



**LM5017
Cap-Drop**

TI reference design number: PMP9310 Rev B

Input: $85V_{AC}$ to $264V_{AC}$

Output: $3.3V_{DC}$

I_{out} : $10mA$ to $180mA$

AC–DC Converter Test Results

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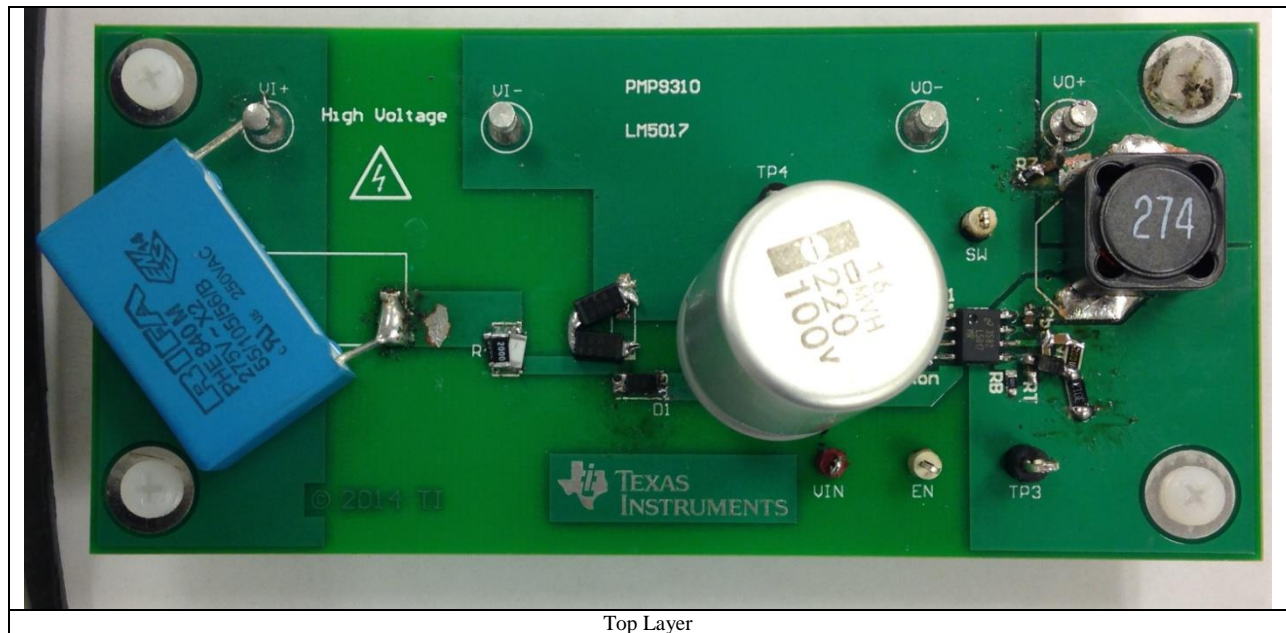
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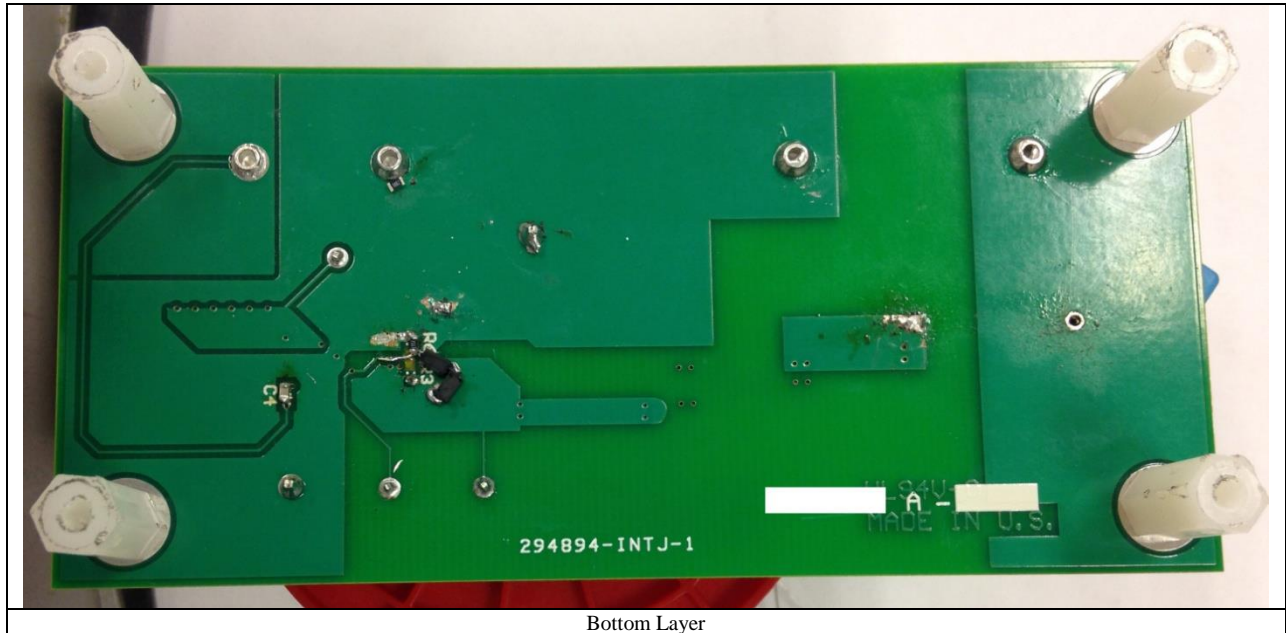
1. Circuit Description

