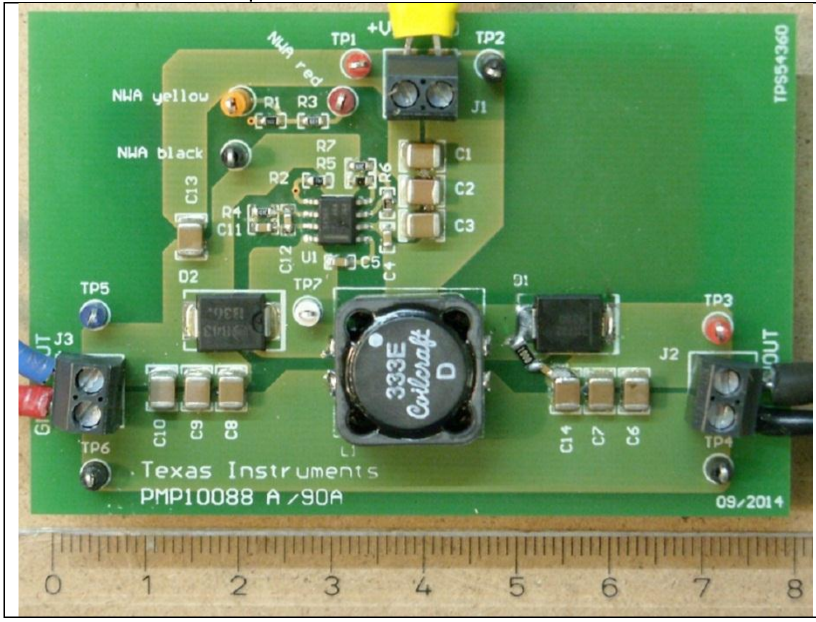
10/7/14

PMP10090RevB Test Results

Topology: Inverting Buck-Boost (dual outputs negative and positive).
Device: TPS54340
Unless otherwise mentioned all measurements were done with 12V input voltage and 0.7A output current on each output



1 Startup

The startup waveform is shown in the Figure 1. The input voltage was set at 12V, with 0.7A load at the output on each output. Power supply was connected.

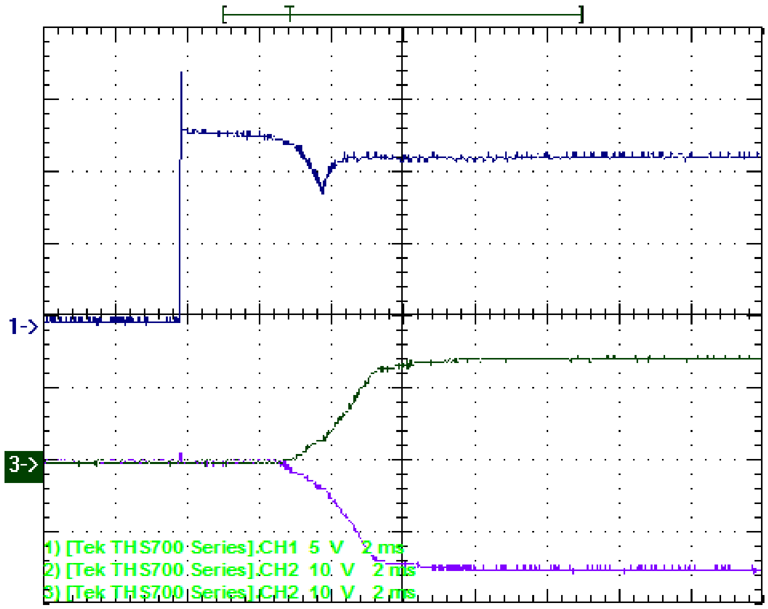
	Ch1=> input voltage 5V/div Ch2=> output voltage 10V/div (-VOUT) Ch3=> output voltage 10V/div (+VOUT) 2ms/div

Figure 1

2 Shutdown

The shutdown waveform is shown in the Figure 2. The input voltage was set at 12V, with 0.7A load on each output. Power supply was disconnected.

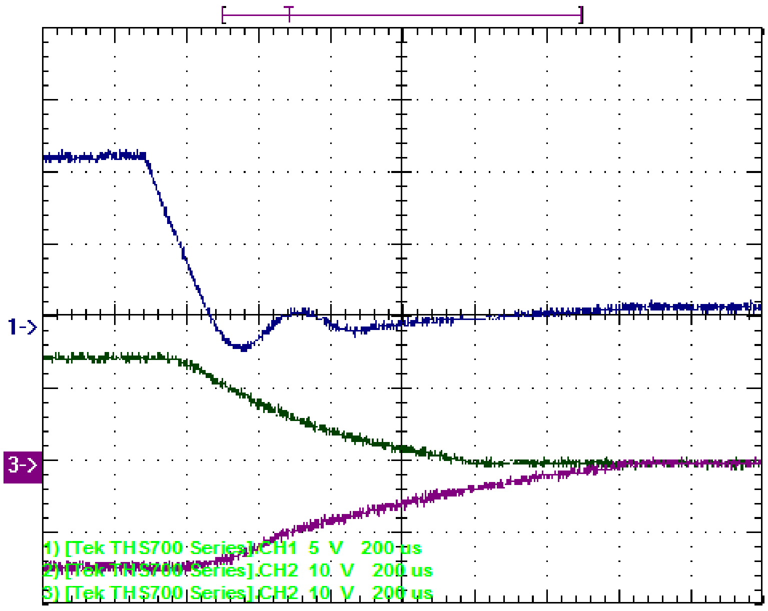
	Ch1=> input voltage 5V/div Ch2=> output voltage 10V/div (VOUT+) Ch3=> output voltage 10V/div (VOUT-) 200µs/div

Figure 2

3 Efficiency

The efficiency is shown in the Figure 3 below. The input voltage was set to 12V. The output currents were changed together (-IOUT = +IOUT). The discontinuity in the curve reflects the transition from discontinuous to continuous mode.

