PMP30122RevA Test Results

**Texas Instruments**

Topology: Nonsynchronuas Buck Converter
Device: TPS54160A, controller & driver w/ integrated FET

- *measurements taken at 48V input voltage and 28V output voltage*
- *switching frequency measured 376kHz*
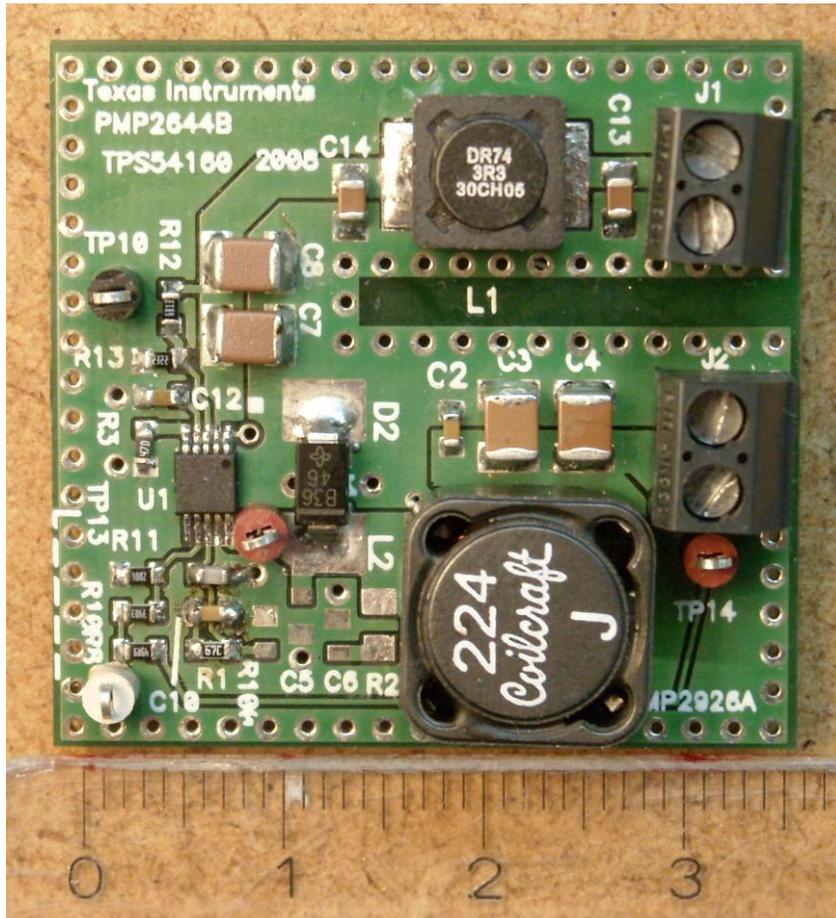
1   Startup

The startup waveform is shown in Figure 1. The input voltage was set to 48V, with 500mA load at the output. Startup takes around 15ms.

Ch1=> input voltage
20V/div

Ch2=> output voltage
10V/div

5ms/div
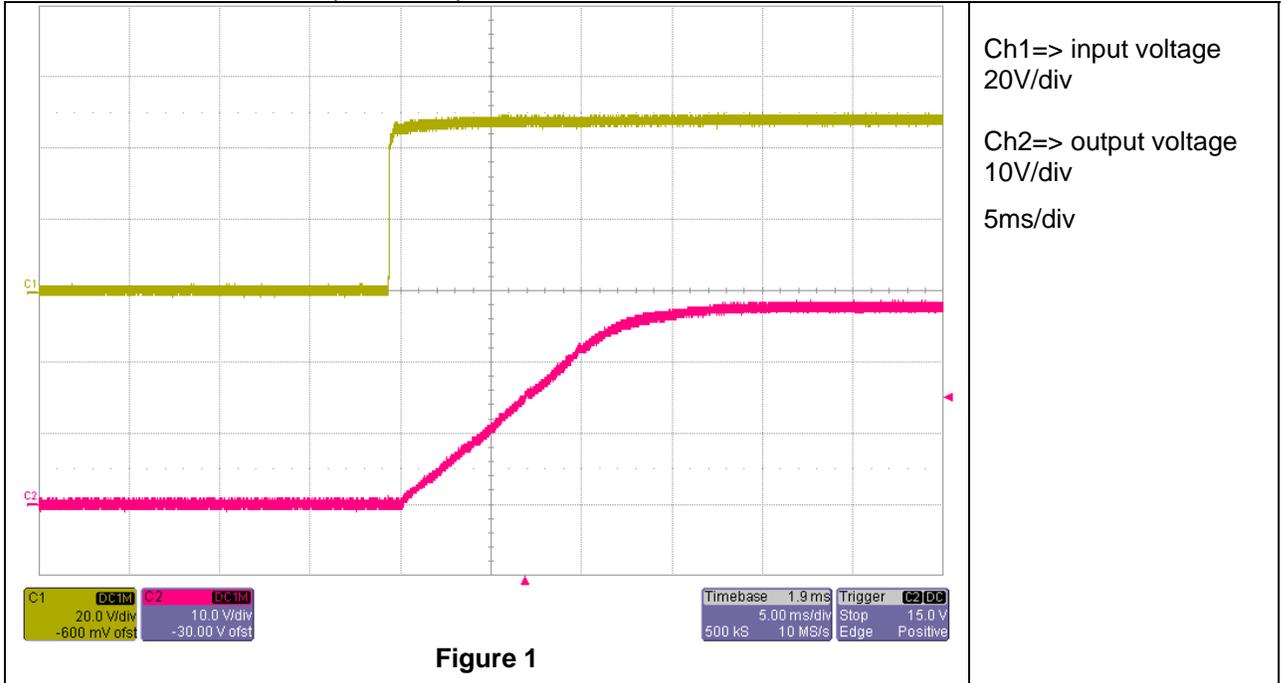
Figure 1

2   Shutdown

The shutdown waveform is shown in Figure 2. The input voltage was set to 48V, with 1A load on the output.

