

**PMP10735
Test Report
09/15/2015**



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I. Overview

The PMP10735 reference design is a 5V, 3A output power supply in 2-layer board design for off-battery automotive instrument cluster applications. It has an input voltage range of 6.5V to 35V, and the peak efficiency is about 94% at 12V input. The reference design features the LM43603-Q1 SIMPLE SWITCHER® wide V_{in} synchronous buck regulator, which is automotive qualified and can provide an easy-to-use, high efficient and compact power solution. The 2-layer board is layout optimized for improved EMI performance, and has an input EMI filter section to further suppress the conducted EMI noise. The board was tested under CISPR 25, the automotive EMC standard, and its conducted emissions were in compliance with the Class 5 limit requirements.

II. Power Specification

Input Voltage:	6.5V – 35V
Output:	5V @ 3A
Total output power:	15W
Switching frequency:	400 kHz

III. Reference Board

The board size is 89 x 76 mm (3.5 x 3 inch). The LM43603-Q1 buck regulator component area is 21 x 18 mm (0.82 x 0.72 inch).

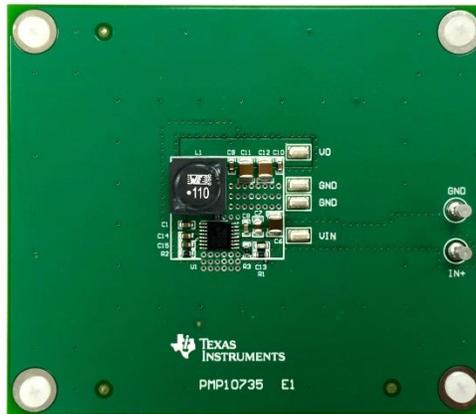


Figure 1 Reference board top view

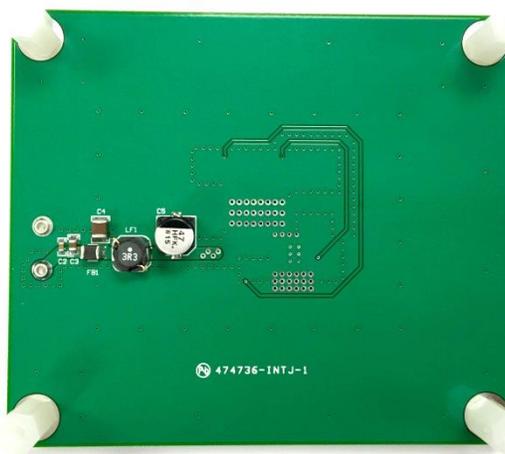


Figure 2 Reference board bottom view

IV. Efficiency

The efficiency was measured with and without the input filter at different input voltage condition. It can be seen from the result that the input filter has little impact to the efficiency.

