Test Data
For PMP10750
09/28/2015

Contents

1. Design Specifications

Table 1: PMP10750 design specifications and recommended operating conditions

Vin Minimum	**4.8VDC**
Vin Maximum	**30 VDC(OVP at 20V)**
Vout1	**3.3 VDC_Slave**
Iout 1	**3A**
Vout2	**3.3VDC_Master**
Iout 2	**3A**
Approximate Switching Frequency	**2.1MHz Approx(all the DC/DC converters)**
EMI	**CISPR25 Class 5**
Protection	**Input Overvoltage, Reverse polarity , Short Circuit protections at Outputs, Load Dump protection**

2. Circuit Description and PCB details

PMP10750 is a System optimized (CISPR 25 Class 5) 20W design for upstream converter used in ADAS system with all the required automotive protection.

The design has various protections such as Load dump through TVS (ISO pulse testing), Reverse Voltage (Innovative Smart diode with very low Iq), Battery Disconnect Switch with OVP protection (PFET) and is EMI optimized to meet Conductive EMI limits of CISPR25 Class5.

Input voltage range is between 4.5V to 30V with OVP at 20V and hence will operate in wide input voltage conditions.

LM74610 is used for Battery reverse protection which utilizes a charge pump to drive an N-channel FET to provide a resistive path for the bypass current to flow. LM53603Q1 is used as front end DC/DC Buck converter which is 2.2MHz switching, Synchronous rectified Wide Vin Buck Converter which can take transient up to 42V.

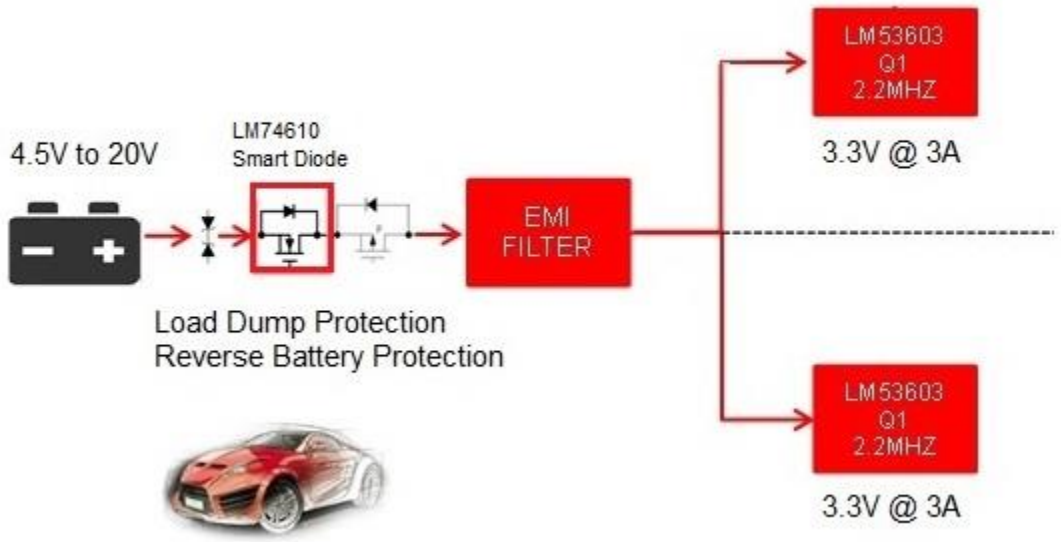

Figure 1: Application block diagram for PMP10750

The Board dimension of PMP10750 PCB is 3450mil * 4950mil. Two layer PCB was used for the design.

