TEXAS INSTRUMENTS INCORPORATED

PMP20657 Rev B

Power Design Services Test Report

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PMP20657 is a pseudo-isolated power converter designed to convert 48V input to a 12Voutput at 400W. The power supply is a phase-shifted full-bridge design with two primary half-bridges, totaling four FETs, a center-tapped secondary, and control-driven synchronous rectifiers.

PMP20657 Rev B Test Results

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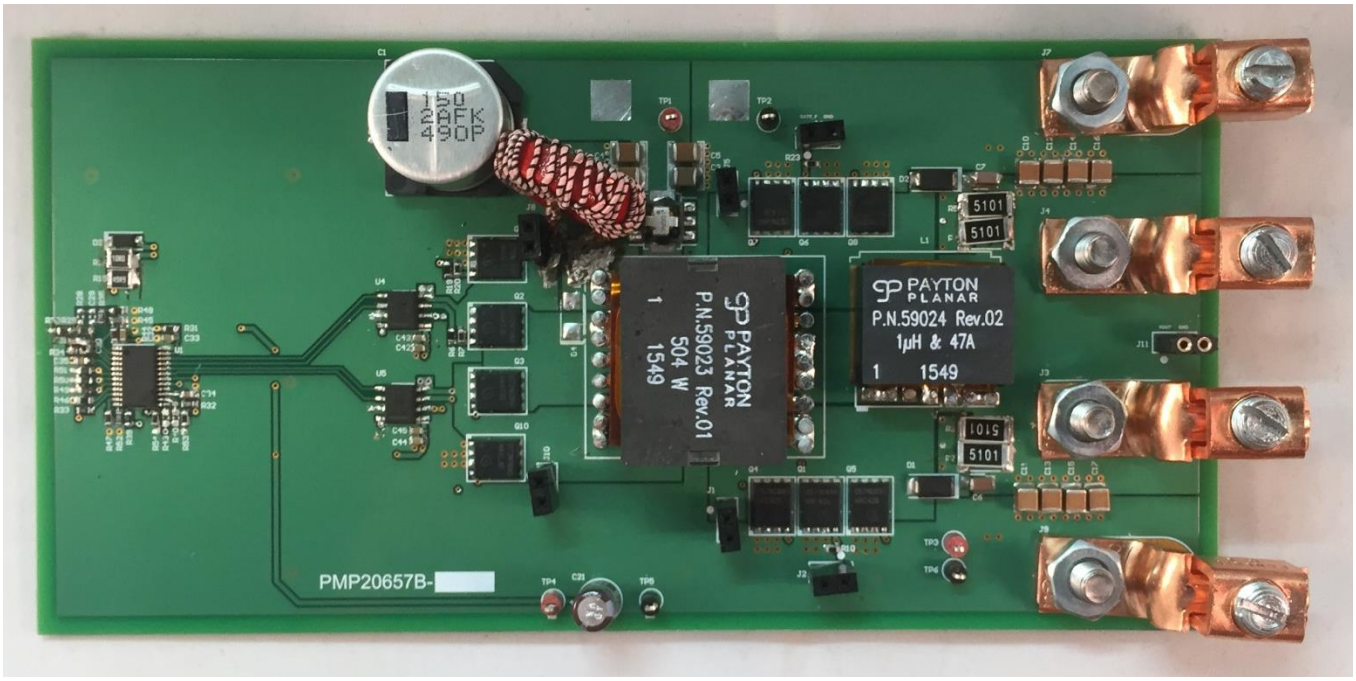
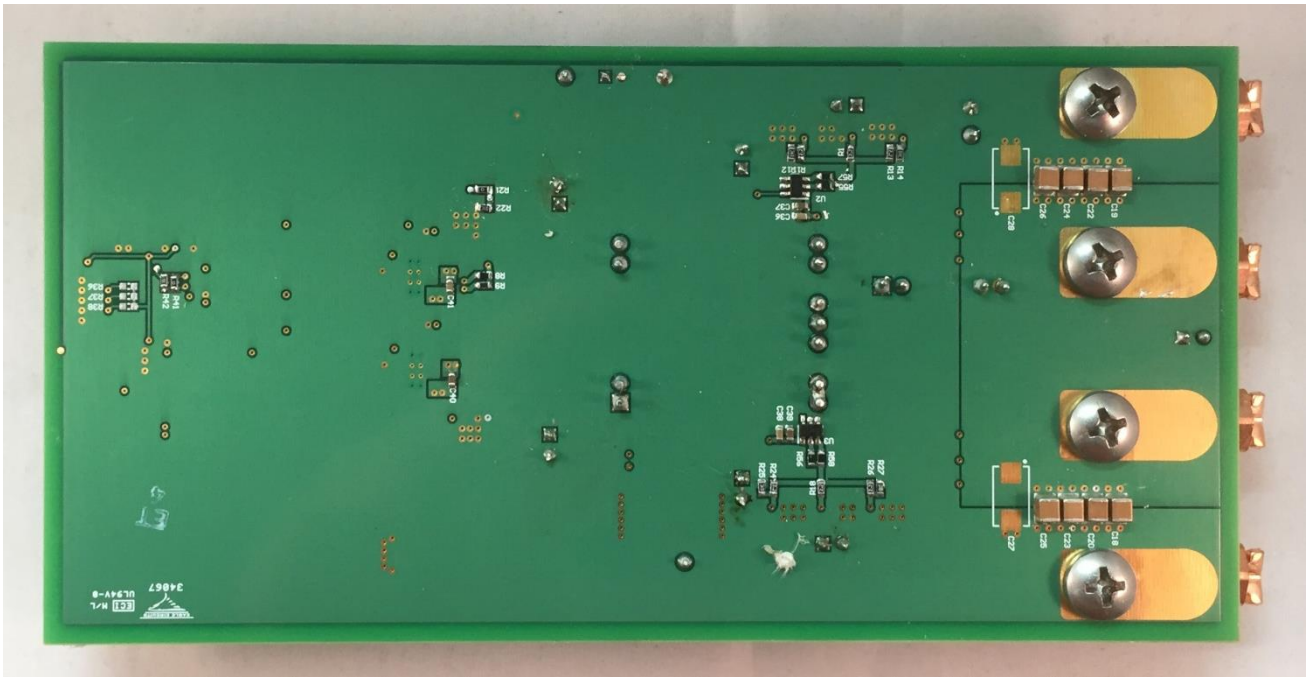
1. PMP20657 REVA 12V/400W – UCC28951-Q1