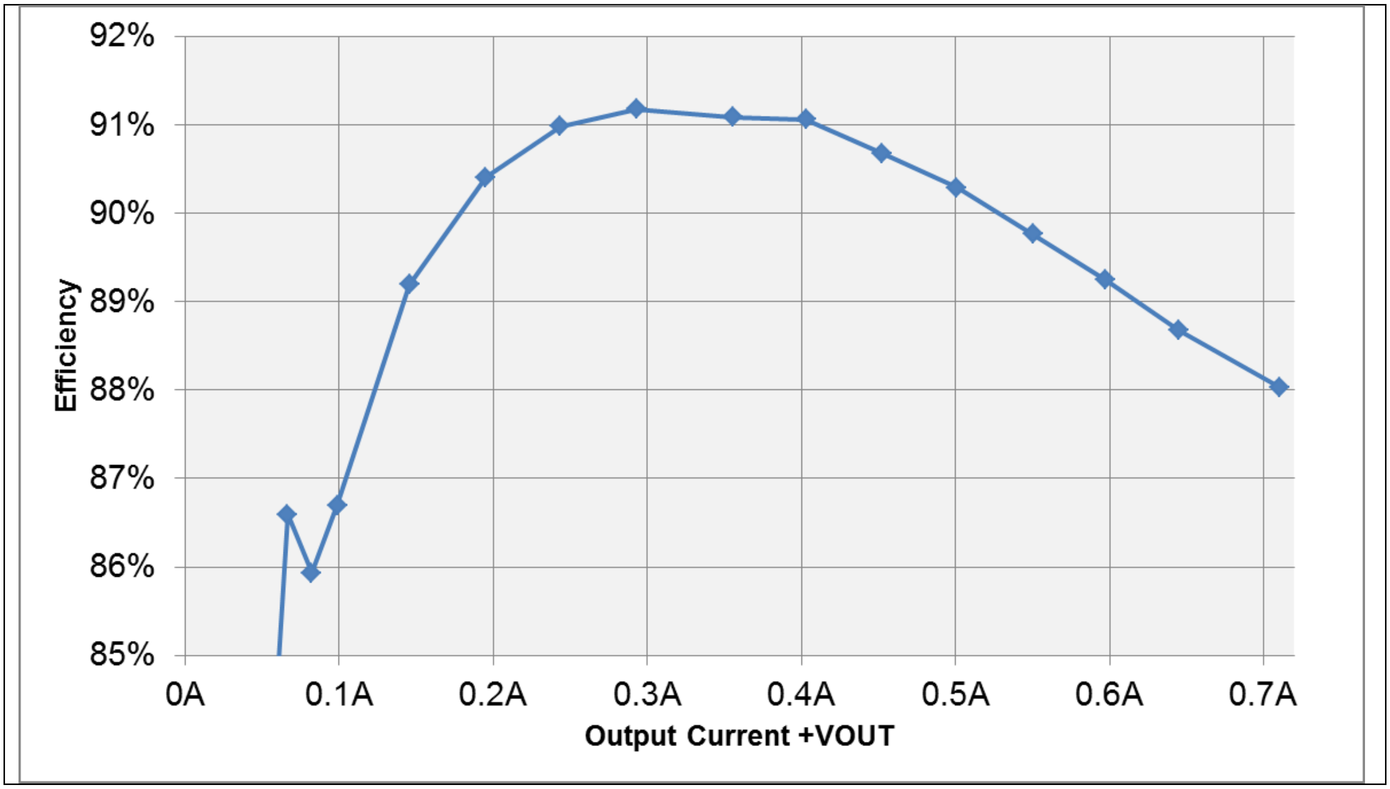


Figure 3

4 Load Regulation

The load regulation of the output is shown in the Figure 4 below.