Ch1=> input voltage
20V/div

Ch2=> output voltage
10V/div

20ms/div

Figure 2

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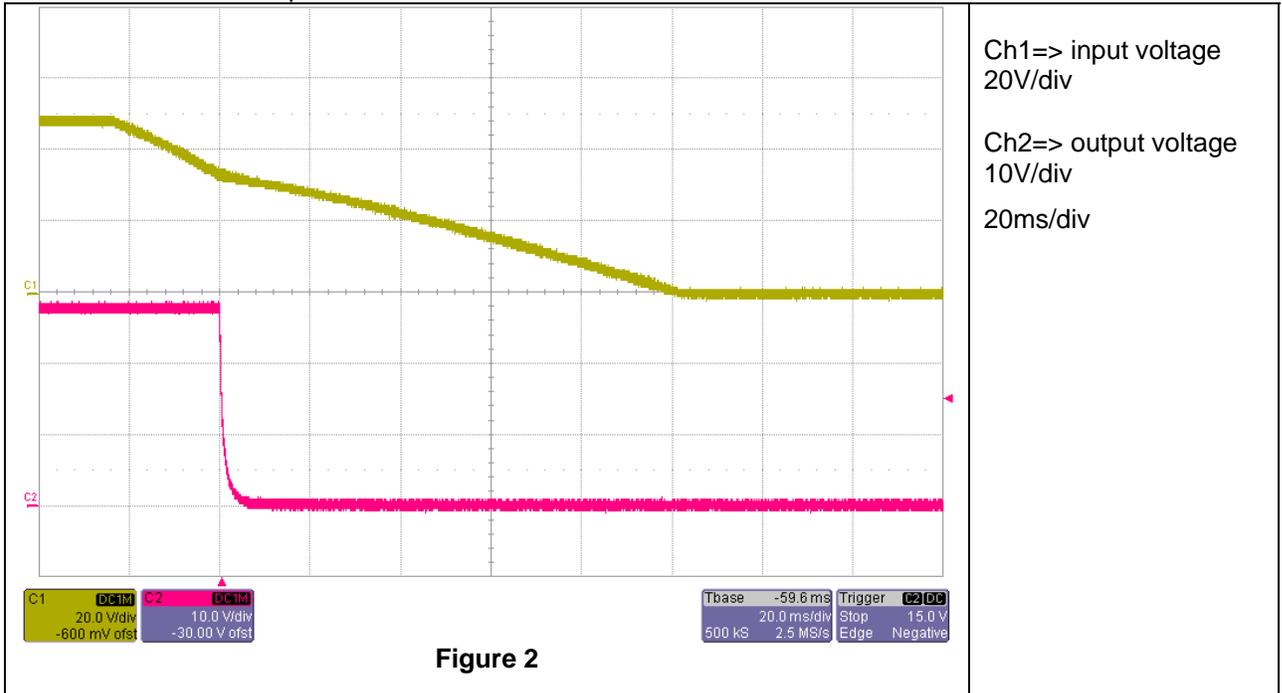
3   Efficiency

The efficiency is shown in Figure 3 below. The input voltage was set to 48V.
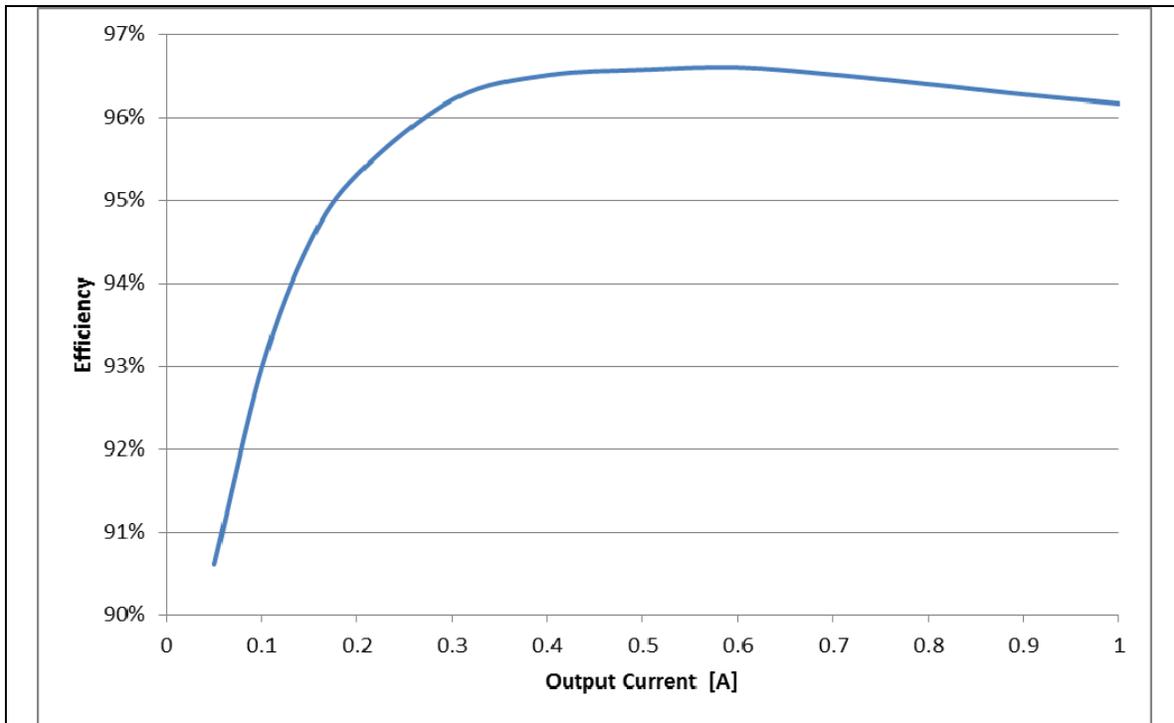