3. PMP10750 Board Photos

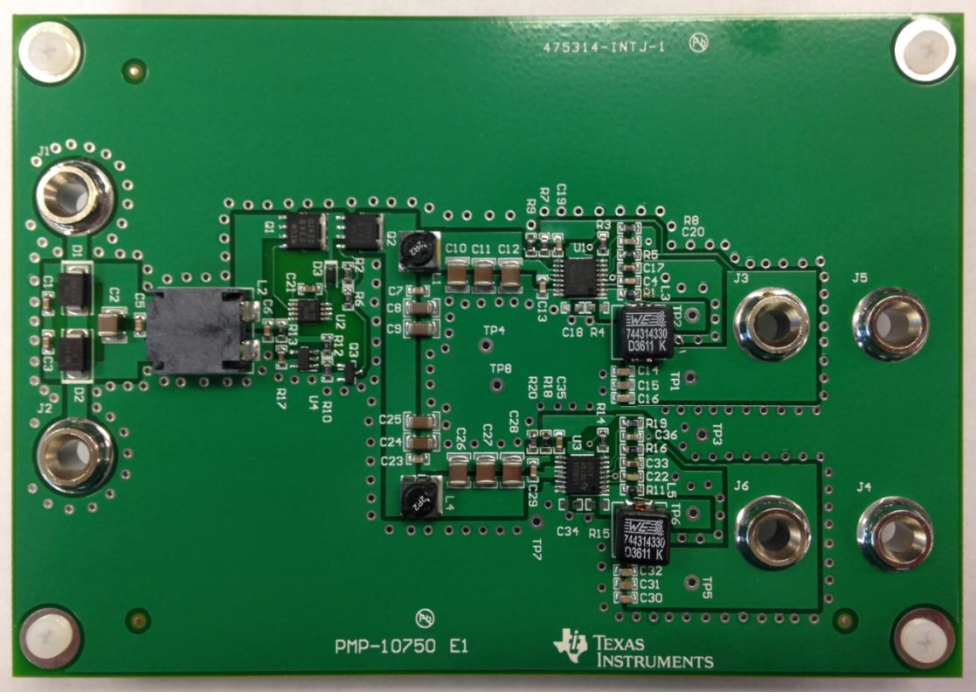

Figure 2: Top of board

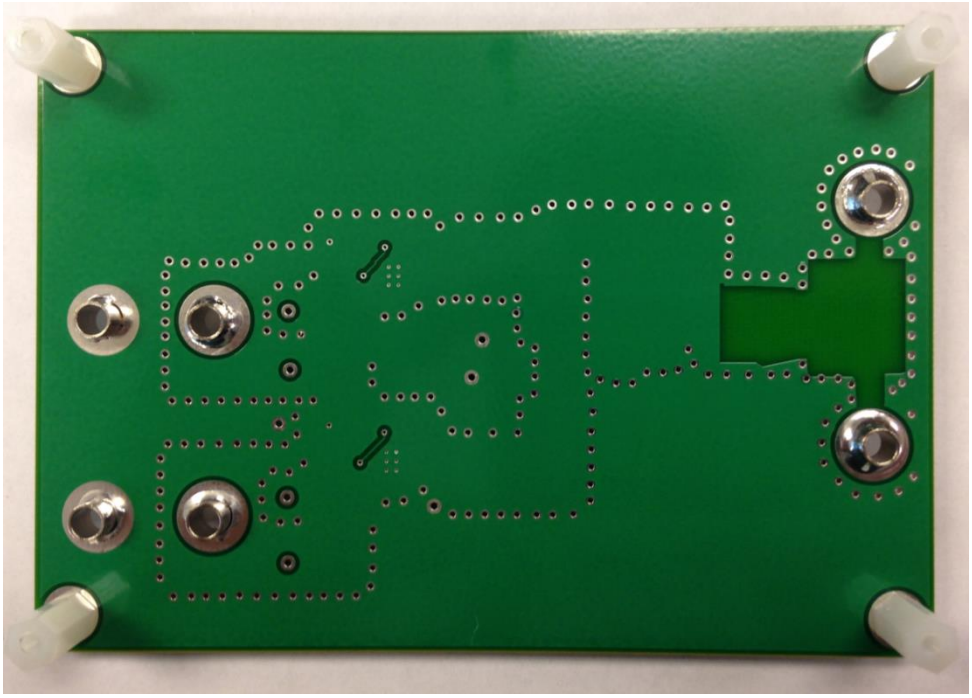

Figure 3: Bottom of board

4. Thermal Data

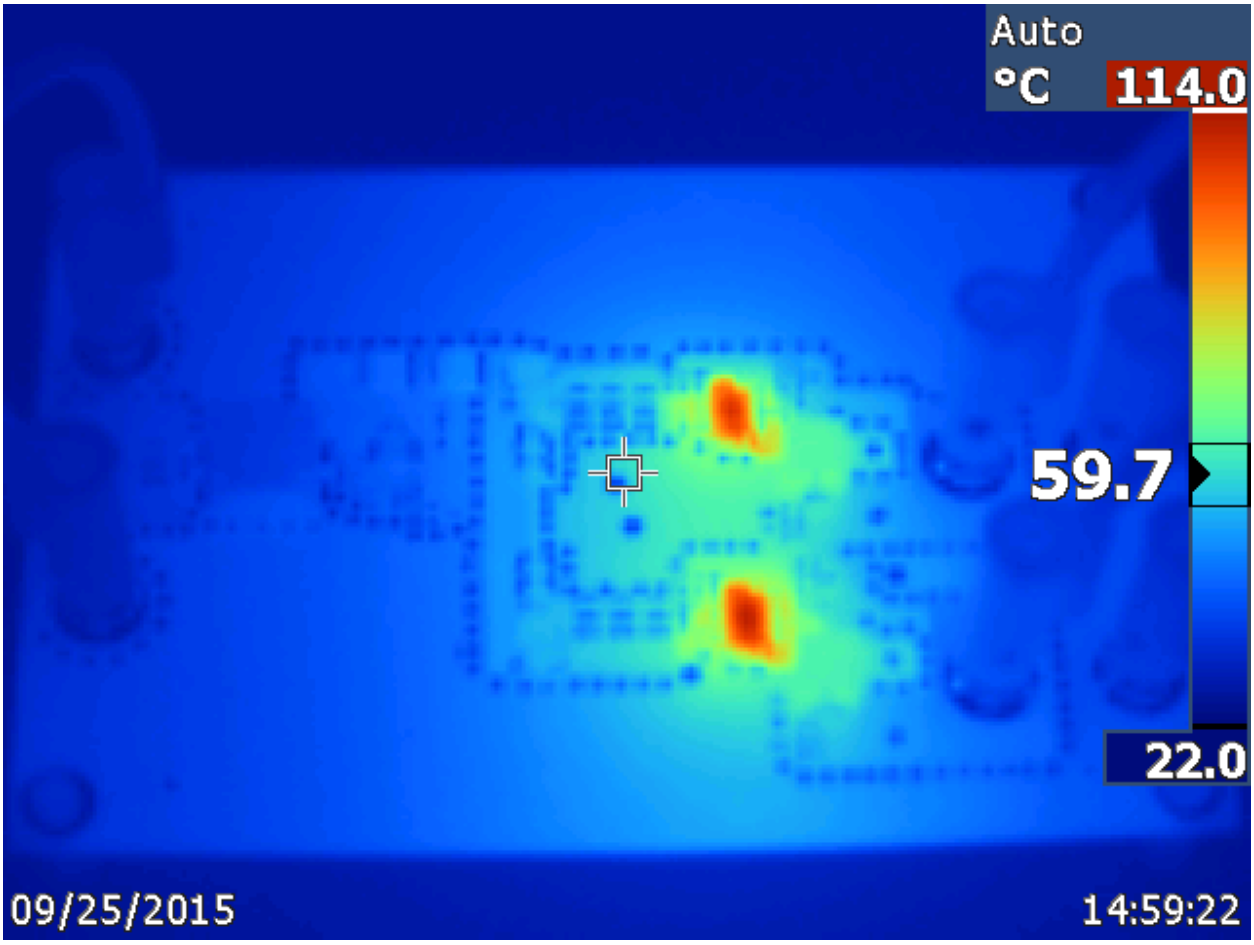

Figure 4: IR thermal image at steady state with 12Vin and both outputs fully loaded