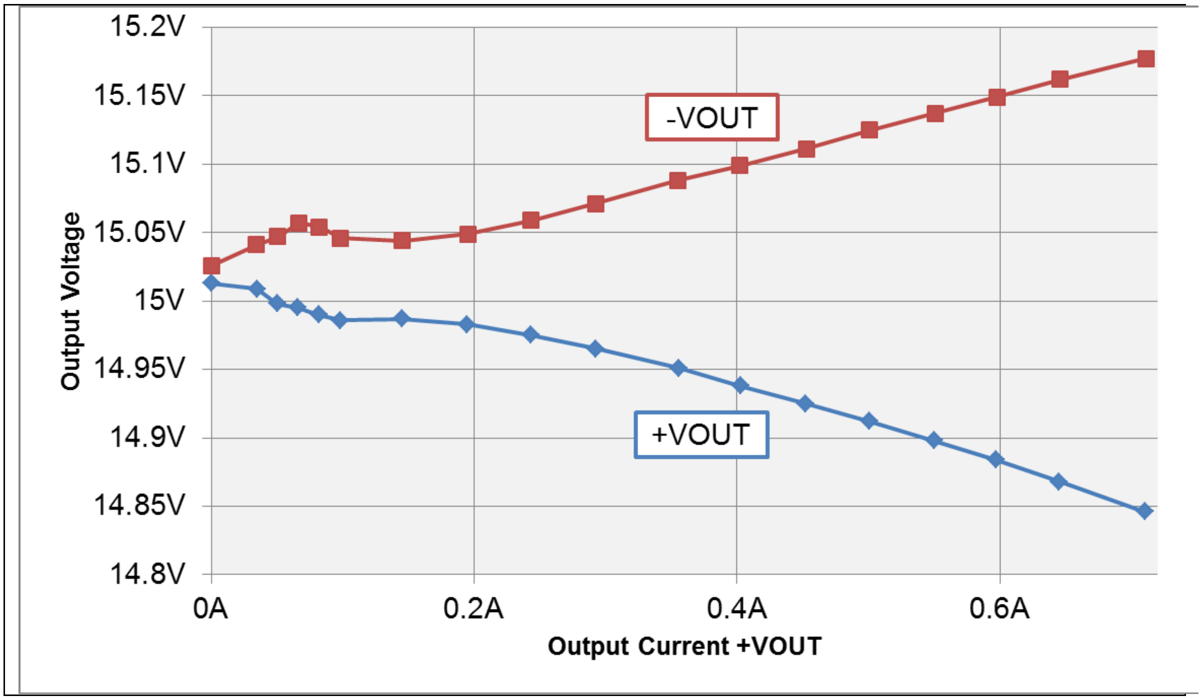


Figure 4

5 Line Regulation

Line regulation at 0.7A output current is shown in Figure 5

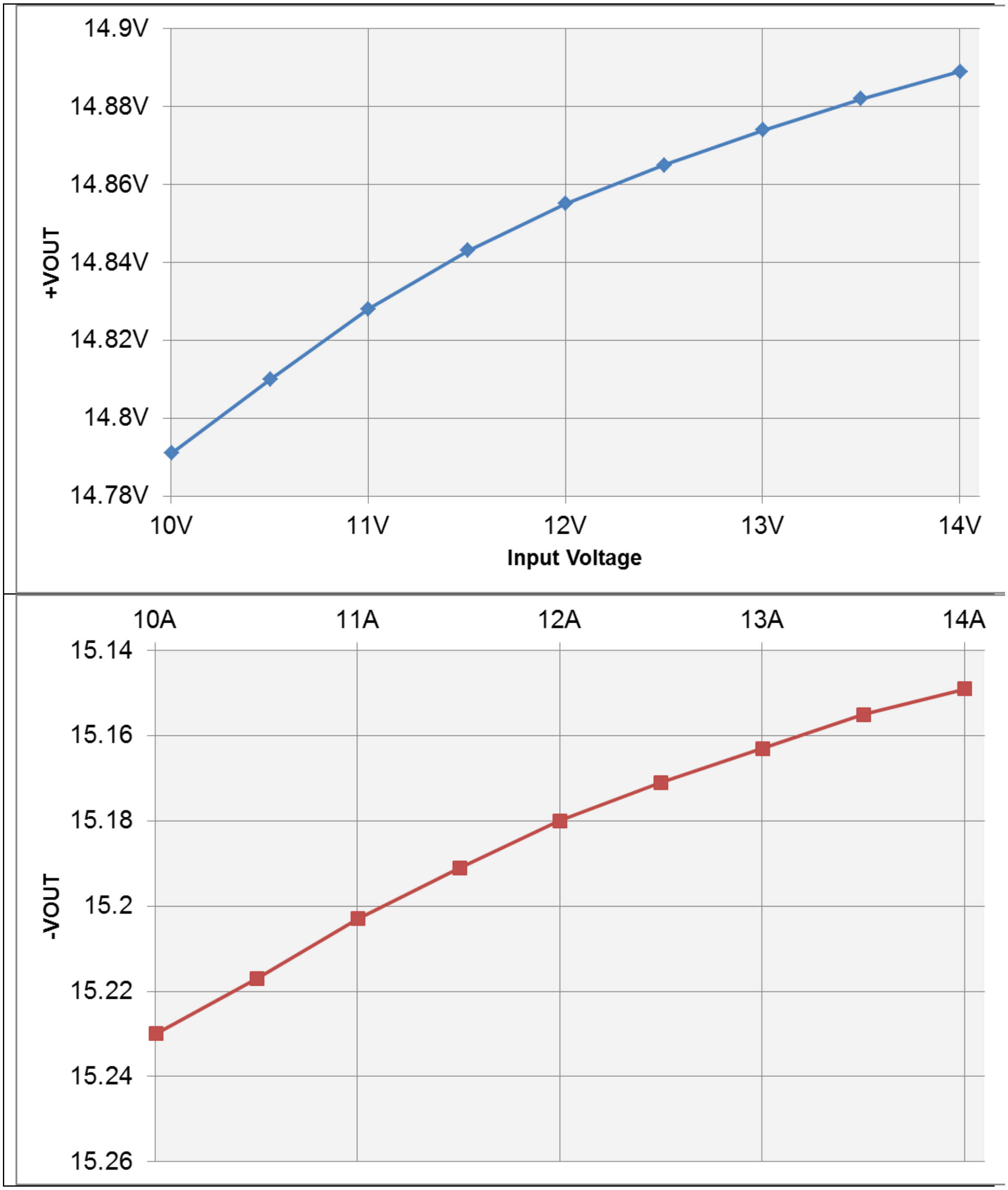


Figure 5

With the same measurement the full load efficiencies across input voltage were calculated

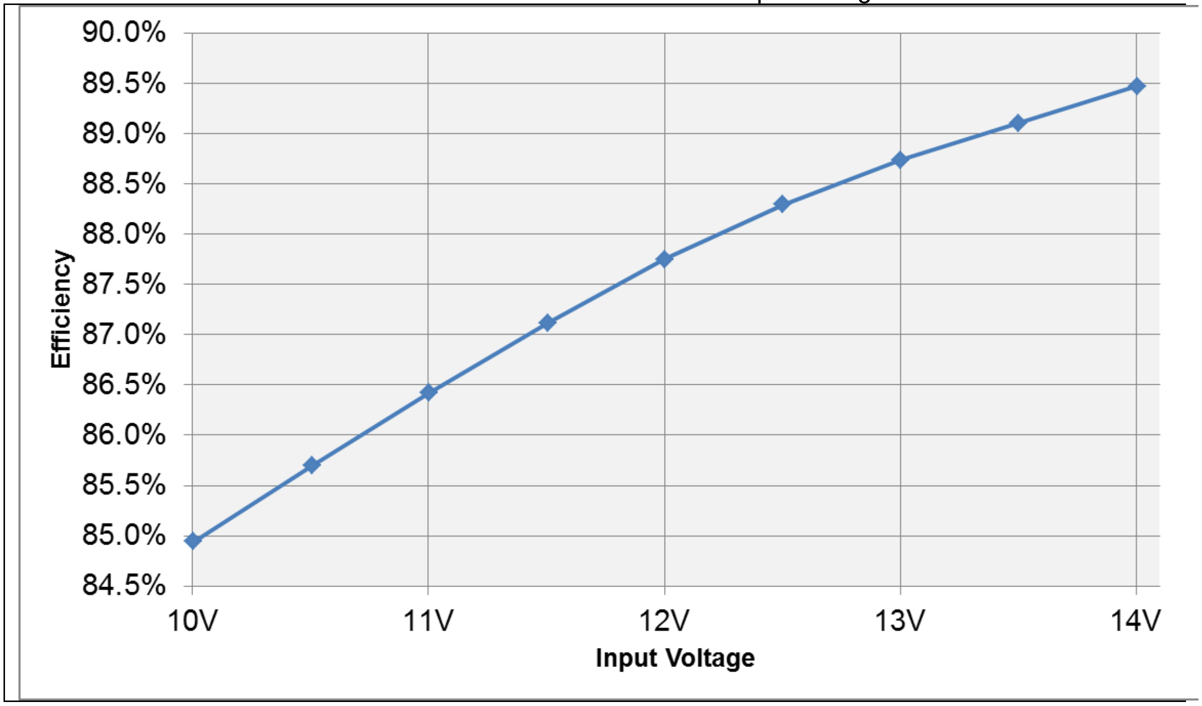


Figure 6

6 Cross Regulation

The output currents were changed separately (0A, 0.2A, 0.4A, 0.7A)
Figure 7 shows the effects on the positive output voltage, if the negative output current is varied. The different curves represent the positive output current settings

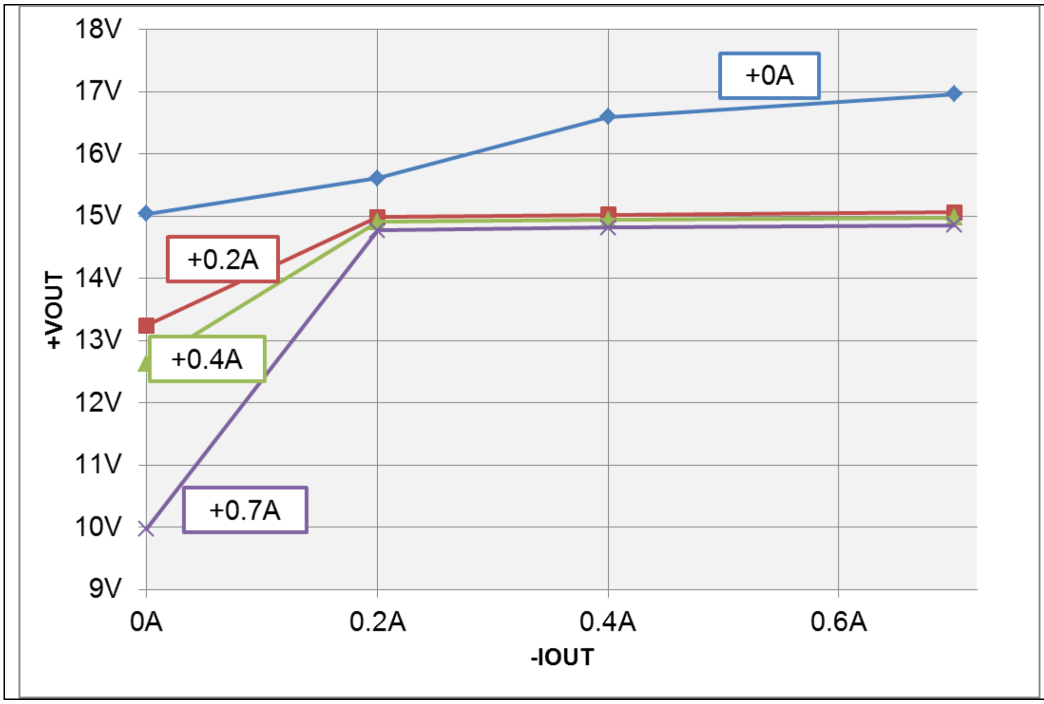


Figure 7

Figure 8 shows the effects on the negative output voltage, if the positive output current is varied. The different curves represent the negative output current settings.