Figure 3

- **at nominal load 500mA efficiency is**   **96.57%**
- **at light load condition 100mA efficiency is**   **92.98%**
- **at peak load 1000mA efficiency is**   **96.15%**

- **peak efficiency of 96.60% is around 600mA load,**
- **efficiency is >96% in a range of 300mA to 1000mA**

4   Load Regulation

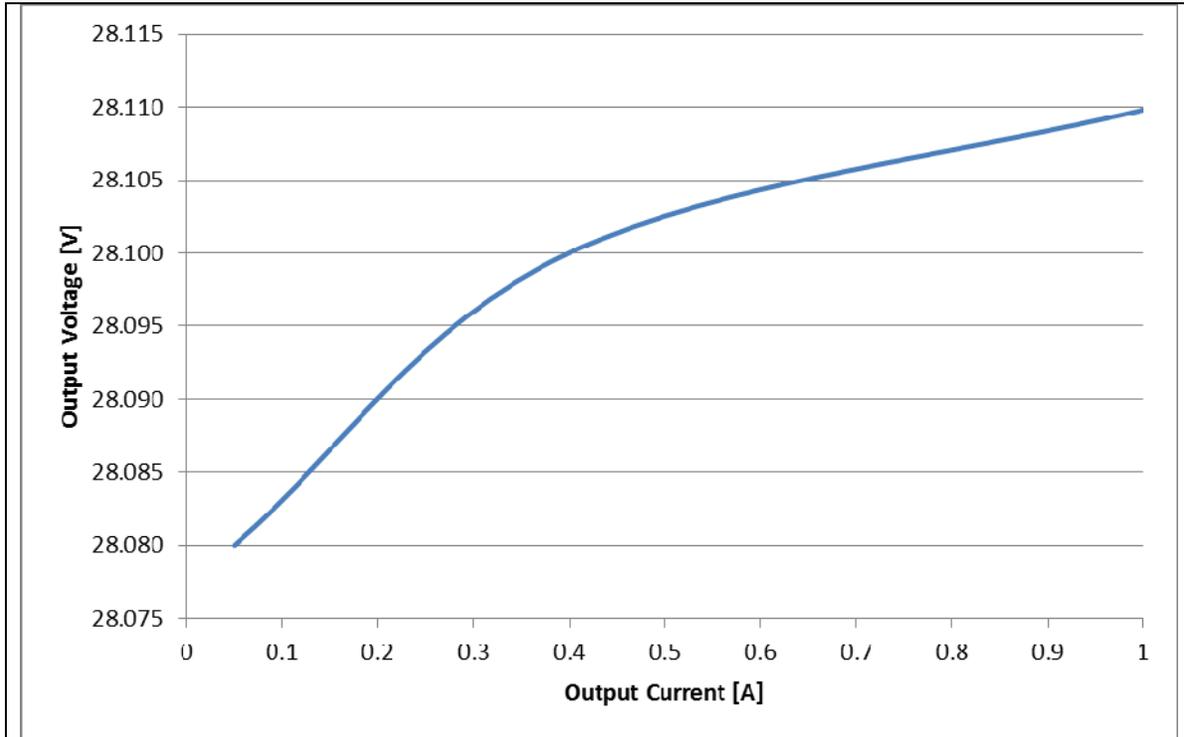The load regulation of the output is shown in **Figure 4** below. The input voltage was set to 48V.
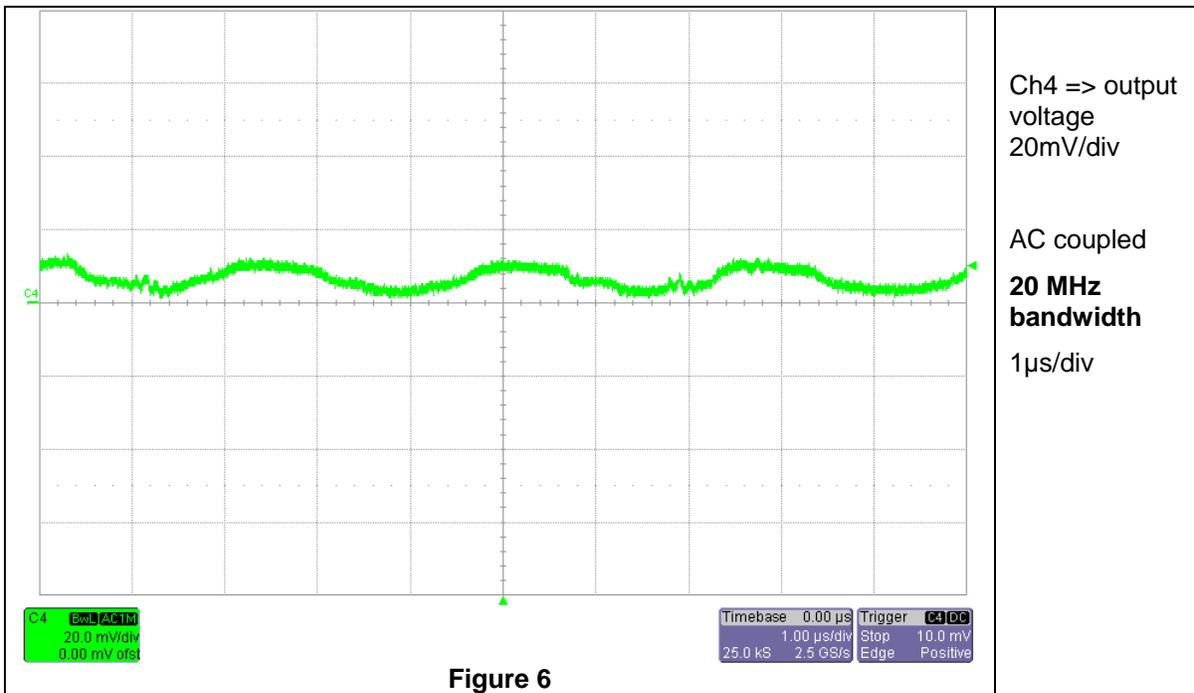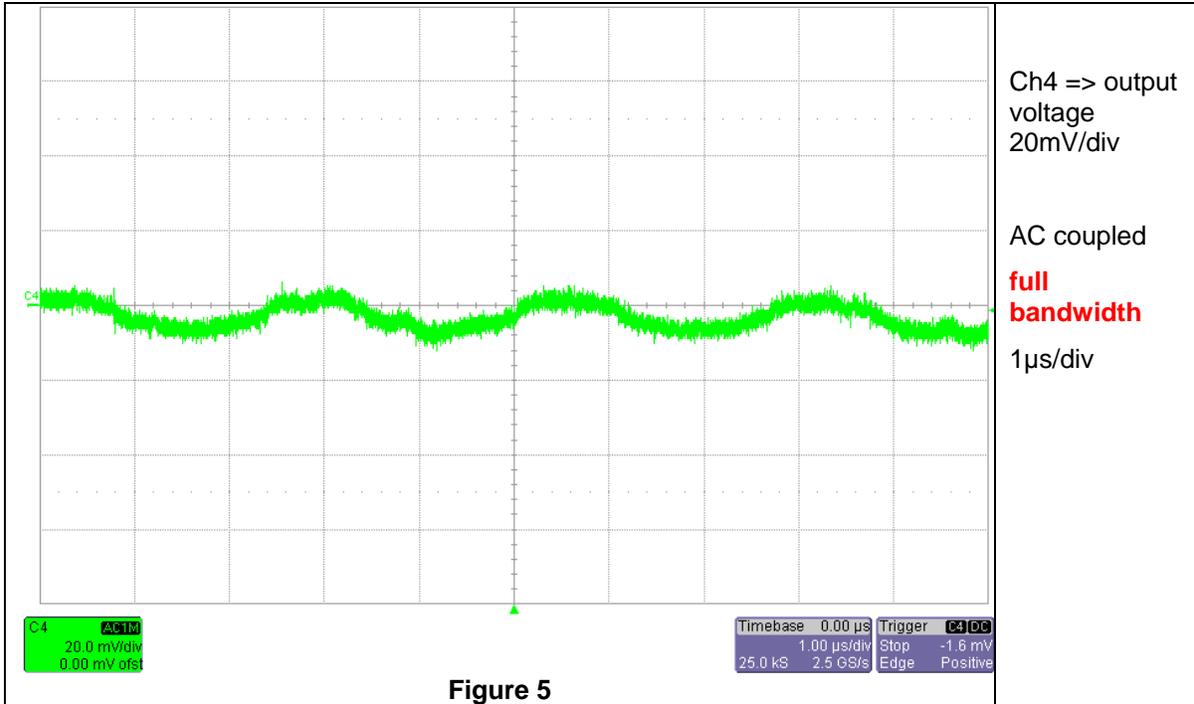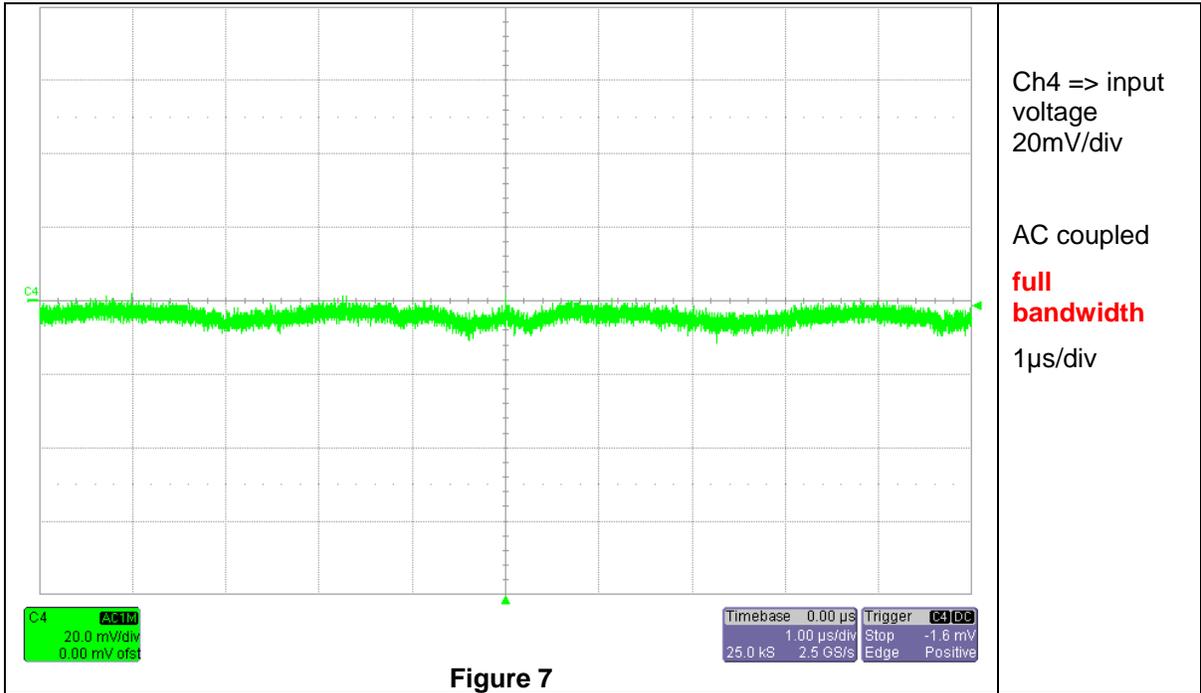