1.1 Board Photos

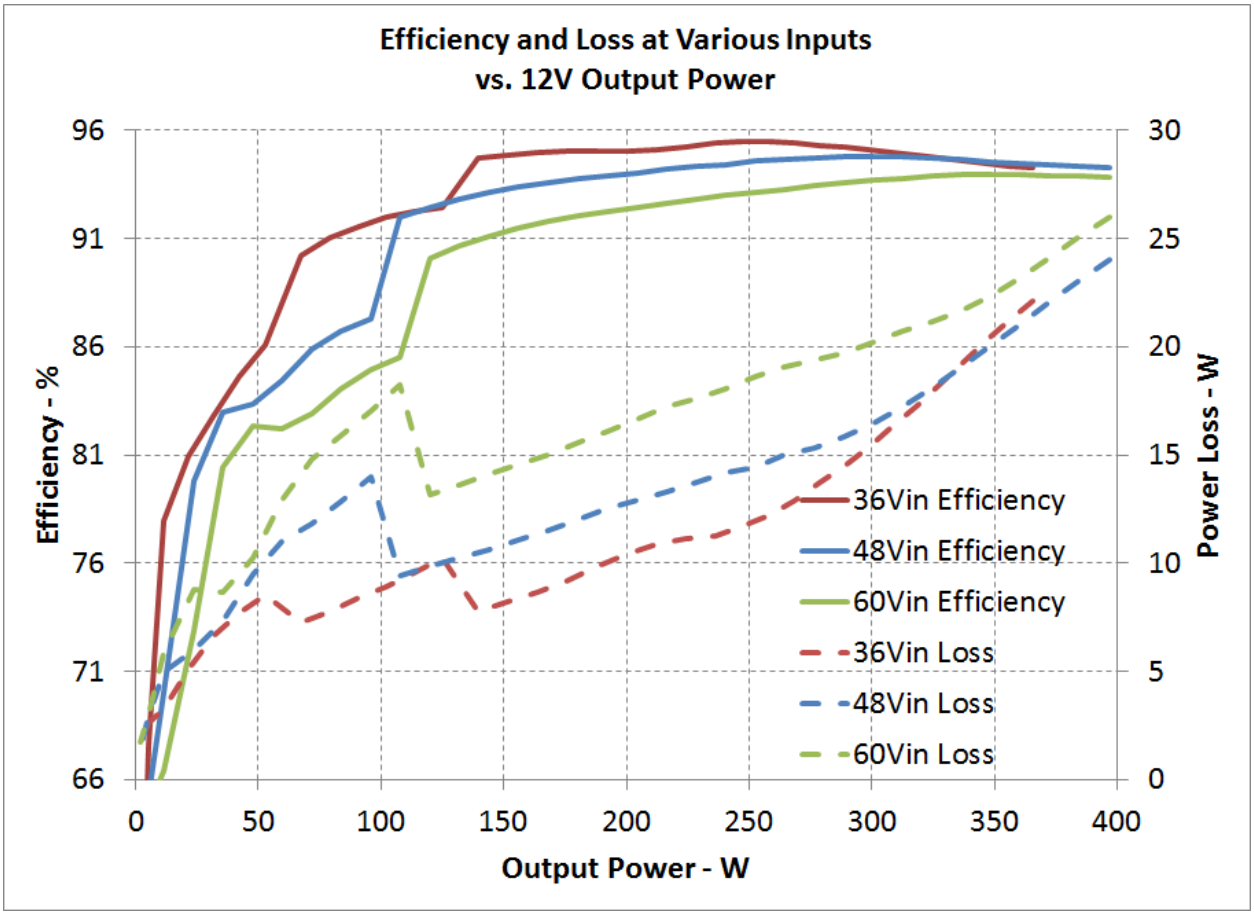
The top and bottom images of PMP20657 are shown below. The board dimensions are 3 in. x 6 in.