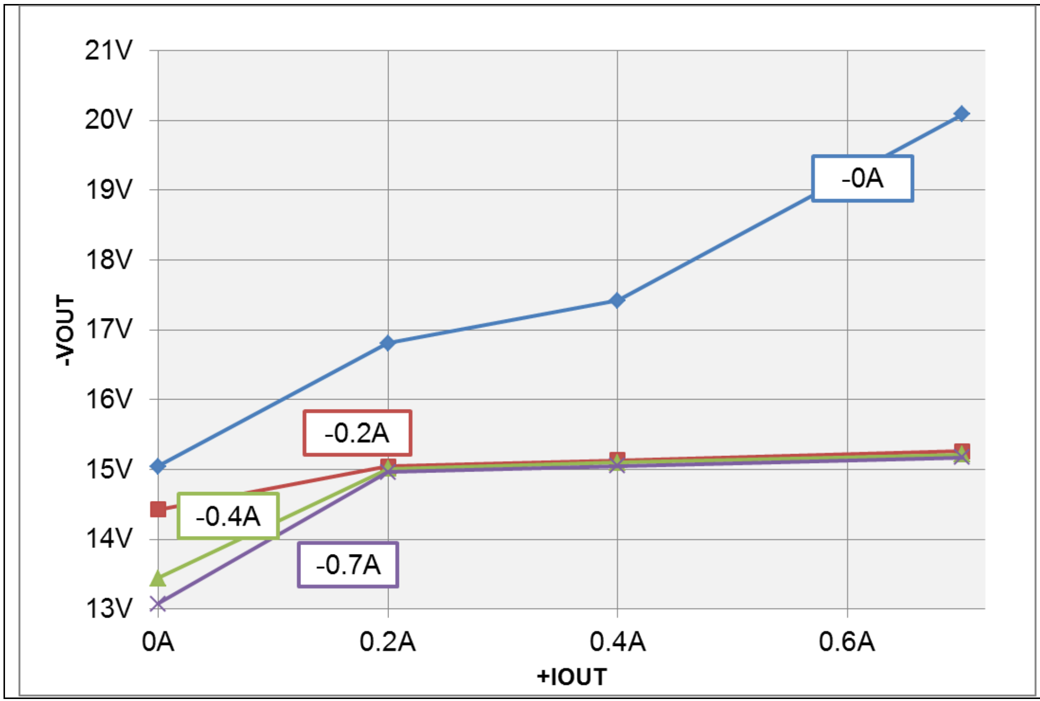


Figure 8

7 Ripple Voltage

7.1 Positive Output

The output ripple voltage is shown in Figure 9. The image was taken with a 0.7A and 12V at the input.

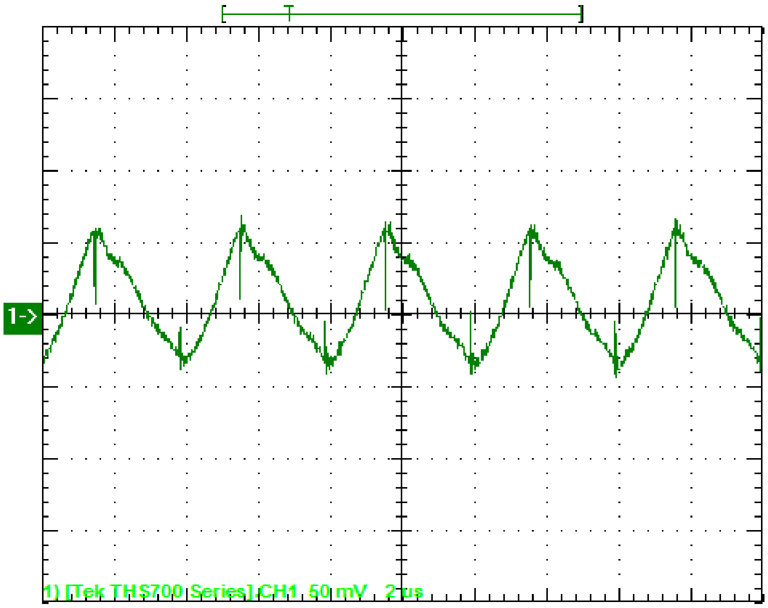
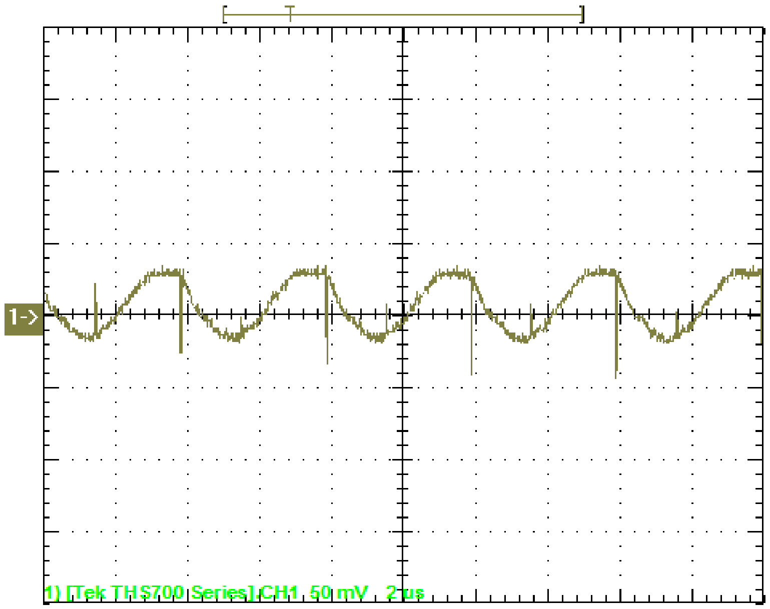
	Ch1 => output voltage (+VOUT) 50mV/div AC coupled 20MHz bandwidth setting 2µs/div

Figure 9

Positive output voltage ripple is at full load is <1%

7.2 Negative Output

The negative output ripple voltage is shown in Figure 10. The image was taken with a 0.7A load 12V at the input.



