PMP10170 Rev. A – Test Report
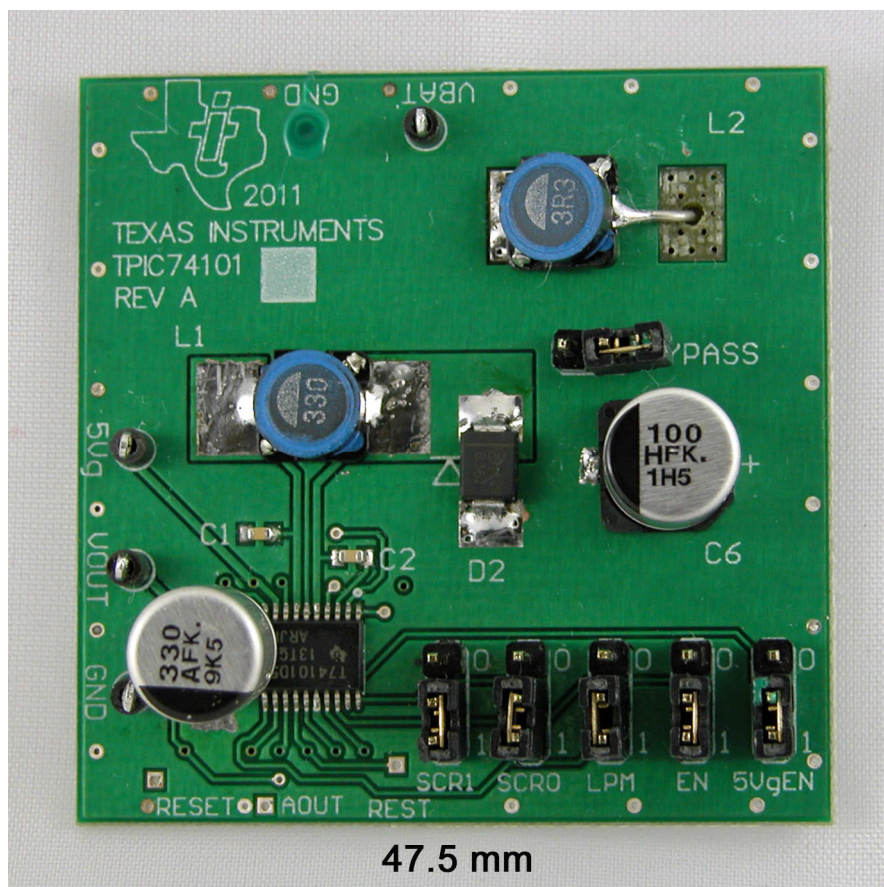
TEXAS INSTRUMENTS

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

47.5 mm

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TEXAS INSTRUMENTS

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

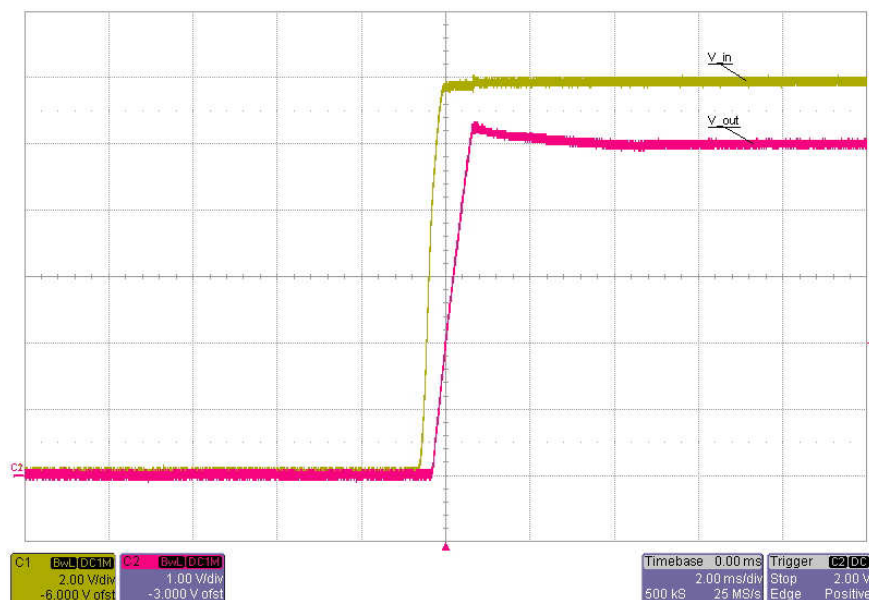Channel C2:   **5.0V Output voltage**   1V/div, 2ms/div

