



**LM5017  
Cap-Drop**

**TI reference design number: PMP9310 Rev B**

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

**Output:  $3.3V_{DC}$**

**I<sub>out</sub>:  $10mA$  to  $180mA$**

**AC–DC Converter Test Results**

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## 1. Circuit Description

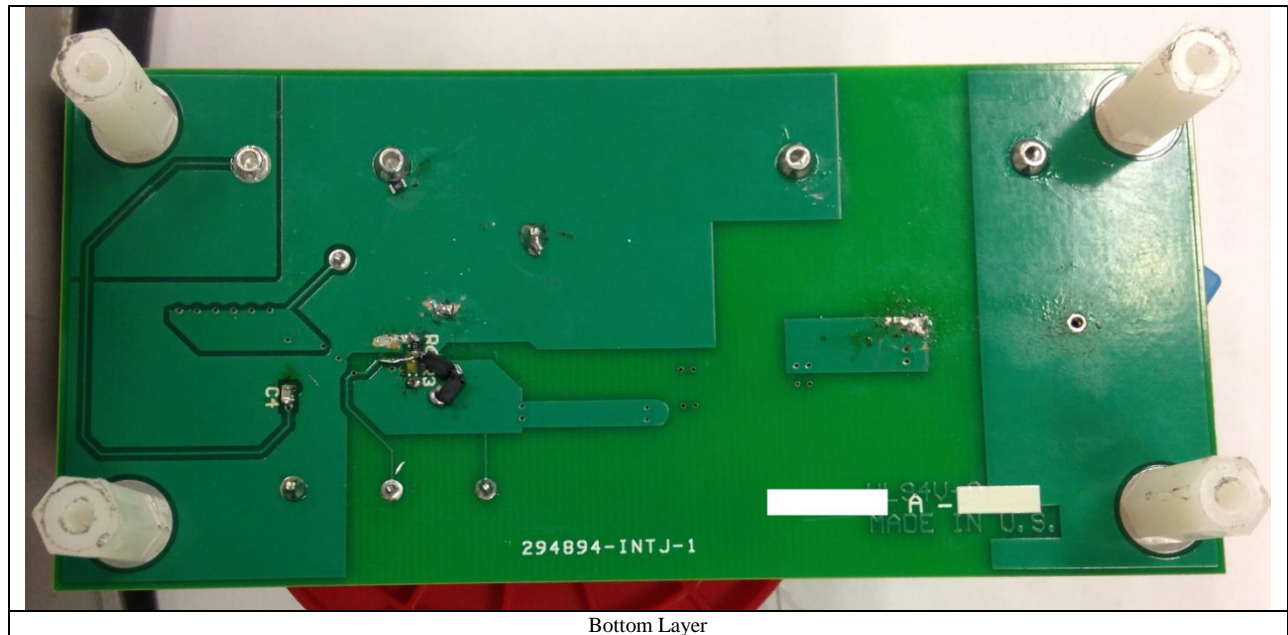
PMP9310 is a Capacitor Drop circuit that utilizes the LM5017 Constant On-Time synchronous Buck Regulator. The EVM is intended to work with an input of 230V<sub>AC</sub> (50 Hz). The output voltage is set to 3.3V<sub>DC</sub>. The output current is dependent on the input voltage and ranges from 10 to 180mA<sub>DC</sub>. 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

