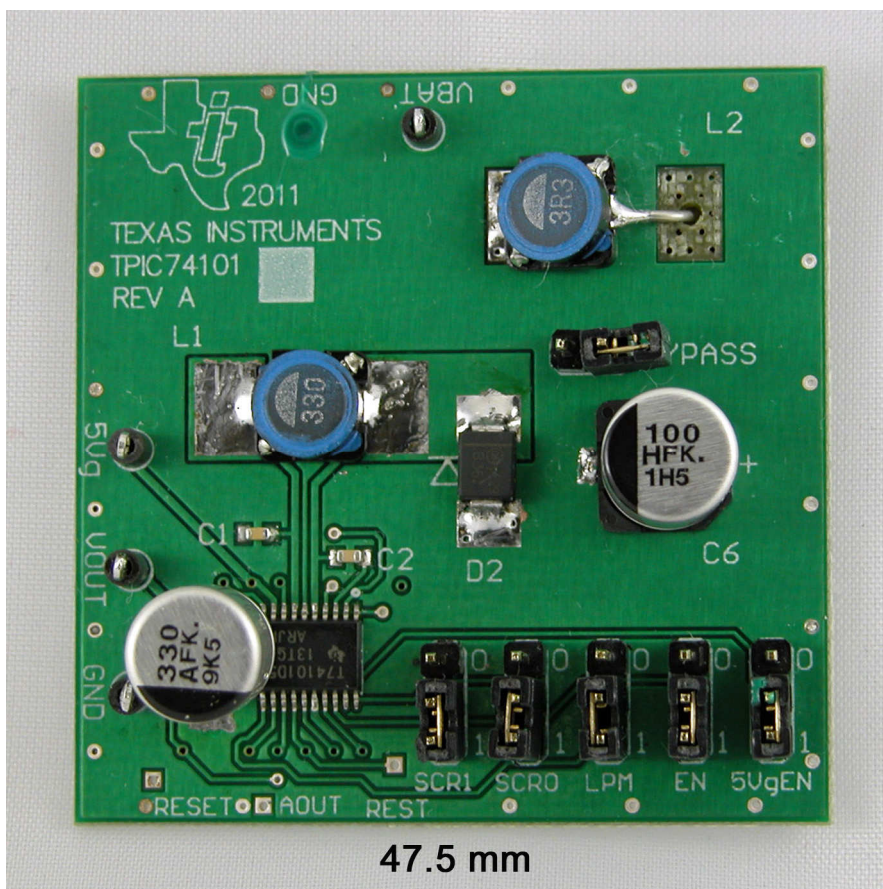


## Automotive Buck-Boost, 5.0V @ 500mA

- Input 4 .. 39V, 8 .. 16V nominal
- Output 5.0V @ 500mA / 700mA peak
- Converter TPIC74101
- Free-Running switching frequency of 380 kHz
- Circuit built on modified EVM



## 1 Startup & Shutdown

The startup waveform at 12.0V input voltage and no load is shown in Figure 1.

Channel C1: **12.0V Input voltage** 2V/div, 2ms/div

Channel C2: **5.0V Output voltage** 1V/div, 2ms/div

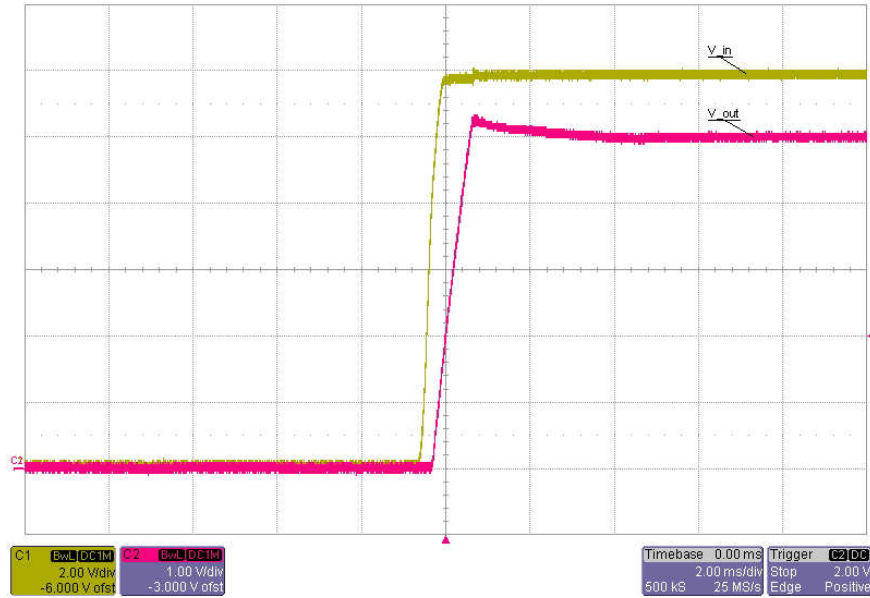


Figure 1

The shutdown waveform at 12.0V input voltage and 500mA load is shown in Figure 2.