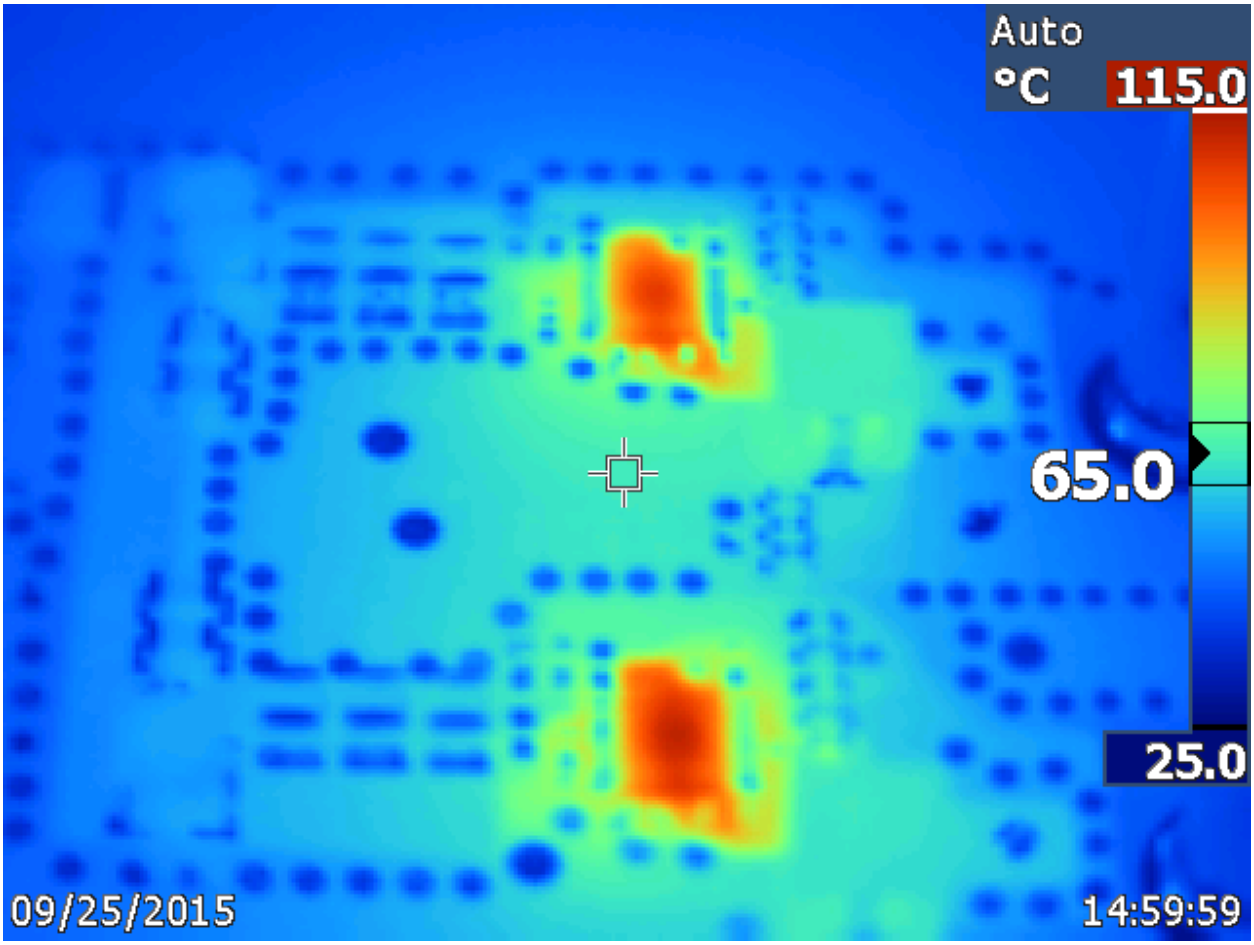

Figure 5: IR thermal image at steady state with 12Vin zoomed on LM53603

5. Efficiency

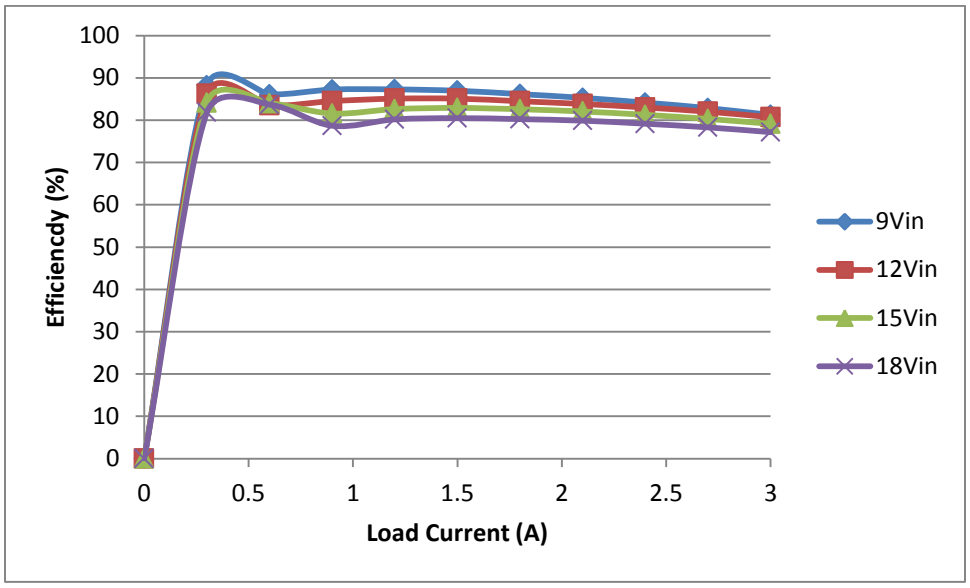

Figure 6: Load current vs efficiency with both outputs identically loaded for various input voltages