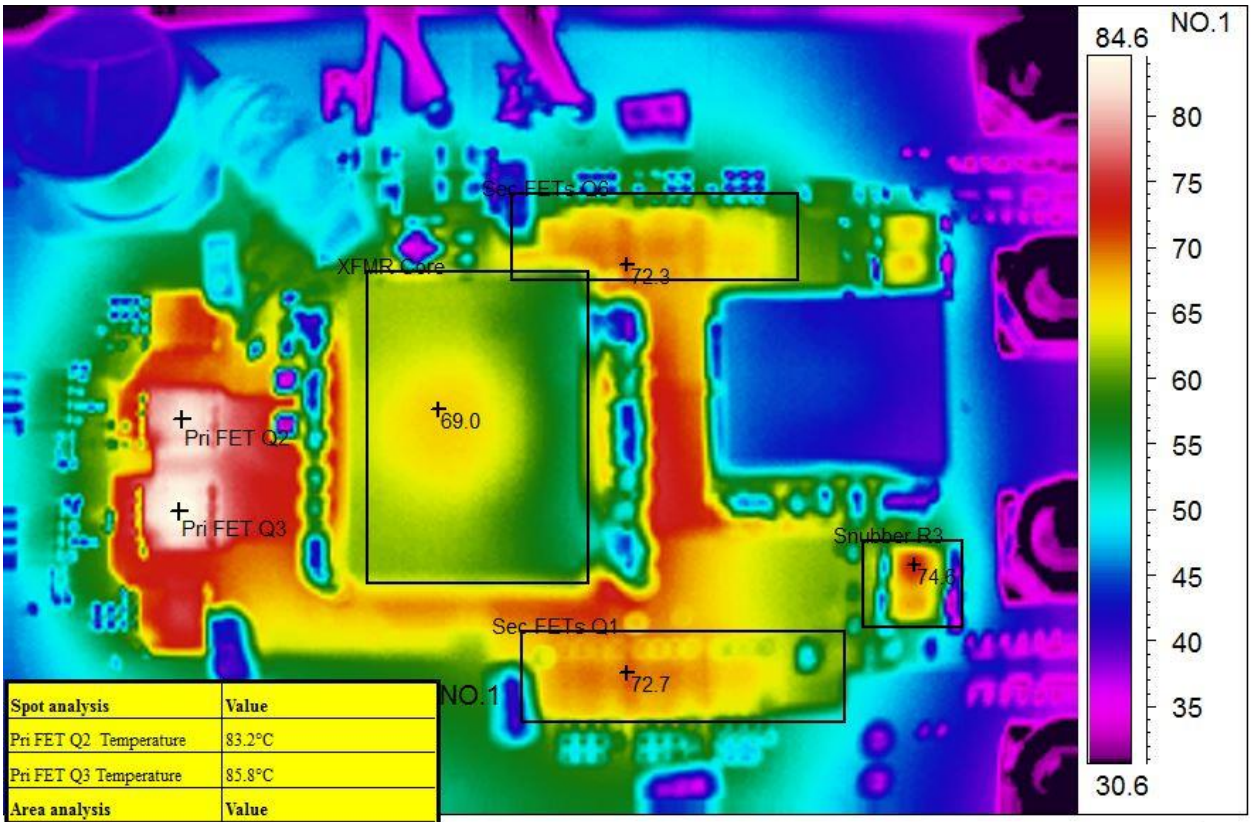
1.2 Efficiency and Power Loss

The efficiency and power loss of the power supply at various operating conditions are shown below. The bias applied is 10V, and the curves below *do not* take into account the ~1.2W of bias losses for IC operation and MOSFET drivers.



1.3 Thermal

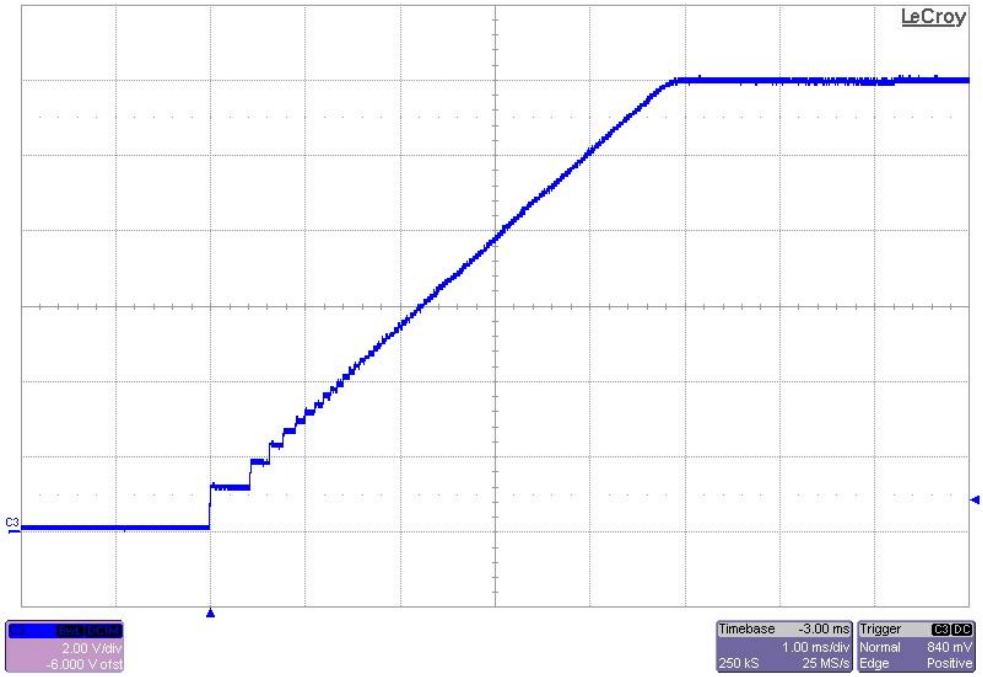
The thermal image of the power supply is shown at room temperature with 48Vin 400Wout with 400 LFM forced air flow moving from East to West in the photo. The power supply was held on for 10 min at 400W before the measurement was taken.