Figure 4

Deviation by load in between 50mA to 1000mA load is 30mV, so around 0.1%

5   Ripple Voltage

The output ripple voltage is shown in Figure 5 and 6. The images were taken with 1A load and 48V input. **Ripple is almost sinusoidal <20mVpp, NO switching spikes at full bandwidth**

Ch4 => output
voltage
20mV/div

AC coupled

**full
bandwidth**

1µs/div

Figure 5

Ch4 => output
voltage
20mV/div

AC coupled

**20 MHz
bandwidth**

1µs/div

Figure 6

The filtered input ripple voltage is shown in Figure 7. The image was taken with 1A load and 48V at the input. **The input filter attenuates the reflected converter ripple <10mVpp.**

Ch4 => input voltage 20mV/div

AC coupled

full bandwidth

1µs/div

Figure 7

The unfiltered input ripple voltage 400mVpp at power stage input C7, C8 is shown in Figure 8. The image was taken with 1A load and 48V at the input. For sensitive bus filter is recommended.

Ch4 => input voltage

100mV/div

unfiltered

AC coupled

full bandwidth

1µs/div
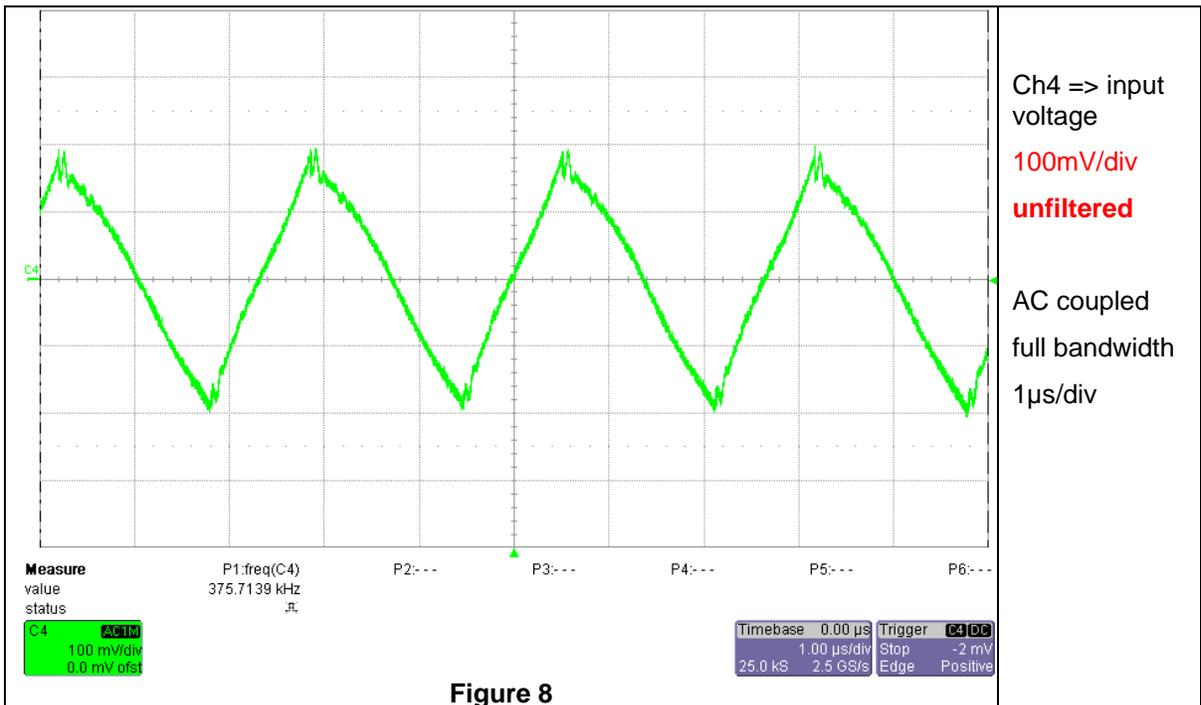
Figure 8

6 Control Loop Frequency Response

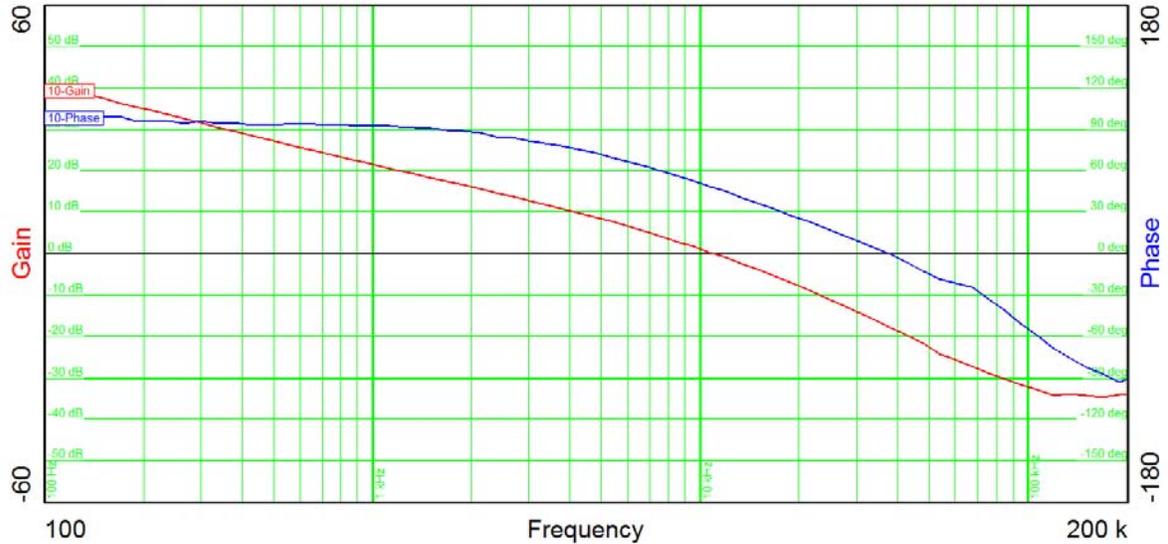Figure 9 below shows the loop response with 1A load and 48V input, Fco 11.7kHz:

