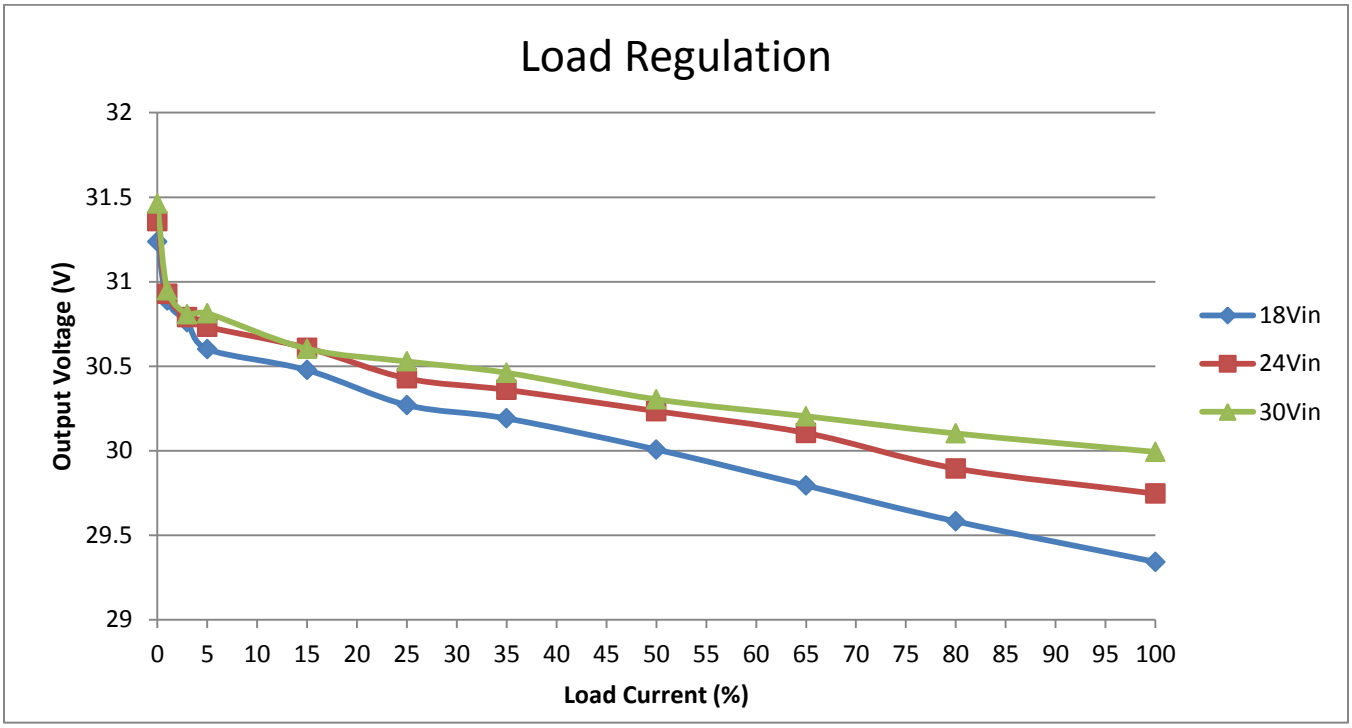
5 Output Voltage Regulation

5.1 Line Regulation



Line Regulation at 0% Load			Line Regulation at 50% Load			Line Regulation at 100% Load		
Vin	Vsec		Vin	Vsec		Vin	Vsec	
18	30.61		18	29.749		18	28.957	
24	30.765		24	30.09		24	29.699	
30	30.957		30	30.297		30	30.09	

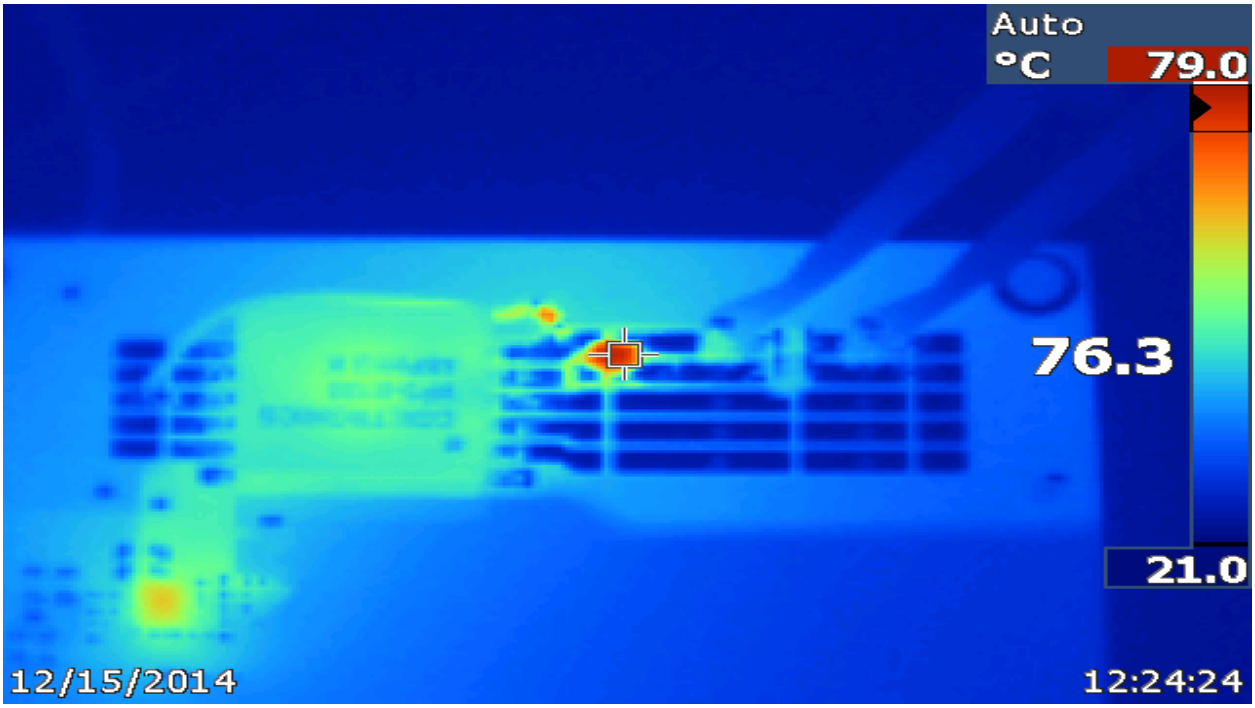
5.2 Load Regulation



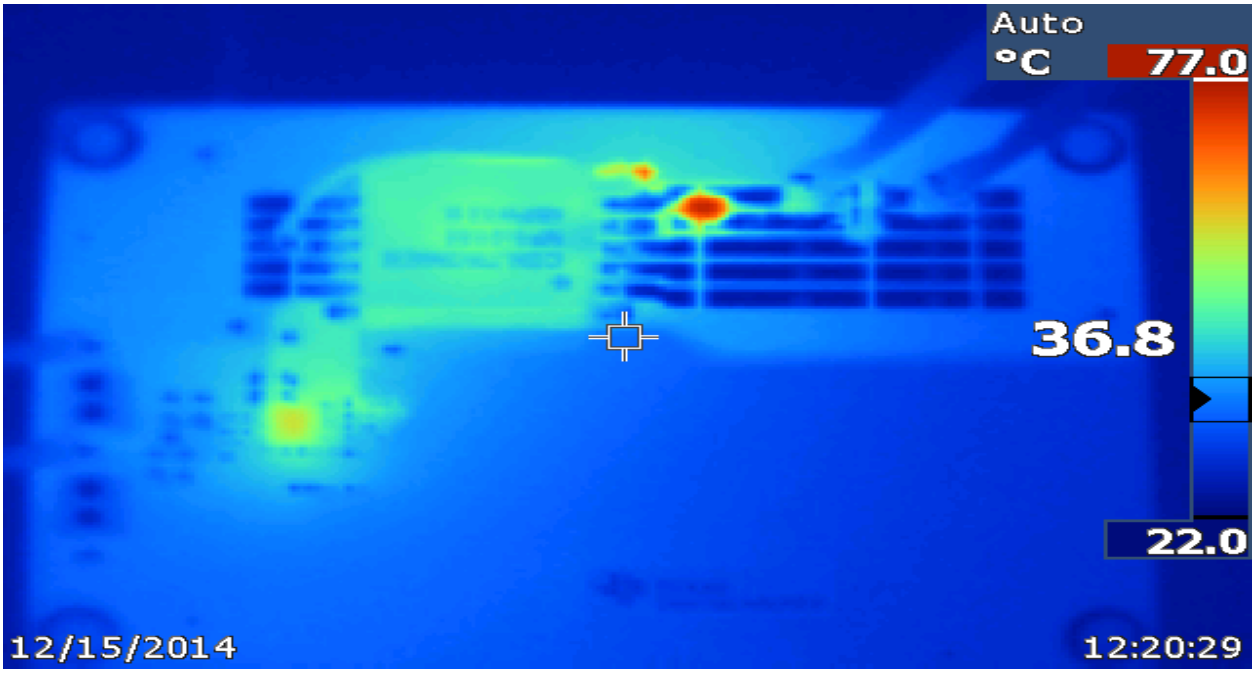
% of Load	18Vin	24Vin	30Vin
0	31.236	31.359	31.462
1	30.889	30.928	30.95
3	30.76	30.79	30.808
5	30.601	30.733	30.813
15	30.477	30.608	30.603
25	30.27	30.428	30.528
35	30.191	30.36	30.461
50	30.007	30.234	30.304
65	29.794	30.105	30.204
80	29.582	29.895	30.102
100	29.342	29.746	29.993

