Test Data
For PMP10748
09/20/2015

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1. Design Specifications

Vin Minimum	**12V**
Vin Maximum	**36V**
Vout	**12VDC**
Iout	**20A**
Reverse Polarity Protection	**Yes**
Over Voltage Range	**36V**
Under Voltage Lockout	**Not Populated**
Over Current Protection	**20A+**
OR-ing Controller	**Yes**

2. Circuit Description

PMP10748 is a complete front end system protection design with the following features:

1. **Reverse Polarity Protection:**
   The LM74610-Q1 Smart diode controller is combined with SQJ422EQ N-Channel MOSFET to provide reverse current and reverse voltage protection. The LM74610-Q1 is used to provide gate drive to the external MOSFET, and to protect the load in the case of reverse polarity by shutting down the gate within 2usec.
2. **Smart Diode OR-ing Controller:**
   The PMP10748 replaces diode ORing for redundant power supplies with LM74610-Q1 Smart Diode Controller solution. This solution makes the OR-ing Controller device 10x more efficient.
3. **Over Voltage Protection:**
   The LM5060 provides an over voltage and series fault protection when the input voltage surges higher than 36V. OVP can be calculated using the following expression:

$$V_{INMAX} = OVP_{TH} + \frac{R_2 \times OVP_{TH}}{R_3}$$

4. **Over Current Protection:**
   The LM5060 uses a sense resistor to provide over current protection when the output current exceeds 20A.
5. **Under Voltage Lockout (optional):**
   This option is not populated, but the design included an under voltage lock out. By placing appropriate resistor values for Ru and Ro, the under voltage lockout can be set to any desired value. The resistor values for under voltage lockout can be calculated using the following expression:

$$R_u = \frac{V_{INMIN} - UVLO_{TH}}{\left(UVLO_{BIAS} + \frac{UVLO_{TH}}{R_o}\right)}$$

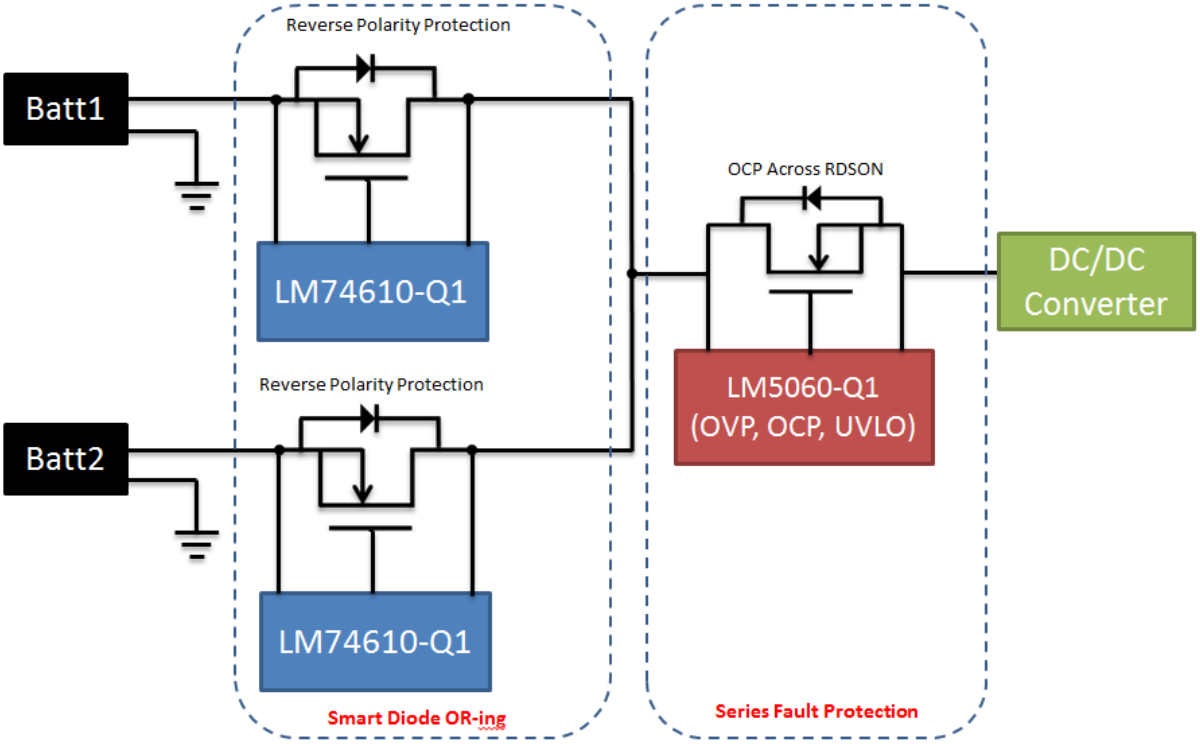
$$V_{INMIN} = UVLO_{TH} + \left[R_u \times \left(UVLO_{BIAS} + \frac{UVLO_{TH}}{R_o}\right)\right]$$