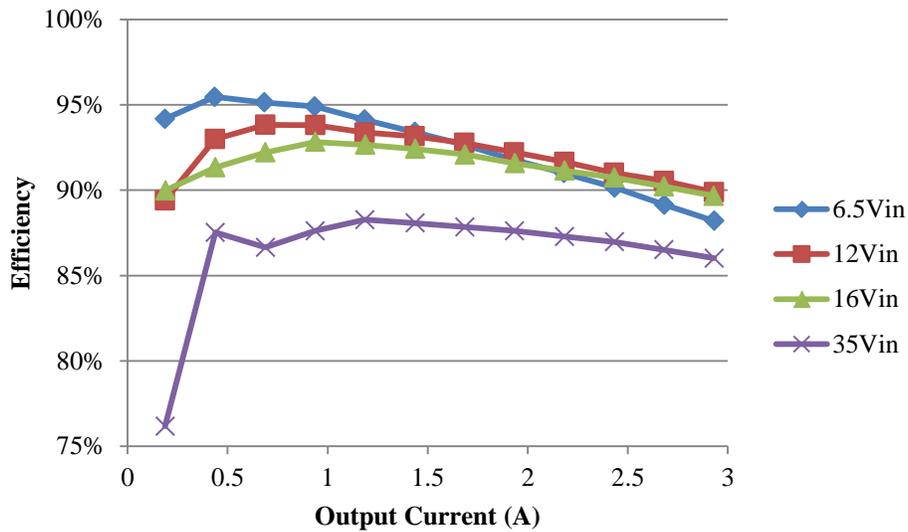


Figure 3 Power efficiency with the input filter

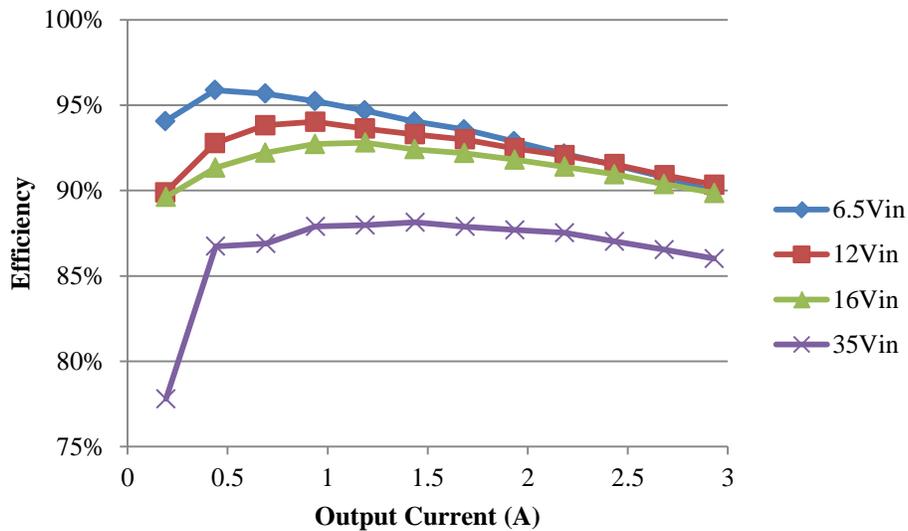


Figure 4 Power efficiency without the input filter

V. Input Current at No Load

The input current was measured at no load condition. The LM43603-Q1 operated in PFM, and drew very low input current at no load condition.

Vin (V)	Iin (μ A)	Vout (V)
6.501	75	5.157
12.001	49	5.164
16.001	41	5.164
35.018	32	5.166

VI. Thermal

The thermal image was taken at 23°C room temperature, no air flow. The board was operating at 12V input, 3A full load output.