Ch1 => output voltage (-VOUT)

50mV/div

AC coupled

20MHz bandwidth setting

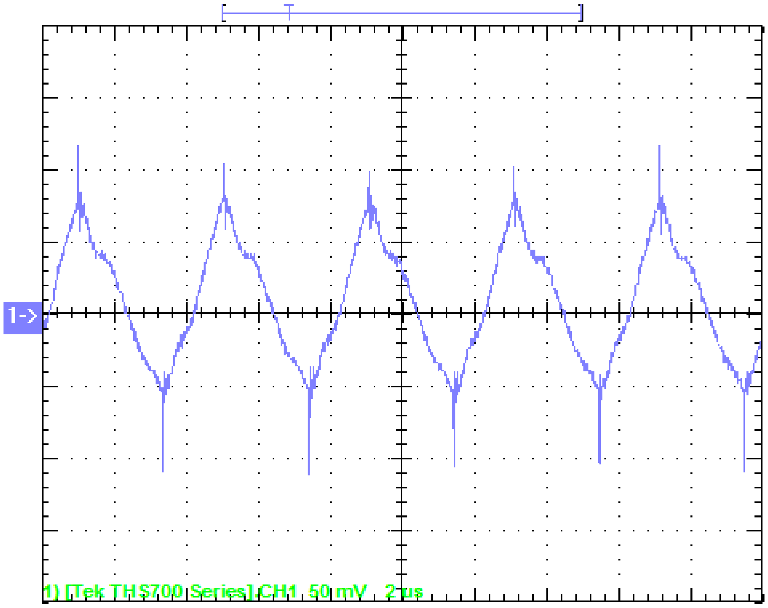
2µs/div

Figure 10

Negative output voltage ripple at full load is <1%

7.3 Input Voltage

The input ripple voltage is shown in Figure 11.



Ch1 => input voltage

50mV/div

AC coupled

20MHz bandwidth setting

1µs/div

Figure 11

8 Control Loop Frequency Response

Figure 12 shows the loop response with 0.7A load and 12V input.

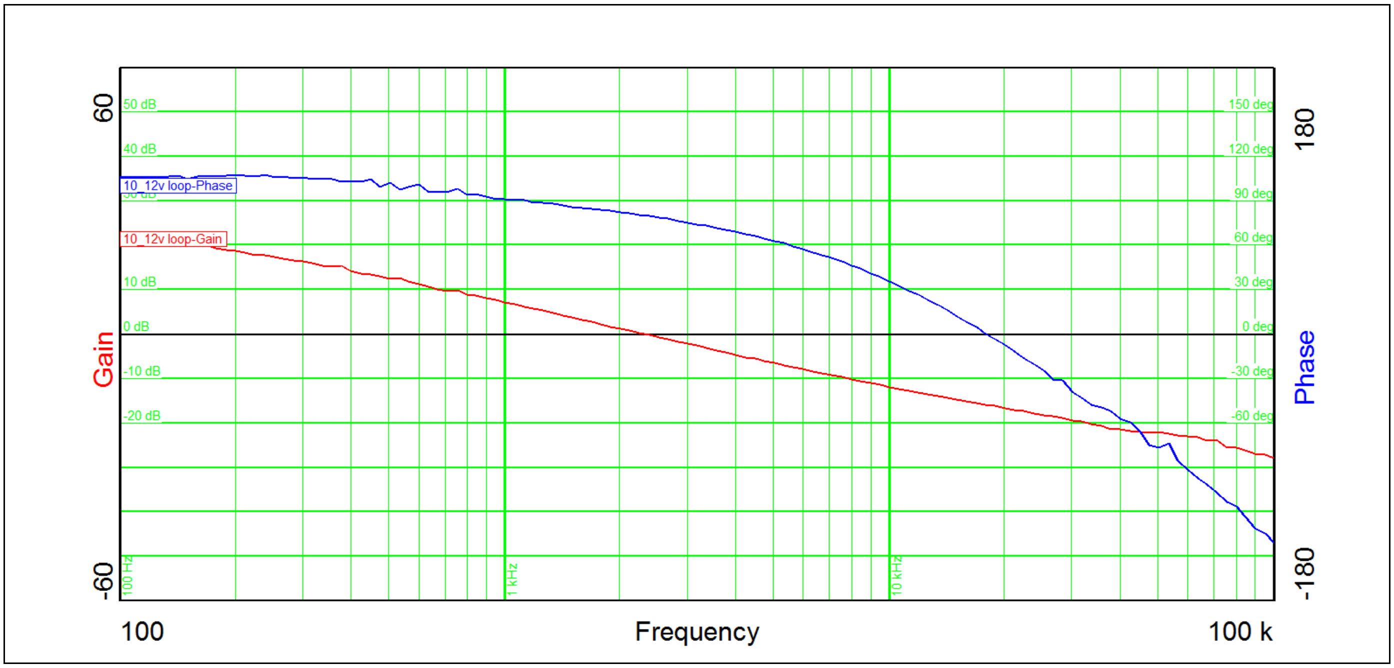


Figure 12

Table 1 summarizes the results

	12V
Bandwidth (kHz)	2.33
Phasemargin	79.8°
slope (20dB/decade)	-0.99
gain margin (dB)	-15.9
slope (20dB/decade)	-0.72
freq (kHz)	18

Table 1

9 Load Transients

9.1 *Transient applied at negative VOUT (-VOUT)*

The Figure 13 shows the response to load transients. The load is switching from 0.35A to 0.7A (50 Hz). Negative VOUT was measured

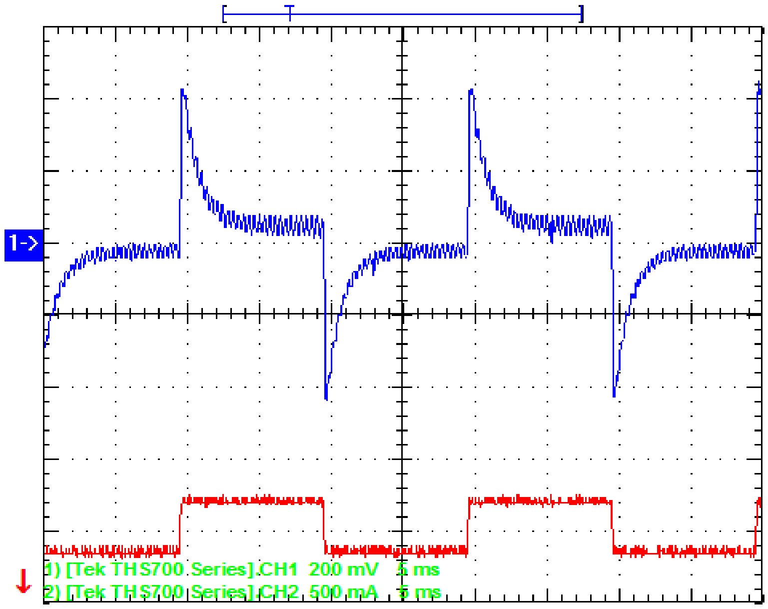
	Ch1 => output voltage (-VOUT) 200mV/div 20MHz bandwidth setting Ch2 => output current 500mA/div 5ms/div du <4%