Channel C1: **12.0V Input voltage** 2V/div, 2ms/div

Channel C2: **5.0V Output voltage** 1V/div, 2ms/div

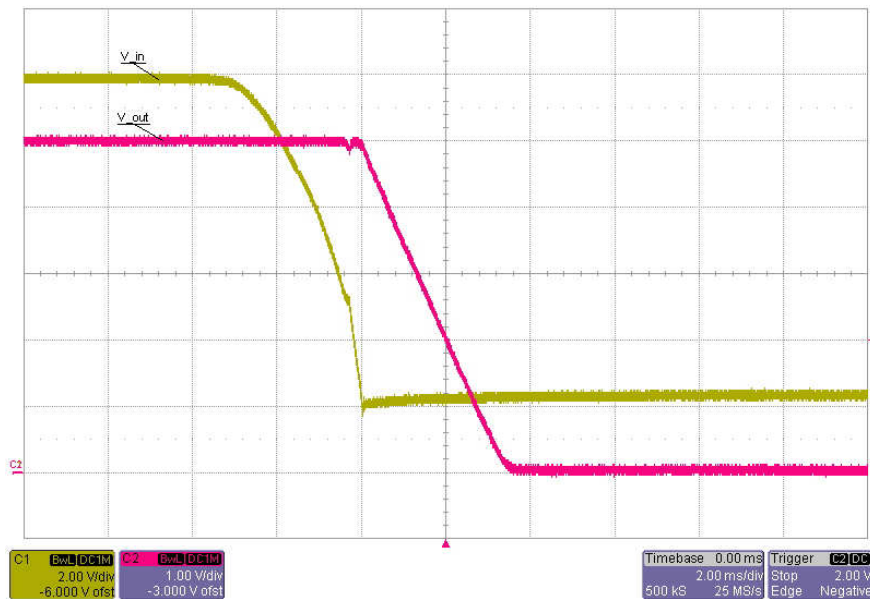


Figure 2

The startup waveform at 5.0V input voltage and 350mA load is shown in Figure 3.

- Channel C1: **Input current** 500mA/div, 1ms/div
- Channel C2: **Output voltage** 2V/div, 1ms/div
- Channel C3: **Input voltage** 1V/div, 2ms/div

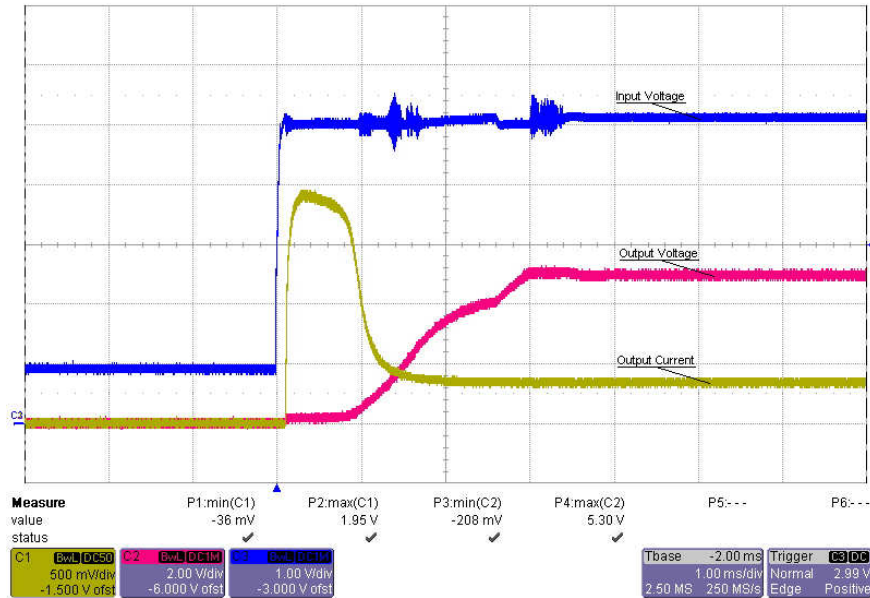


Figure 3

The shutdown waveform at 12.0V input voltage and 350mA load is shown in Figure 4.