6. Waveforms

6.1 Reverse Protection –Smart diode

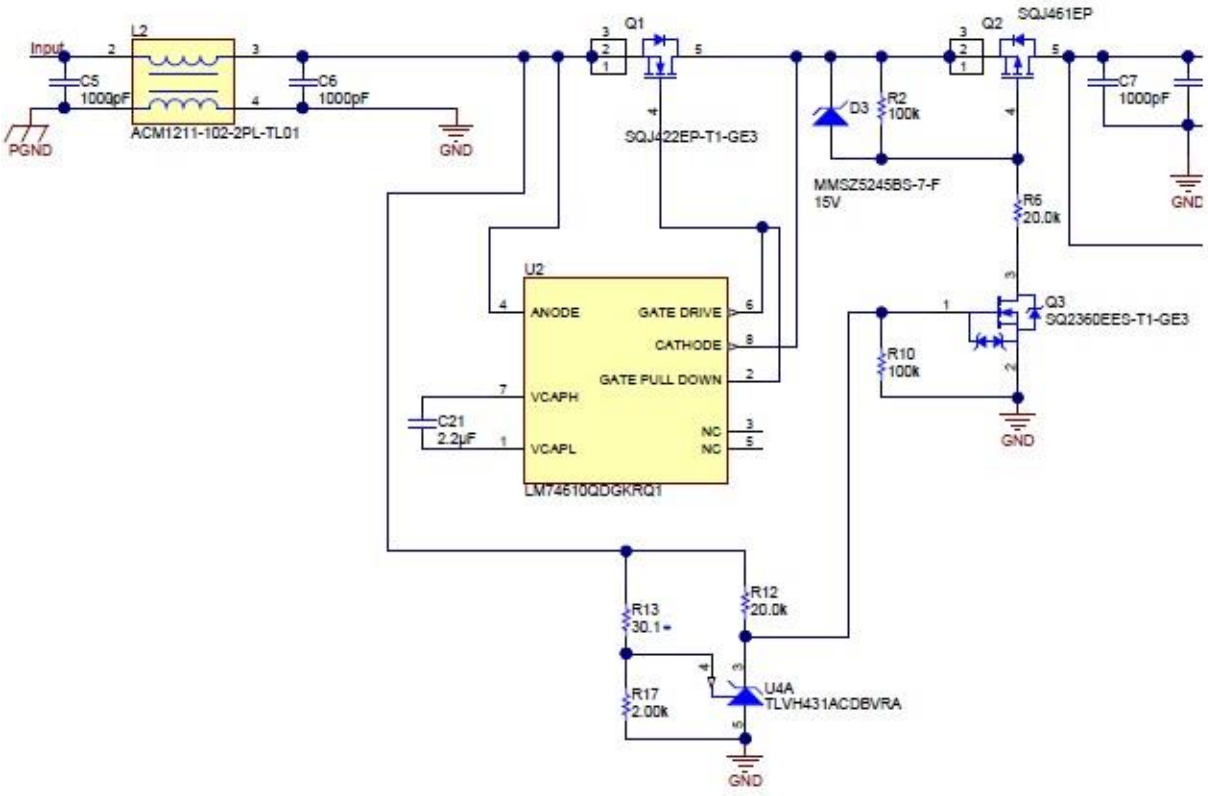

Figure 7: Reverse protection using smart diode circuit schematic

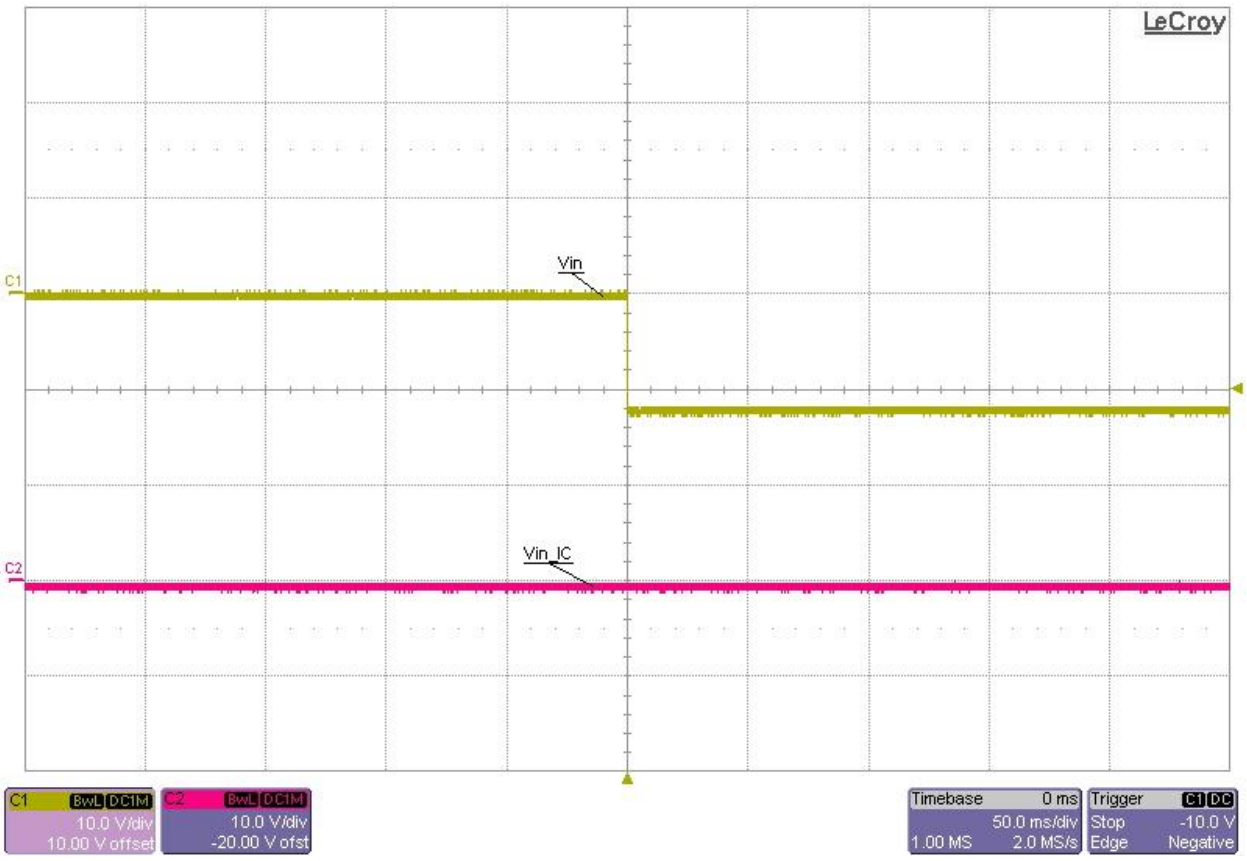

Figure 8: Reverse input voltage protection as Vin transitions to -12V while Vin to the IC remains unchanged

6.2 Input Overvoltage Protection – PFET Fault switch

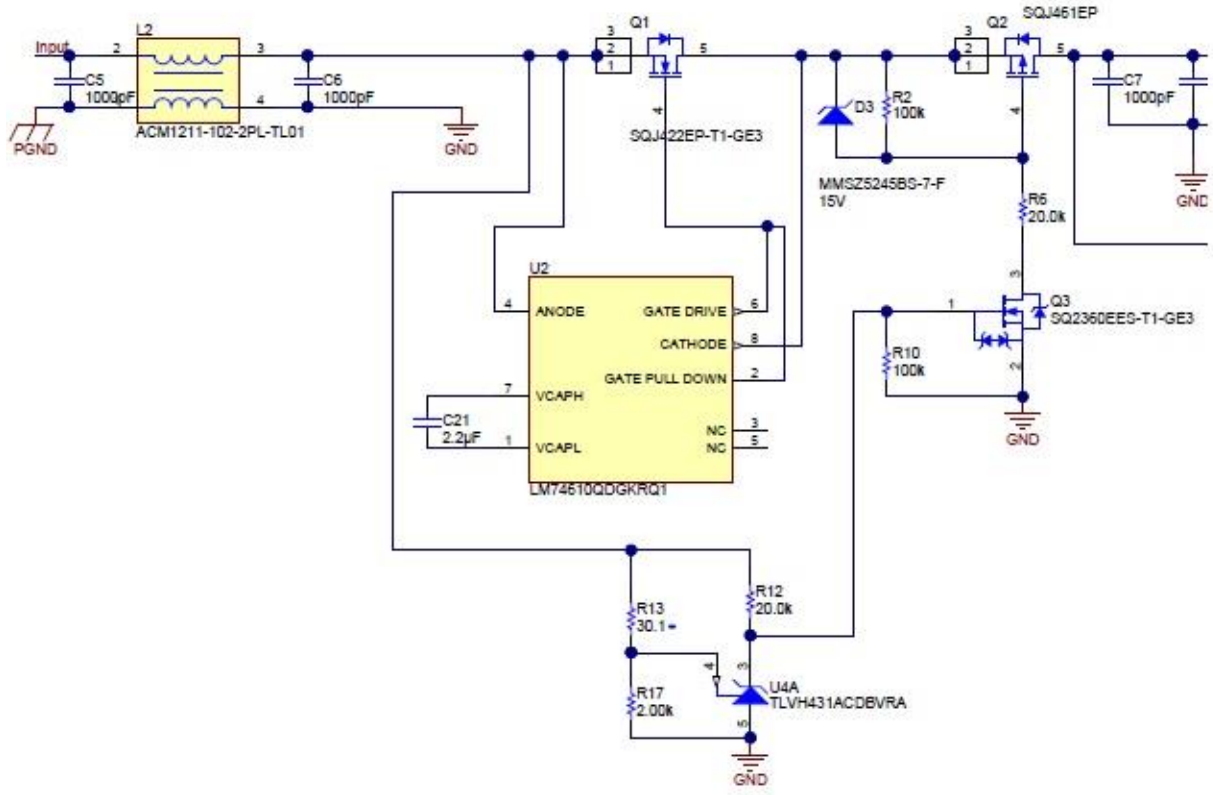

Figure 9: Input overvoltage protection using a PFET fault switch circuit schematic

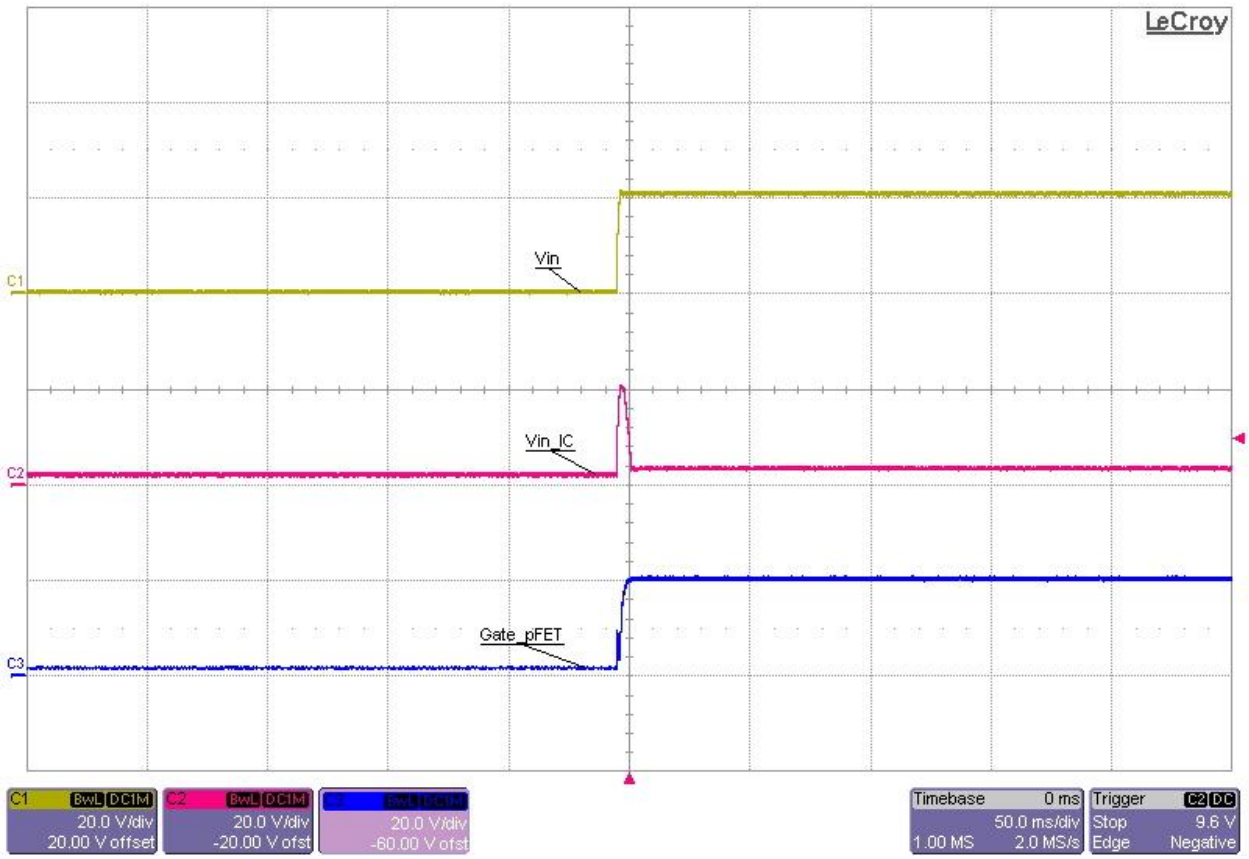

Figure 10: Transition to overvoltage condition shown on C1 forces the PFET gate shown on C3 high bringing the input voltage to the IC shown on C2 low