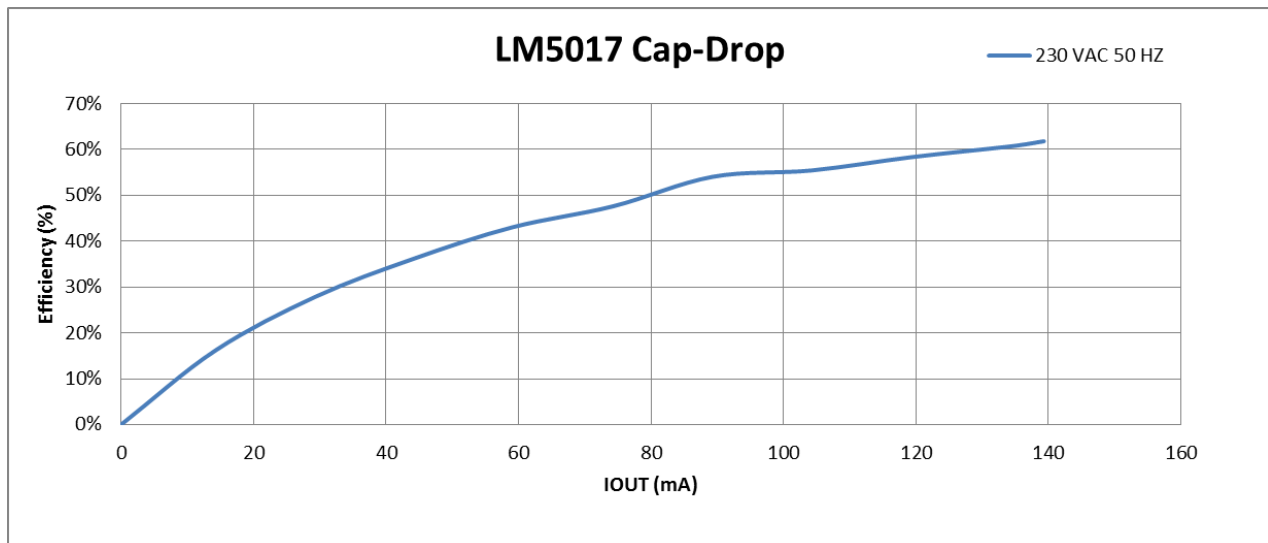
The LM5017 Cap-Drop circuit is a four layer board with overall dimensions of 1.925" (50mm) x 4.2" (106mm). The copper weight is 1oz on the outer layer and 0.5oz the inner layer.