Spot analysis	Value
Pri FET Q2 Temperature	83.2°C
Pri FET Q3 Temperature	85.8°C
Area analysis	**Value**
Sec FETs Q1 Max	72.7°C
Sec FETs Q6 Max	72.3°C
Snubber R3Max	74.6°C
XFMR Core Max	69.0°C

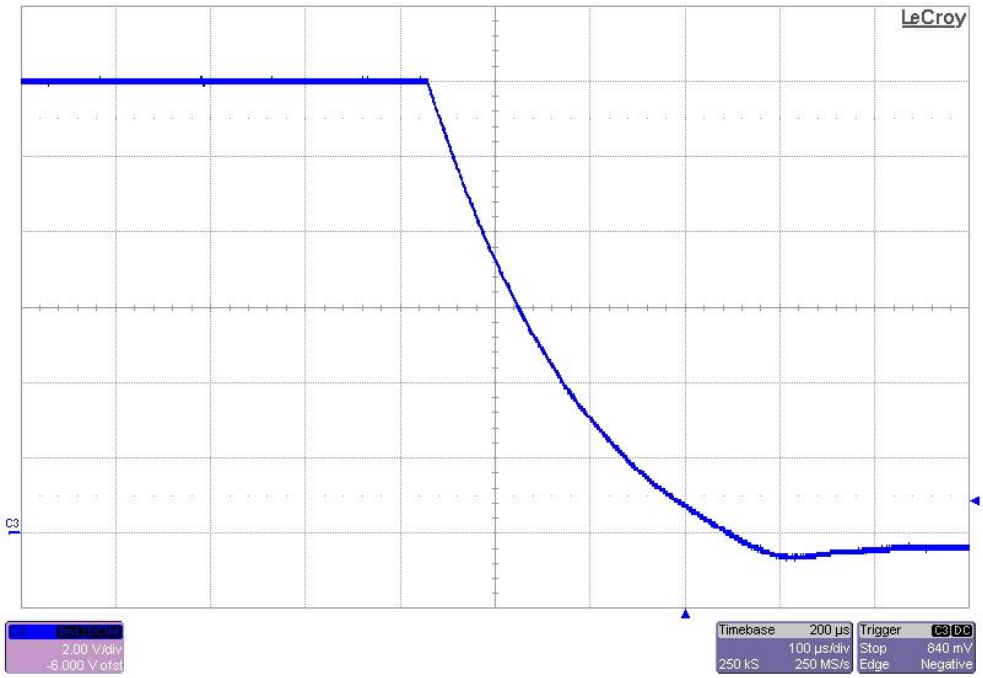
1.4 Startup

The power supply startup at 0A is shown below. Startup occurs by providing an 10V bias while the 48V input is present. The startup time is 5ms.