6 Thermal Images

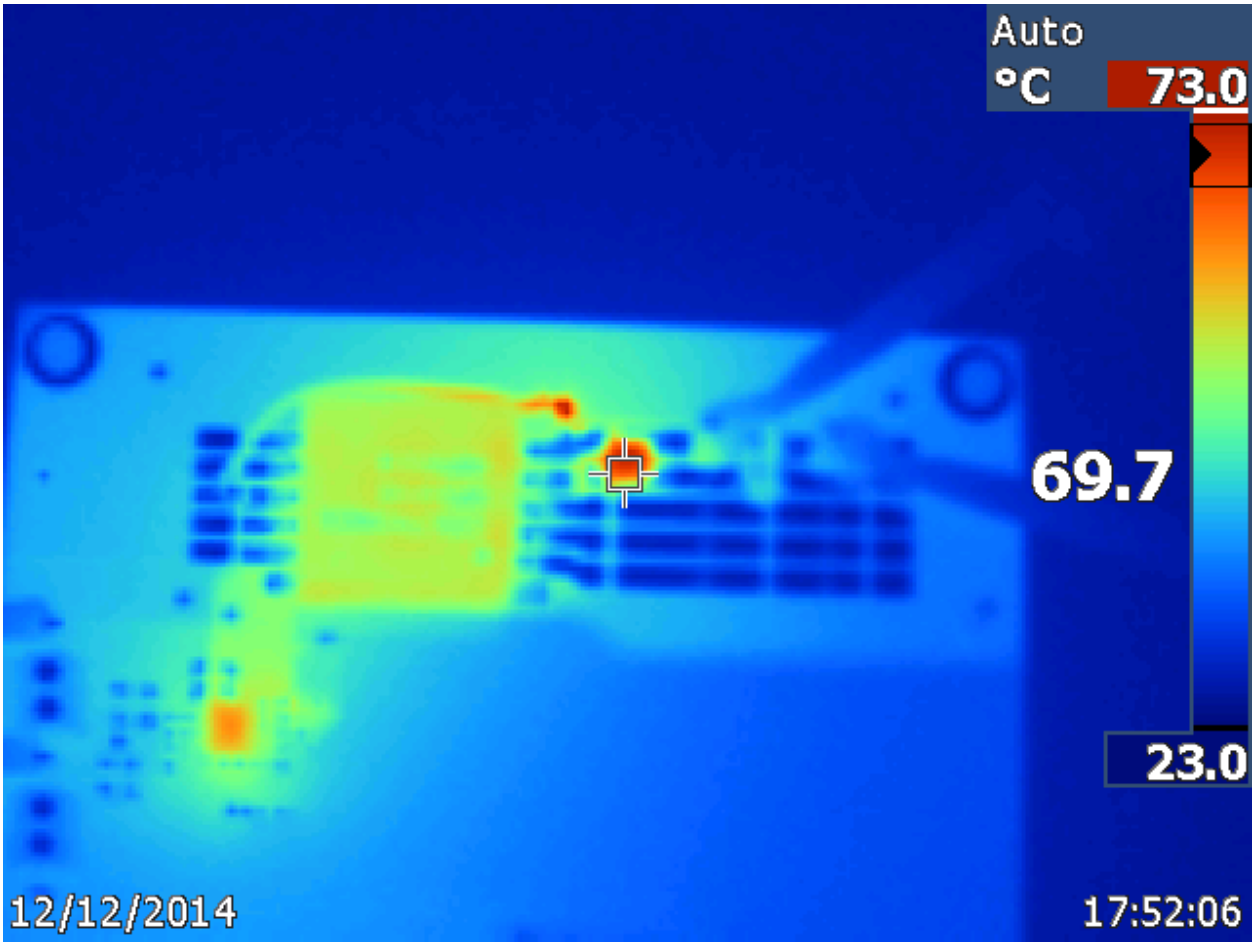
Note: At 18V input, the total power dissipated to the board is 3.57W at full load. The IC will rise 33.4 degrees per watt dissipated. Thermal could be improved by building a 4-layer board with thicker copper. Another way is to use a bigger package rectifier on the output.



IR Thermal Image Taken at Steady State at 18Vin and Output at Full Load (Vout Primary Unloaded)



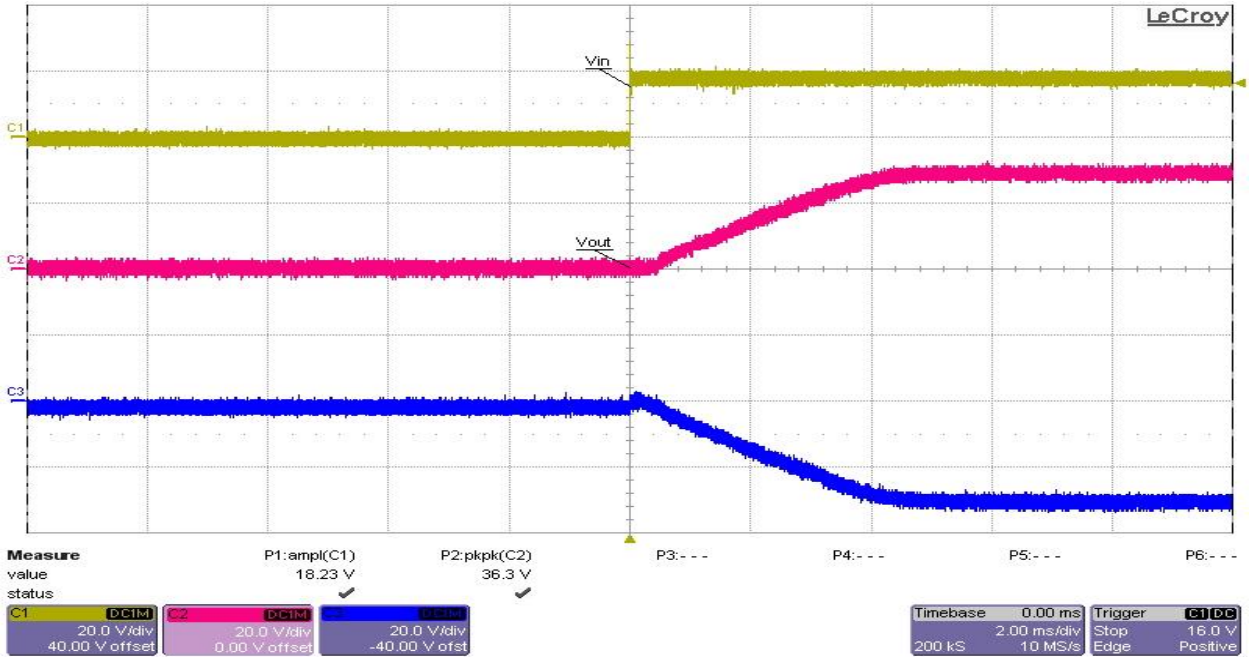
IR Thermal Image Taken at Steady State at 24Vin and Output at Full Load (Vout Primary Unloaded)