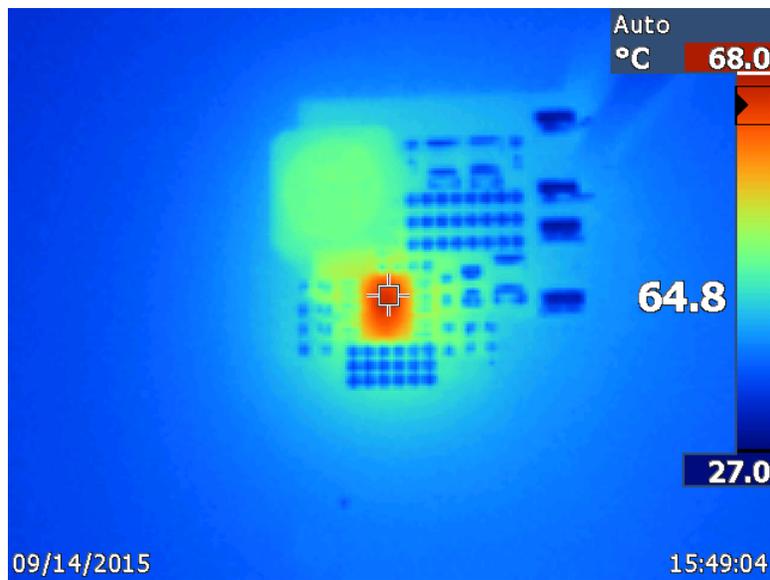


Figure 5 Thermal image from top view

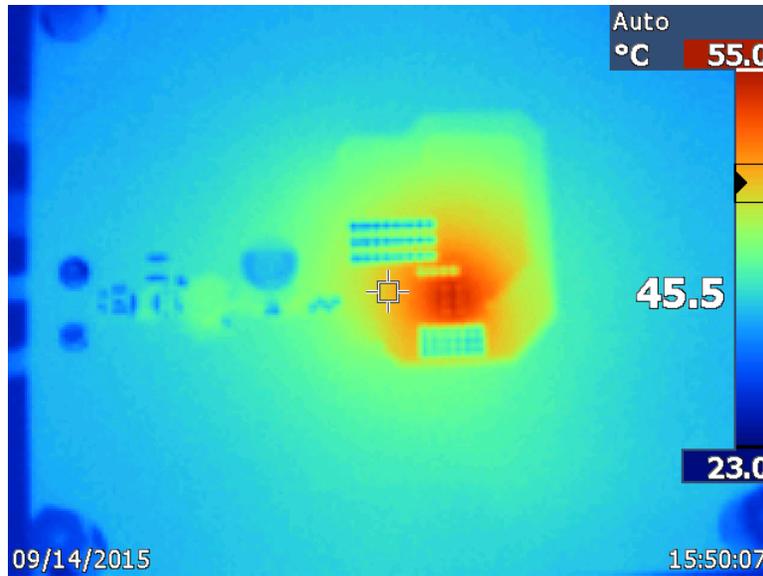


Figure 6 Thermal image from bottom view

VII. Conducted EMI

The conducted emissions were tested under the CISPR 25 standards. The test setup is shown in Figure 7. The input voltage at the board was set at 13V. The resistor load (3x 5Ω in parallel) was soldered on the output terminals of the test board as the 3A load. The frequency band examined spans from 150 kHz to 108 MHz covering the AM, FM radio bands, VHF band, and TV band specified in the CISPR 25. The scan results (Figure 8, Figure 9,) show the EMI noise using peak detector (yellow) and average detector (blue) in the spectrum analyzer. The limit lines in red are the Class 5 limits for conducted disturbances at different frequency bands specified in the standard, and the peak limits are the higher ones than the average limits. It can be seen that, with the input filter, the peak/average noise is lower than the corresponding peak/average limits in the scan results. Therefore, the reference board is in compliance with the CISPR 25 Class 5 conducted emissions standard.