*Pick any value for Ro and R3 below 100kΩ

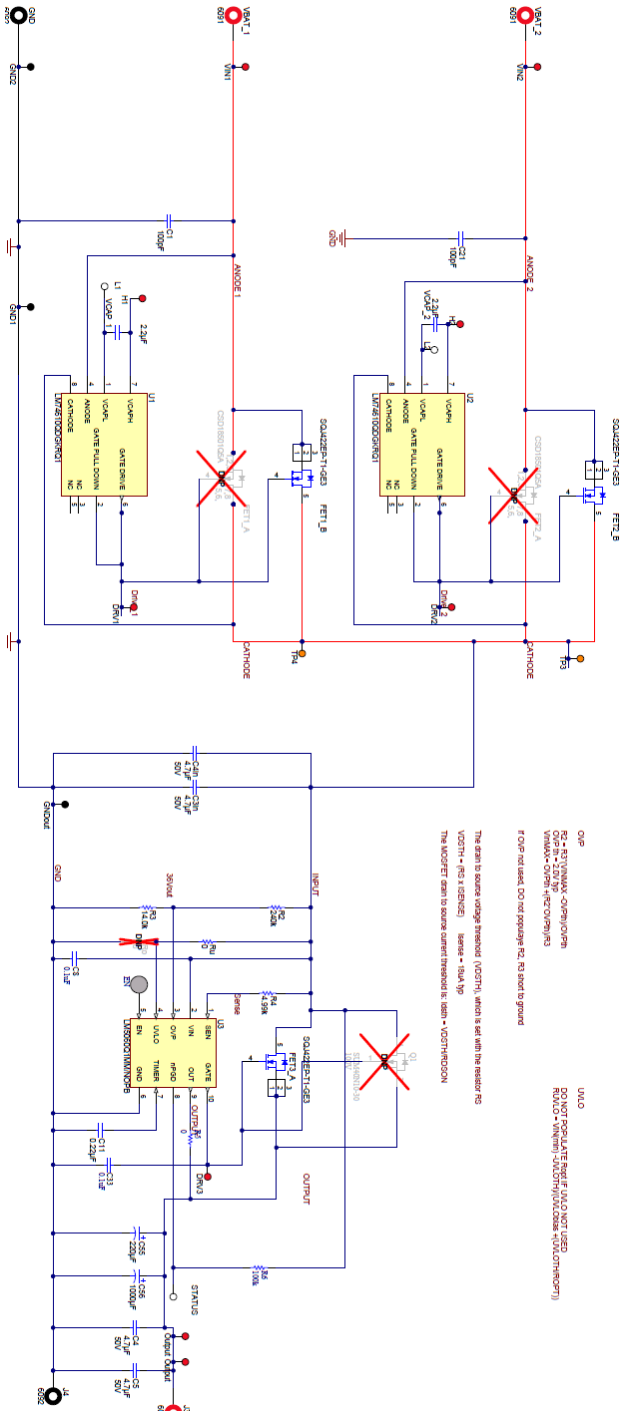
*$UVLO_{BIAS}$ = 5.5µA, $UVLO_{TH}$ = 1.6V