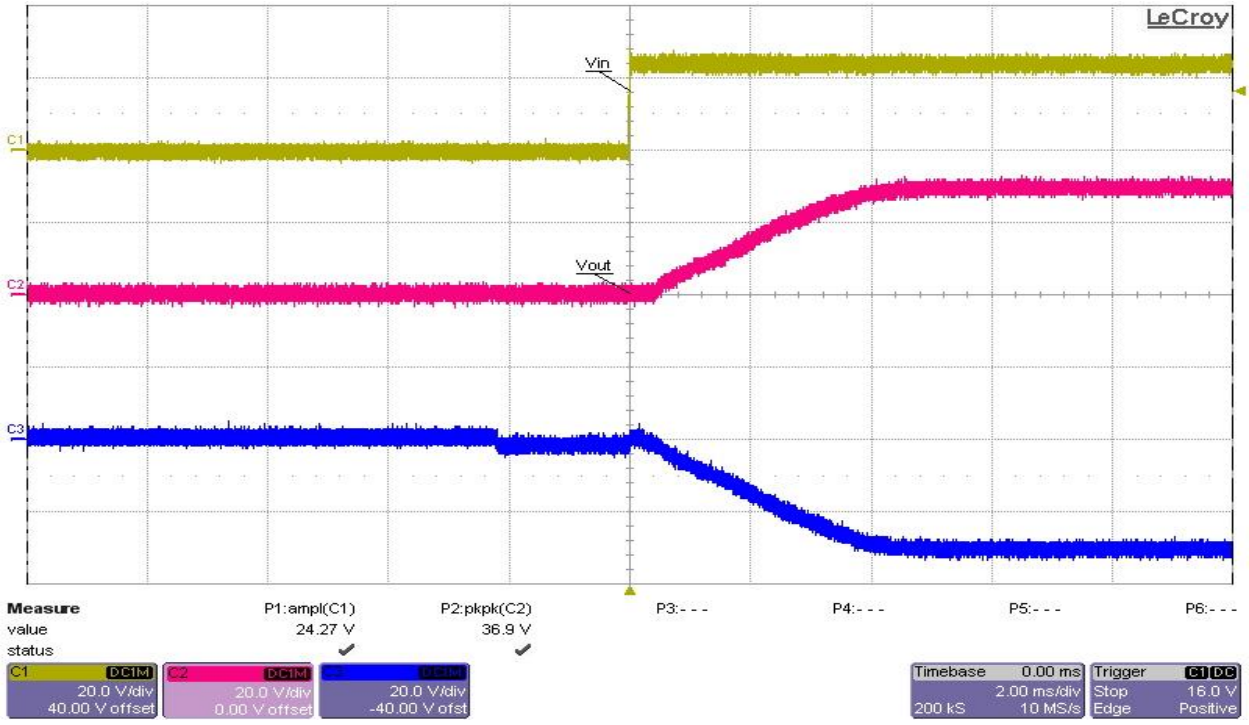
IR Thermal Image Taken at Steady State at 30Vin and Output at Full Load (Vout Primary Unloaded)

7 Waveform

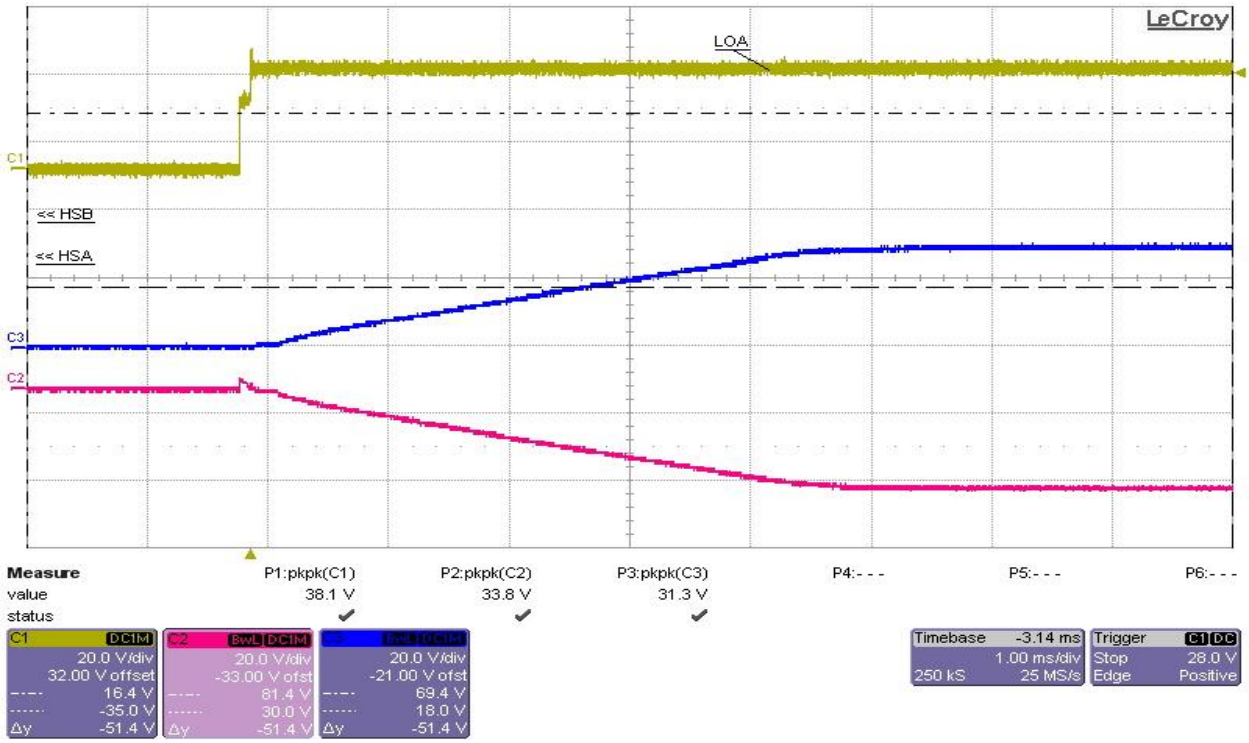
7.1 Start-Up



Startup into Full Load at 18Vin, Ch1 input, Ch2 Vout, Ch3 Vpri.

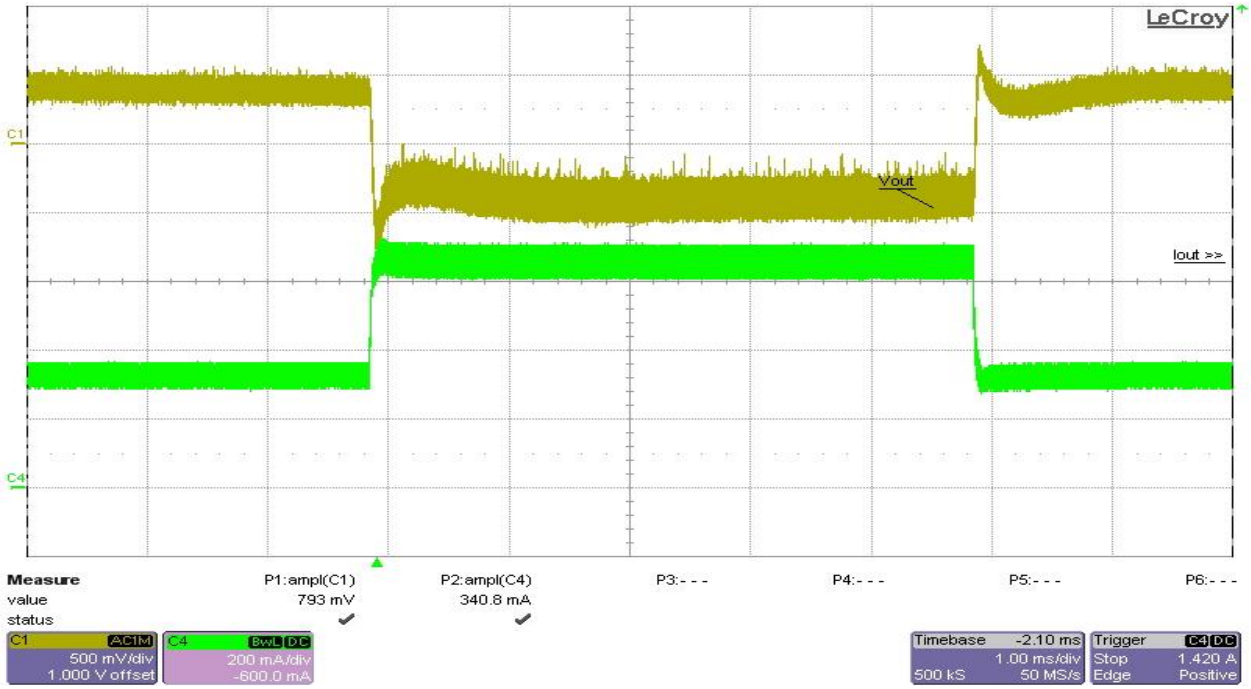


Startup into Full Load at 24Vin, Ch1 input, Ch2 Vpri, Ch3 Vout.