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

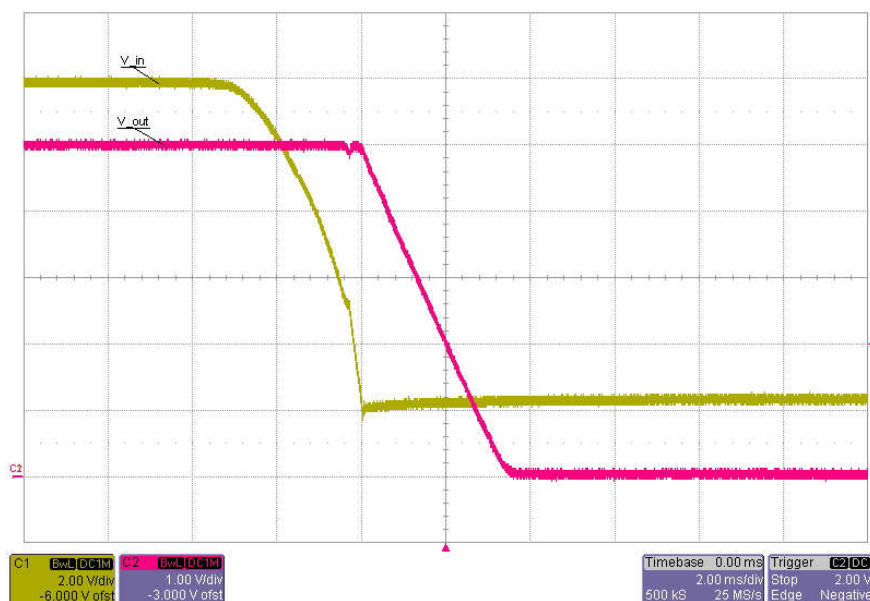Channel C2:   **5.0V Output voltage**   1V/div, 2ms/div

Figure 2

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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
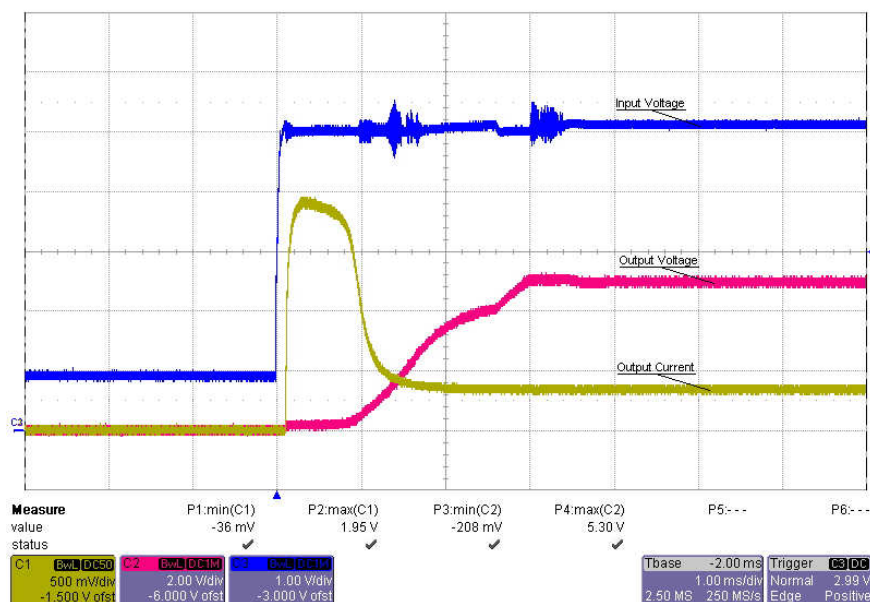