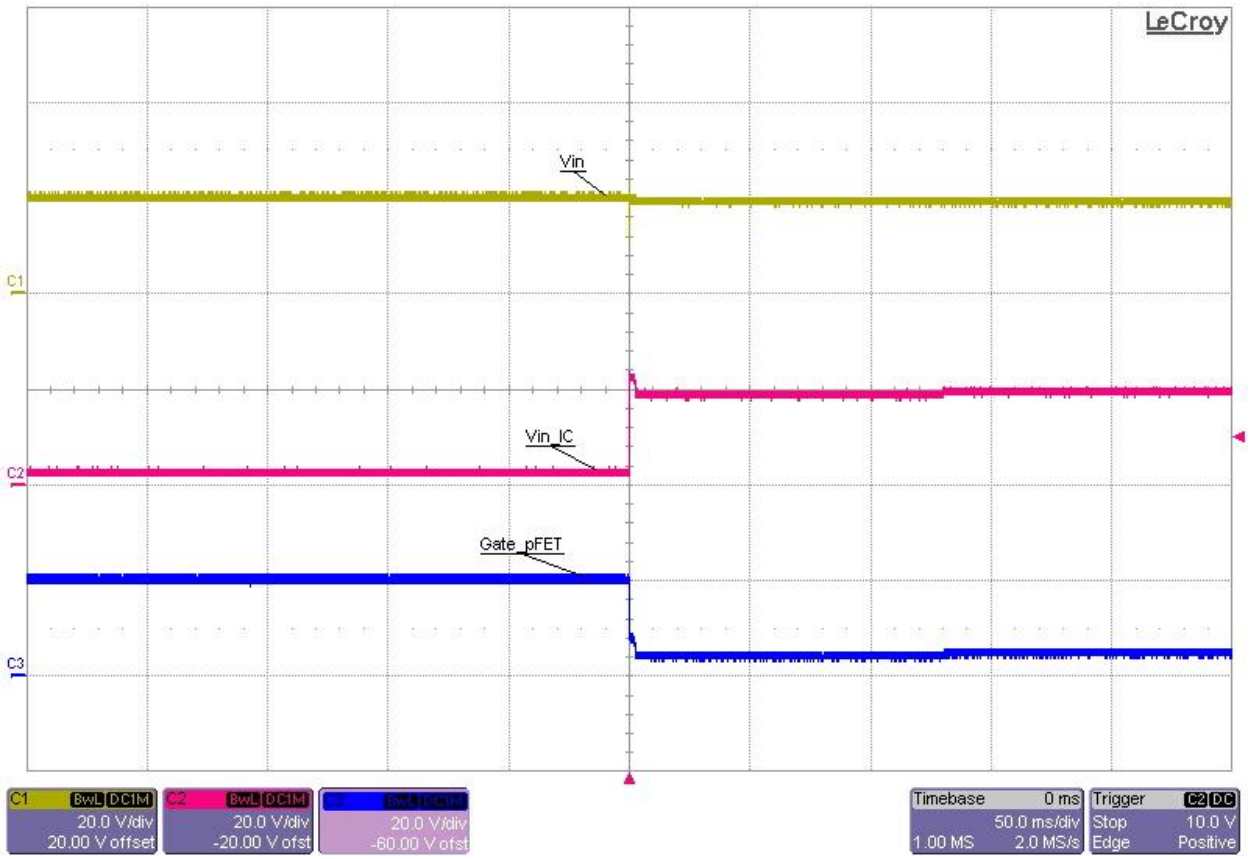

Figure 11: Transition to normal condition shown on C1 forces the PFET gate shown on C3 low allowing the input voltage to the IC shown on C2 to come up

6.4 Output Voltage Ripple and Switch Node Voltage

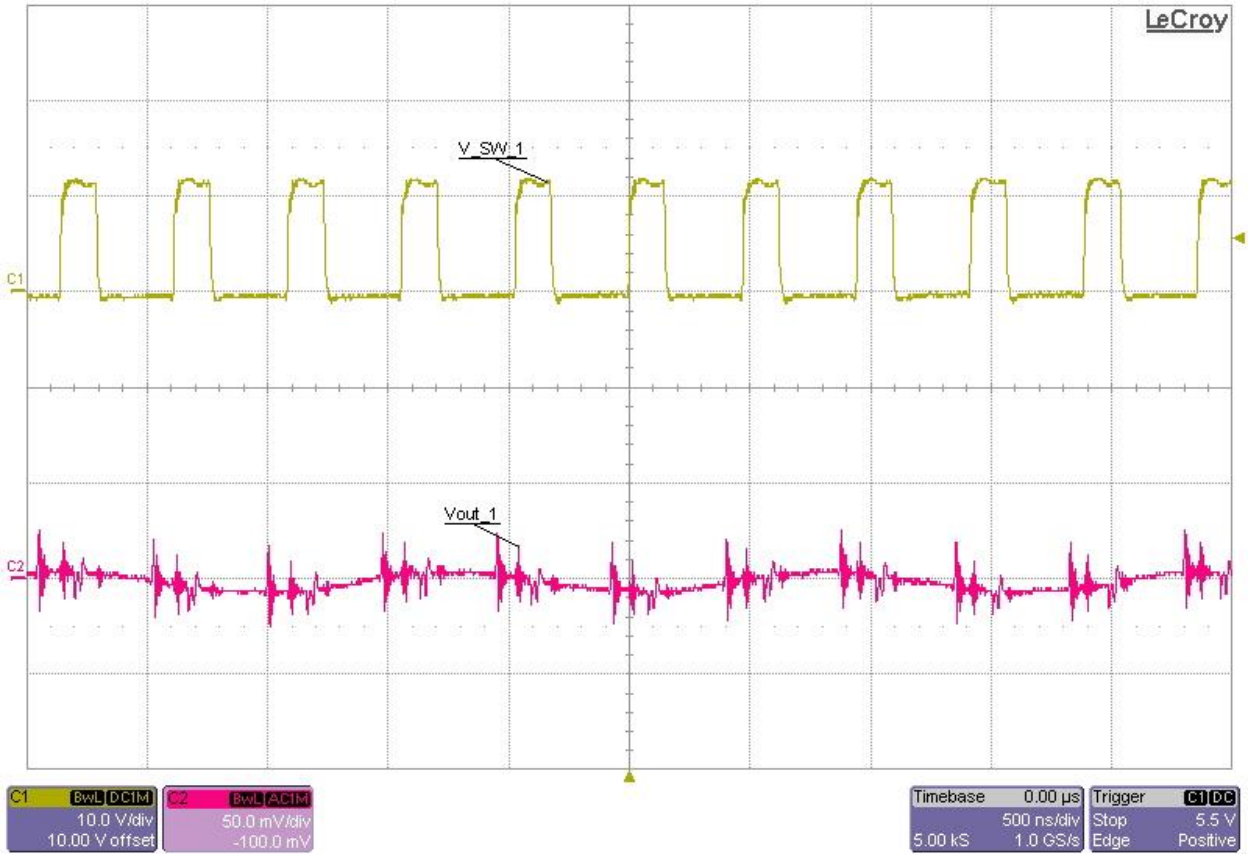

Figure 12: Switch node voltage and output voltage ripple for the 3.3V_Slave channel of LM53603 with both outputs fully loaded