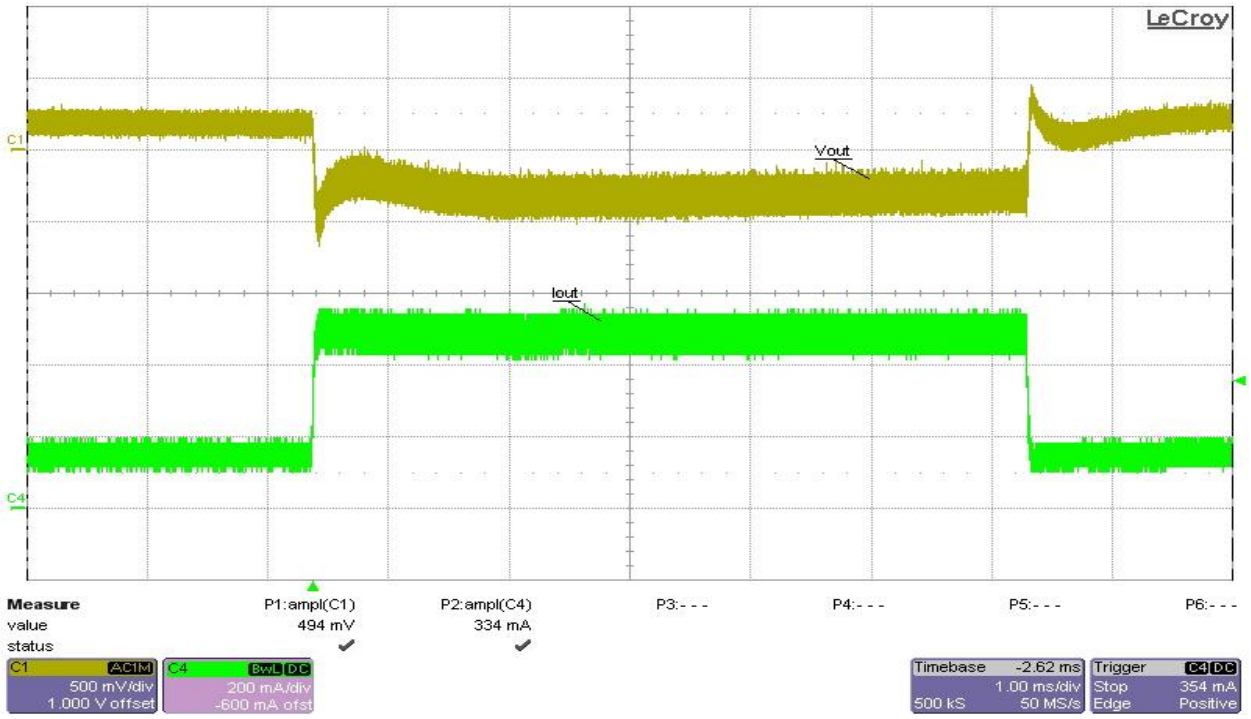


Startup into Full Load at 30Vin, Ch1 input, Ch2 Vpri, Ch3 Vout.

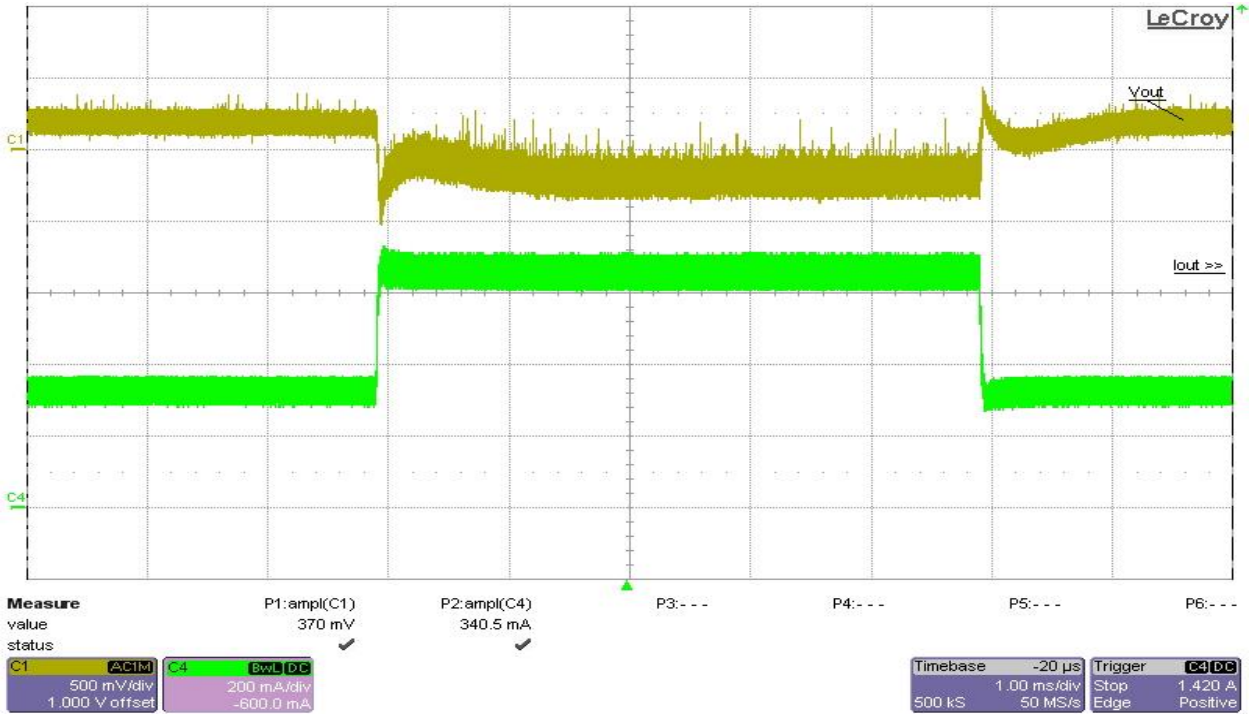
7.2 Load-Transient



Load Transient Response of Vout Rail Undergoing 50% to 100% Load Step at 18Vin. Ch4 is load current, Ch1 is Vout AC coupled.

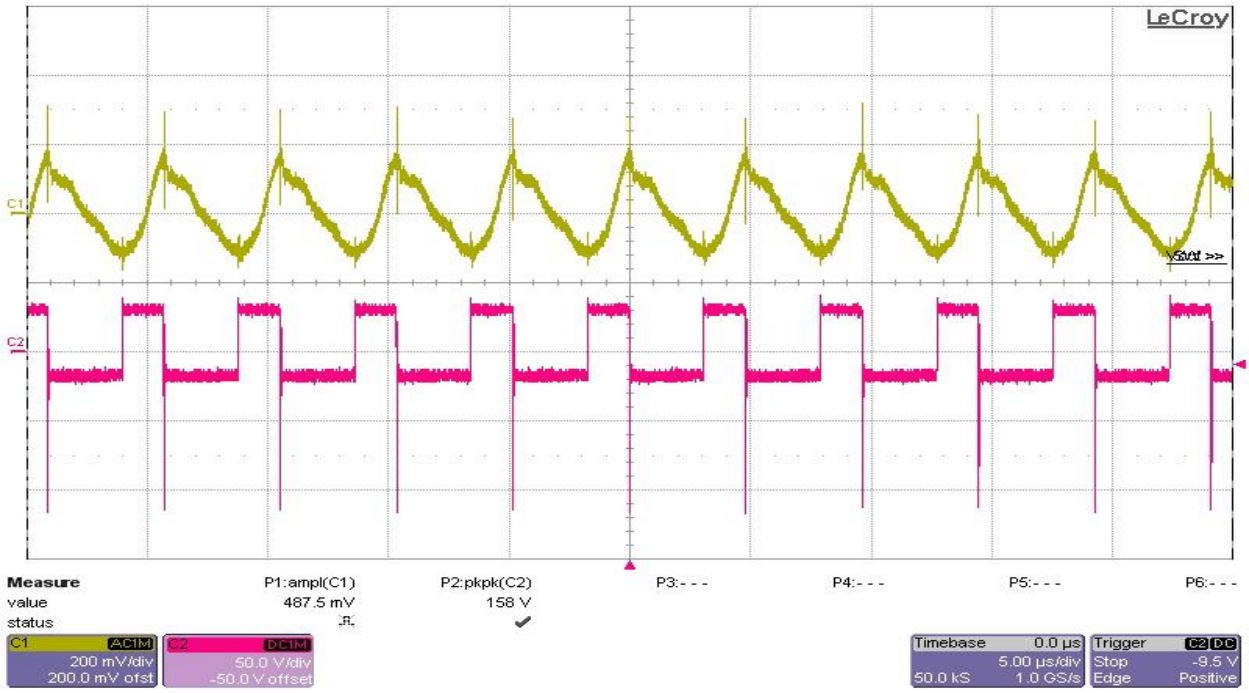


Load Transient Response of Vout Rail Undergoing 50% to 100% Load Step at 24Vin. Ch4 is load current, Ch1 is Vout AC coupled.