Figure 3

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

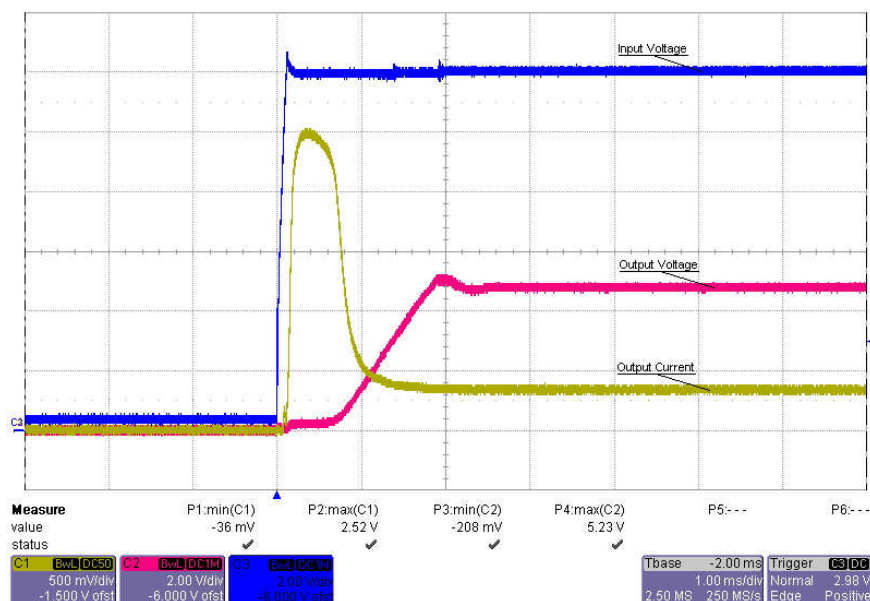Channel C3:   **Input voltage**   2V/div, 2ms/div

Figure 4

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INSTRUMENTS

2 Efficiency

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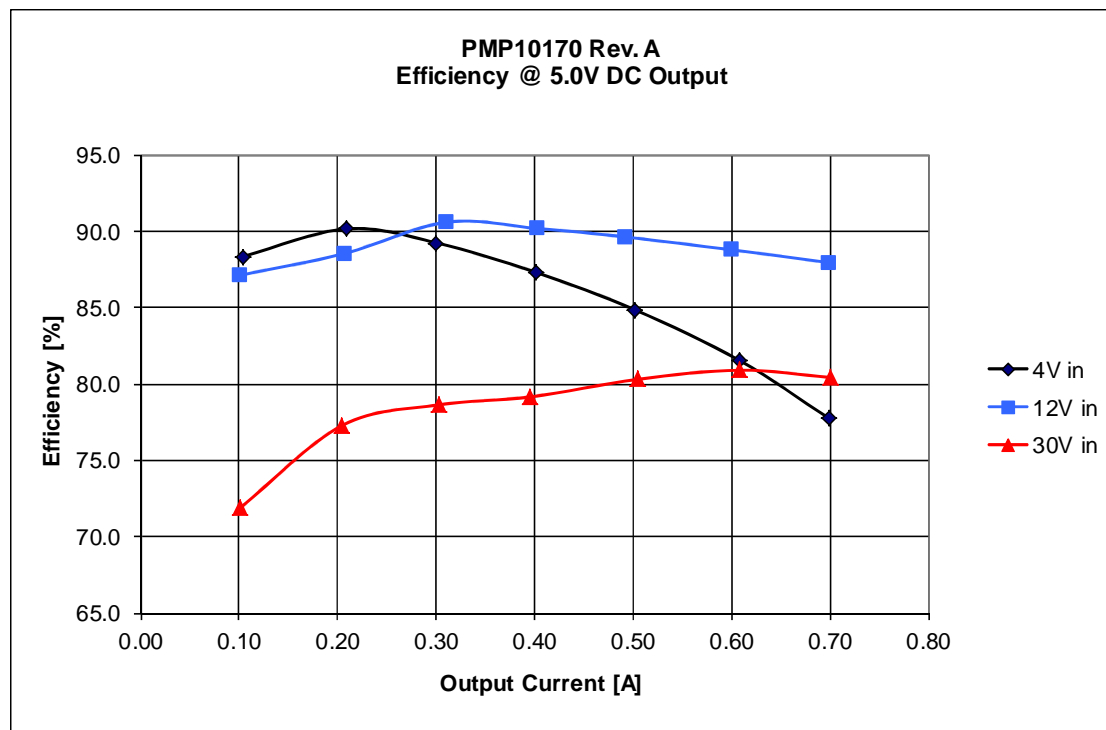