- Channel C1: **Input current** 500mA/div, 1ms/div
- Channel C2: **Output voltage** 2V/div, 1ms/div
- Channel C3: **Input voltage** 2V/div, 2ms/div

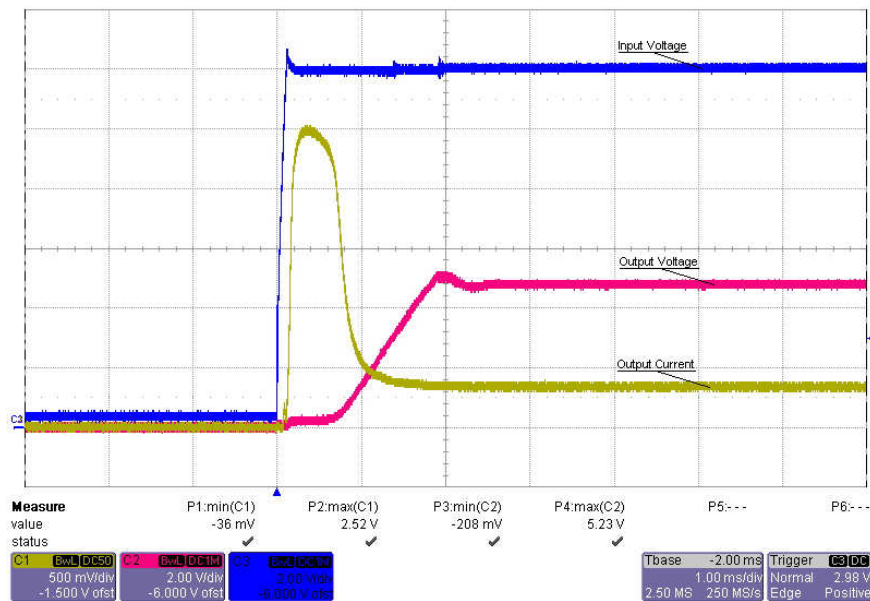


Figure 4

## 2 Efficiency

The efficiency and load regulation are shown in Figure 5 and Figure 6.