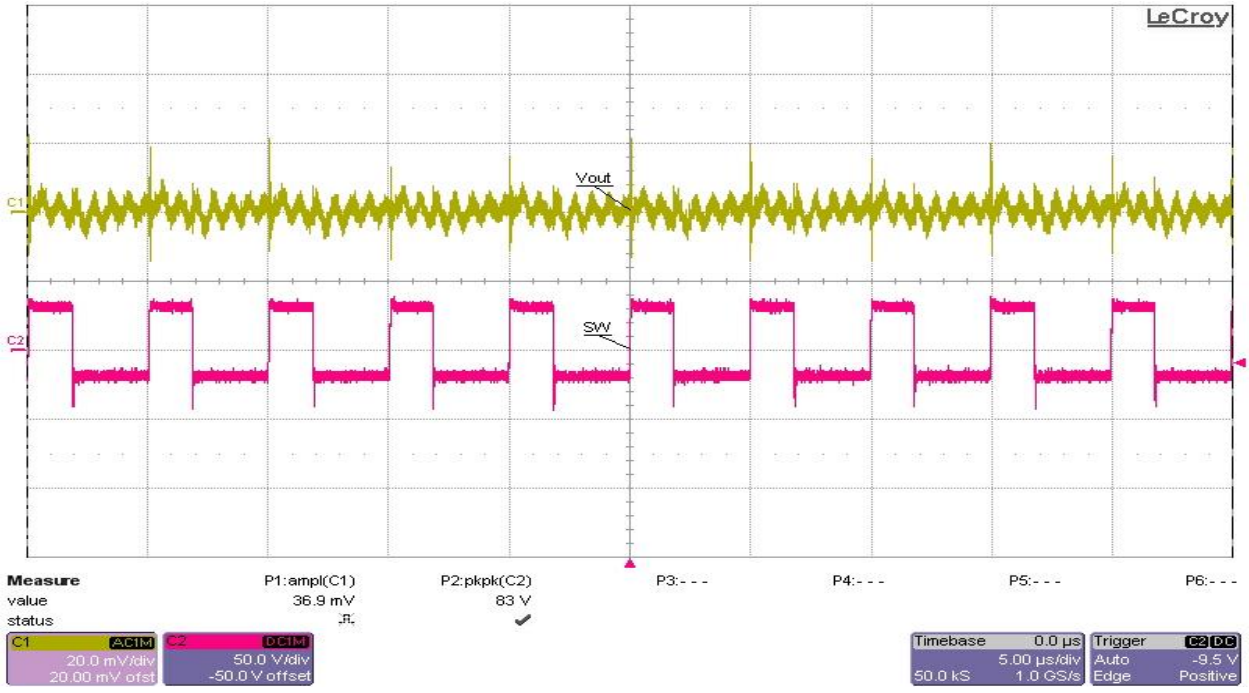


Load Transient Response of Vout Rail Undergoing 50% to 100% Load Step at 30Vin. Ch4 is load current, Ch1 is Vout AC coupled.

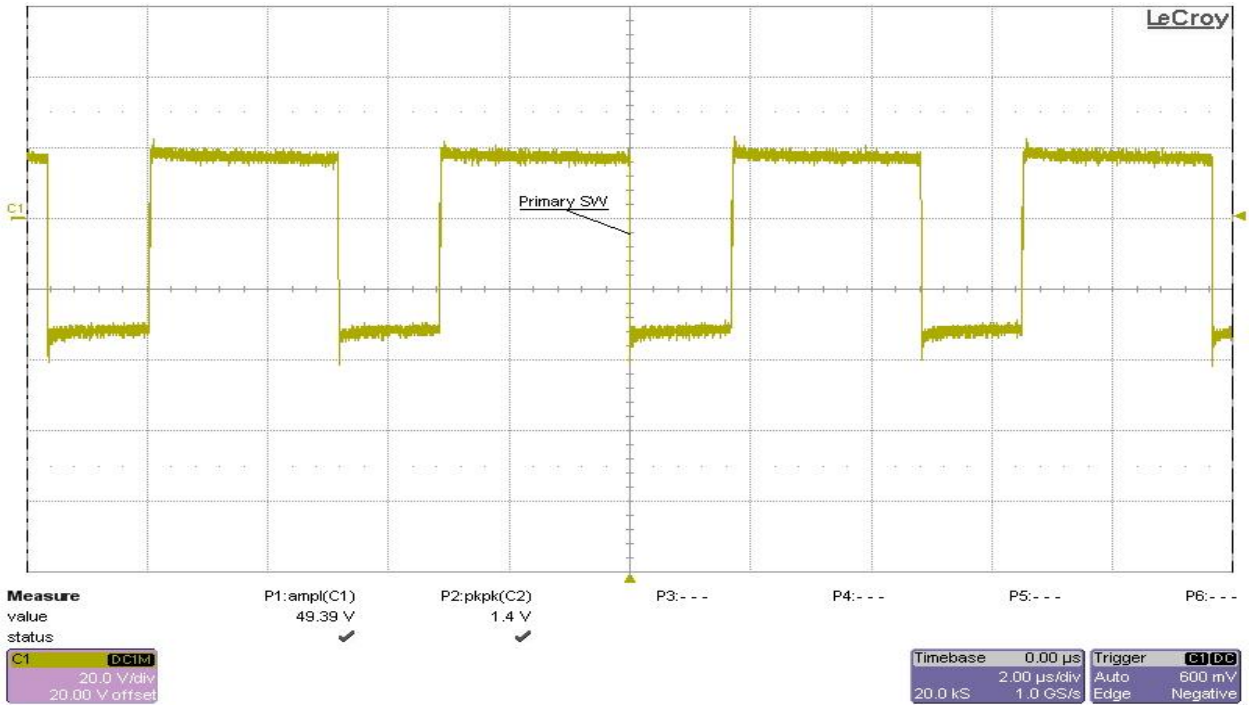
7.3 Switching Waveform and Output Ripple



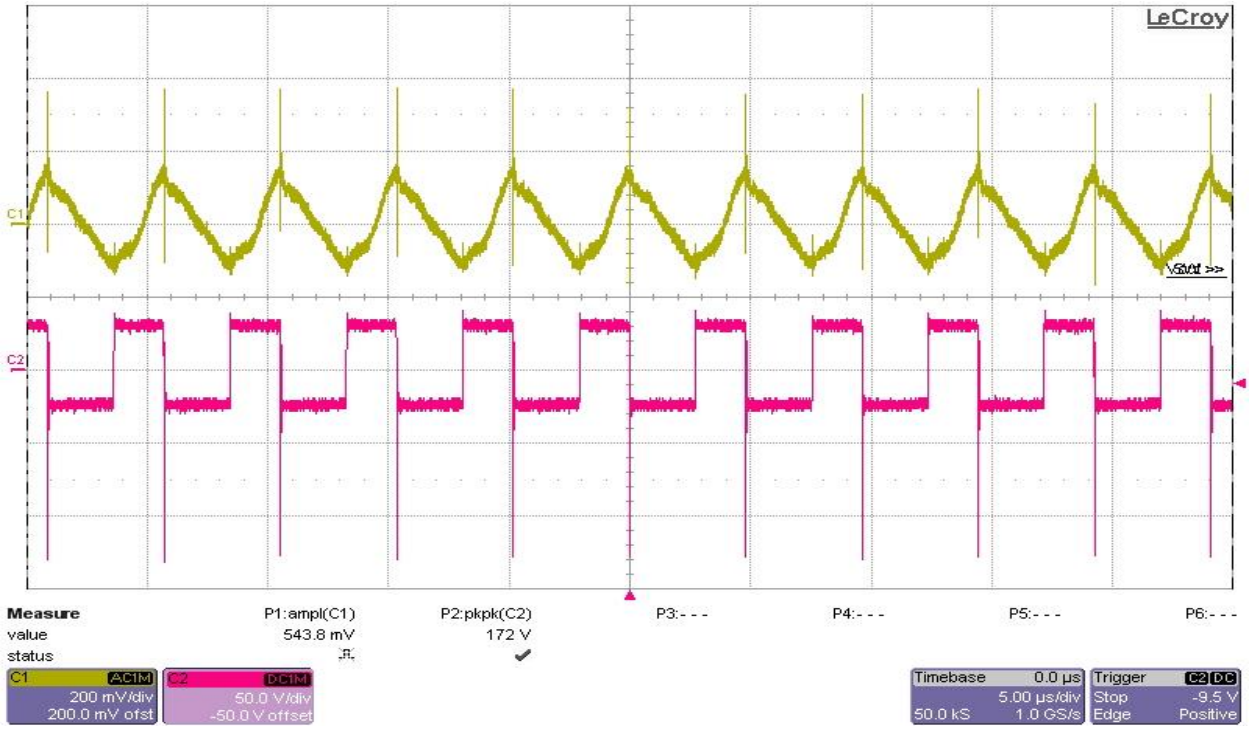
18Vin, 100% load. Ch2 measures secondary switching waveform, Ch1 is AC coupled to measure ripple across Cout.