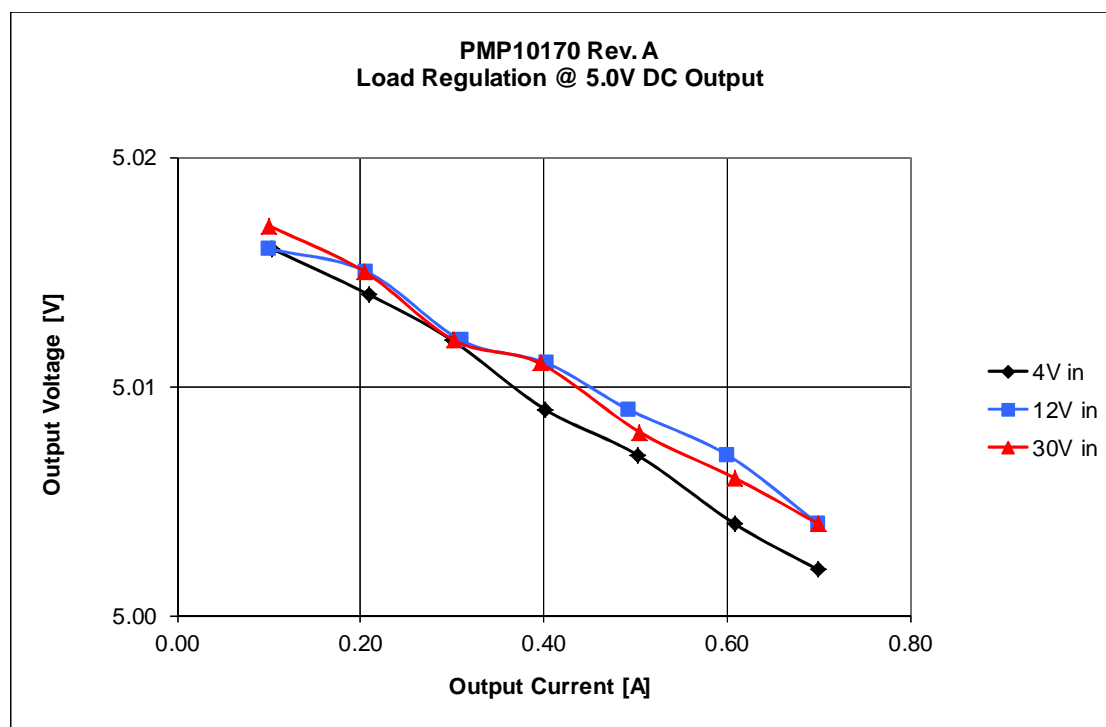**Figure 5**

Figure 6

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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
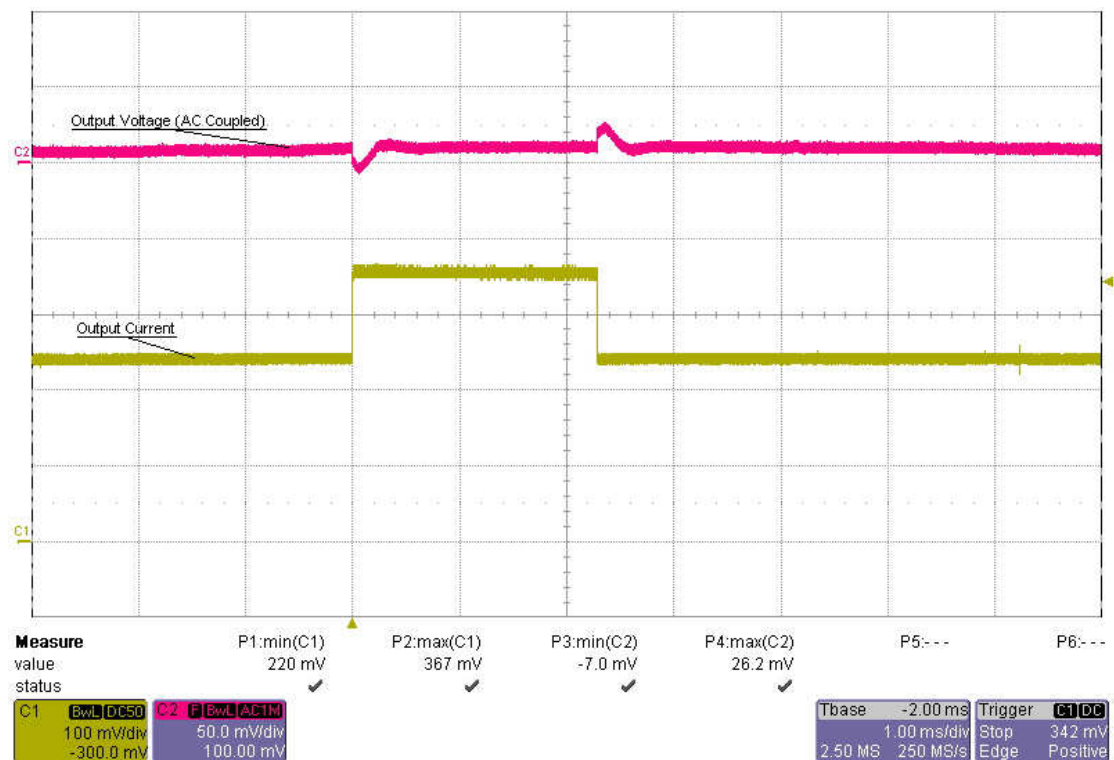   Load step 250mA to 350mA and vice versa