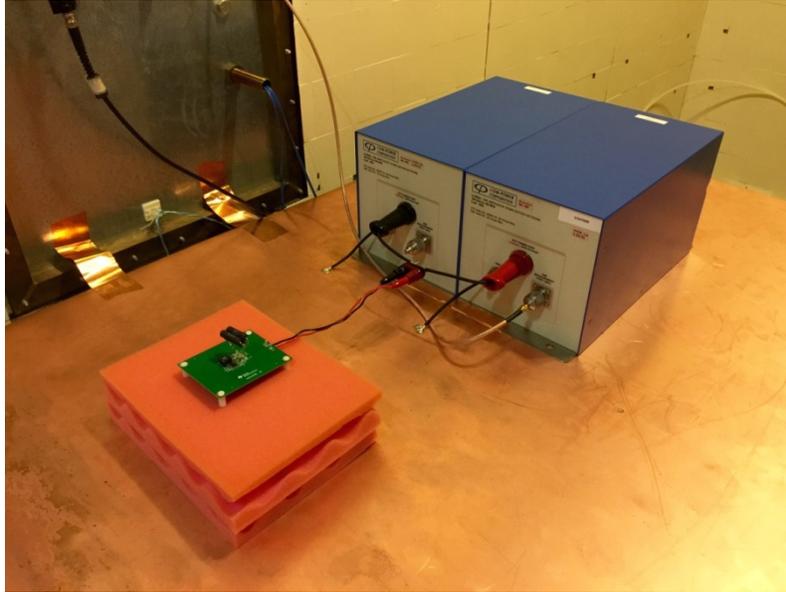


Figure 7 Conducted EMI Test Setup

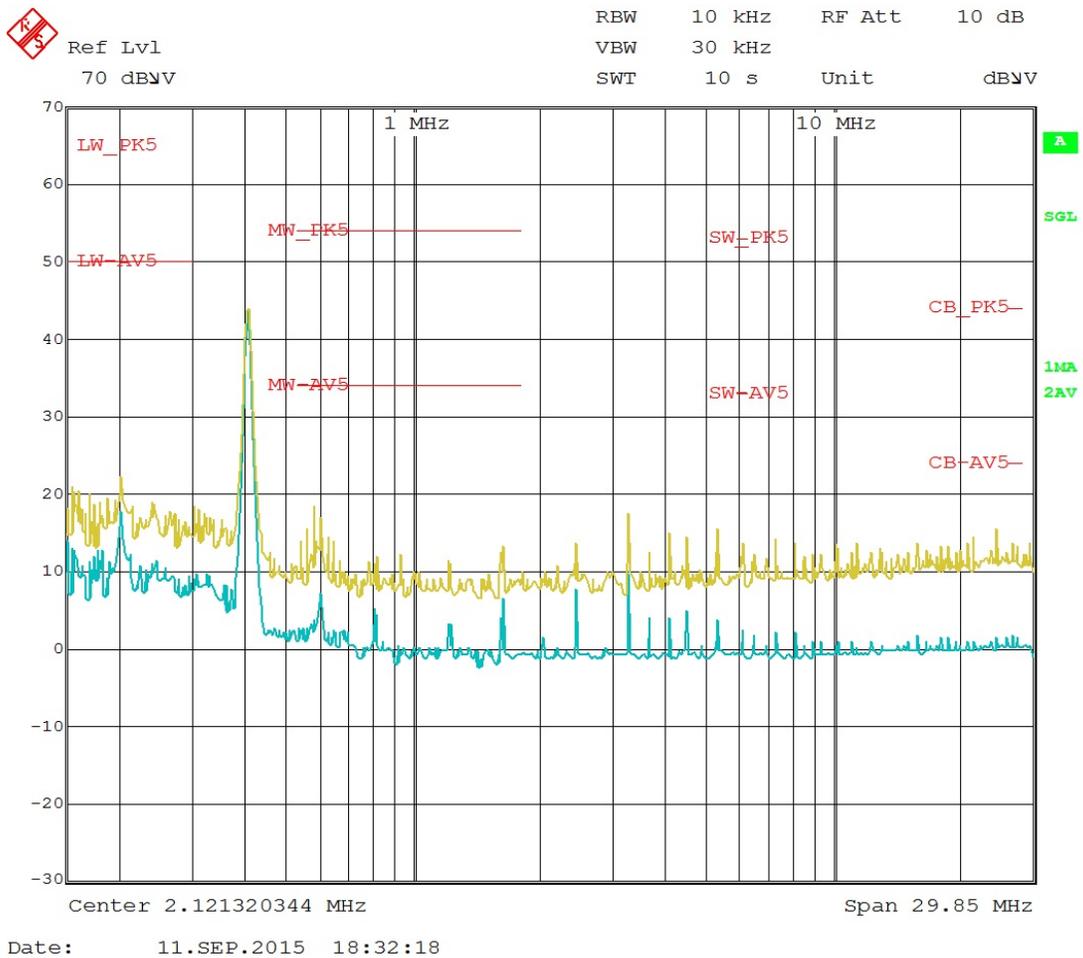


Figure 8 Conducted EMI scan, 150 kHz – 30 MHz, with the EMI filter

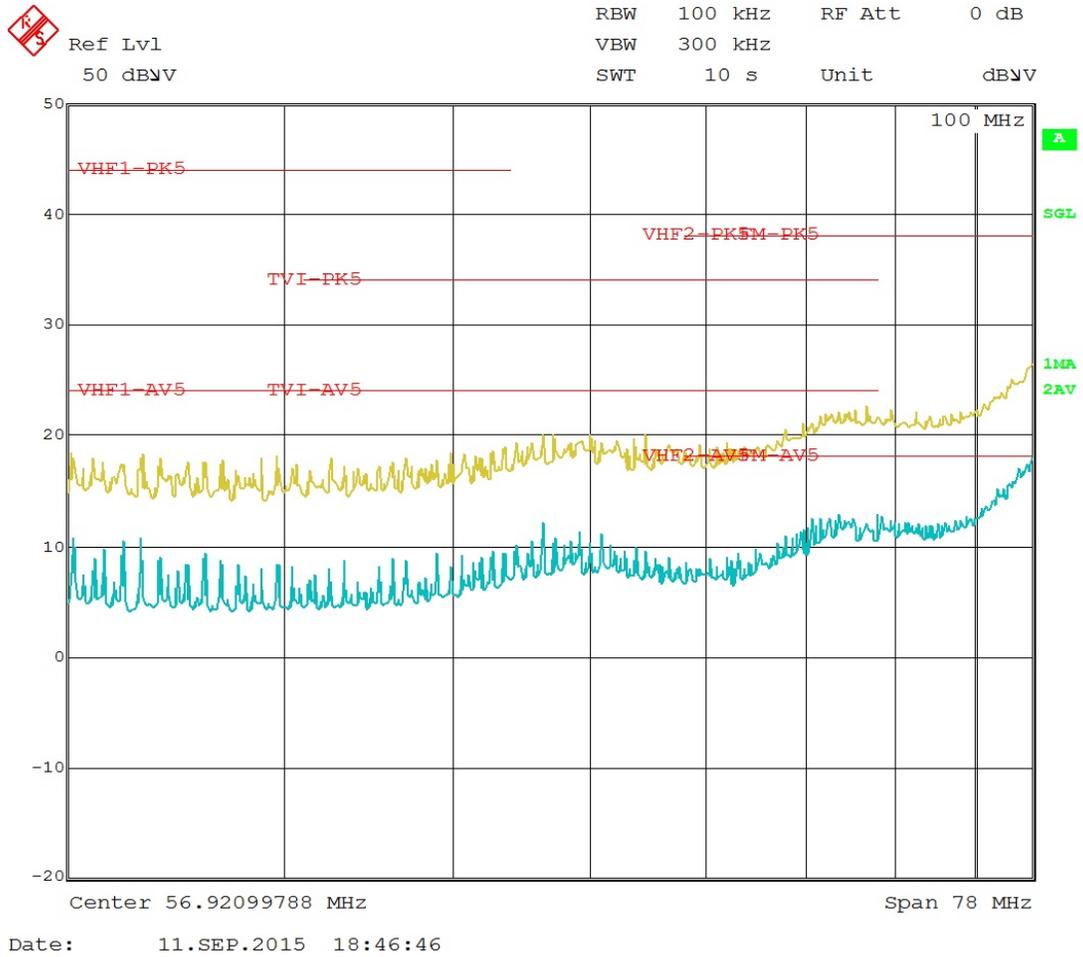


Figure 9 Conducted EMI scan, 30 MHz – 108 MHz, with the EMI filter

VIII. Power Up