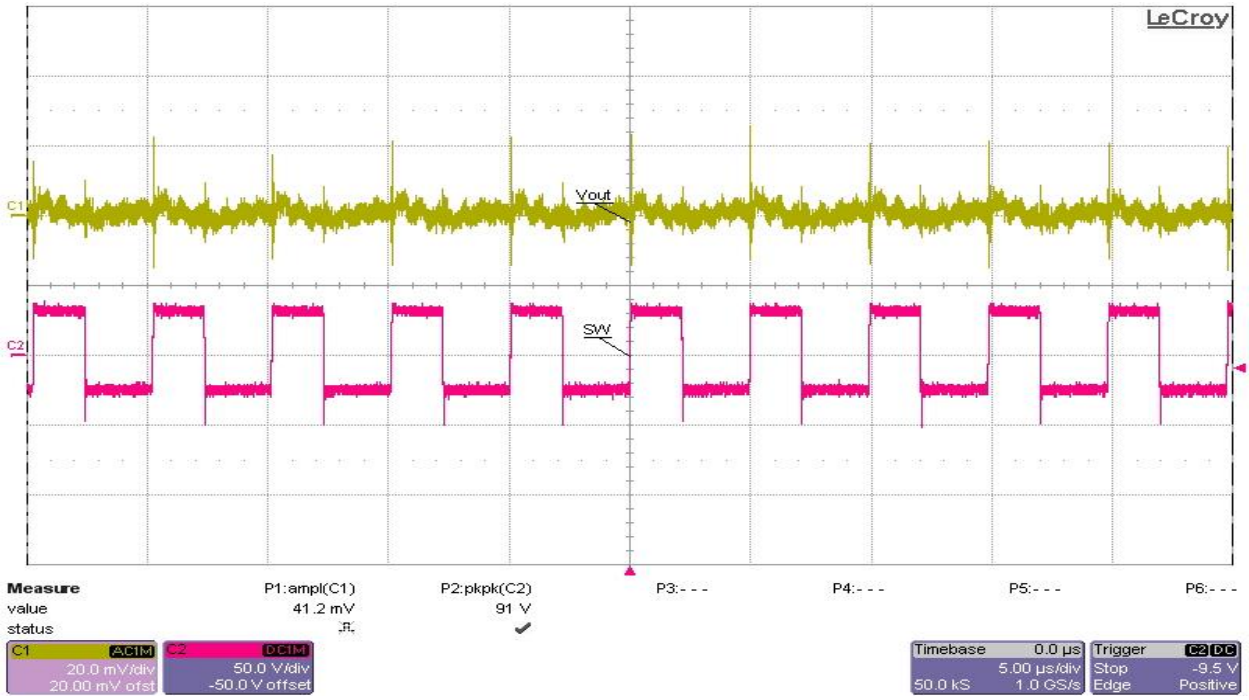
18Vin, 0% load. Ch2 measures secondary switching waveform, Ch1 is AC coupled to measure ripple across Cout.



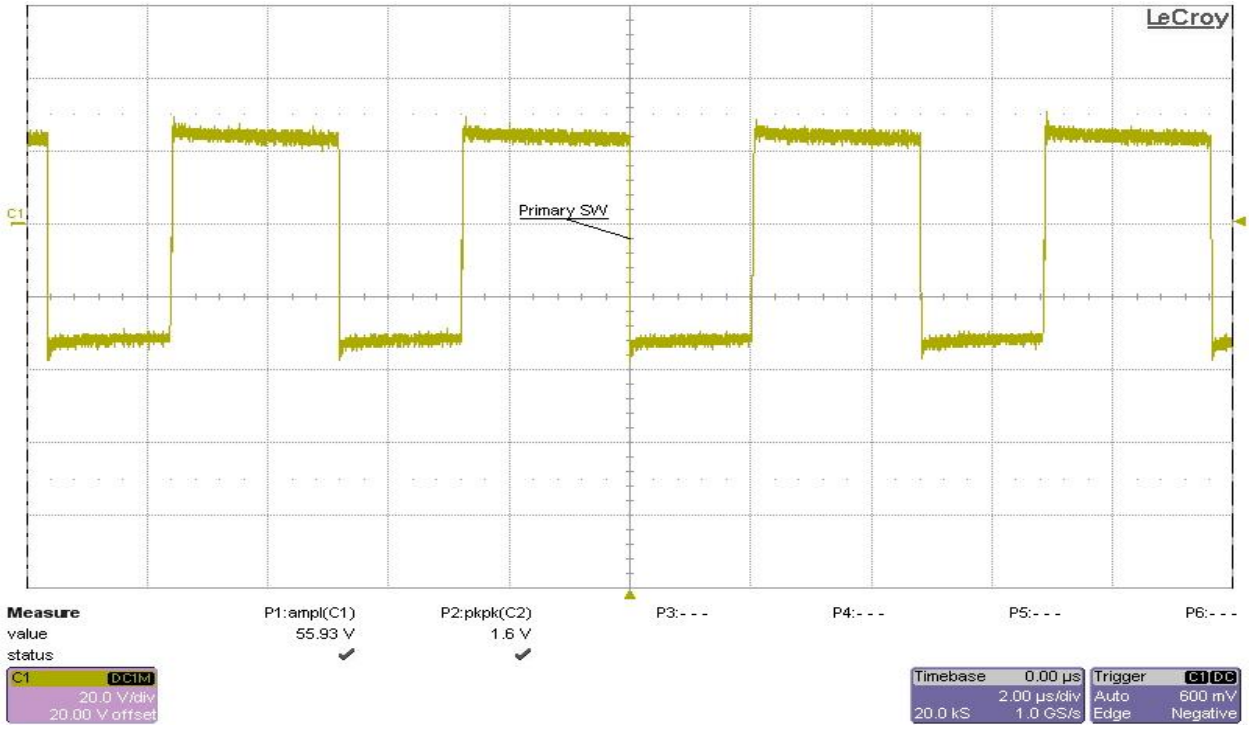
18Vin, 100% load. Ch1 measures primary switching waveform.