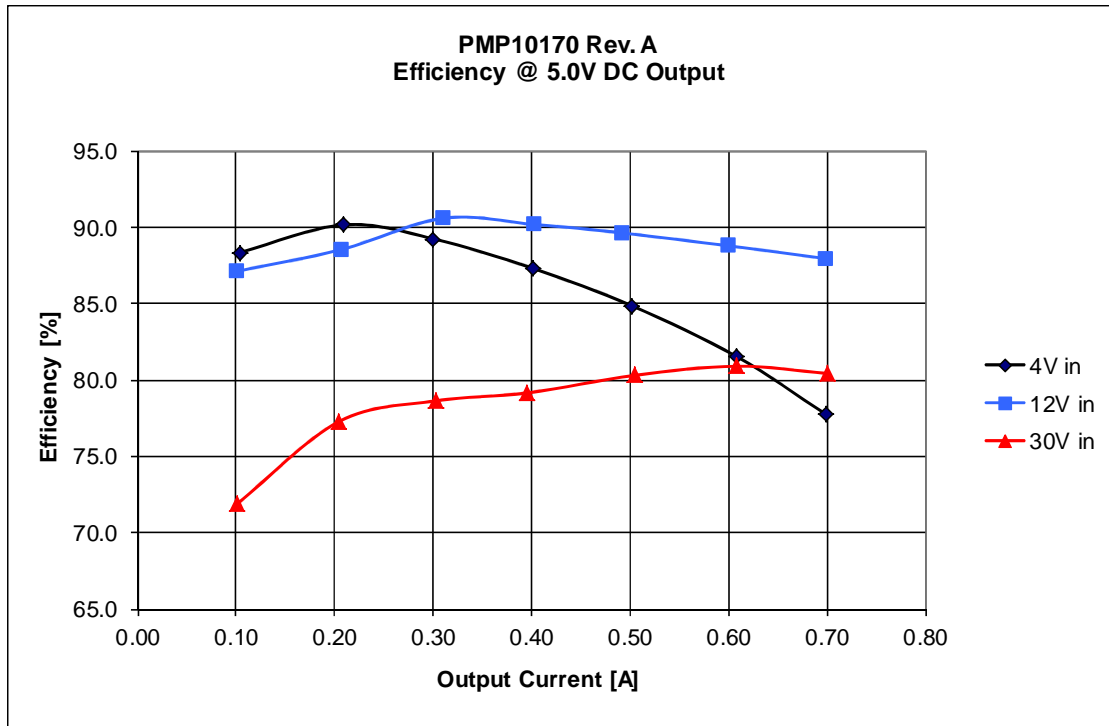


Figure 5

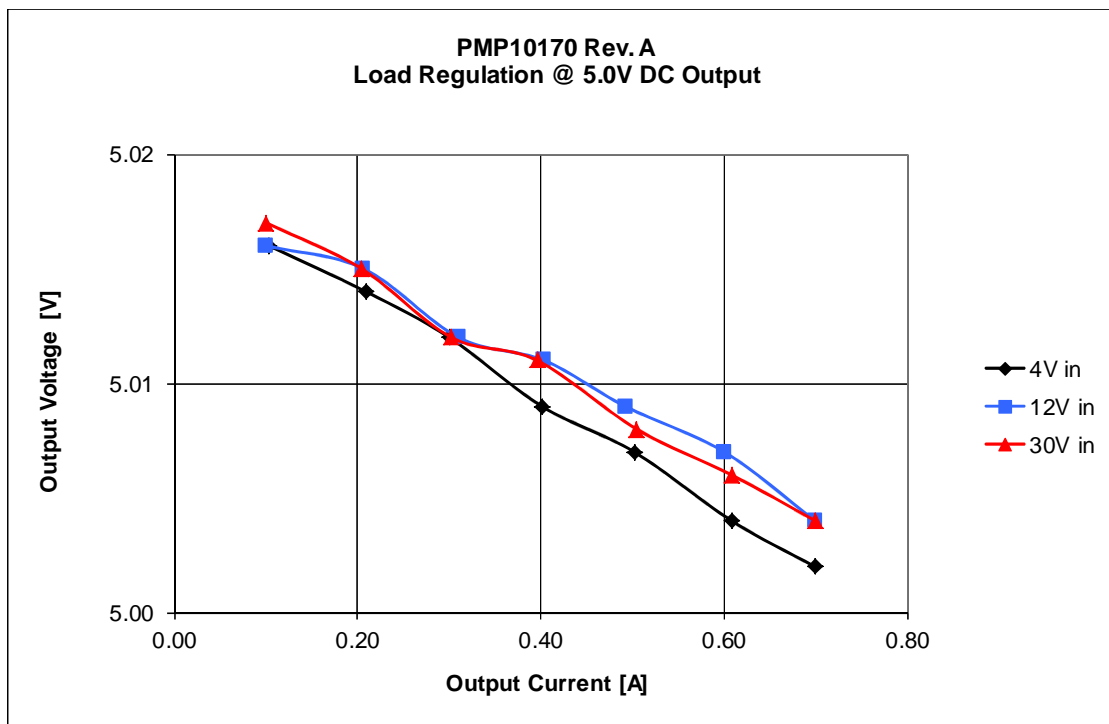


Figure 6

### 3 Load Step

The response to a load step and a load dump for the 5.0V output at an input voltage of 12.0V is shown in Figure 7.

Channel C2: **Output voltage** 50mV/div, 1ms/div, AC coupled  
 -20mV undershoot, 20mV overshoot

Channel C1: **Load current** 100mA/div, 1ms/div  
 Load step 250mA to 350mA and vice versa