The reference board was tested under no load and full load at 12V input. Ch1 (yellow) is the input voltage, and Ch2 (green) is the output voltage.



Figure 10 Power up into no load at 12V input

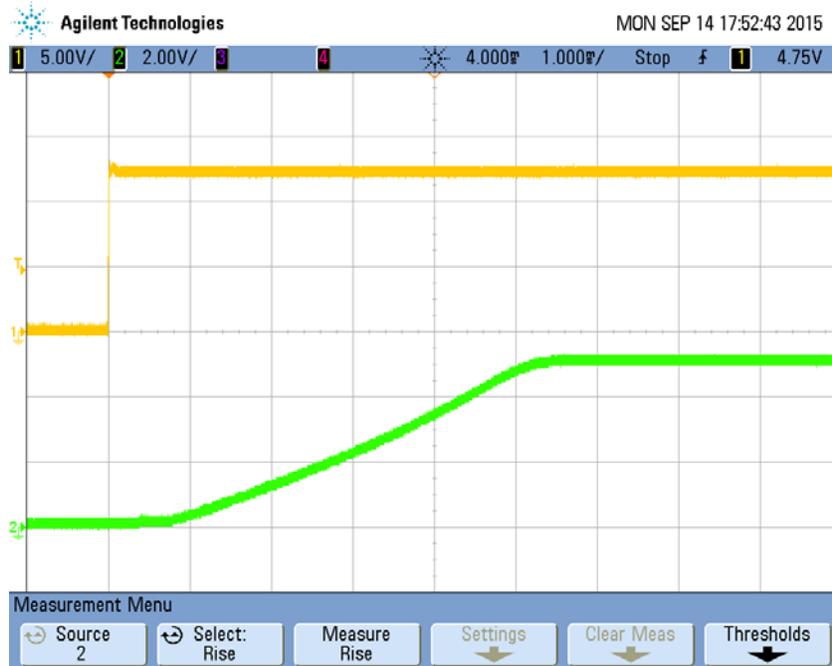


Figure 11 Power up into full load at 12V input

IX. Switching Waveforms

Ch1 (yellow) is the switch node voltage.