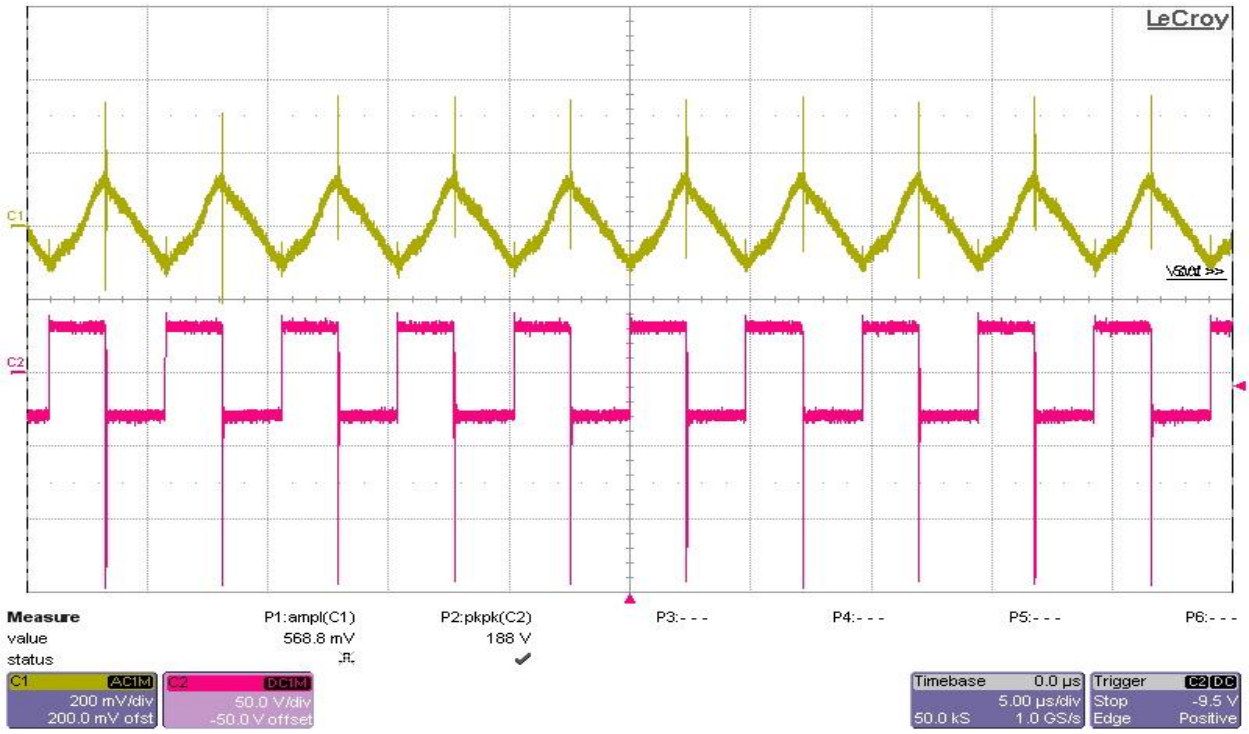
24Vin, 100% load. Ch1 measures secondary switching waveform, Ch2 is AC coupled to measure ripple across Cout.



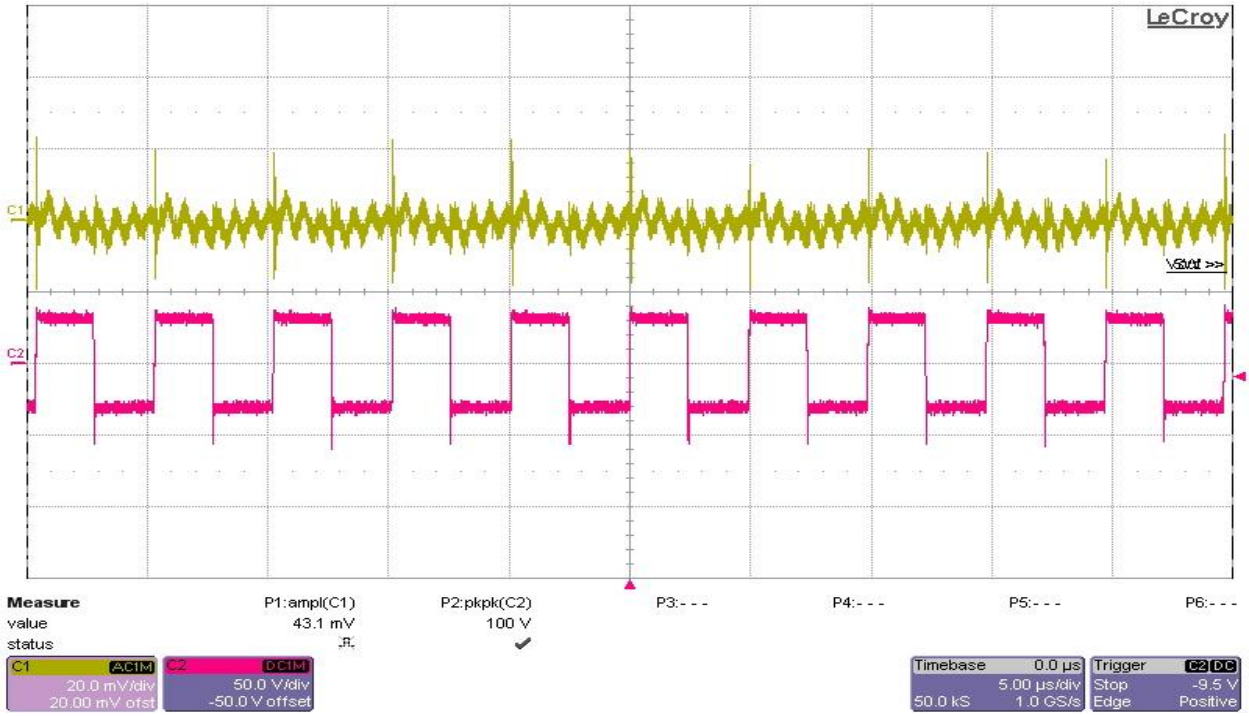
24Vin, 0% load. Ch2 measures secondary switching waveform, Ch1 is AC coupled to measure ripple across Cout.



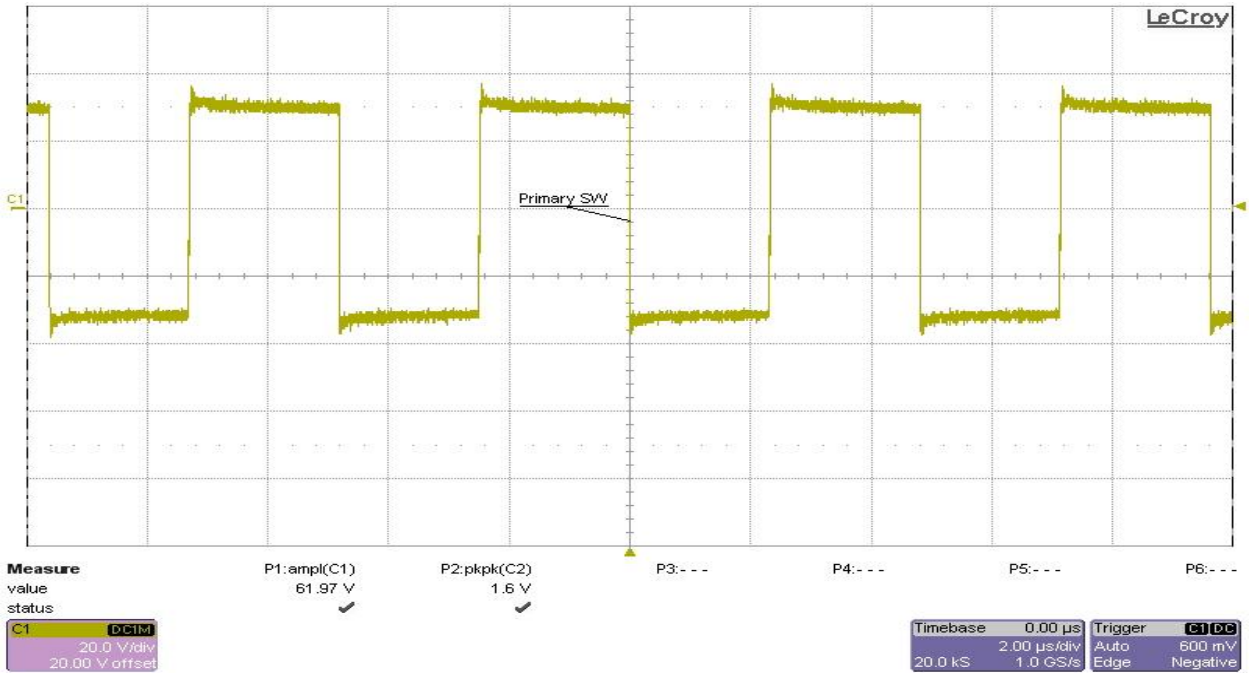
24Vin, 100% load. Ch1 measures primary switching waveform.



30Vin, 100% load. Ch2 measures secondary switching waveform, Ch1 is AC coupled to measure ripple across Cout.