Top Layer



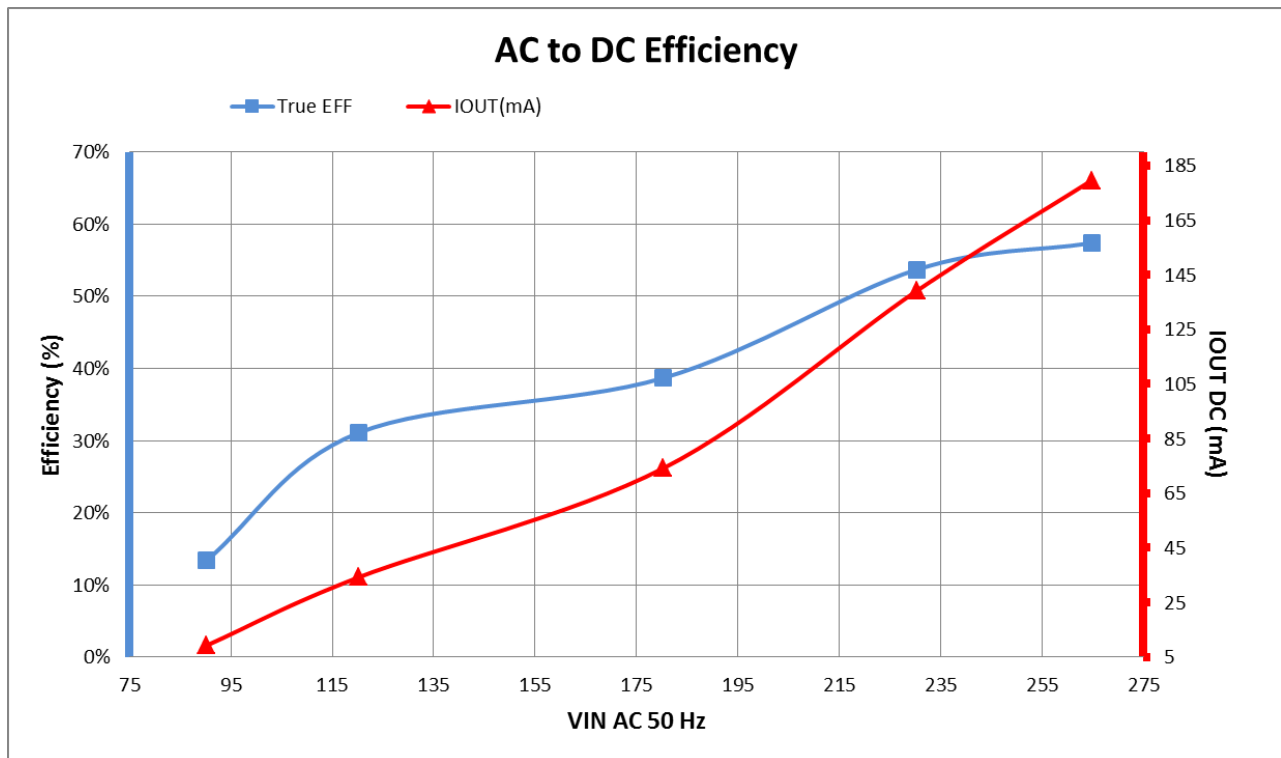
### 3.1 DC to DC Efficiency



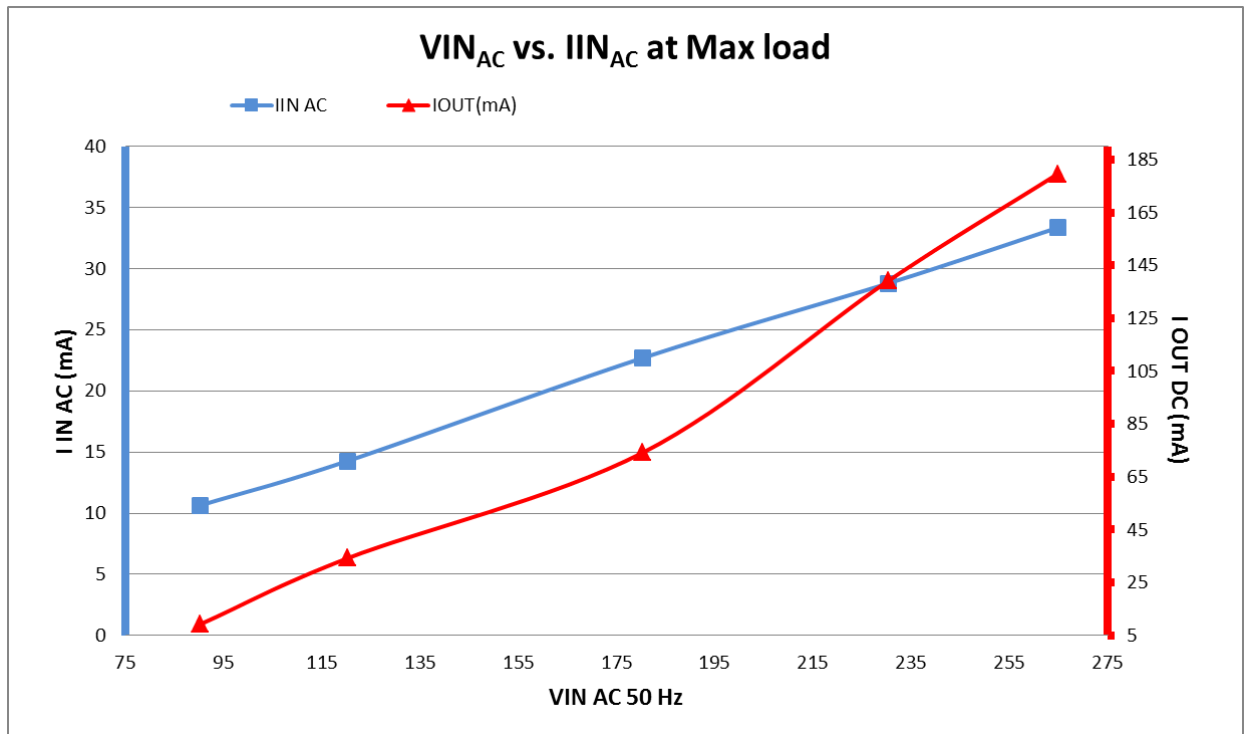
### 3.2 LM5017 Cap-Drop Efficiency Data

Vin (V <sub>DC</sub> )	Iin (mA <sub>DC</sub> )	Vout (V <sub>DC</sub> )	Iout (mA <sub>DC</sub> )	Efficiency (%)	Pin (mW)	Pout (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