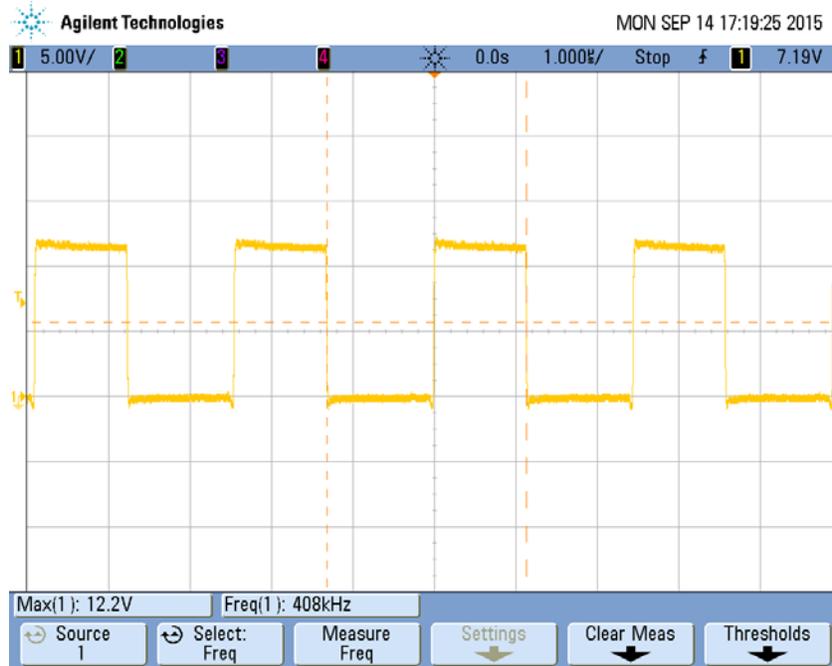


Figure 12 PWM switching waveform at full load, 12V input

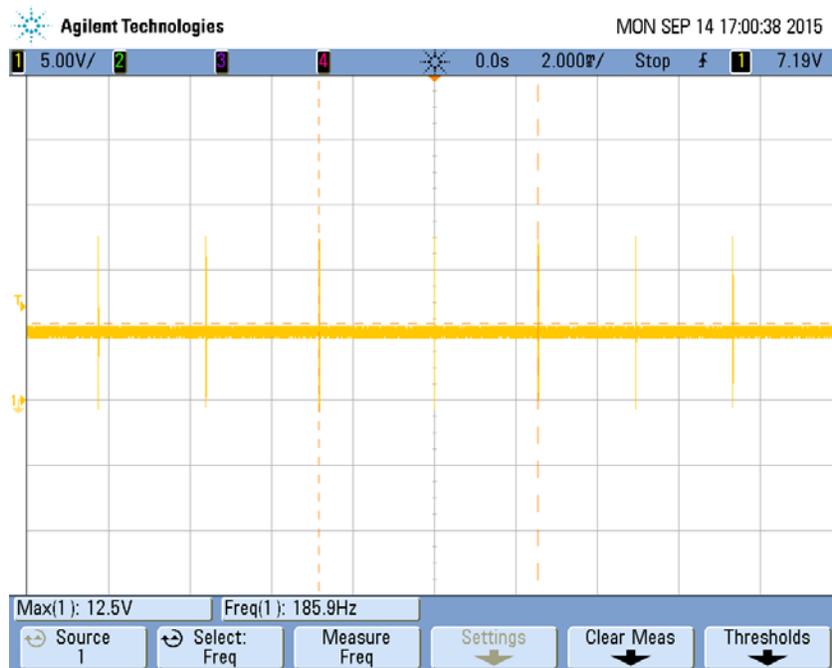


Figure 13 PFM switching waveform at no load, 12V input

X. Load Transients

The load transient responses were tested by applying output load steps from 50% to 100%. Ch3 (purple) is the output voltage in AC mode, and Ch4 (magenta) is the output current.