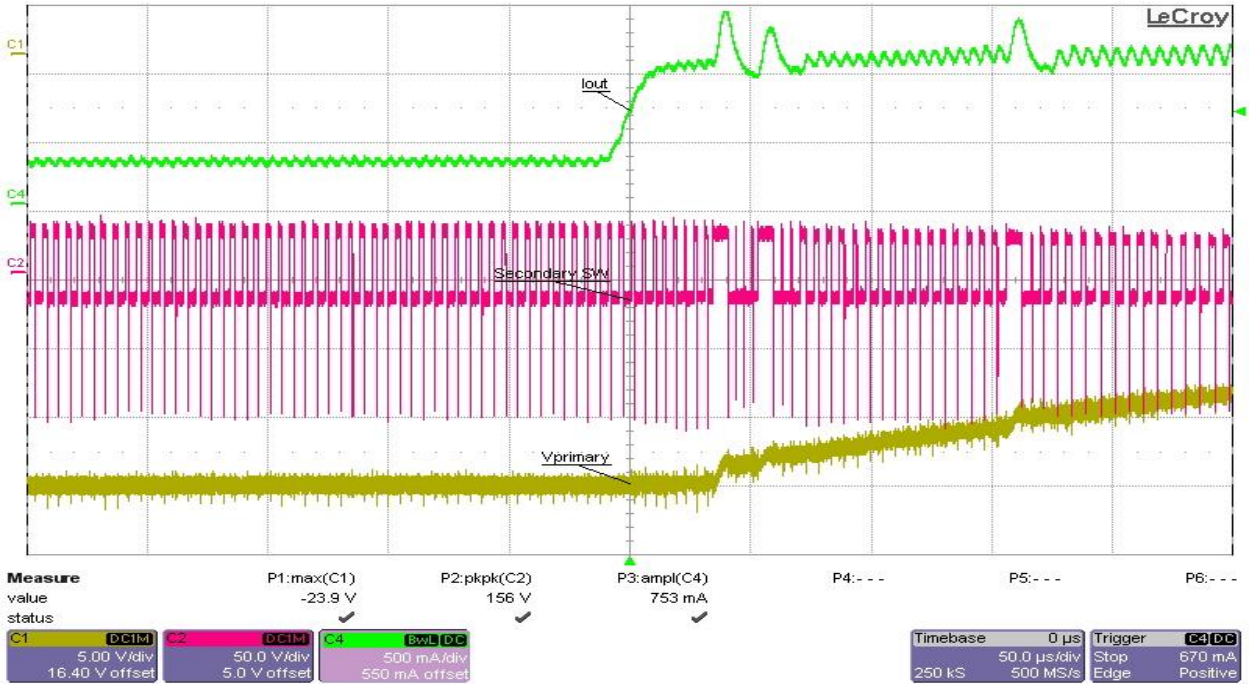


30Vin, 0% load. Ch1 measures secondary switching waveform, Ch2 is AC coupled to measure ripple across Cout.

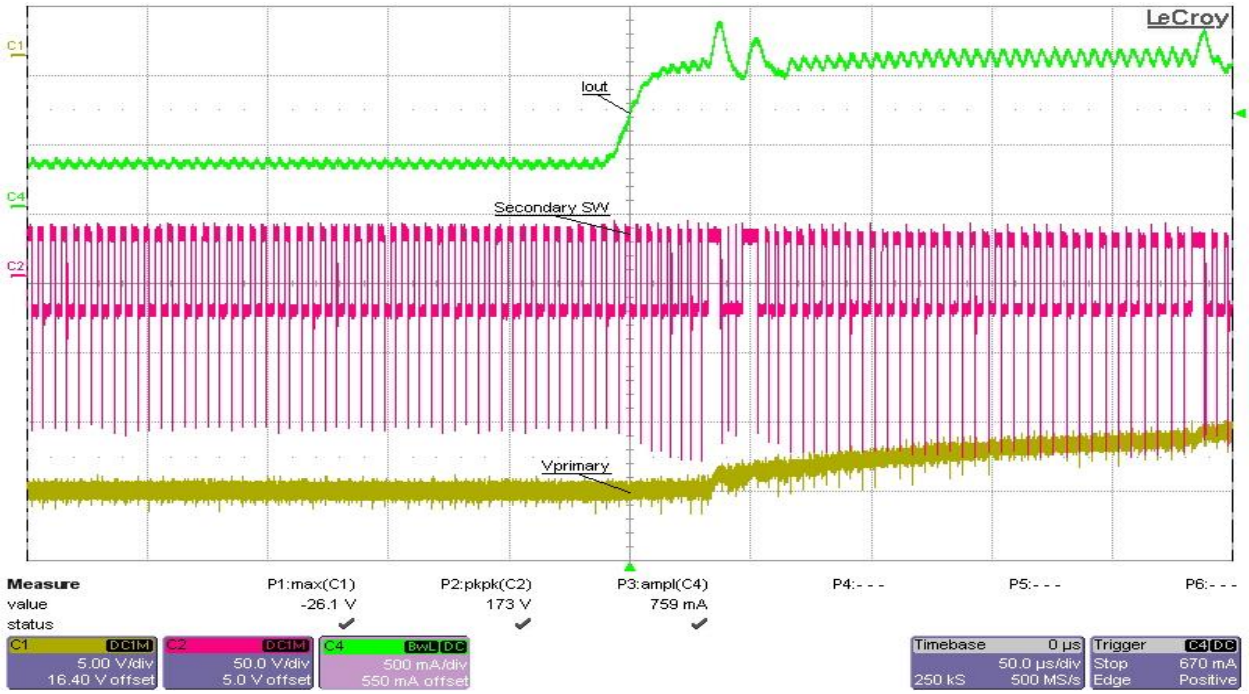


30Vin, 100% load. Ch1 measures primary switching waveform.

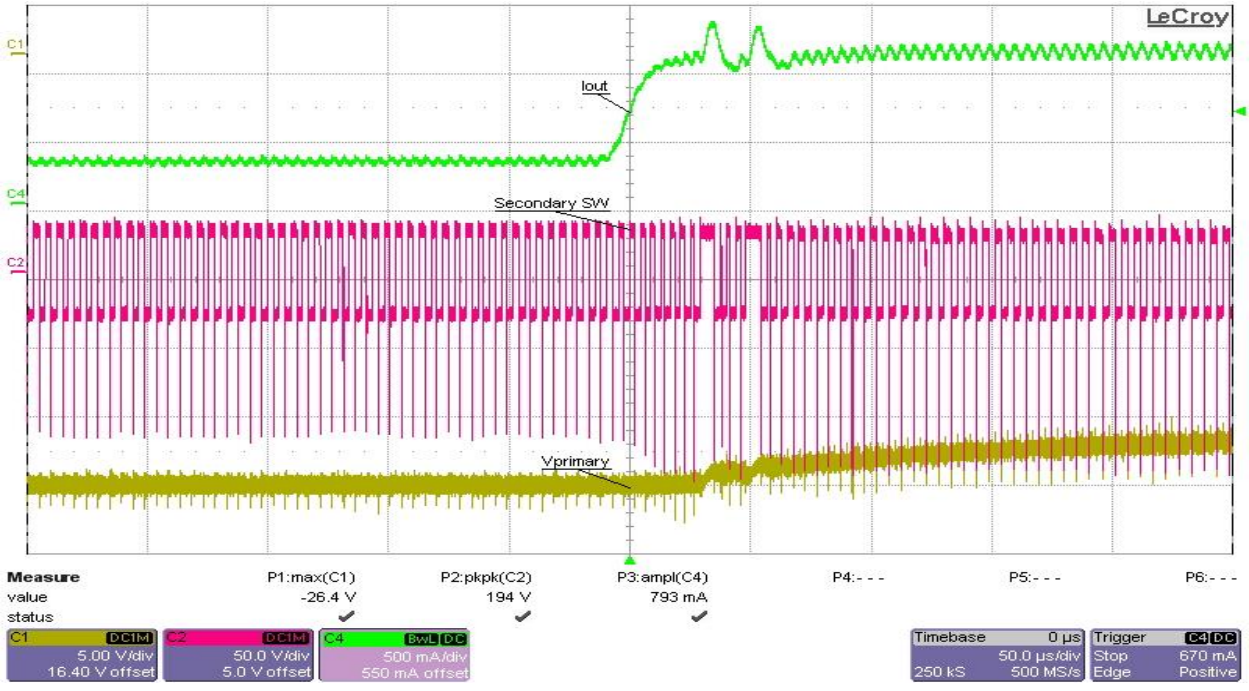
7.4 Overcurrent Protection



18Vin, Ch4 measure load current and steps from 50%load to 165% load; Ch1 measure primary side voltage; Ch3 measures secondary switching waveform.



24Vin, Ch4 measure load current and steps from 50%load to 165% load; Ch1 measure primary side voltage; Ch3 measures secondary switching waveform.



30Vin, Ch4 measure load current and steps from 50%load to 165% load; Ch1 measure primary side voltage; Ch3 measures secondary switching waveform.

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