Figure 9

Phase Margin: 47.71°

Gain Margin: 17.5 dB

PMP30122RevA Test Results

7   Load Transients

Figure 10 shows the response to load transients. The load is switching from 0.1A to 0.6A with 500 Hz frequency. The input voltage was set to 48V. **Deviation 2.5%**
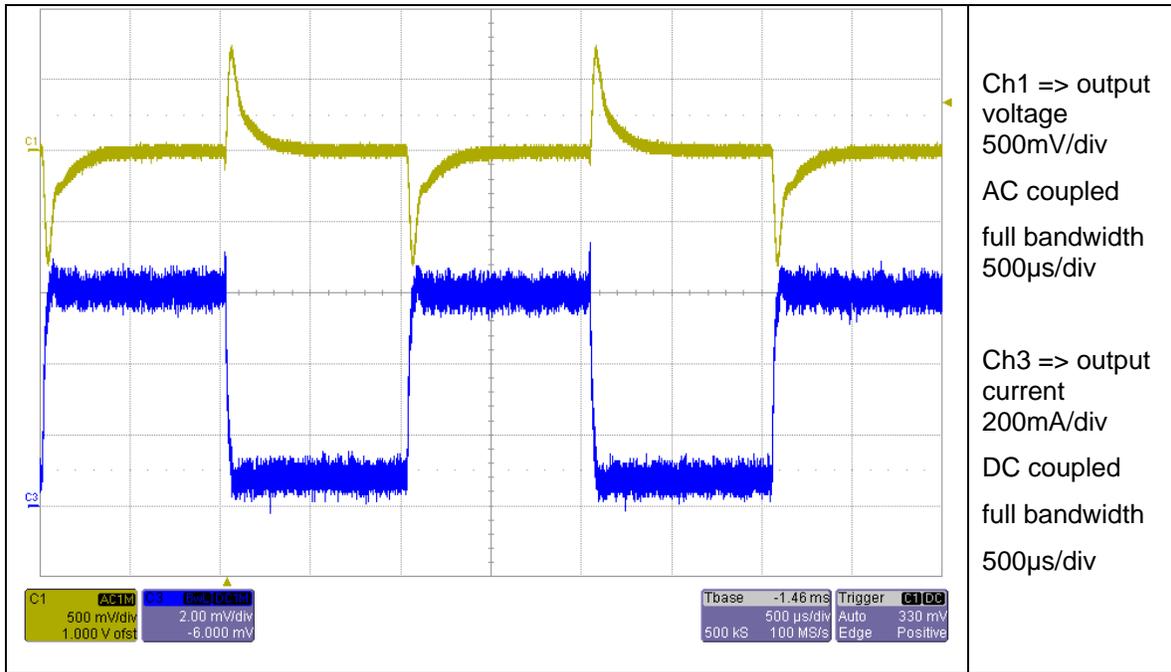

Ch1 => output voltage 500mV/div

AC coupled

full bandwidth 500µs/div

Ch3 => output current 200mA/div

DC coupled

full bandwidth

500µs/div

Figure 10

Figure 11 shows a load transient from 0.25A to 0.5A with 500 Hz frequency. The input voltage was set to 48V. **Deviation <1.5% for standard transient 50%**.