* OVP_{BIAS} = 0µA, OVP_{TH} = 2.0V

3. Block Diagram

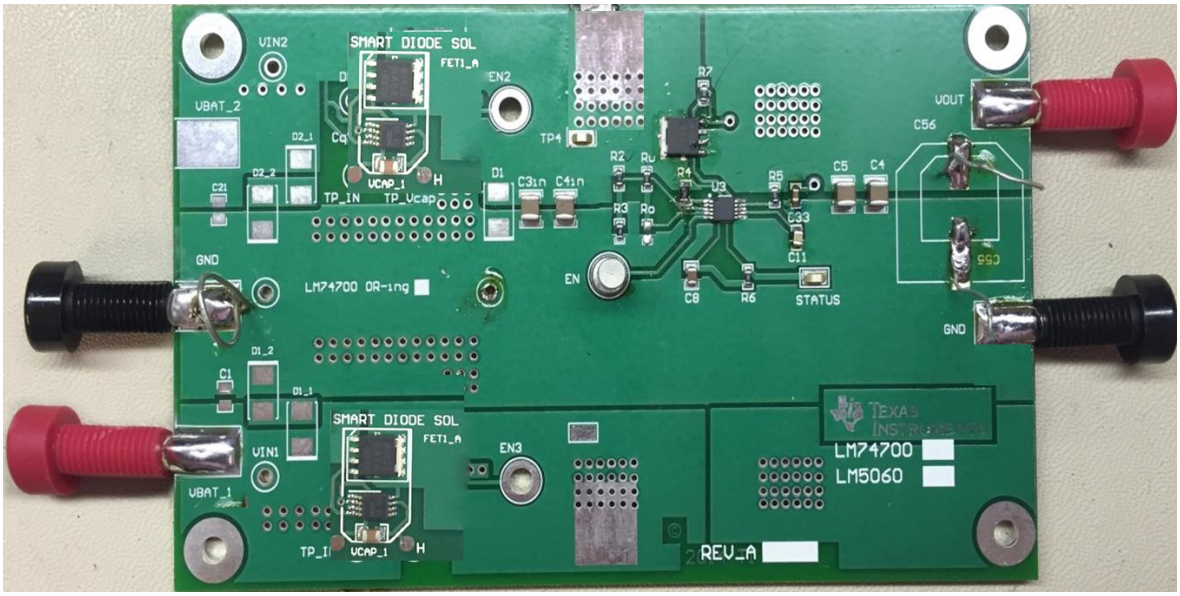


4. Board Schematic

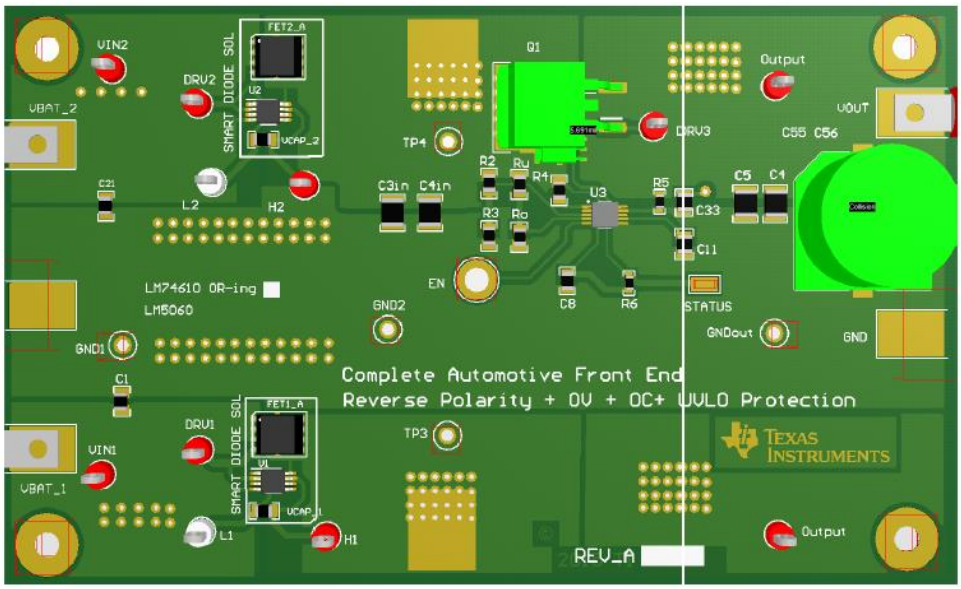