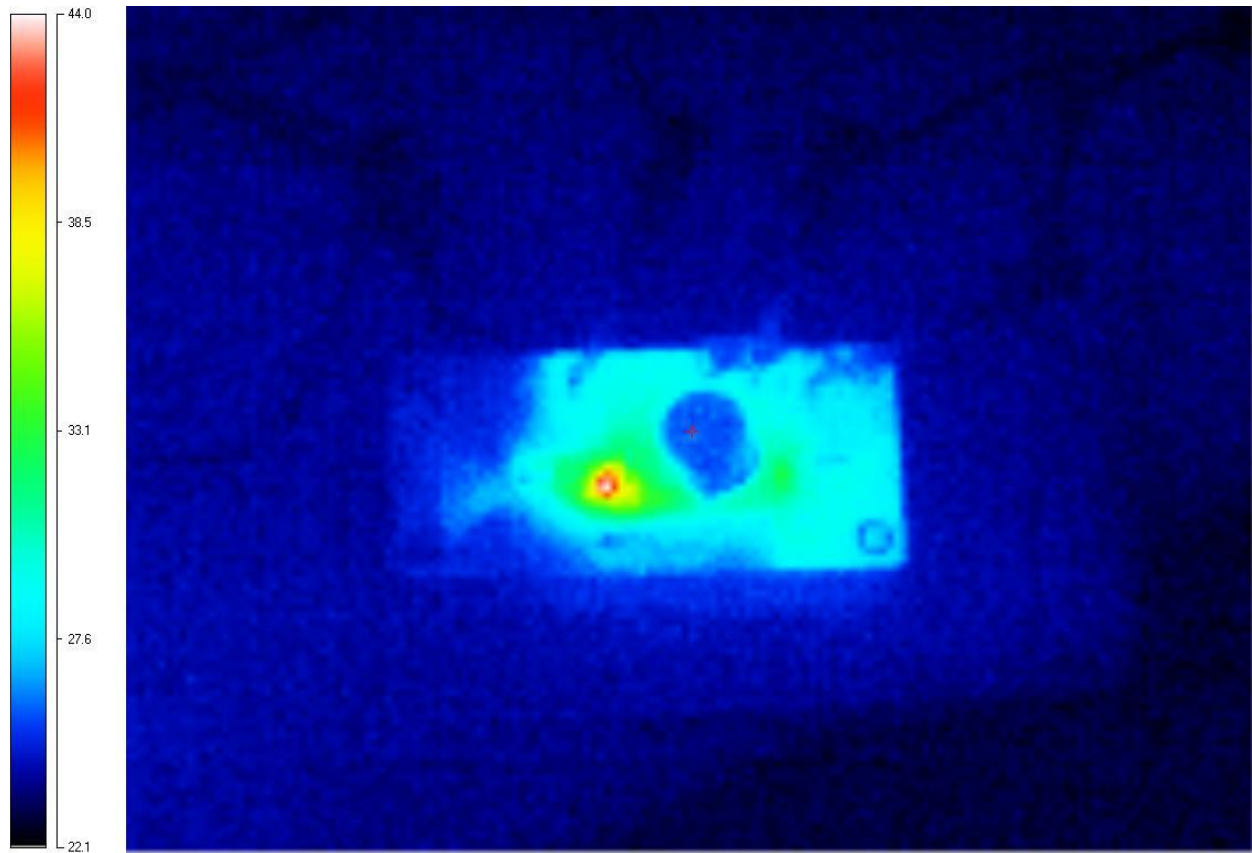


### 3.4 LM5017 Cap-Drop $V_{IN\_AC}$ vs. $I_{IN\_AC}$ at Max load



## 4. Thermal

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



*Top View*

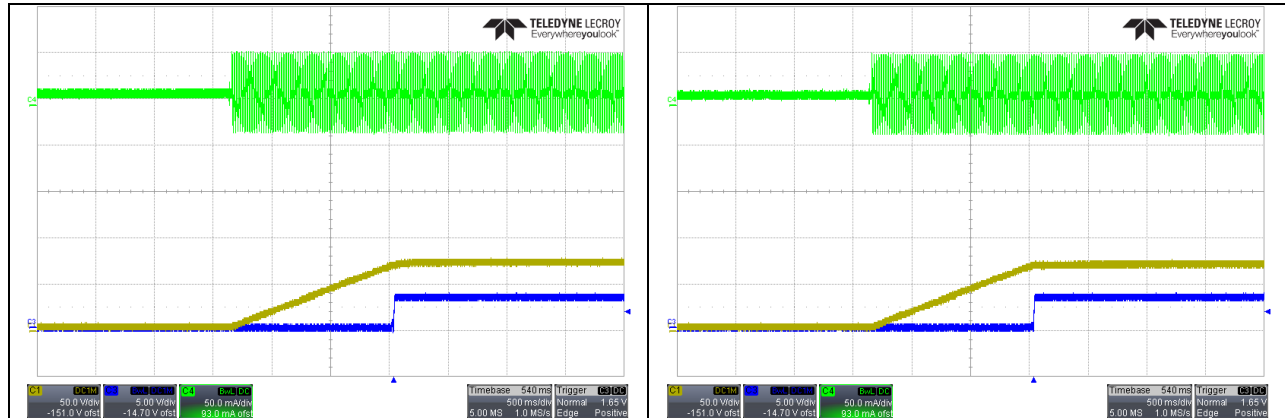
The RIN resistors are the warmest component on the PCB and display a temperature rise of 20°C