Ch1 => output voltage 200mV/div

AC coupled

full bandwidth 500µs/div

Ch3 => output current 200mA/div

DC coupled

full bandwidth

500µs/div

Figure 11

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PMP30122RevA Test Results
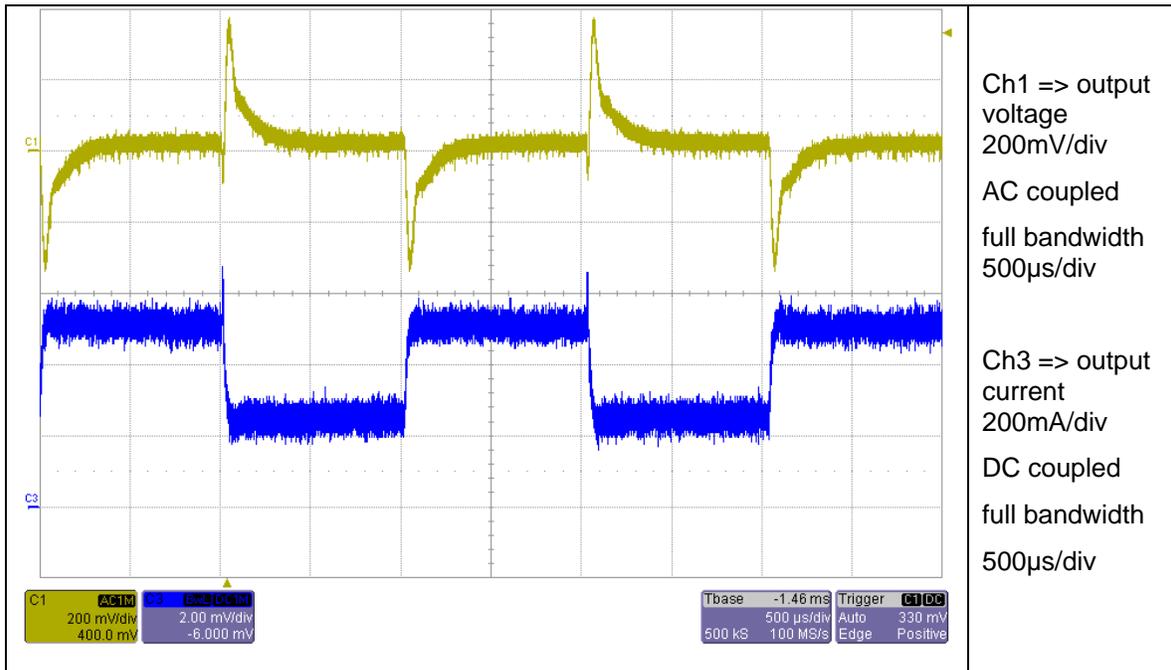
Figure 12 shows a load transient from 0.1A to 1A with 500 Hz frequency. The input voltage was set to 48V. **Deviation 4% for a 90% transient to peak load condition 1000mA**.
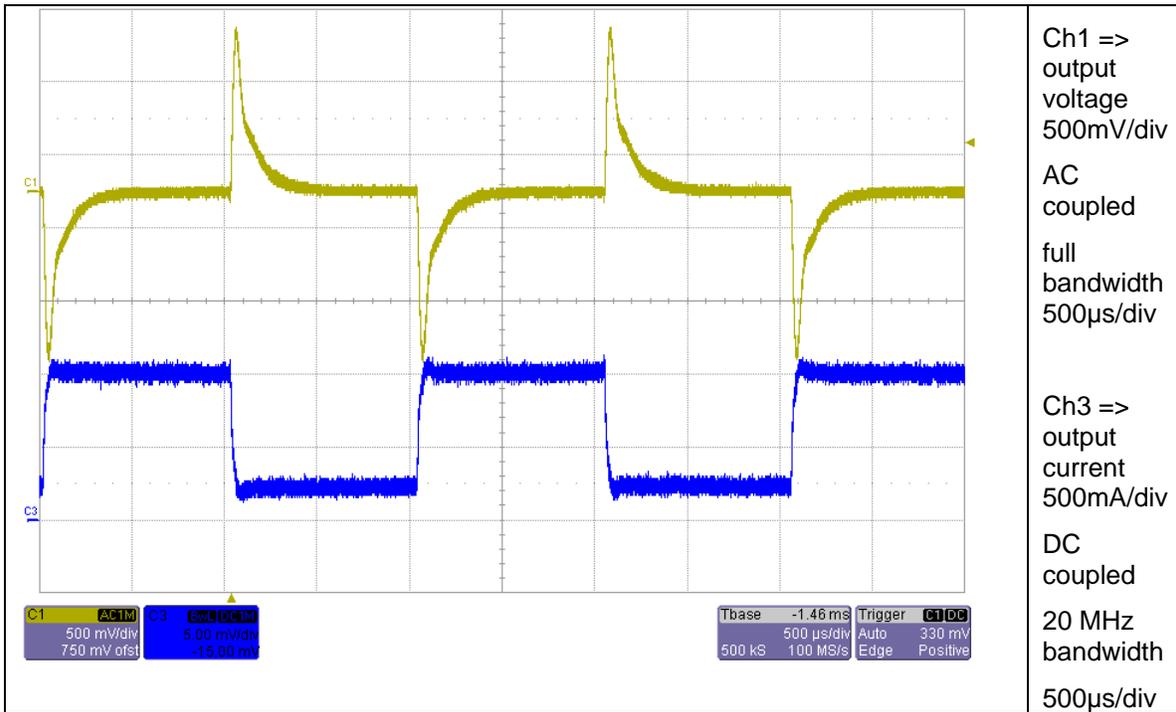

Ch1 =>
output
voltage
500mV/div

AC
coupled

full
bandwidth
500µs/div

Ch3 =>
output
current
500mA/div

DC
coupled

20 MHz
bandwidth

500µs/div

Figure 12

PMP30122RevA Test Results

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8 Miscellaneous Waveforms

8.1 *Switch node (D2)*

With input voltage set to 48V and 1A peak output current the drain waveform can be observed at the switch node – **full bandwidth**:

Ch2 =>
Switch node

10V/div

1µs/div
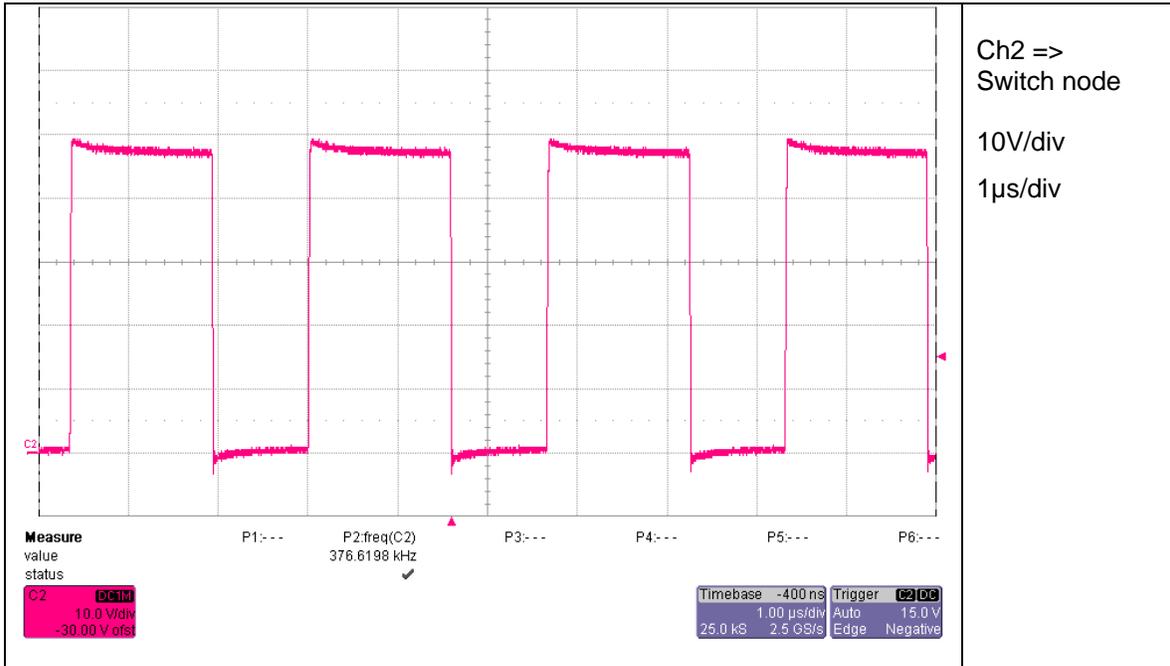
dedicated low impedance layout results in drain waveform w/out RF ringing at switch node