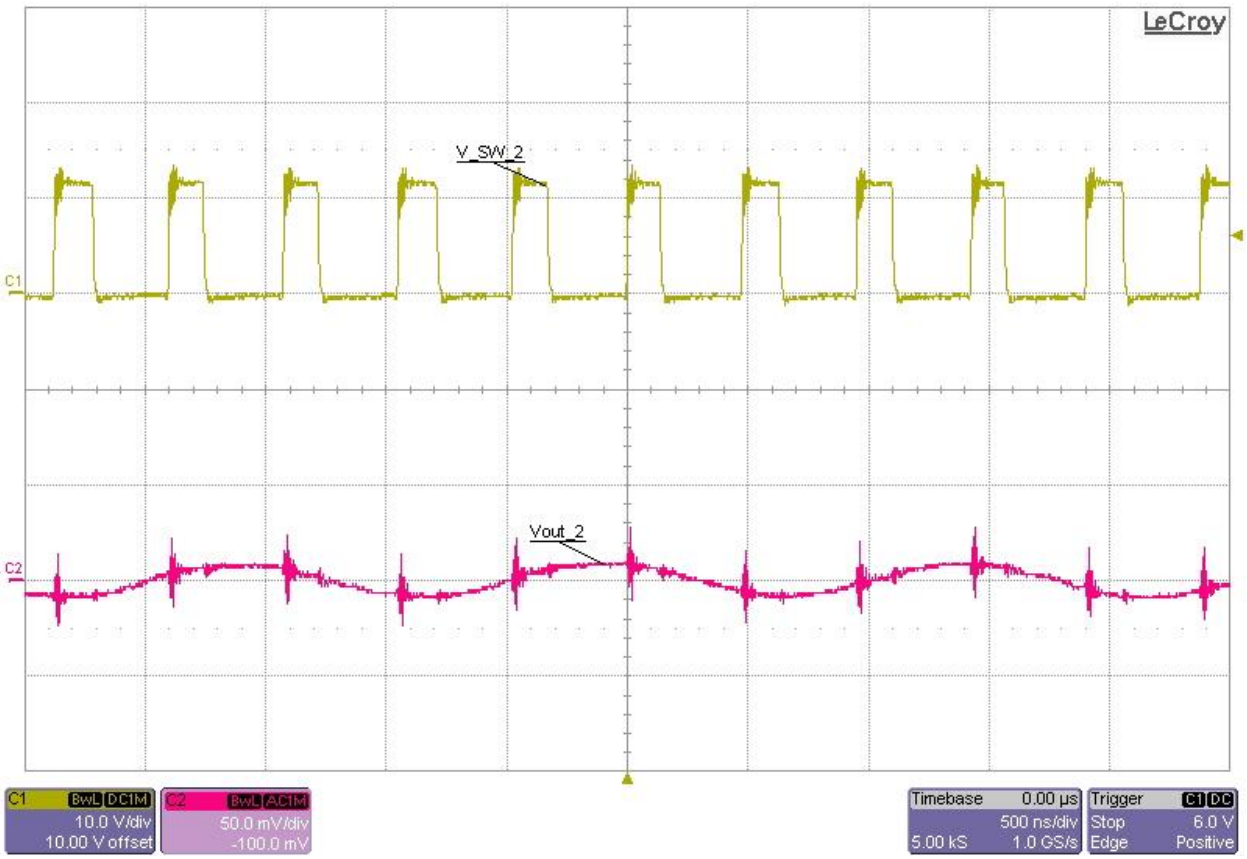

Figure 13: Switch node voltage and output voltage ripple for the 3.3V_Master channel of LM53603 with both outputs fully loaded

6.5 Load Transient Response

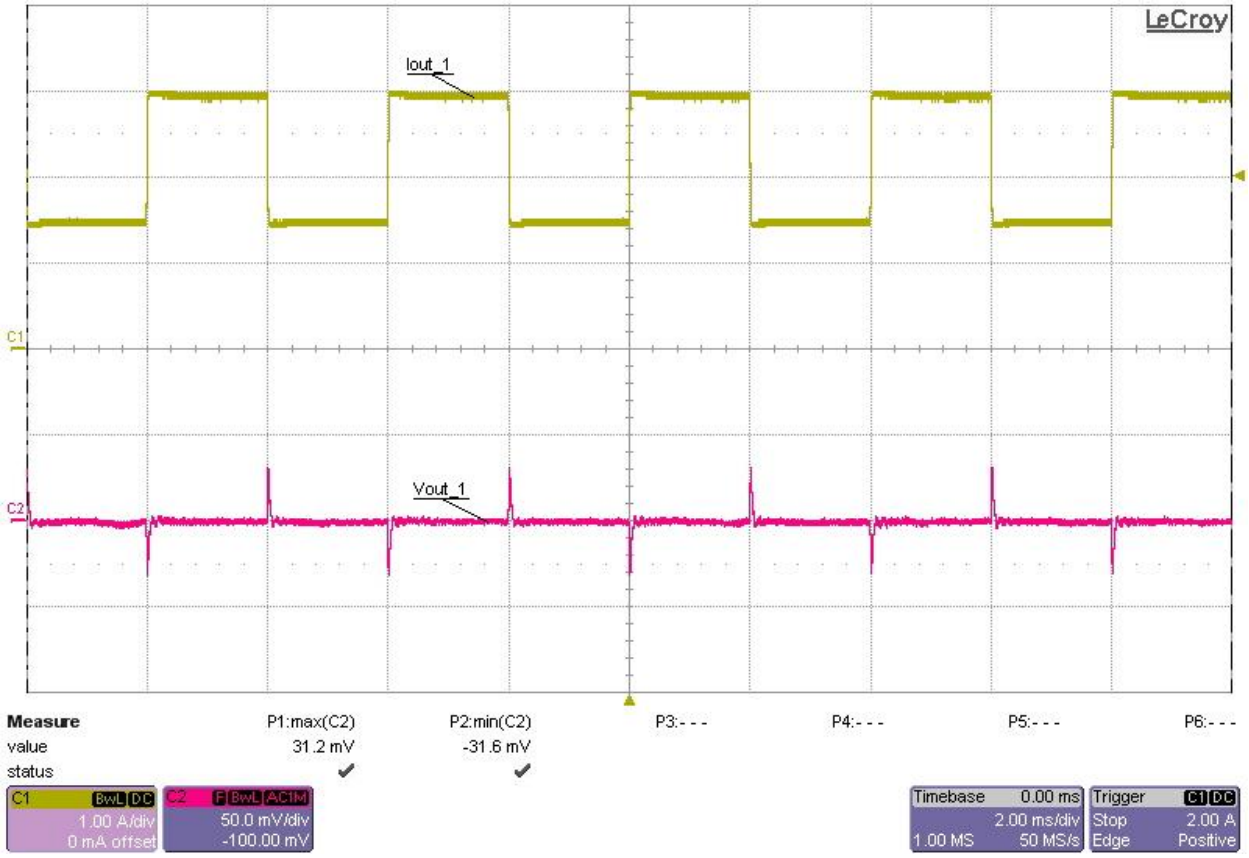

Figure 14: Load transient response shown on C2 for 3.3V_Slave channel at 6Vin with a 50%-to-100% load step shown on C1 while 3.3V_Master channel is under full load