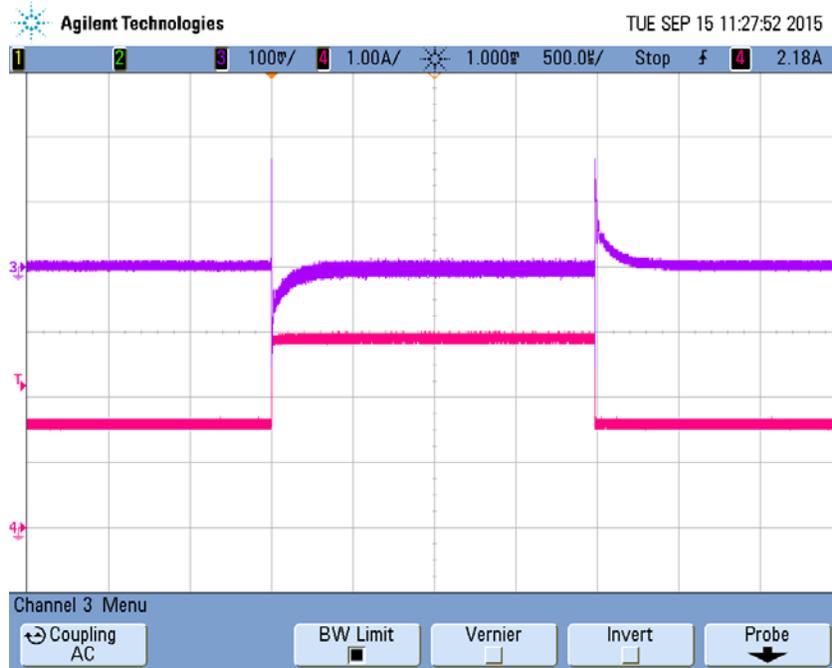


Figure 14 Output load transient response at 12V input

XI. Output Voltage Ripples

The output ripples were measured directly at the output capacitors at full load condition. Ch1 (yellow) is the switch node voltage, and Ch3 (purple) is the output voltage ripple in AC mode.

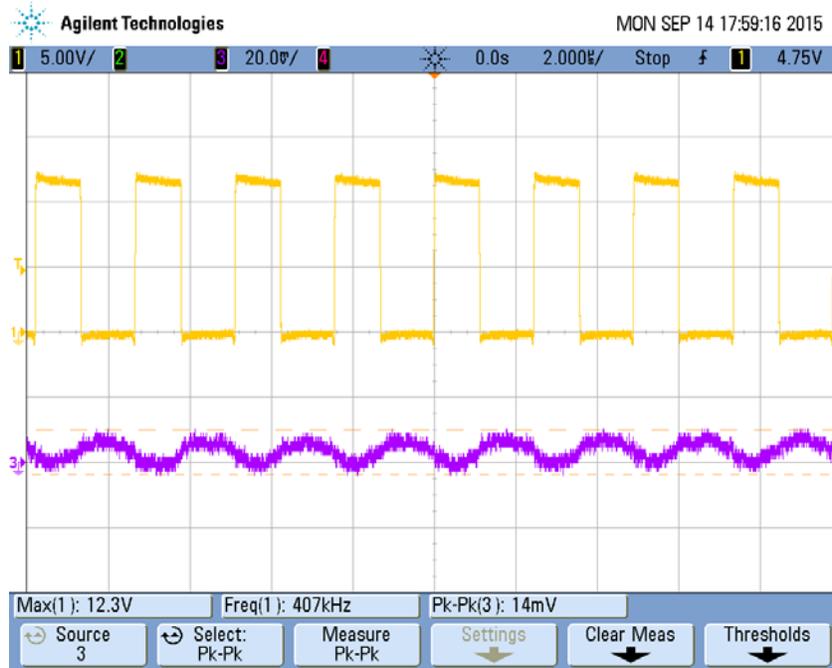


Figure 15 Output ripple at full load, 12Vin

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