Figure 13

The Figure 14 shows the response to load transients. The load is switching from 0.35A to 0.7A (50 Hz). Positive VOUT was measured

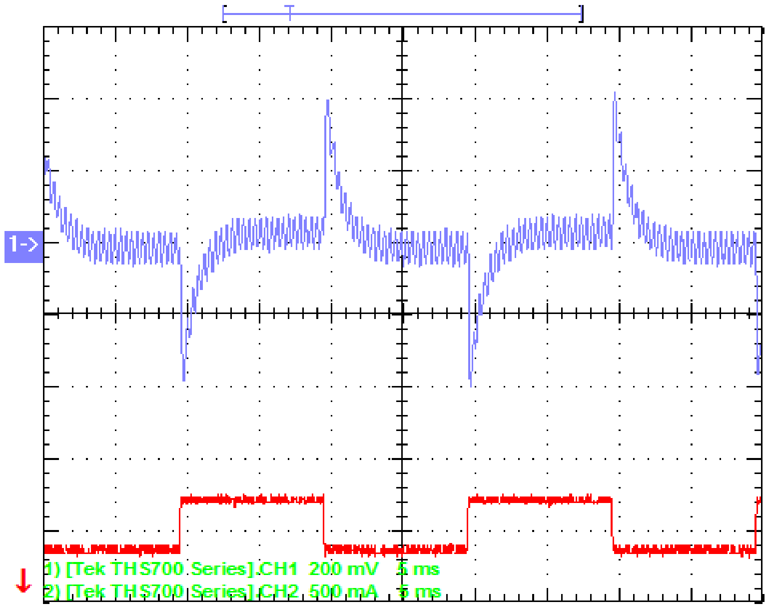
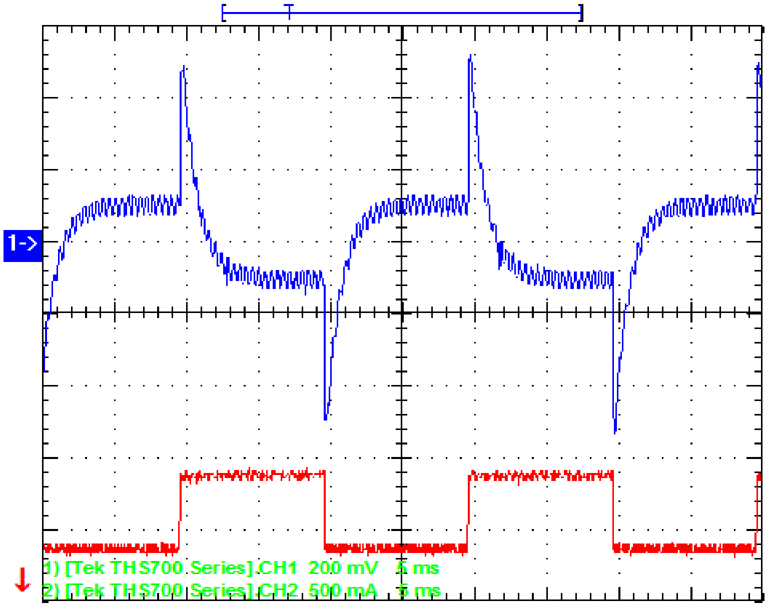
	Ch1 => output voltage 200mV/div 20MHz bandwidth setting Ch2 => output current 500mA/div 5ms/div du <4%

Figure 14

9.2 Transient applied at positive VOUT (+VOUT)

The Figure 13 shows the response to load transients. The load is switching from **0.34A to 0.86A** (load precision !) (50 Hz). Negative VOUT was measured



Ch1 => output voltage (-VOUT) 200mV/div

20MHz bandwidth setting

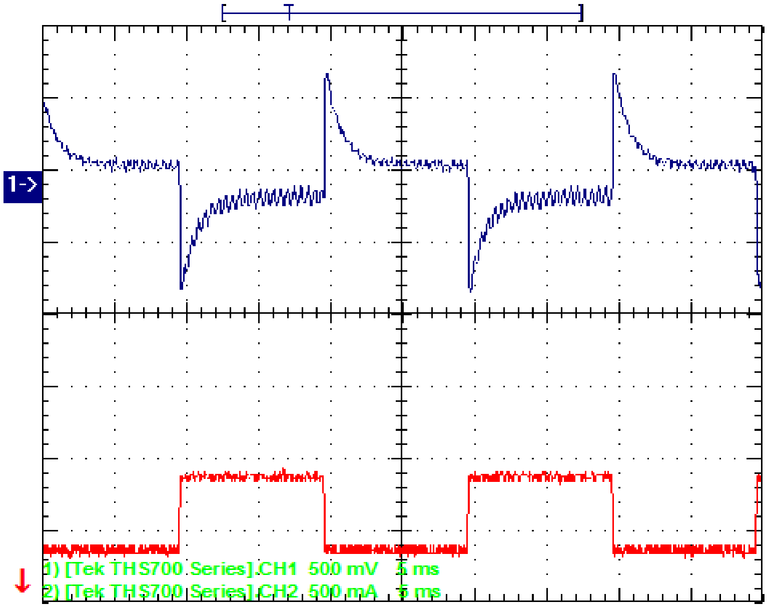
Ch2 => output current 500mA/div

5ms/div

du <4%

Figure 15

The Figure 14 shows the response to load transients. The load is switching from **0.34A to 0.86A** (50 Hz). Positive VOUT was measured



Ch1 => output voltage (+VOUT) **500mV/div**

20MHz bandwidth setting

Ch2 => output current 500mA/div

5ms/div

du =7% (!)

Figure 16

For better transient response just increase output capacitance.