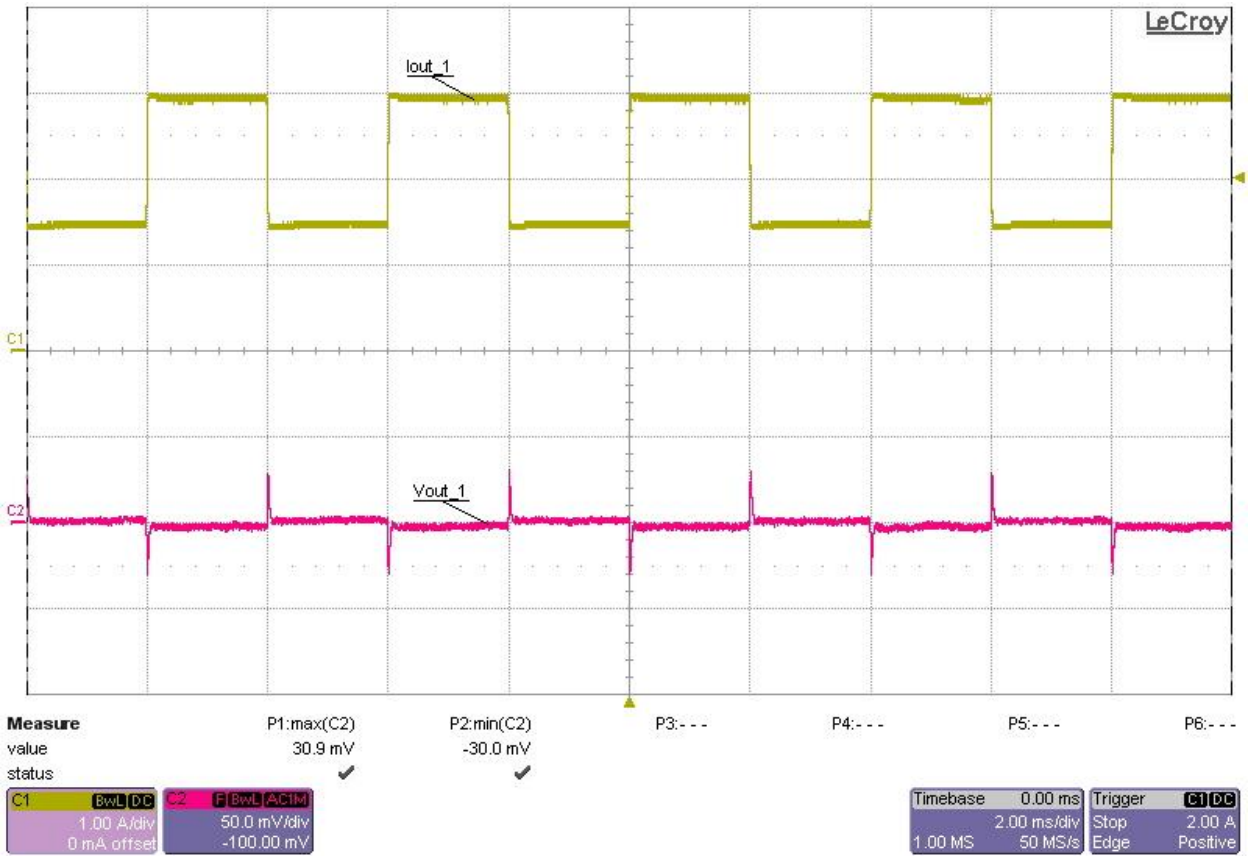

Figure 15: Load transient response shown on C2 for 3.3V_Slave channel at 12Vin with a 50%-to-100% load step shown on C1 while 3.3V_Master channel is under full load

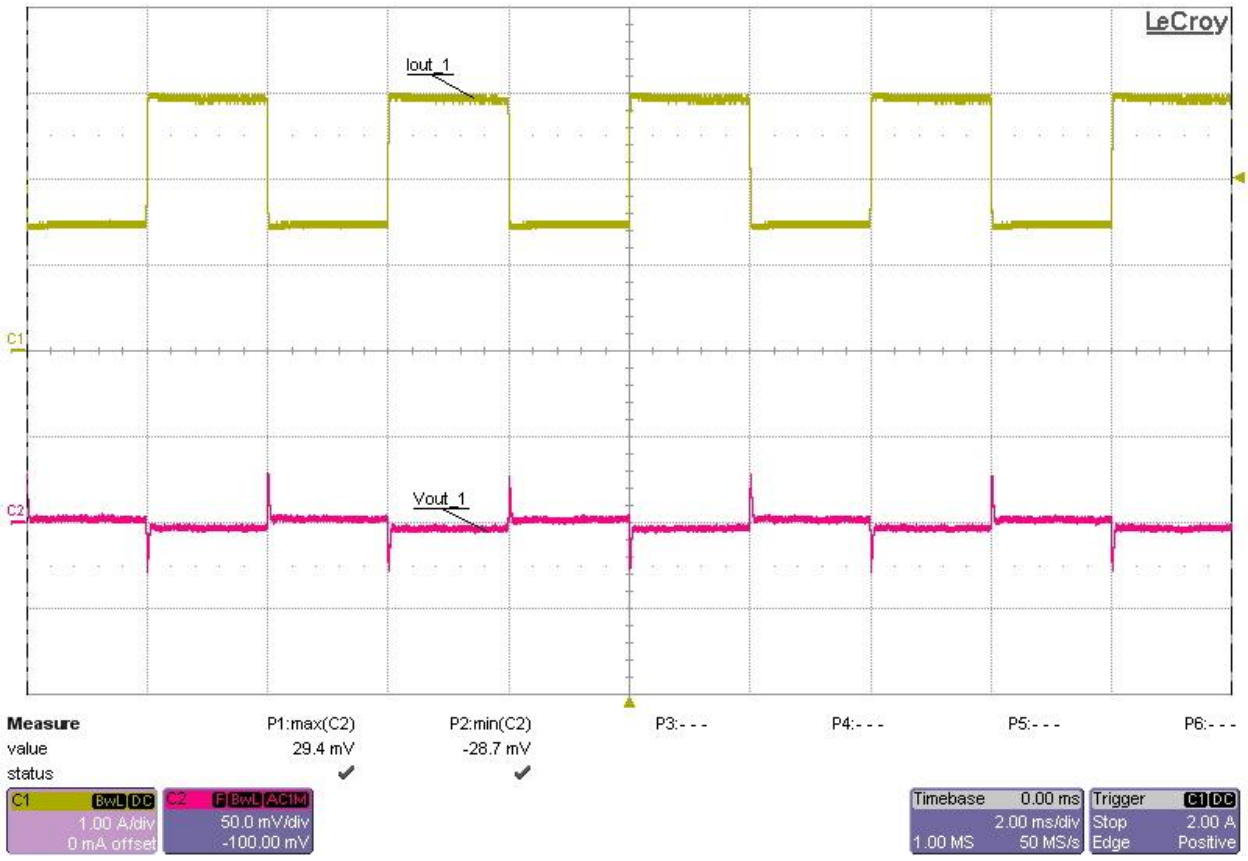

Figure 16: Load transient response shown on C2 for 3.3V_Slave channel at 18Vin with a 50%-to-100% load step shown on C1 while 3.3V_Master channel is under full load

The load transient response for the other channel (3.3V_Master) is identical to that of the 3.3V_Slave channel shown above.

7. Conducted Emissions

The conducted emissions is tested followed the of CISPR 25 standards. 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.

Figure 17 shows the test result using peak detection (yellow trace) and average detection (blue trace) measurements respectively up to 30MHz. Figure 18 shows the test result using peak detection (yellow trace) and average detection (blue trace) measurements respectively from 30MHz to 108MHz. The limit lines shown in red are the Class 5 limits(up 108MHz) for conducted disturbances specified in the CISPR 25. The results show the power supply operates quietly and the noise is below the Class 5 limits overall.