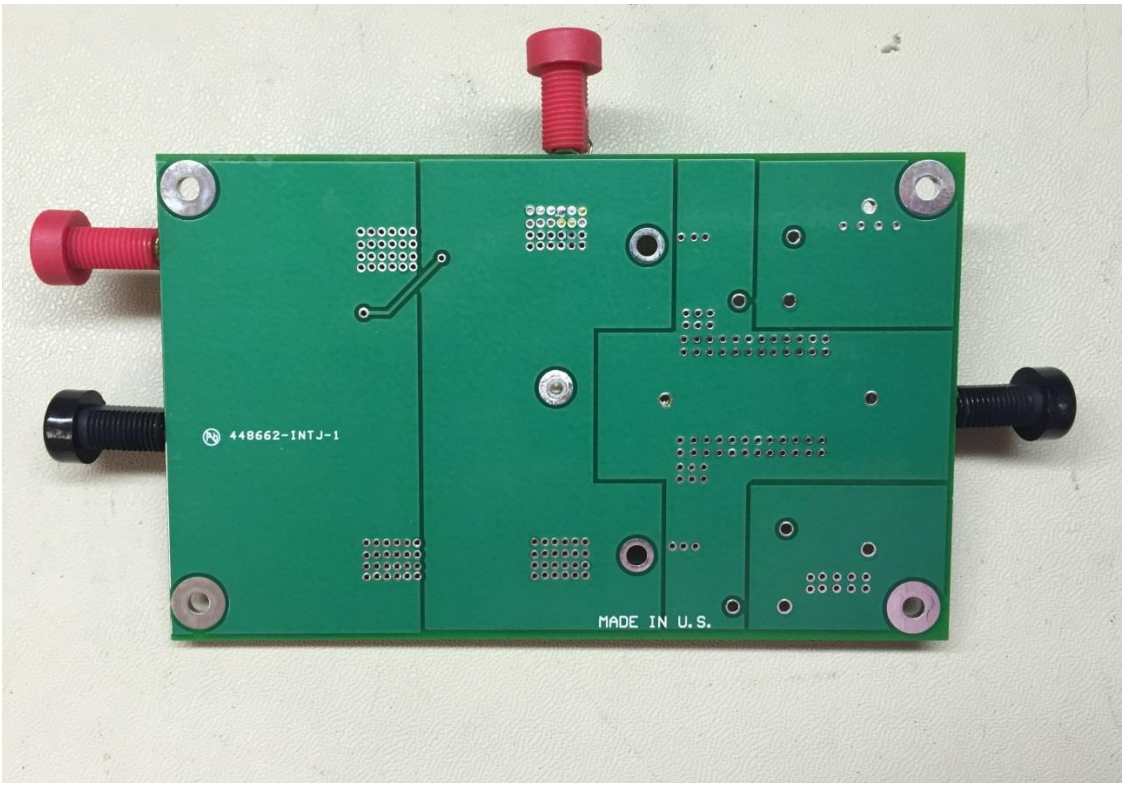
5. PMP10748 Board Photos

Board Dimensions: 4682mil *2840mil

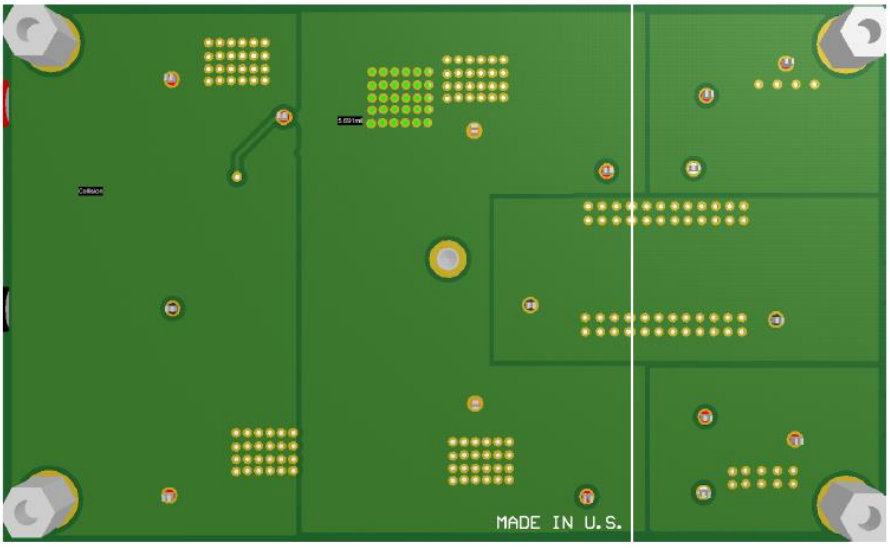


Board Photo (Top)