PMP9310 is a Capacitor Drop circuit that utilizes the LM5017 Constant On-Time synchronous Buck Regulator. The EVM is intended to work with an input of 230V_{AC} (50 Hz). The output voltage is set to 3.3V_{DC}. The output current is dependent on the input voltage and ranges from 10 to 180mA_{DC}. The switching frequency of the EVM is programmed to 100 kHz. The EVM includes an external UVLO Circuit and also an external Soft-Start Circuit. PMP9310 is suitable for single phase e-meters applications.

2. Fabrication

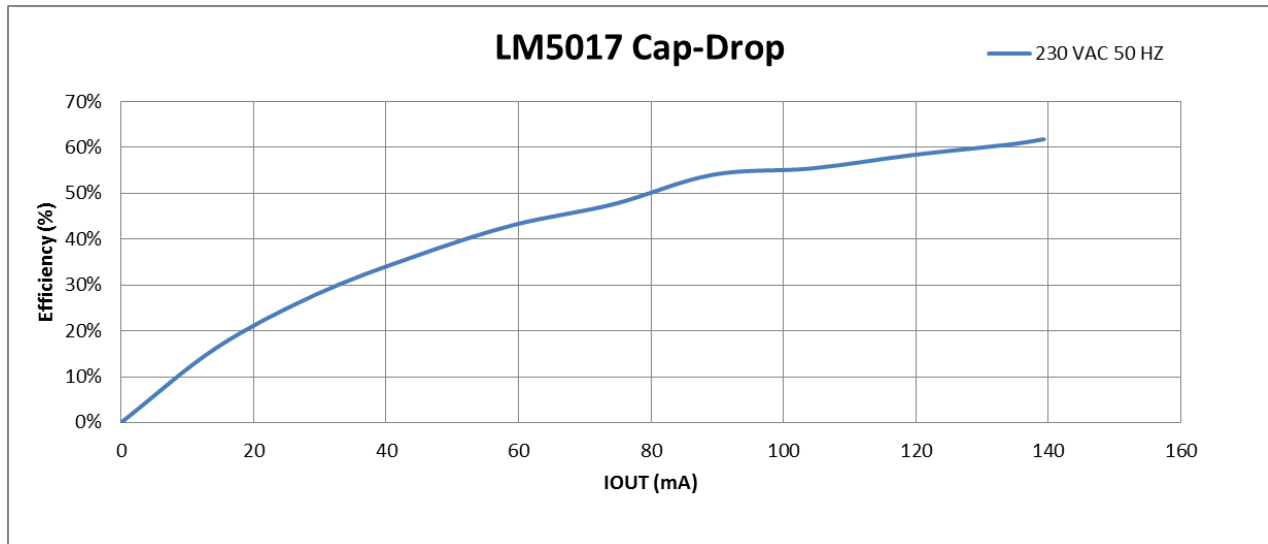
The LM5017 Cap-Drop circuit is a four layer board with overall dimensions of 1.925" (50mm) x 4.2" (106mm). The copper weight is 1oz on the outer layer and 0.5oz the inner layer.