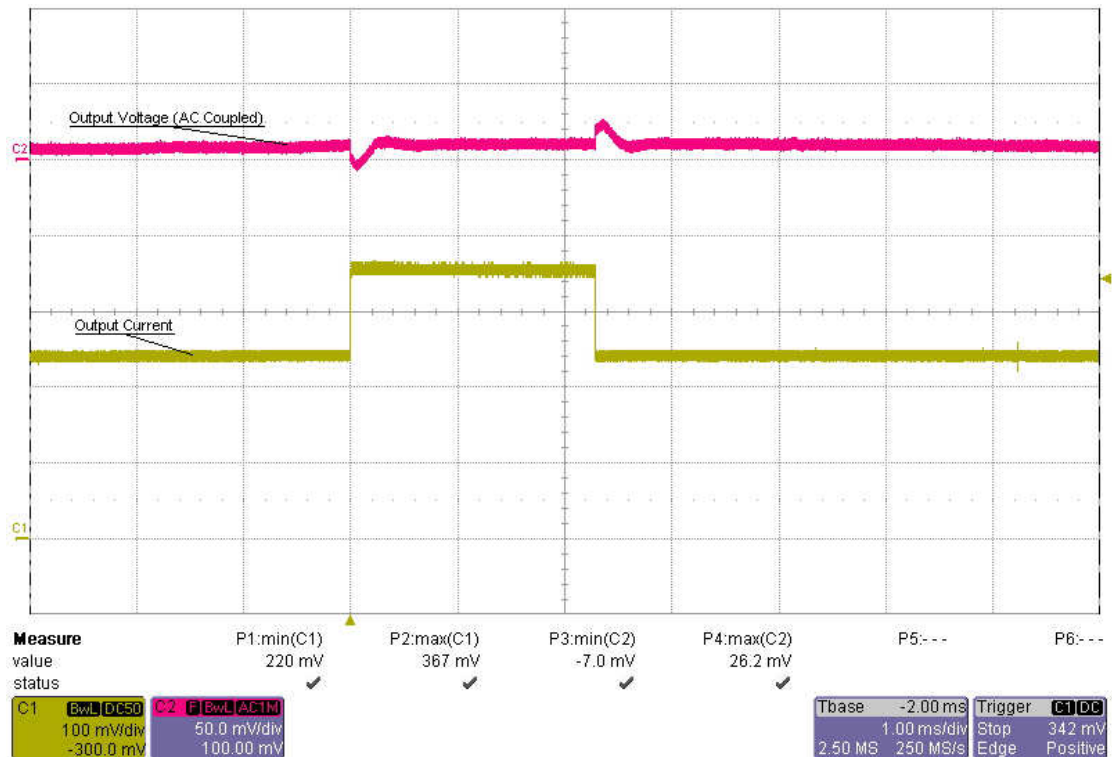


Figure 7

## 4 Switching Node

The drain-source voltage on the switching node is shown in Figure 8. The image was captured with 30.0V input and 500mA load.

Channel C2: **Drain-source voltage** 5V/div, 1us/div  
 -1.5V minimum voltage, 32.3V maximum voltage