Board Photo (Bottom)

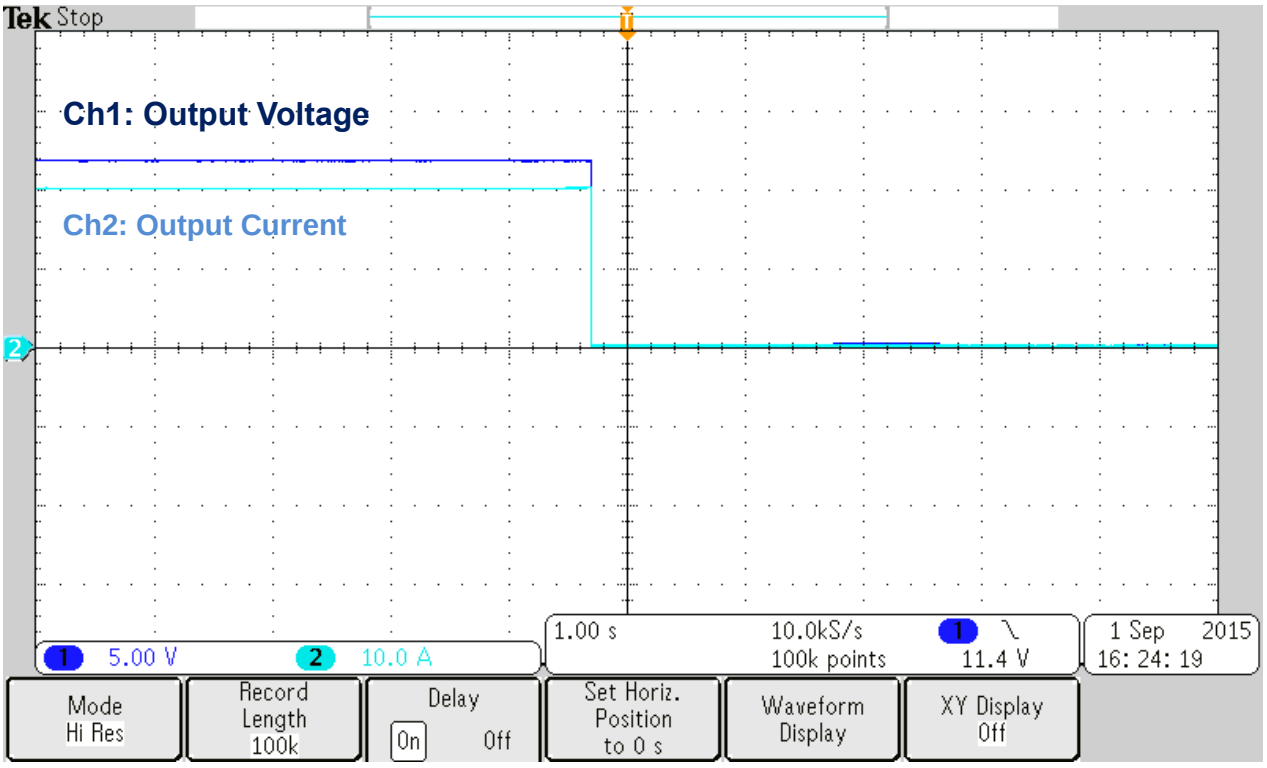


6. Adjustable Overcurrent Protection Test Results

For the test performed, the sense resistor was set at 5kΩ which allowed the Overcurrent threshold to be set around 20A.