Figure 7

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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
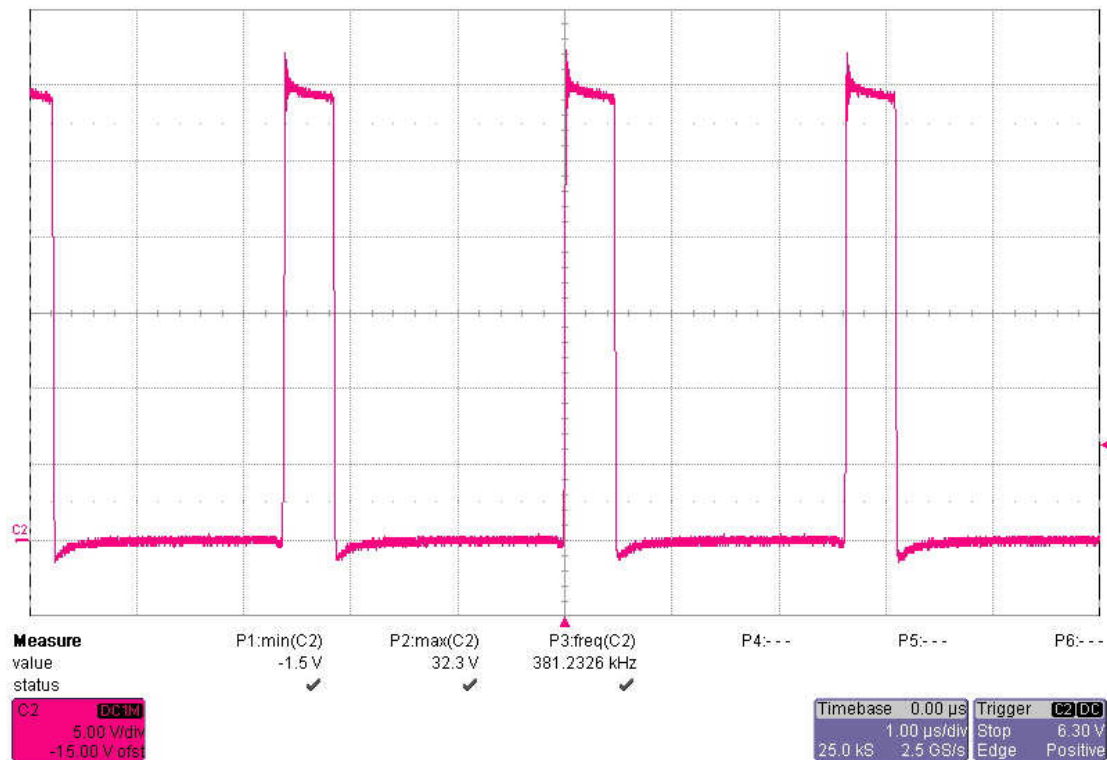   -1.5V minimum voltage, 32.3V maximum voltage