10 Miscellaneous Waveforms

Switch node ("SW" to -VOUT)) waveform shown in Figure 17

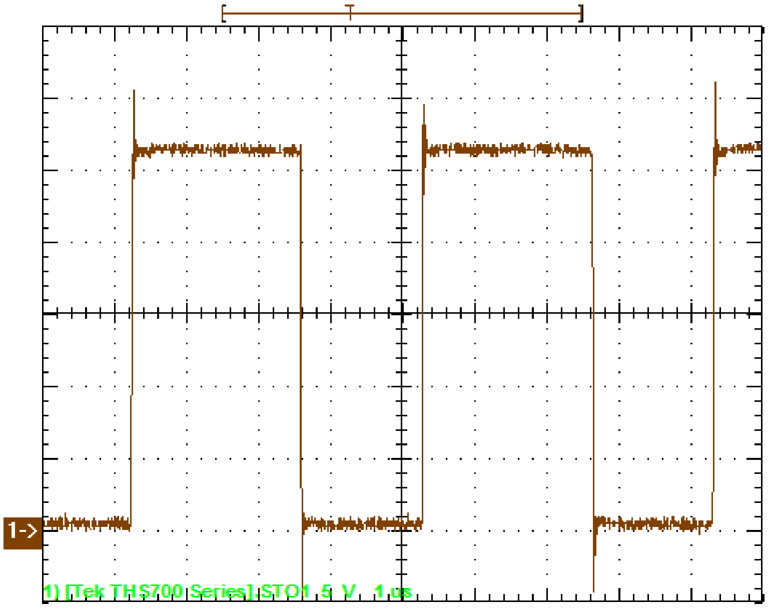
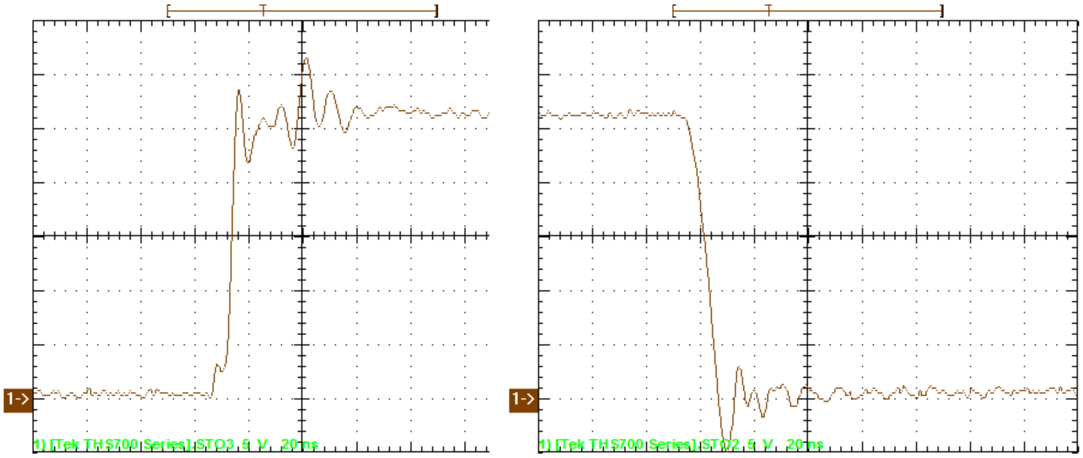
	Ch1 => 5V/div 1µs/div
	Ch1 => 5V/div 20ns/div

Figure 17

Switchnode ("SW" to GND measured at the inductor pads) results in the waveform shown in Figure 18.

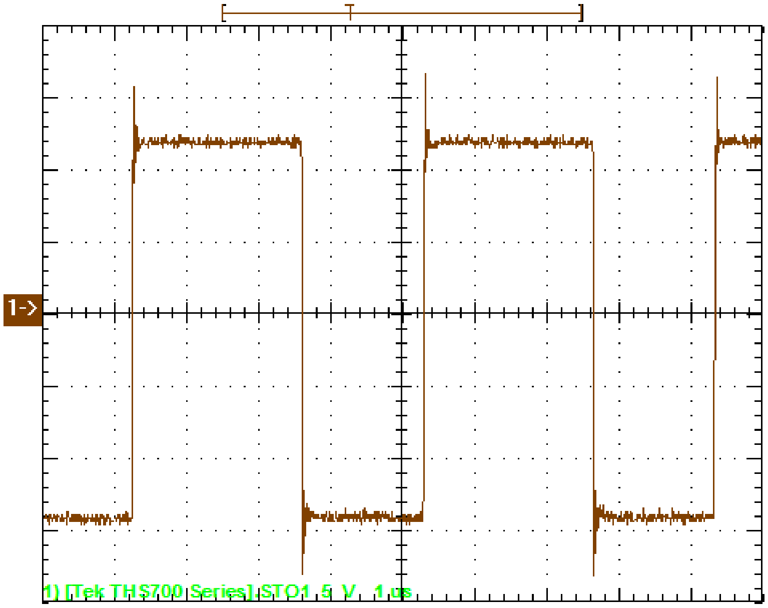
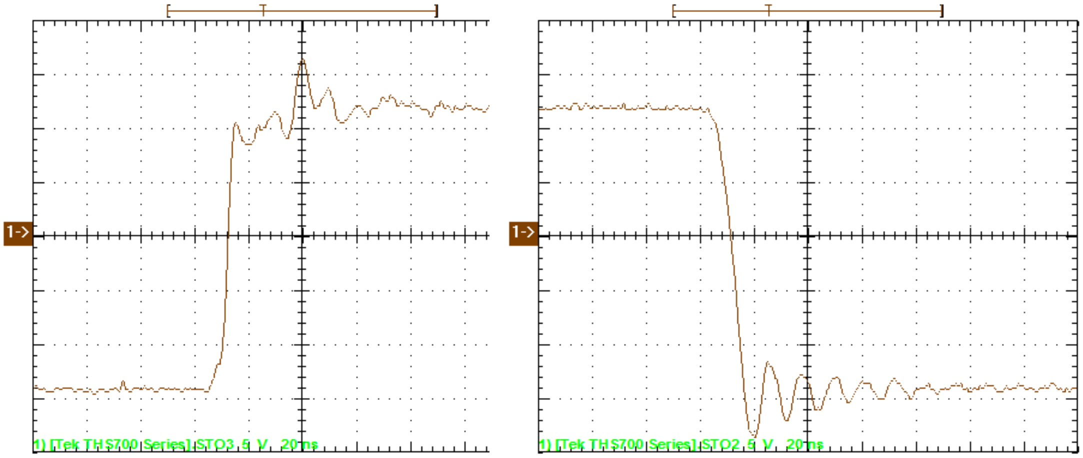
	Ch1 => 5V/div 1µs/div
	Ch1 => 5V/div 20ns/div

Figure 18

"Secondary" swithchnode (measured at the inductor pads): the waveform is shown in **Figure 19**.