## 5. Power Up

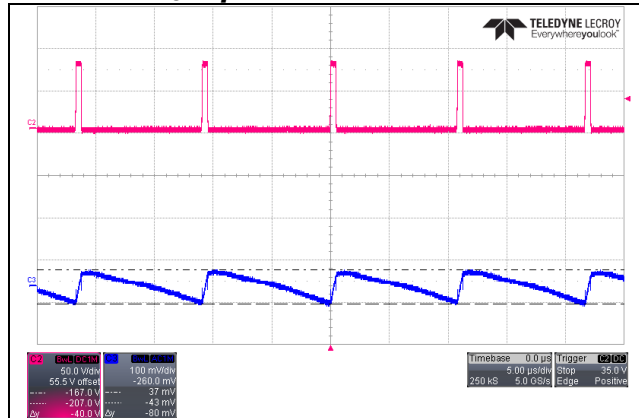
### 5.1 Power Up at 230V<sub>AC</sub> Input – No Load

### Power Up at 230V<sub>AC</sub> Input – 140mA



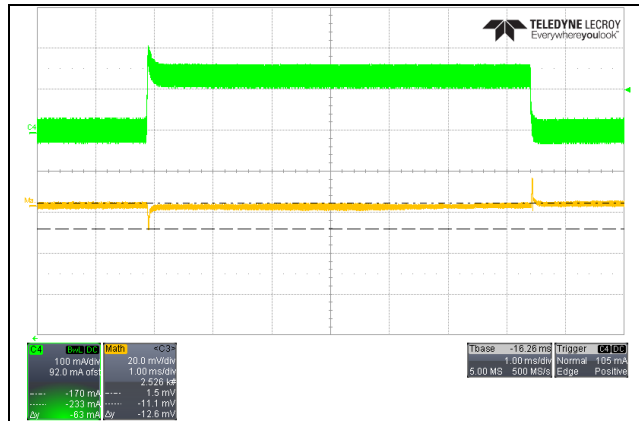
## 6. Switch Node Voltage and Output Ripple Voltage

### 6.1 230V<sub>AC</sub> Input – 140mA Load



## 7. Transient Response

### 7.1 230V<sub>AC</sub> Input – 40mA to 140mA, 100mA/μs, 100 Hz.



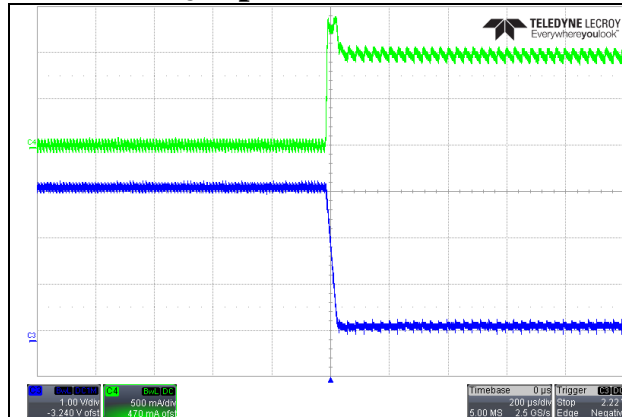
Cursors indicate ~12.6mV maximum deviation across output capacitor.

Channel 1 VOUT

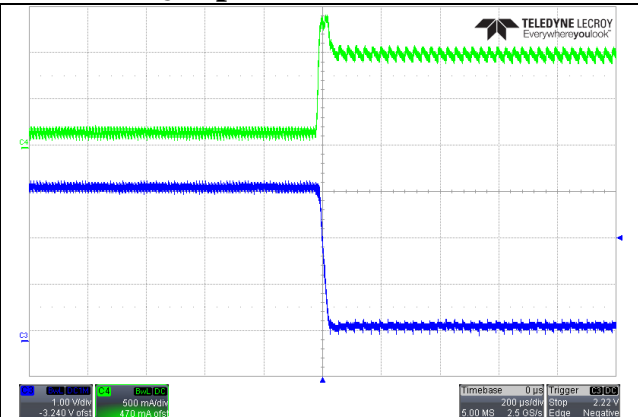
Channel 4 IOU

## 8. Short Circuit Tests

### 8.1 230V<sub>AC</sub> input - No Load



### 230V<sub>AC</sub> input – 140mA Load



Channel 2 VOUT  
Channel 3 IOU

Power will need to be recycled for Short Circuit Recovery

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