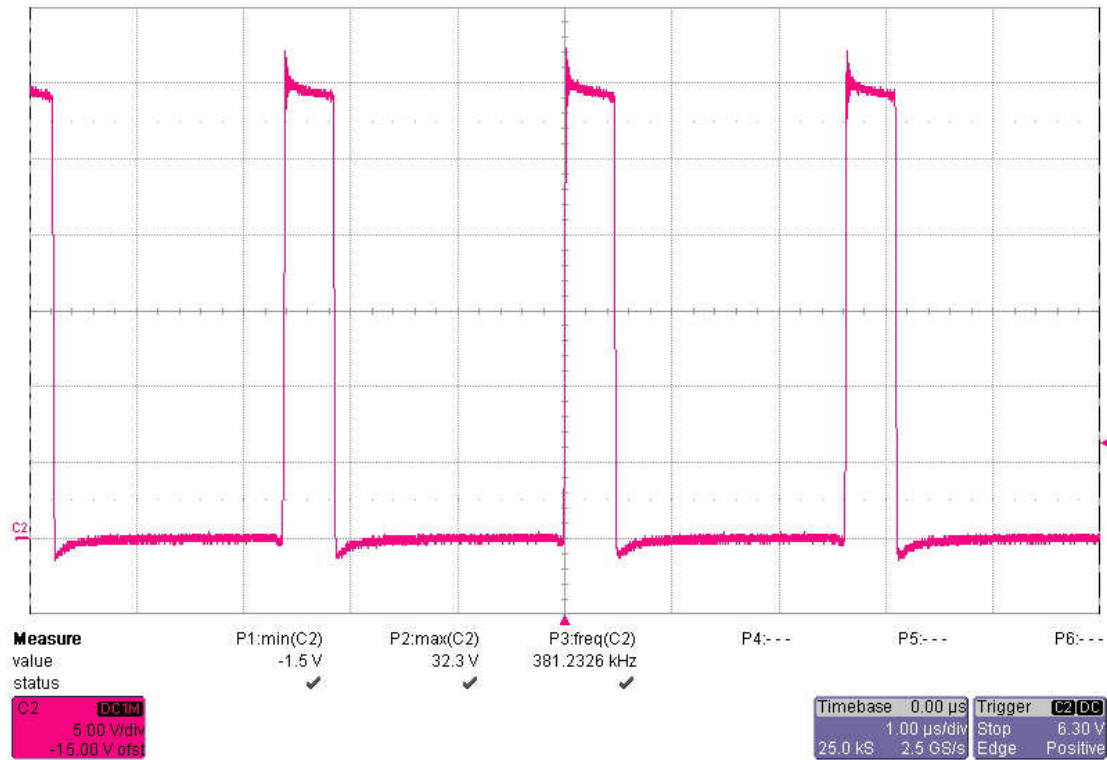


Figure 8

## 5 Output Ripple Voltage

The output ripple voltage at 500mA load and 3.5V, 12.0V and 30.0V input voltage is shown in Figure 9.

Channel M1:	<b>Output voltage @ 3.5V input</b>	20mV/div, 2us/div, AC coupled
	39mV peak-peak	
Channel M2:	<b>Output voltage @ 12.0V input</b>	20mV/div, 2us/div, AC coupled
	9mV peak-peak	
Channel M3:	<b>Output voltage @ 30.0V input</b>	20mV/div, 2us/div, AC coupled
	13mV peak-peak	

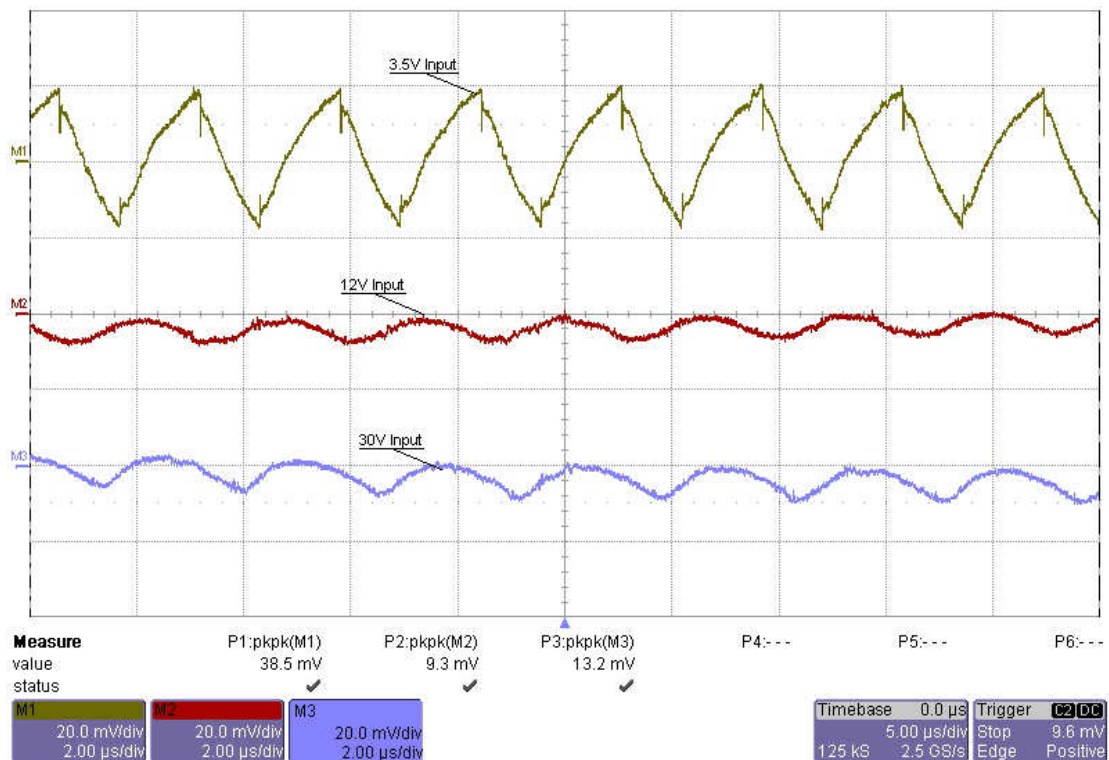
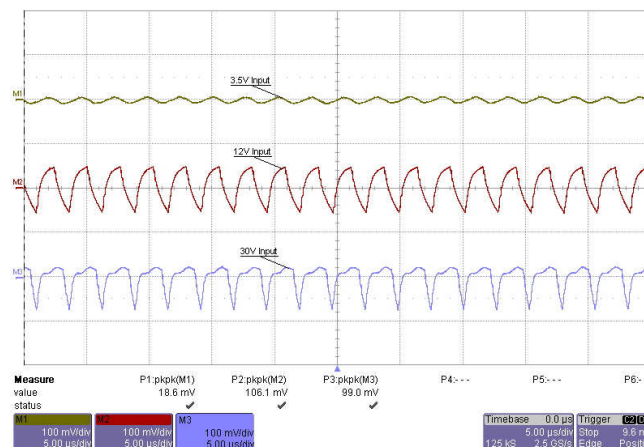