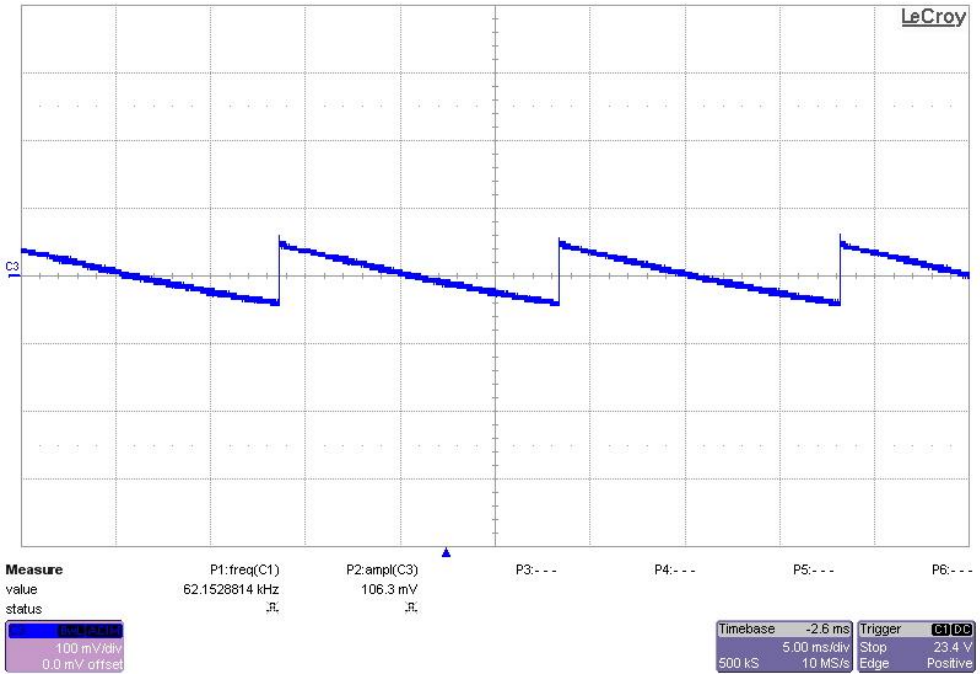
1.5 Shutdown

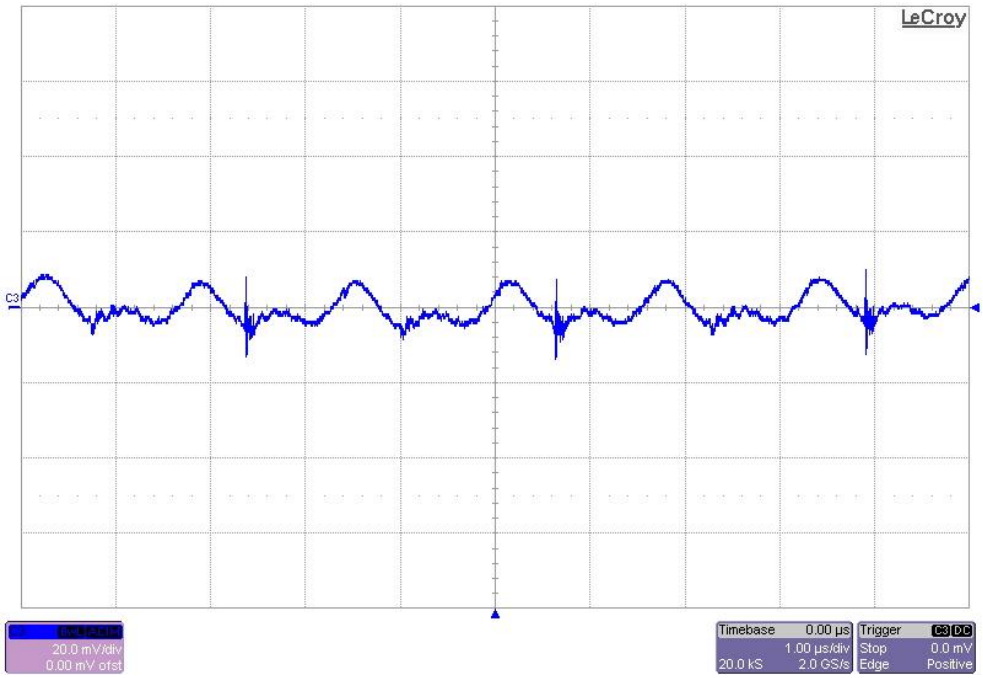
The shutdown of the power supply with ~1.2Ω constant resistance load is shown below. Shutdown occurs by removing the 10V bias with the 48V input present.