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

Figure 9
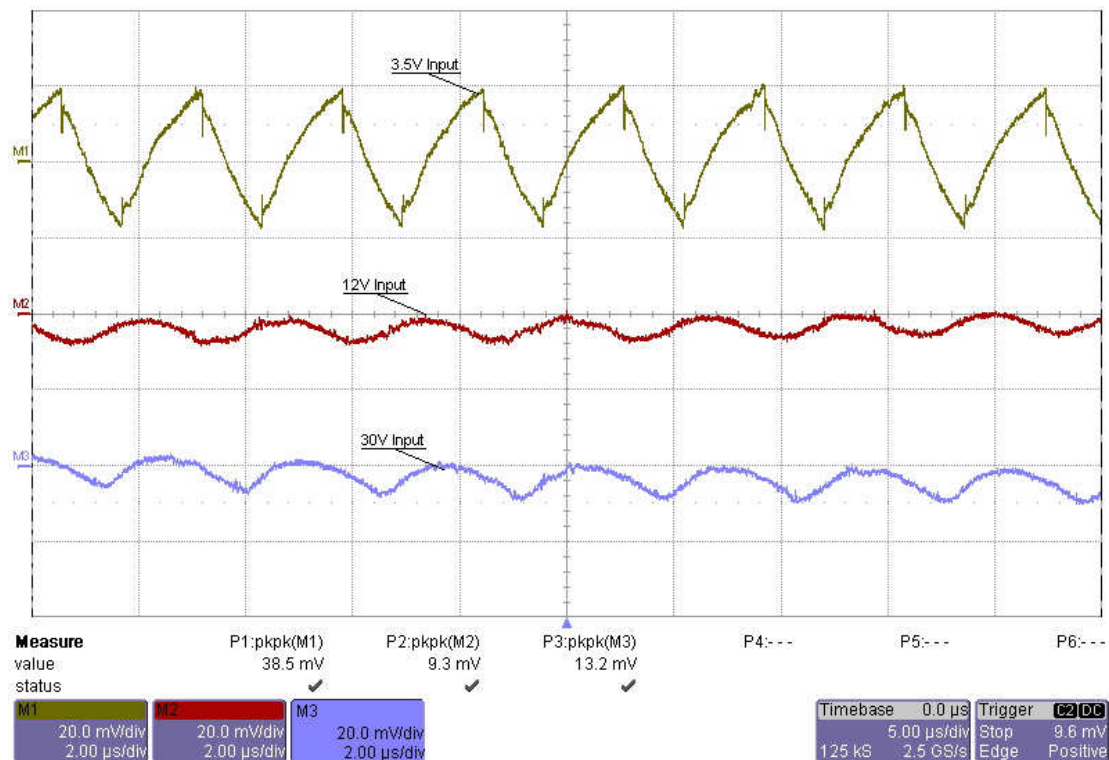
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6   Input Ripple Voltage