4.2 Waveforms

4.2.1 20A+ Overcurrent Protection

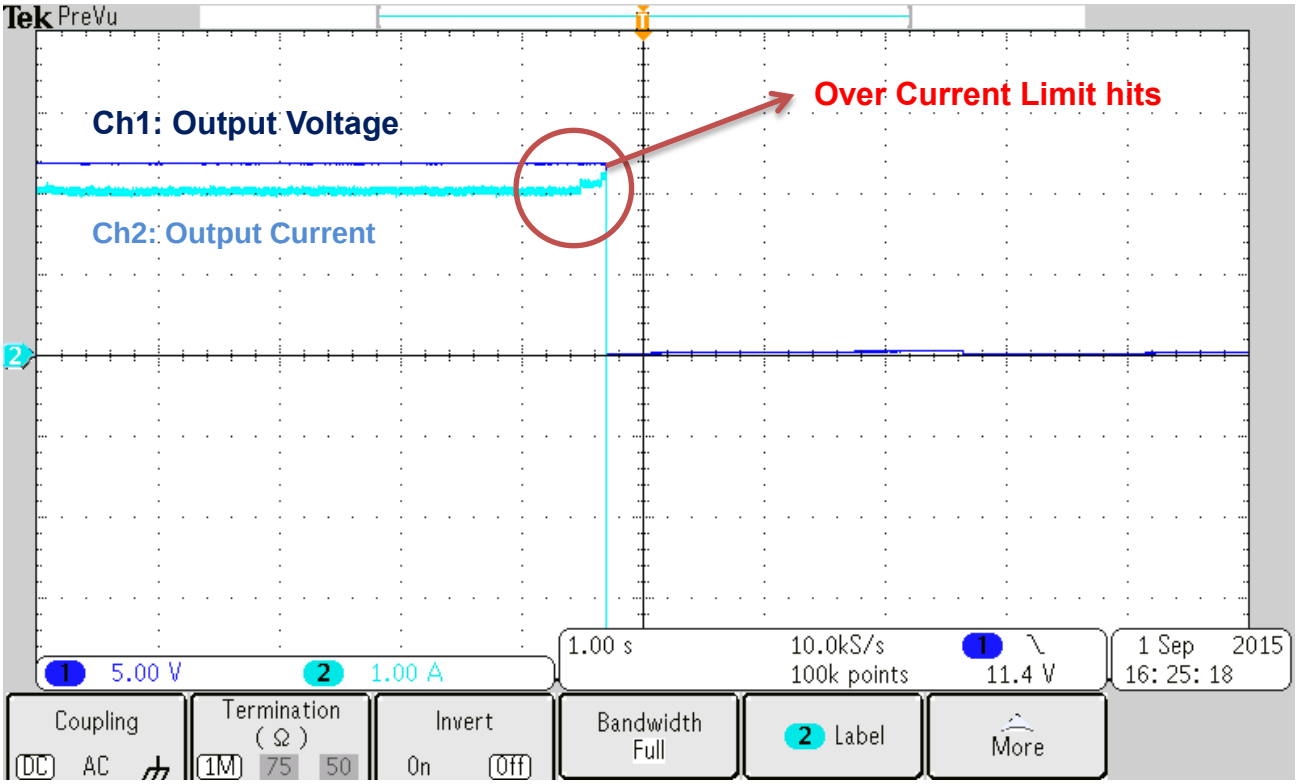


Overcurrent Protection Response: Current shift from 19.5A steady state to 20A.

R_{sense} =5kΩ.

Teal- I_{out}

Blue- V_{out}



(Zoomed in)