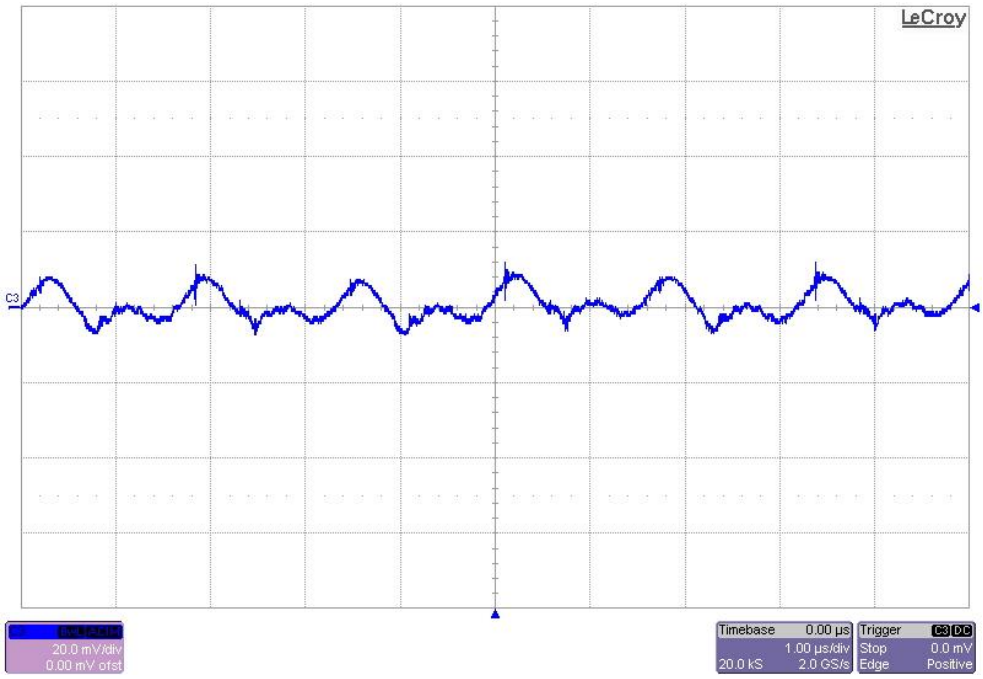


1.6 Output Ripple

The 12V output ripple is shown in blue below, AC coupled. The input is 48V and the load currents are 0A, 15A, and 33A, respectively. Peak to peak output ripple voltage is ~100mV with 0A load. The UCC28951-Q1 operates in burst mode at low load currents, which allows the total power supply to achieve <100mW of loss with no load current. In higher current operation, the peak-to-peak ripple voltage is ~20mVpp.

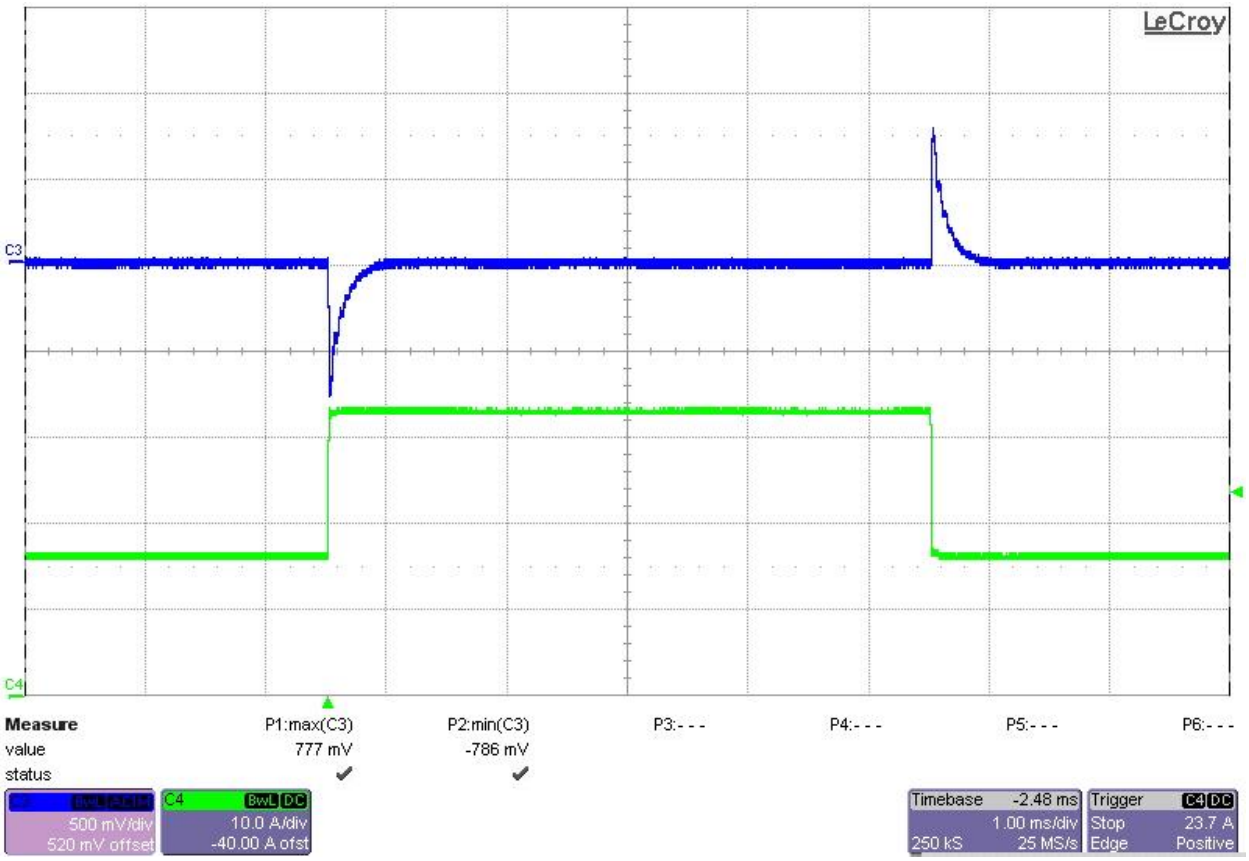





LeCroy
C3
20.0 mV/div
0.00 mV ofst
Timebase 0.00 µs
1.00 µs/div
20.0 kS 2.0 GS/s
Trigger C3 DC
Stop 0.0 mV
Edge Positive