Bottom Layer

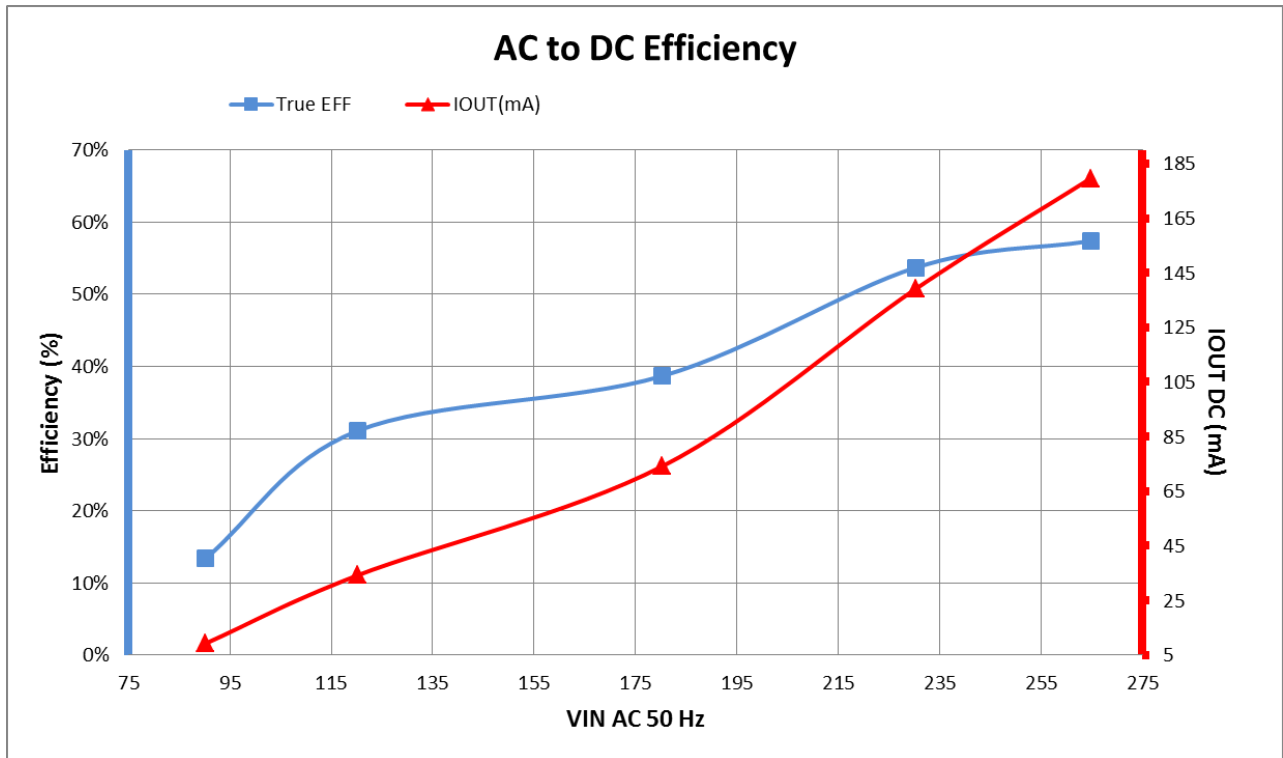
3.1 DC to DC Efficiency



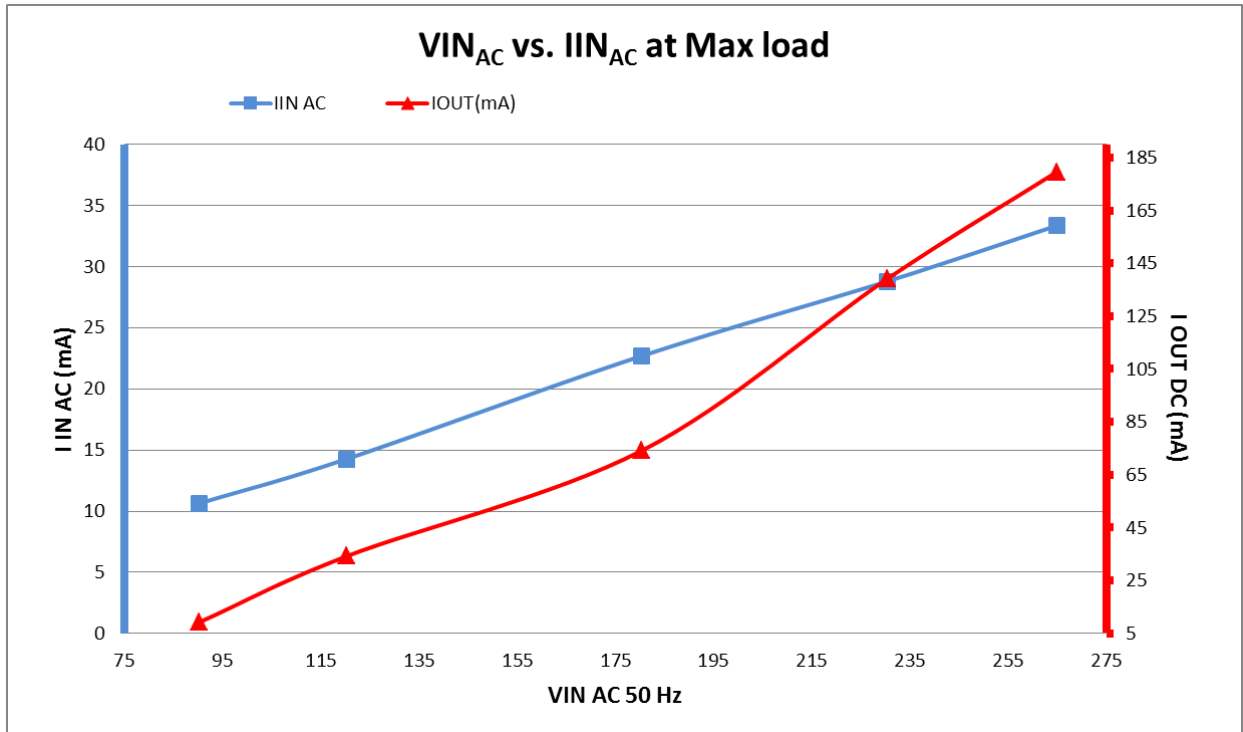
3.2 LM5017 Cap-Drop Efficiency Data

V _{in} (V _{DC})	I _{in} (mA _{DC})	V _{out} (V _{DC})	I _{out} (mA _{DC})	Efficiency (%)	P _{in} (mW)	P _{out} (mW)	Losses (mW)
75.4	3.180	3.31	0.000	0.00%	239.8	0.0	239.8
75.3	3.875	3.31	14.290	16.21%	291.7	47.3	244.4
75.2	4.627	3.31	29.290	27.86%	347.9	96.9	251.0
74.9	5.399	3.31	44.280	36.25%	404.4	146.6	257.8
74.5	6.100	3.31	59.130	43.07%	454.5	195.7	258.7
74.3	6.950	3.31	74.322	47.64%	516.4	246.0	270.4
73.8	7.411	3.31	89.300	54.07%	546.7	295.6	251.1
73.4	8.498	3.31	104.295	55.45%	623.3	345.7	277.7
73.0	9.272	3.31	119.292	58.33%	676.9	394.9	282.0
72.5	10.100	3.31	134.295	60.71%	732.3	444.5	287.7
72.1	10.365	3.32	139.313	61.82%	747.3	462.0	285.3