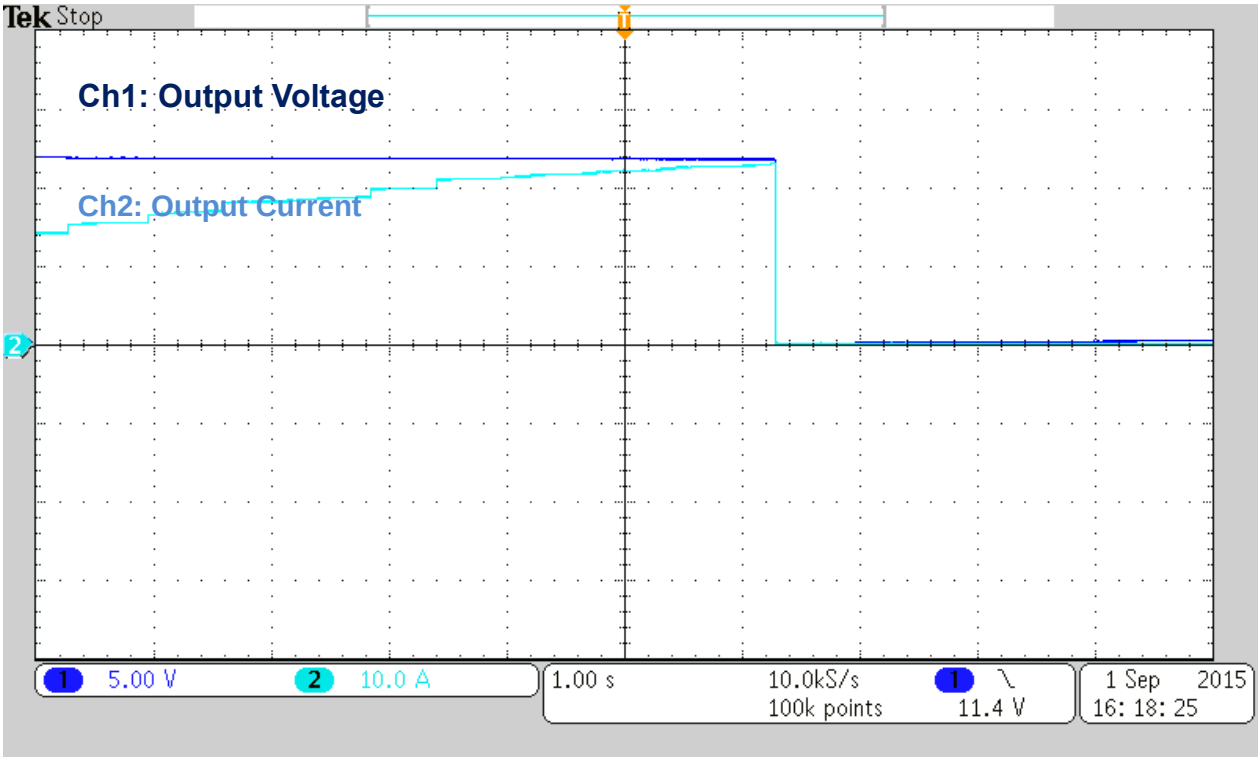
Overcurrent Protection Response: Current shift from 19.5A steady state to 20A.

R_{sense} =5kΩ.

Teal- I_{out}

Blue- V_{out}

4.2.2 20A Overcurrent Protection (Ramp input)



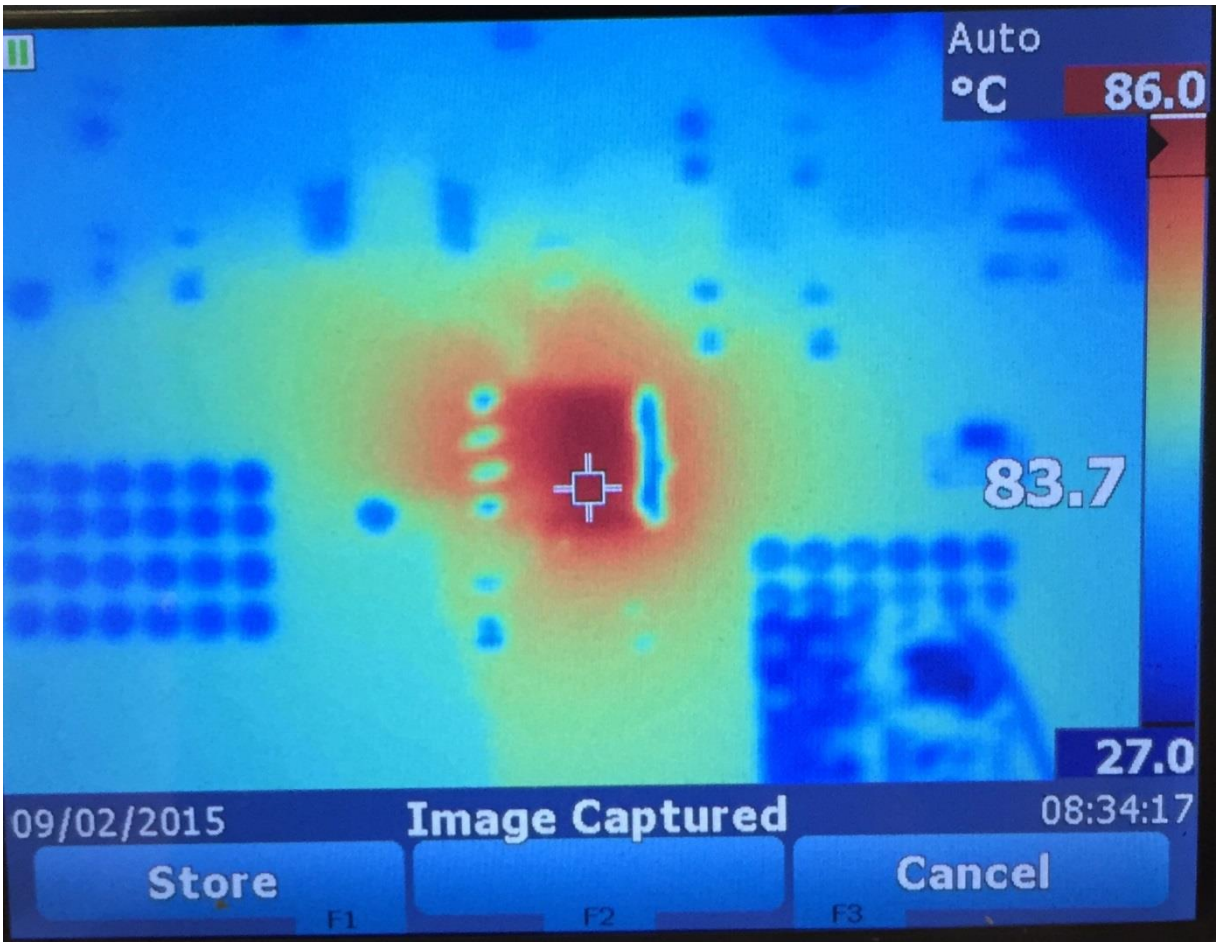
Overcurrent Protection Response: Current ramp from 0A to +20A.