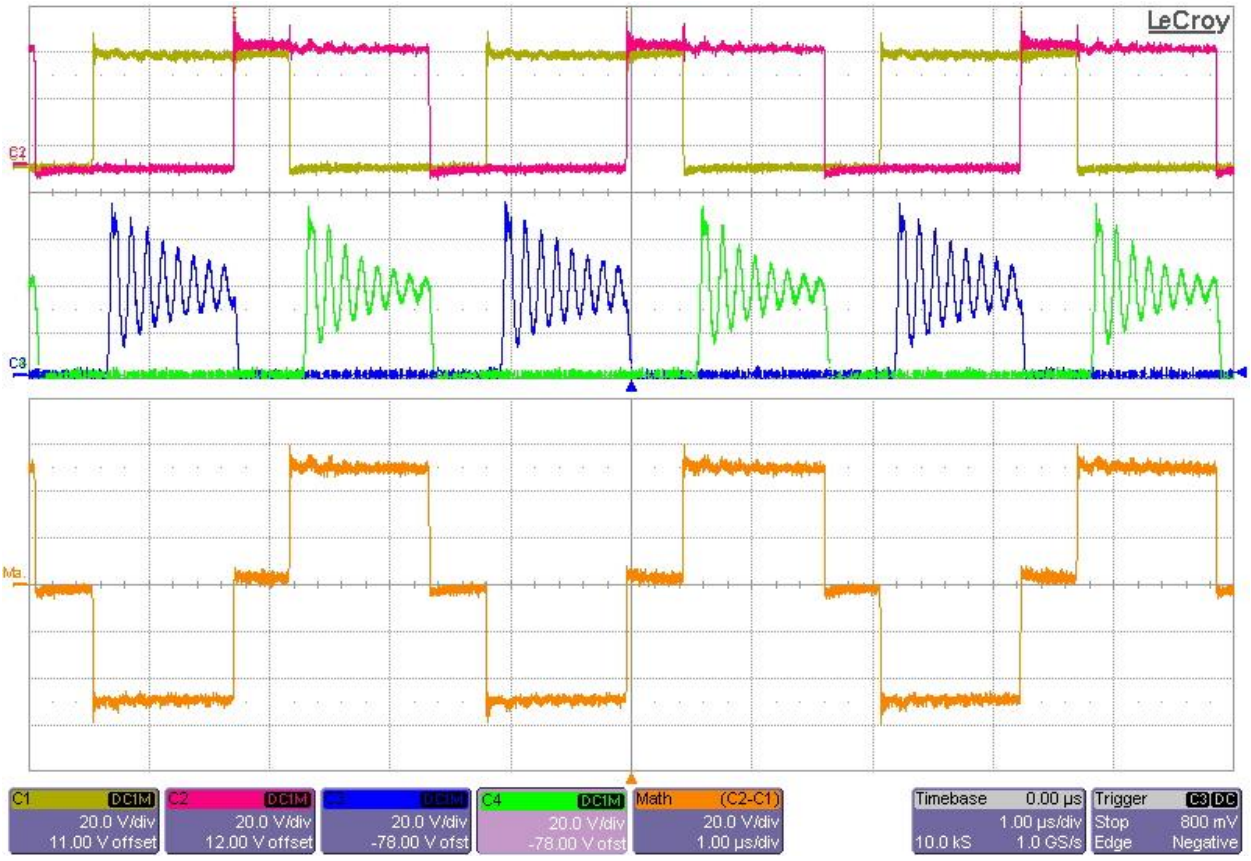
1.7 Transient Response

The transient response at 48Vin is shown in the plot below. The blue trace is the output voltage AC coupled. The green trace is the load current, which is stepped from 16.5A to 33A. The peak-to-peak deviations is +-780mV, or +-6.5%. The transient deviation can easily be reduced with loop redesign or additional capacitors.