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9   Thermal Performance

Thermal image at 48V input and 500mA nominal load after 30 min continuous operation
[Rt = 25°C] – temperature rise dT slightly more than 20K at nominal load:
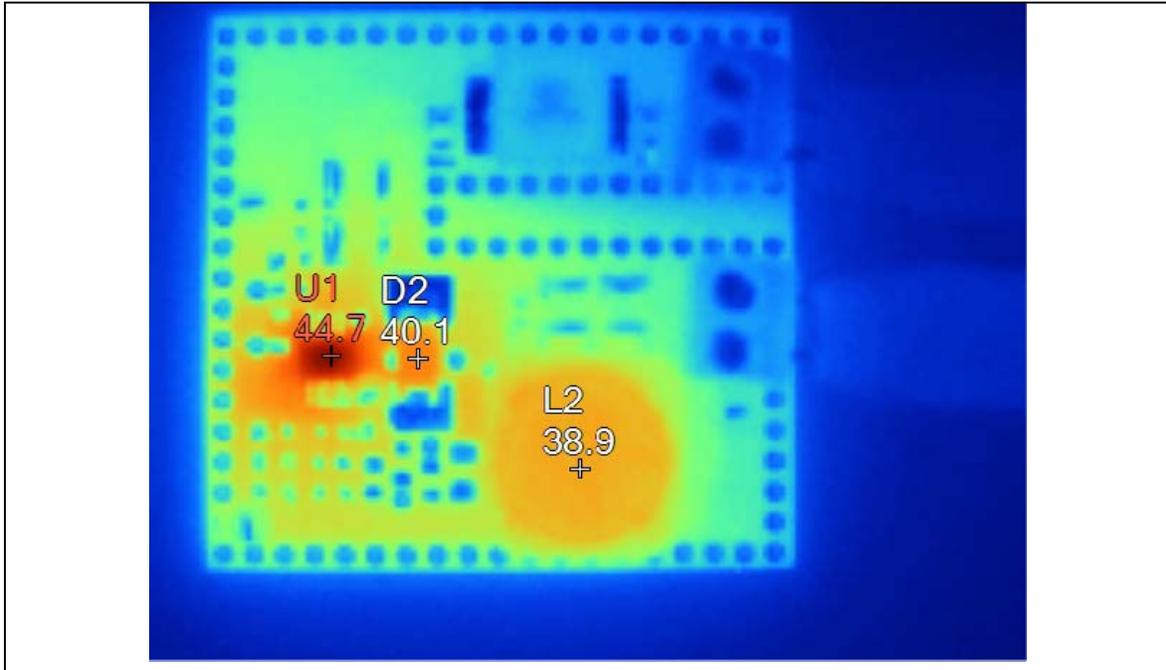
Thermal image at 48V input and 1000mA peak load after 30 min continuous operation
 [Rt = 25°C] – temperature rise dT around 45K at peak load:
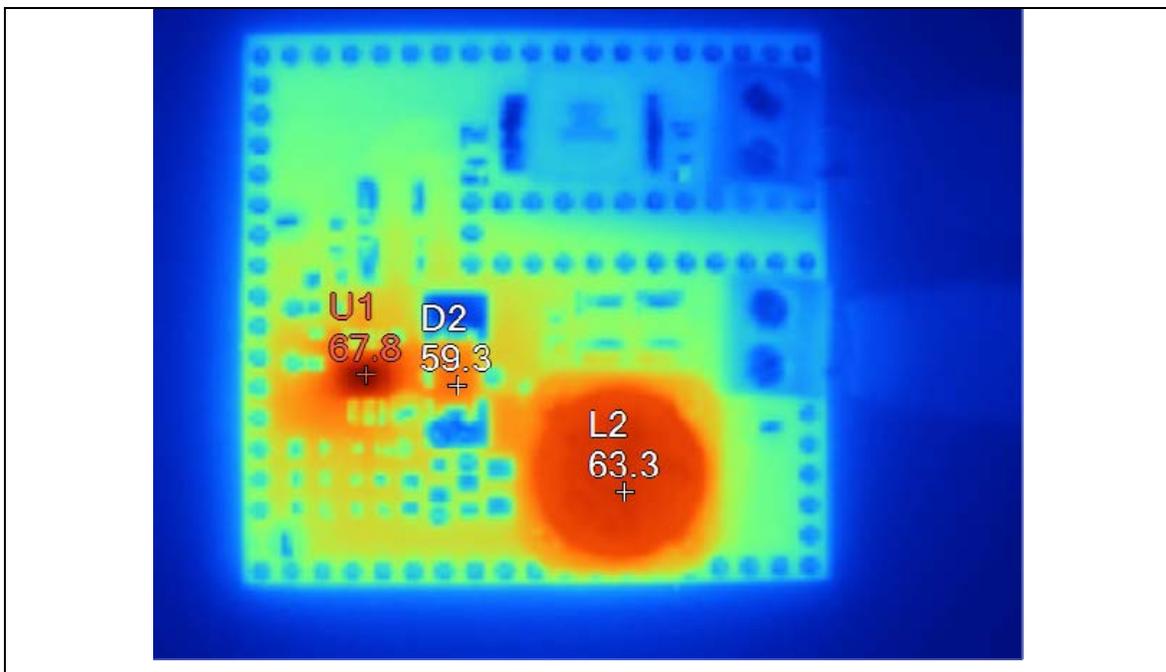
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