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.

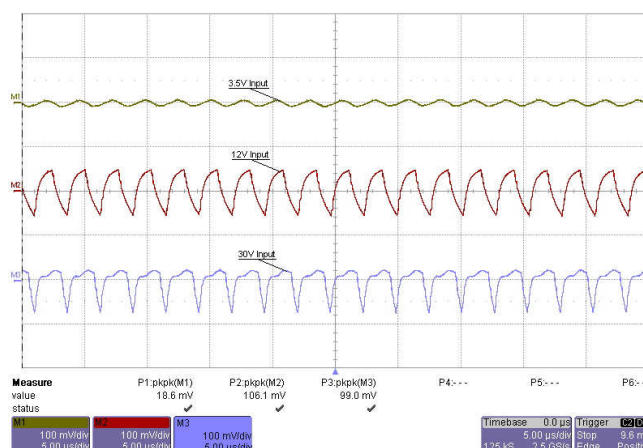| Channel M1: | **Input voltage @ 3.5V input** | 100mV/div, 5us/div, AC coupled |
	19mV peak-peak	
Channel M2:	**Input voltage @ 12.0V input**	100mV /div, 5us/div, AC coupled
	106mV peak-peak	
Channel M3:	**Input voltage @ 30.0V input**	100mV /div, 5us/div, AC coupled
	99mV peak-peak	

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

Figure 11

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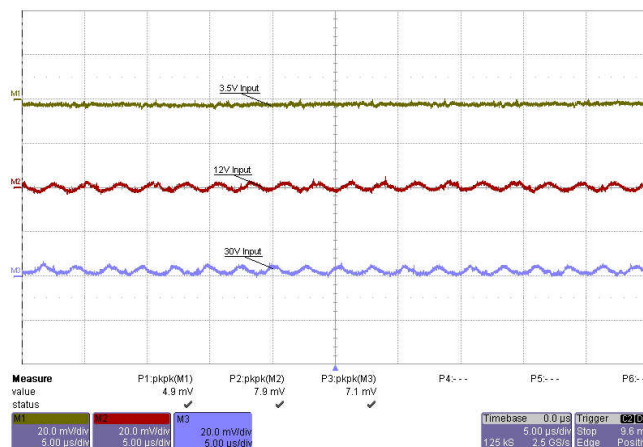
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7   Cranking Pulse