Figure 9

## 6 Input Ripple Voltage

The input ripple voltage at 500mA load and 3.5V, 12.0V and 30.0V input voltage on the switcher (C102) is shown in Figure 10.

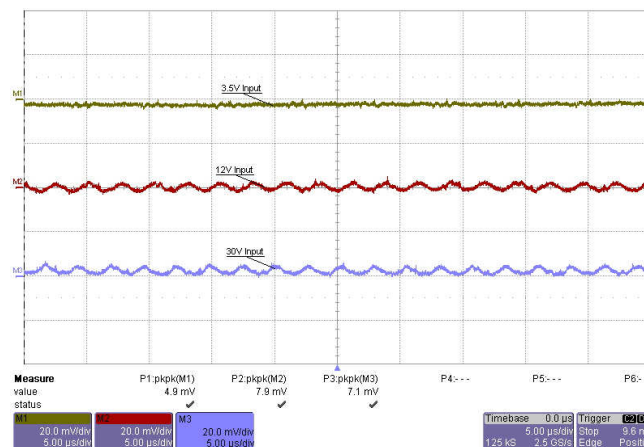
Channel M1:	<b>Input voltage @ 3.5V input</b>	100mV/div, 5us/div, AC coupled
	19mV peak-peak	
Channel M2:	<b>Input voltage @ 12.0V input</b>	100mV /div, 5us/div, AC coupled
	106mV peak-peak	
Channel M3:	<b>Input voltage @ 30.0V input</b>	100mV /div, 5us/div, AC coupled
	99mV peak-peak	



**Figure 10**

The input ripple voltage at 500mA load and 3.5V, 12.0V and 30.0V input voltage on the connector (C101) is shown in Figure 11.

Channel M1:	<b>Input voltage @ 3.5V input</b>	20mV/div, 5us/div, AC coupled
	5mV peak-peak	
Channel M2:	<b>Input voltage @ 12.0V input</b>	20mV/div, 5us/div, AC coupled
	8mV peak-peak	
Channel M3:	<b>Input voltage @ 30.0V input</b>	20mV/div, 5us/div, AC coupled
	7mV peak-peak	



**Figure 11**



## 7 Cranking Pulse

The response to a drop of the input voltage from 13.0V to 4.0V within 3.5ms with a load of 500mA is shown in Figure 12.

- Channel C1: **Output current** 200mA/div, 5ms/div
- Channel C2: **Output voltage** 100mV /div, 5ms/div, AC coupled  
-140mV undershoot, 64mV overshoot
- Channel C3: **Input voltage** 5V /div, 5ms/div

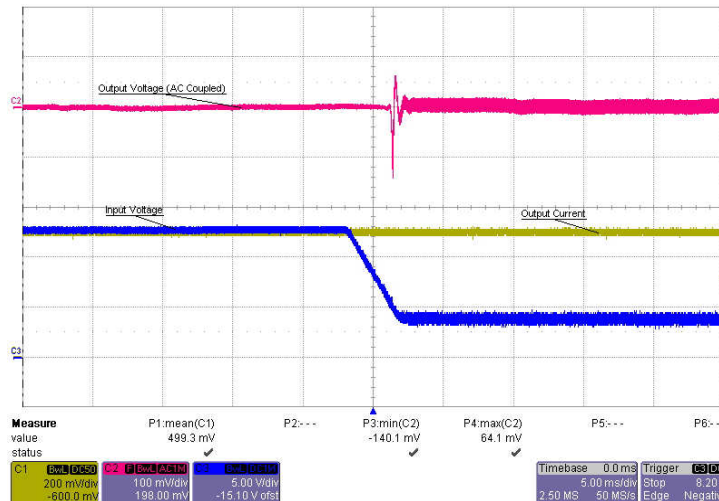


Figure 12

The response to a rise of the input voltage from 4.0V to 13.0V within 3.5ms with a load of 500mA is shown in Figure 13.