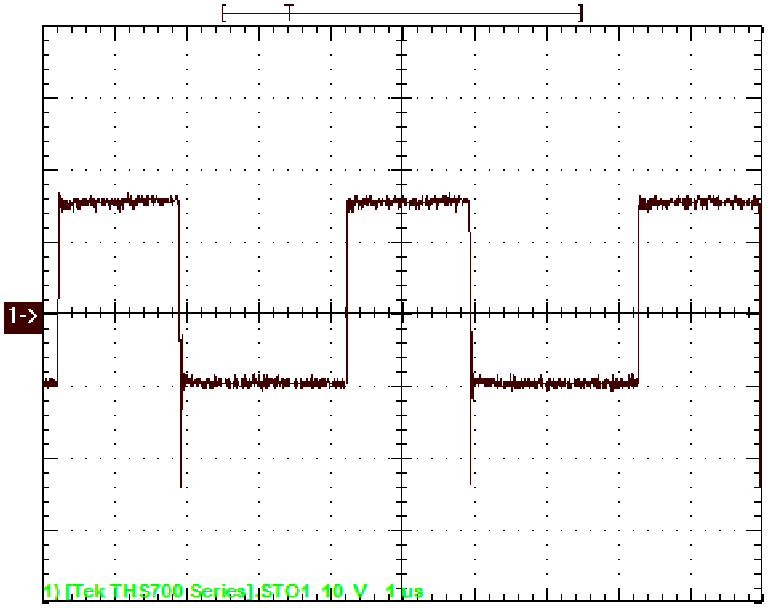
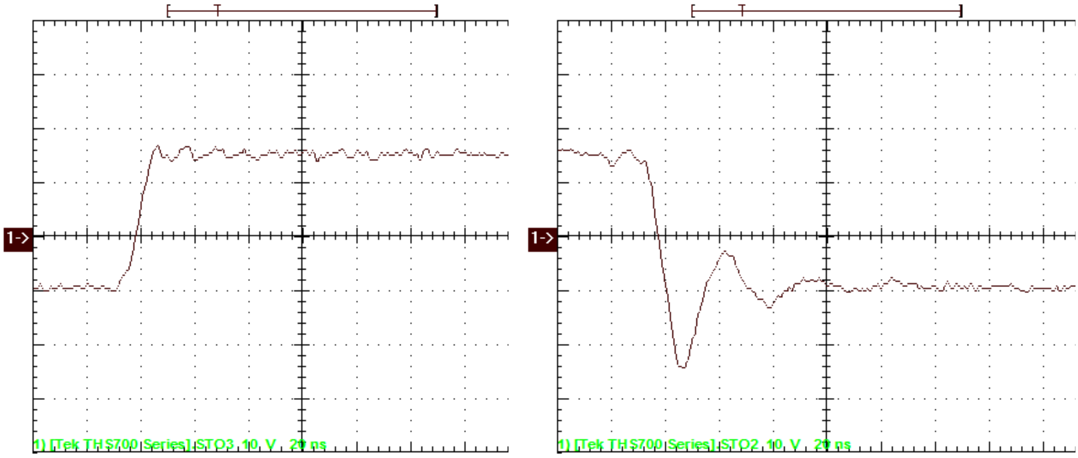
	Ch1 => 10V/div 1µs/div full bandwidth
	Ch1=>10V/div 20ns/div

Figure 19

Secondary switchnode (SW2 to +VOUT) the waveform is shown in Figure 20.

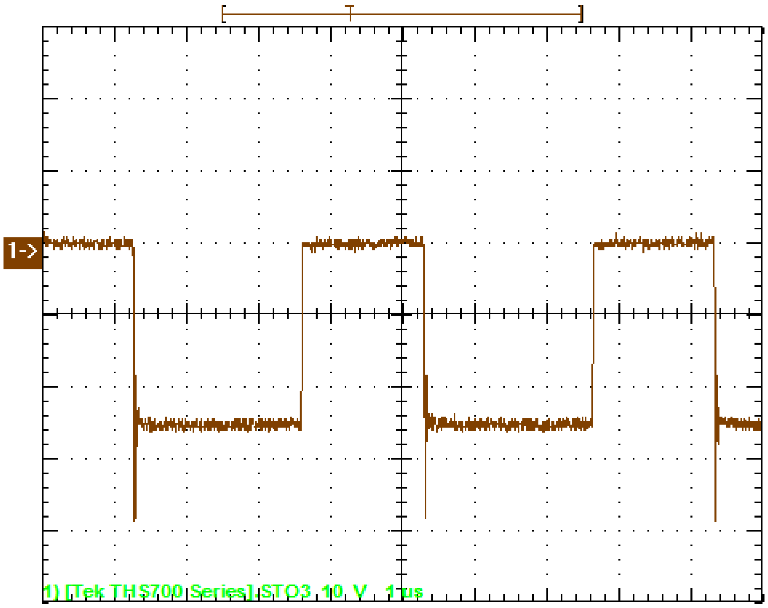
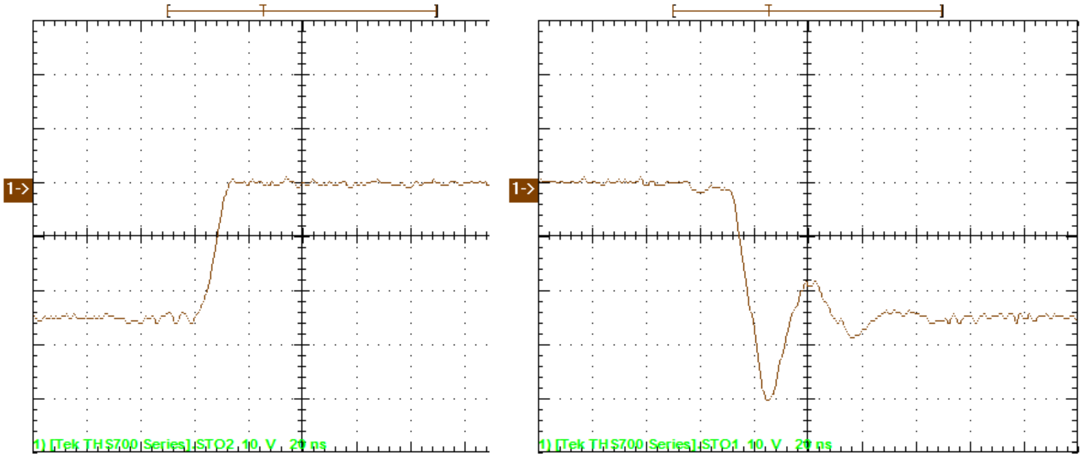
	Ch1 => 10V/div 1µs/div
	Ch1 => 10V/div 20ns/div

Figure 20

11 Thermal Image

Thermal image is shown in Figure 21. Input voltage was set to 12V and output current **0.5A** on each channel, thermal pic taken after 1hr operation, dT = 40K at U1:

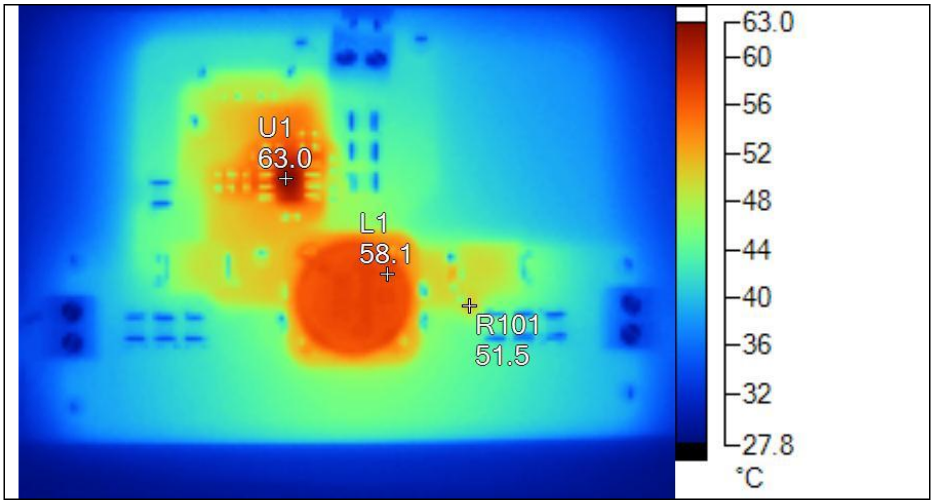


Figure 21

Name	Temperature
U1	63.0°C
L1	58.1°C
R101	51.5°C

Table 2

Continuous full load operation 2x 700mA at ambient temperature +85c needs forced cooling >100lfm / 0.5m/s.

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