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

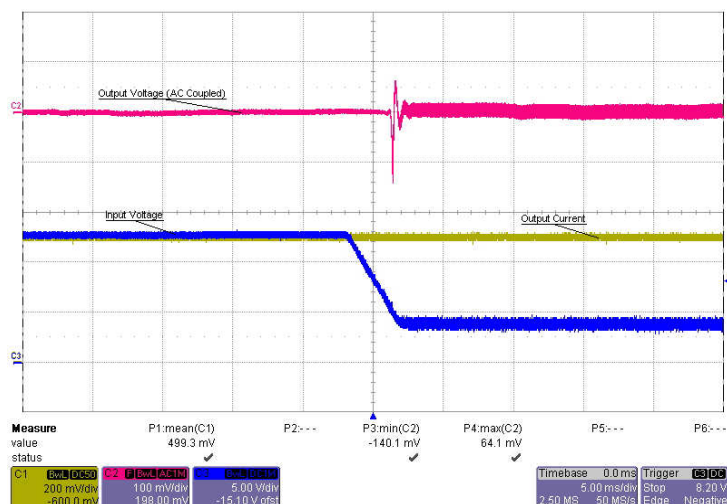Channel C3:   **Input voltage**   5V /div, 5ms/div

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

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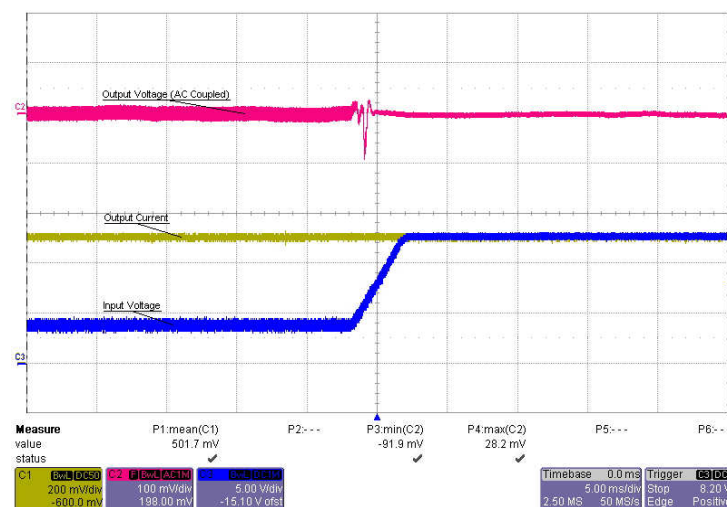
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8   Thermal measurement

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.
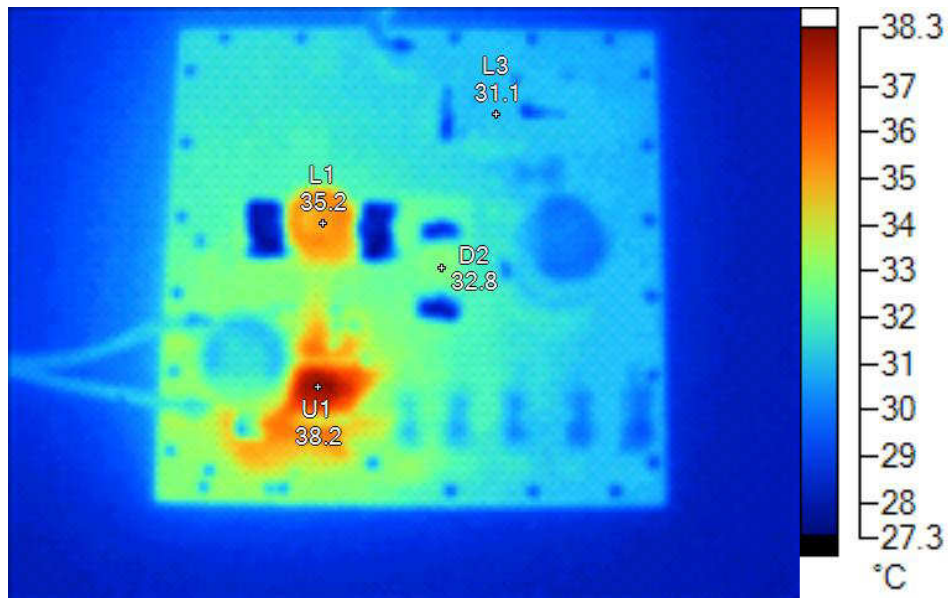

Figure 14

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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