- Channel C1: **Output current** 200mA/div, 5ms/div
- Channel C2: **Output voltage** 100mV /div, 5ms/div, AC coupled  
-92mV undershoot, 28mV overshoot
- Channel C3: **Input voltage** 5V /div, 5ms/div

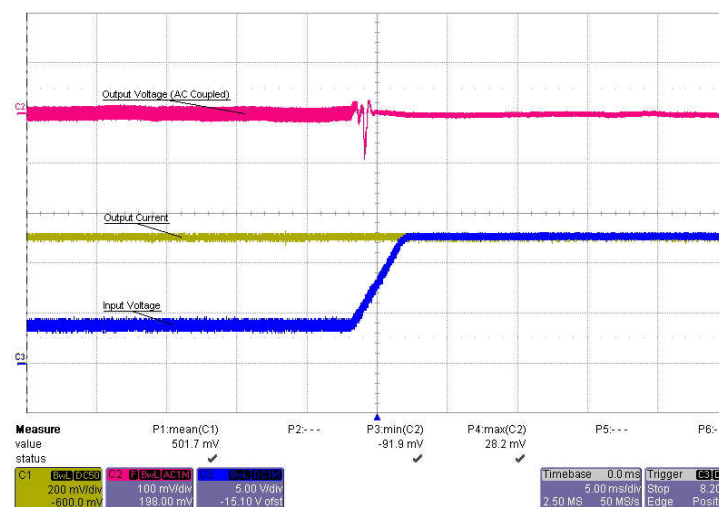


Figure 13

## 8 Thermal measurement

The thermal image (Figure 14) shows the circuit at an ambient temperature of 21 °C with an input voltage of 12.0V and a load of 500mA.

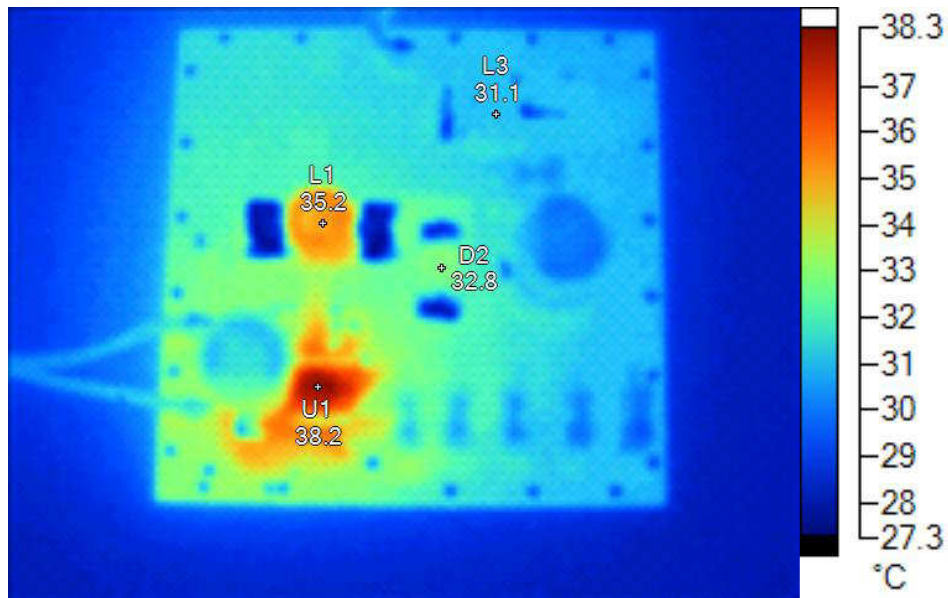


Figure 14

### Markers

Label	Temperature	Emissivity	Background
L1	35.2 °C	0.95	21.0 °C
U1	38.2 °C	0.95	21.0 °C
D2	32.8 °C	0.95	21.0 °C
L3	31.1 °C	0.95	21.0 °C

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