3.3 AC to DC Efficiency

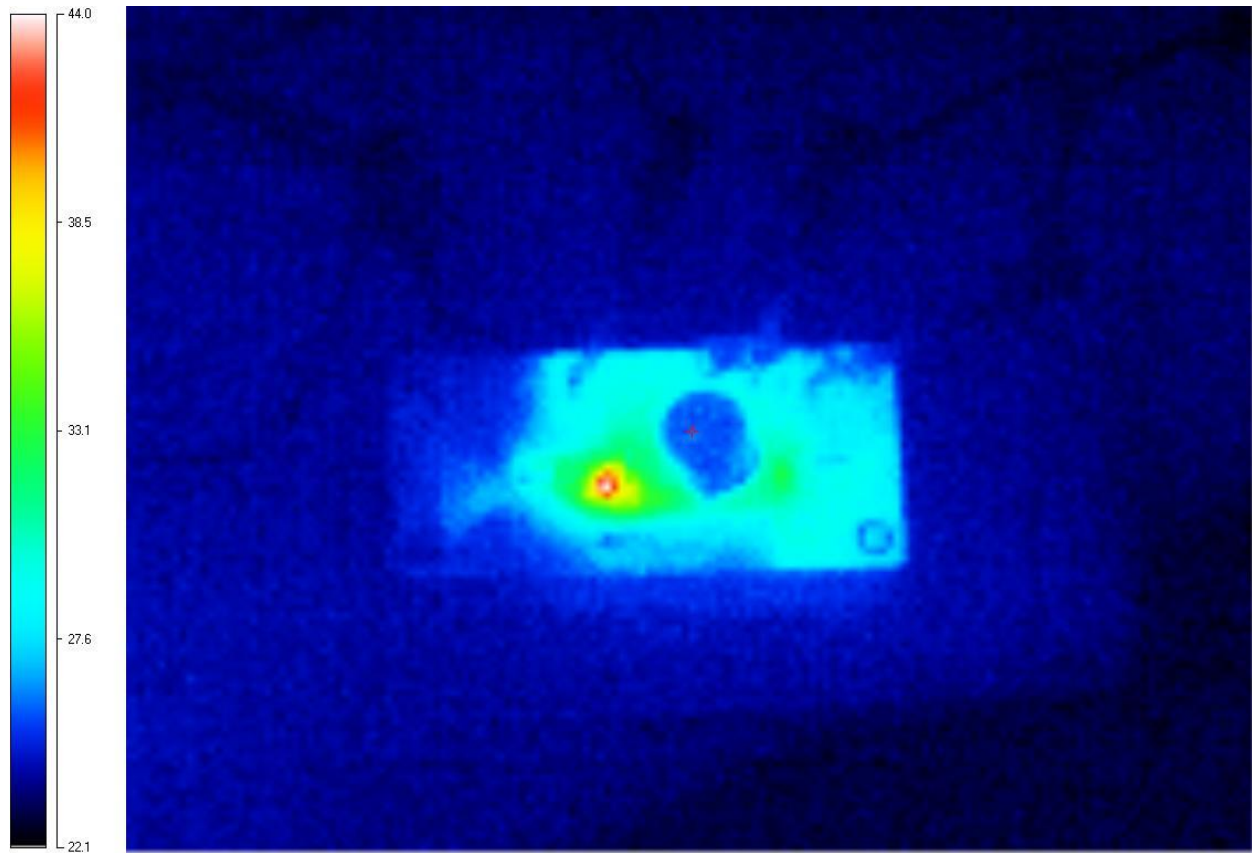


3.4 LM5017 Cap-Drop $V_{IN_{AC}}$ vs. $I_{IN_{AC}}$ at Max load



4. Thermal

4.1 Steady State Temperature - 230VAC in, 3.3VDC out at a load of 140mA



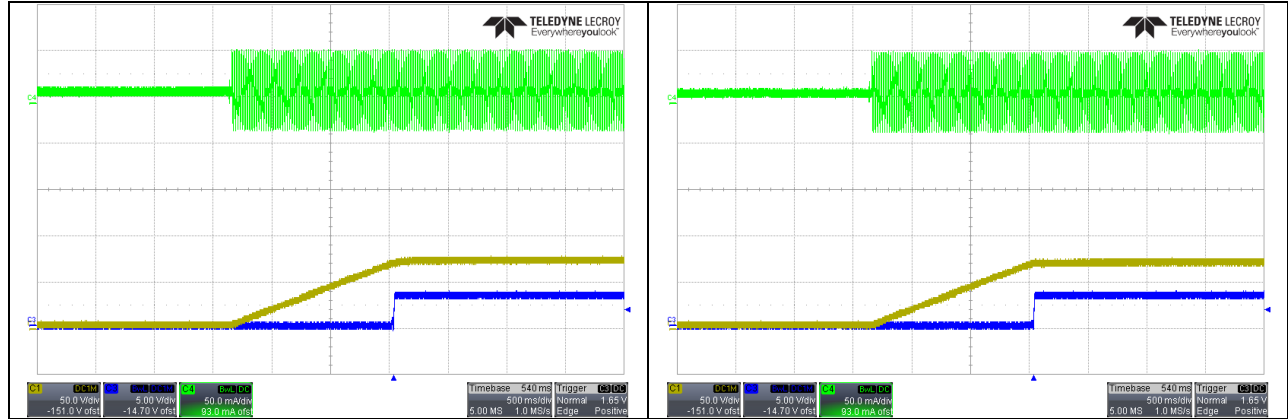
Top View

The RIN resistors are the warmest component on the PCB and display a temperature rise of 20°C