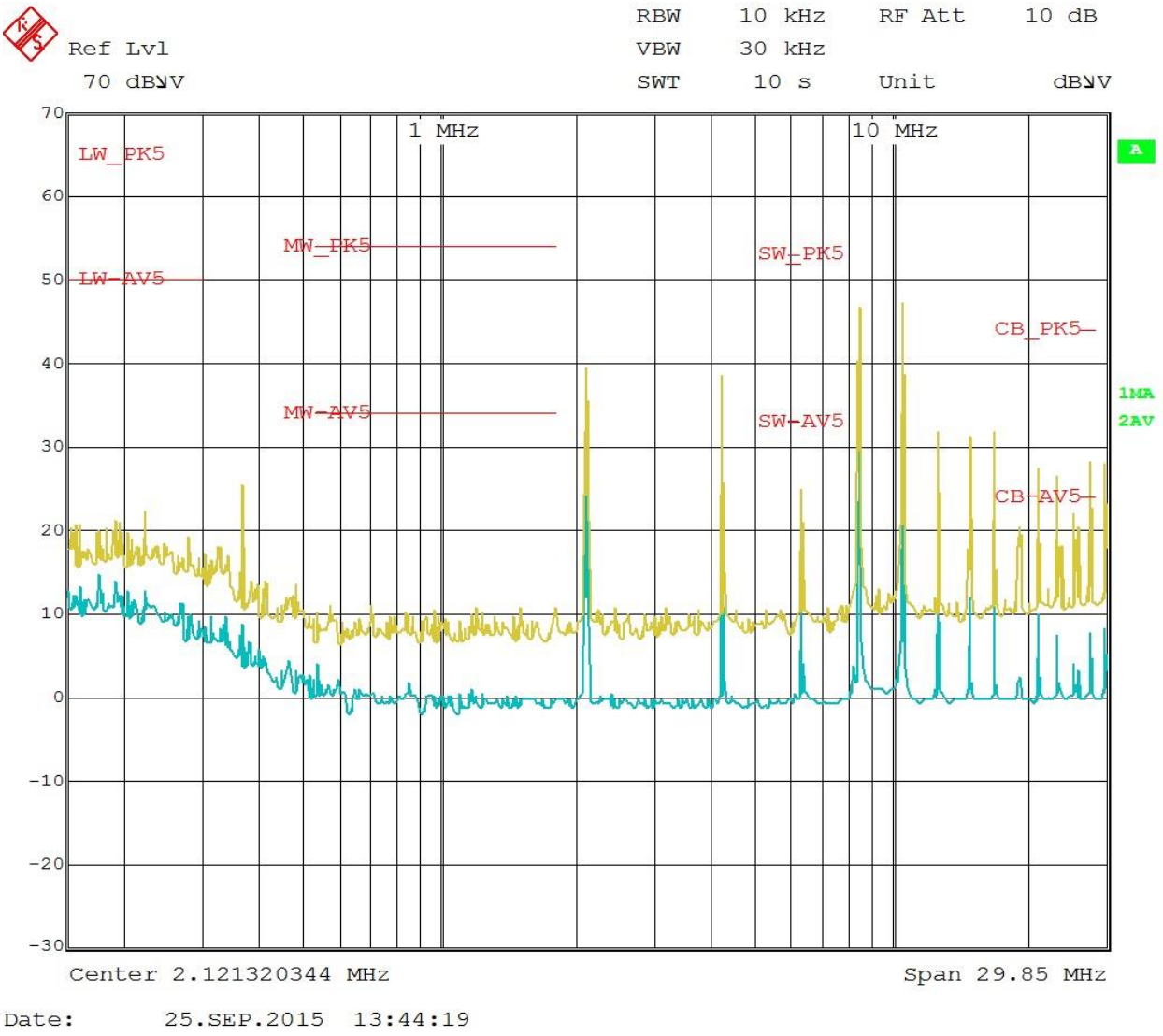

Figure 17: EMI testing for PMP10750 up to 30 MHz showing the peak detection (yellow), average detection (blue), and Class 5 peak and average limits (red)

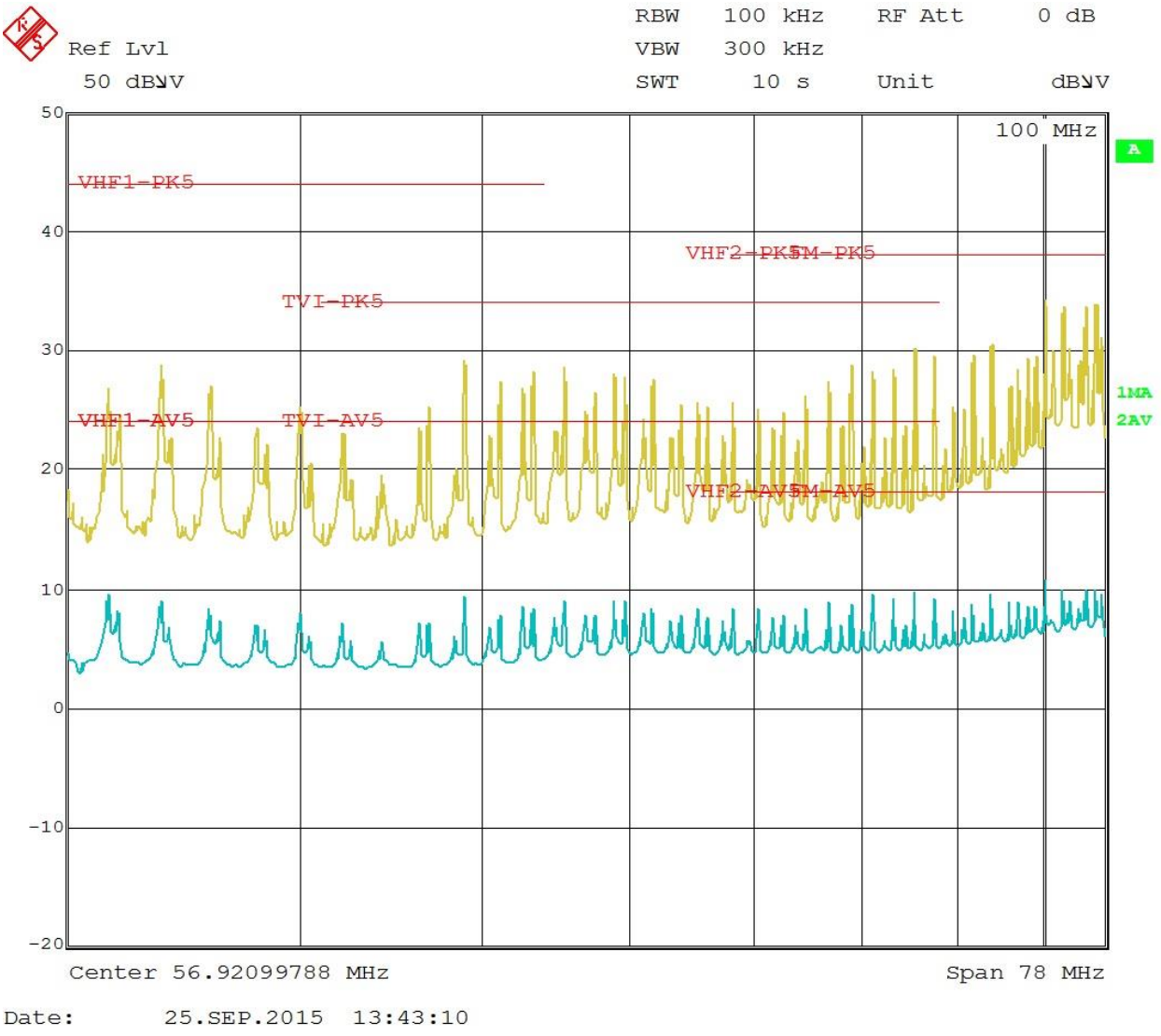

Figure 18: EMI testing for PMP10750 from 30 MHz to 108MHz showing the peak detection (yellow), average detection (blue), and Class 5 peak and average limits (red)

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