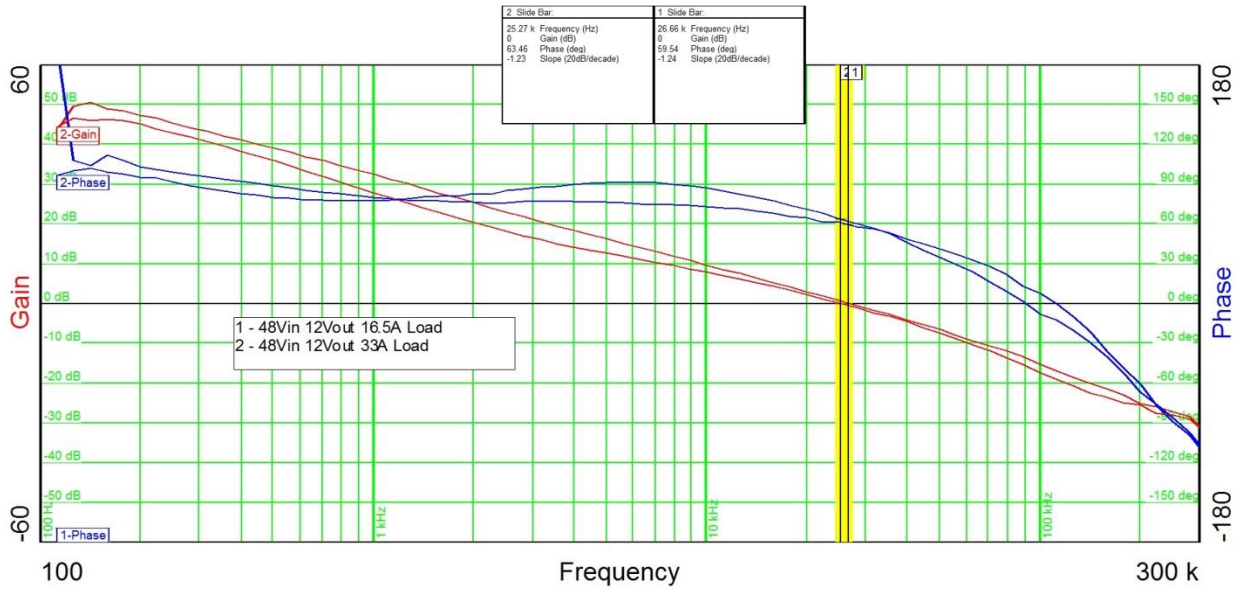
1.8 Switching Waveforms

The primary switching waveforms are shown in the plot below. The circuit conditions are 48Vin and 12V output at 33A. The AB Leg and CD Leg are shown in red and yellow. The difference between AB and CD is plotted as a math function in orange – this is the voltage across the transformer. The green and blue waveforms are the VDS of the synchronous rectifiers. Each leg switches at 300kHz, and the output inductor sees 600kHz.



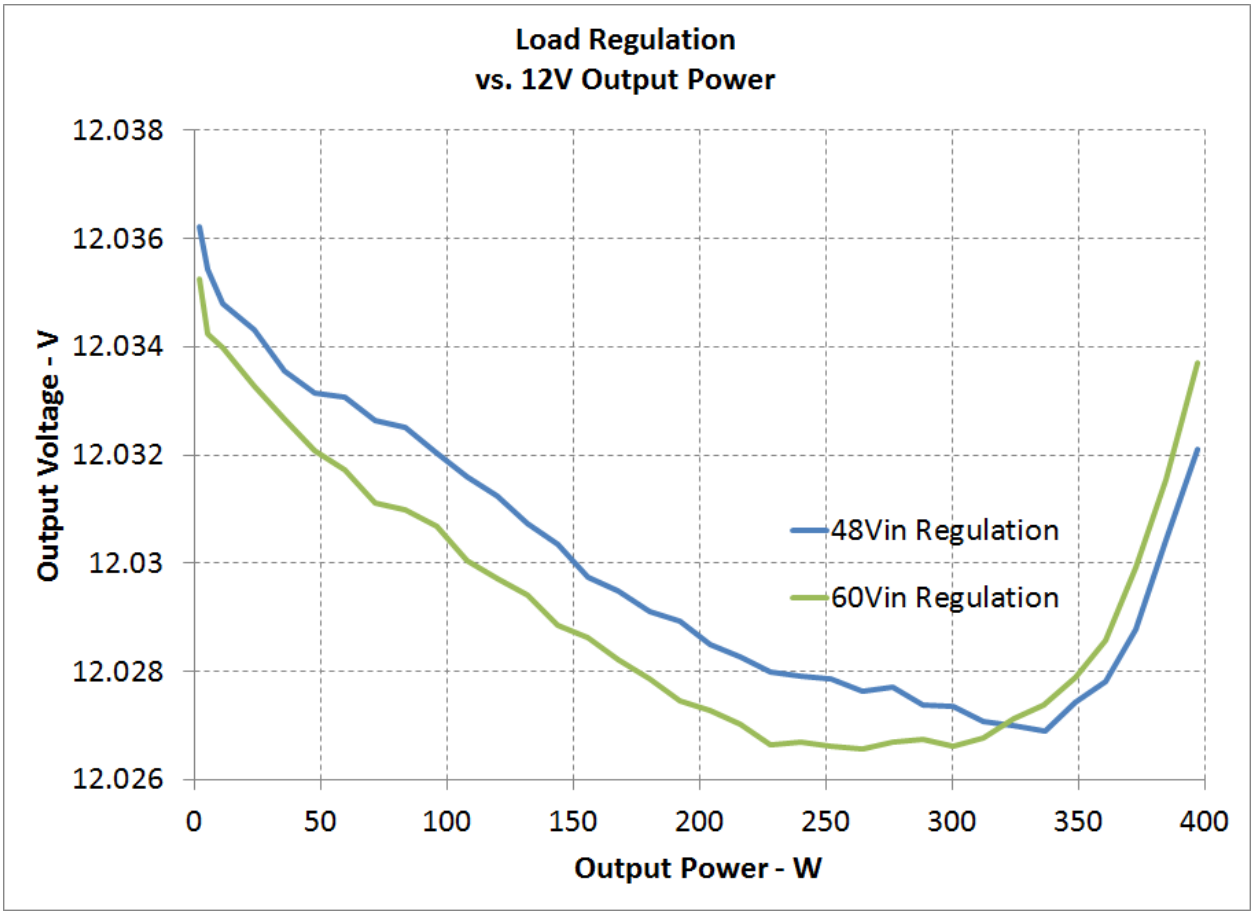
1.9 Loop Response

The loop response of the power supply at 48Vin and 12Vout at 50% load and 100% load are shown below. The bandwidth is ~25kHz with 60° of phase margin.



1.10 Load Regulation

The load regulation for the power supply operating at 48Vin is shown below.



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