5. Power Up

5.1 Power Up at 230V_{AC} Input – No Load

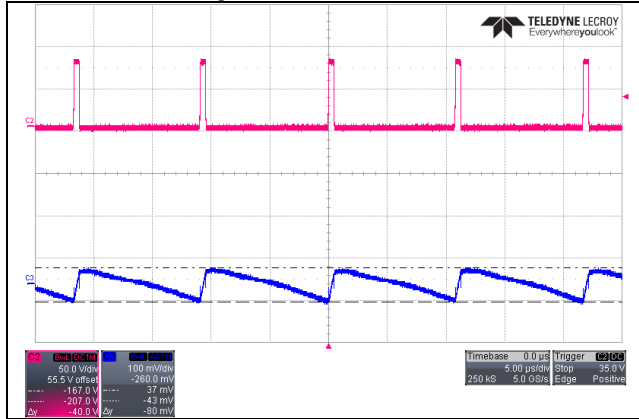
Power Up at 230V_{AC} Input – 140mA



Channel 1 VIN
Channel 3 VOUT
Channel 4 IIN

6. Switch Node Voltage and Output Ripple Voltage

6.1 230V_{AC} Input – 140mA Load



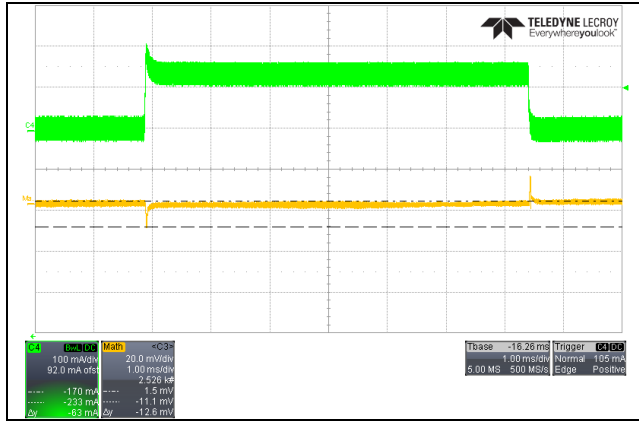
Less than 80mV p-p Ripple

Channel 2 VSW

Channel 3 VOUT

7. Transient Response

7.1 230V_{AC} Input – 40mA to 140mA, 100mA/μs, 100 Hz.



Cursors indicate ~12.6mV maximum deviation across output capacitor.

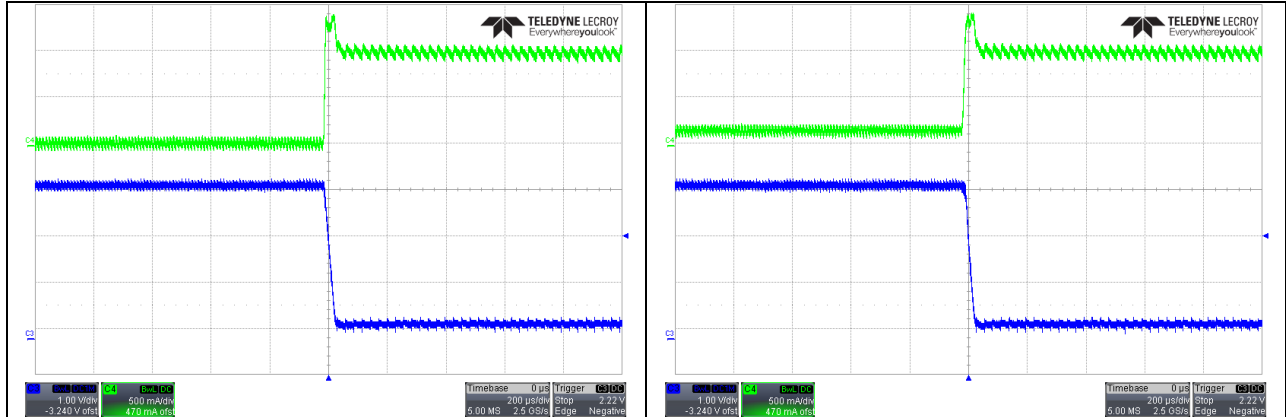
Channel 1 VOUT

Channel 4 IOU

8. Short Circuit Tests

8.1 230V_{AC} input - No Load

230V_{AC} input – 140mA Load



Channel 2 VOUT
Channel 3 IOU

Power will need to be recycled for Short Circuit Recovery

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