R_{sense} =5kΩ.

Teal- I_{out}

Blue- V_{out}

4.1 Thermal Data

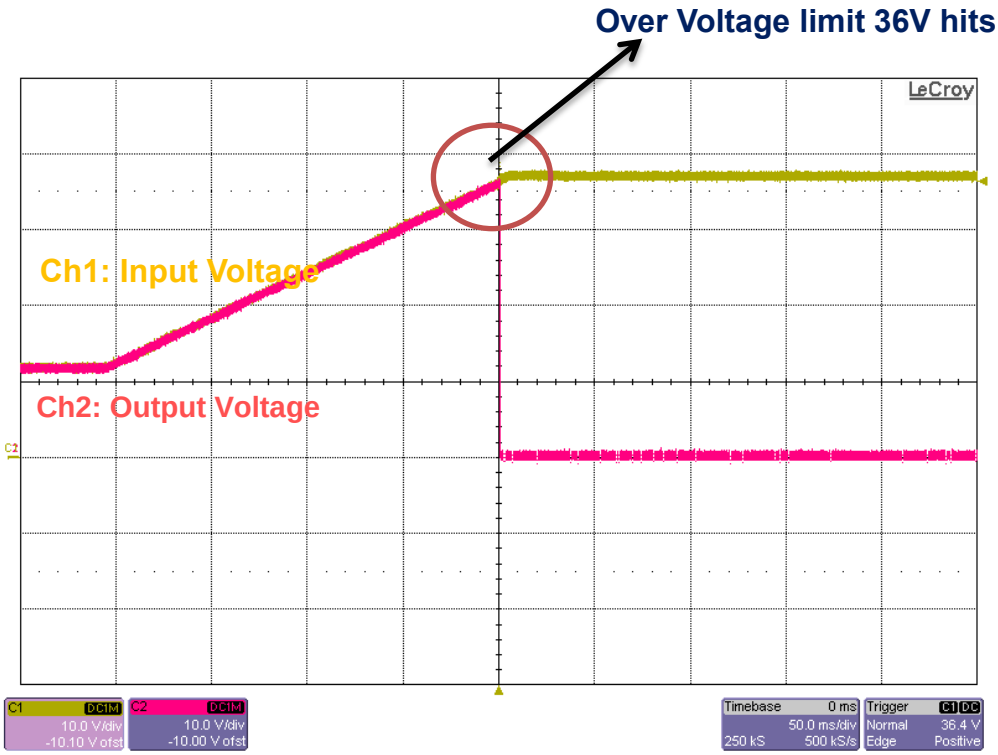


IR thermal image taken at steady state with 12V V_{in} and 20 A load.

5. Adjustable Overvoltage Protection Test Results

The Overvoltage threshold was set at 36V. This is done by……..

5.1 Waveforms



Overvoltage Protection Response: Voltage ramp from 0V to 36V.

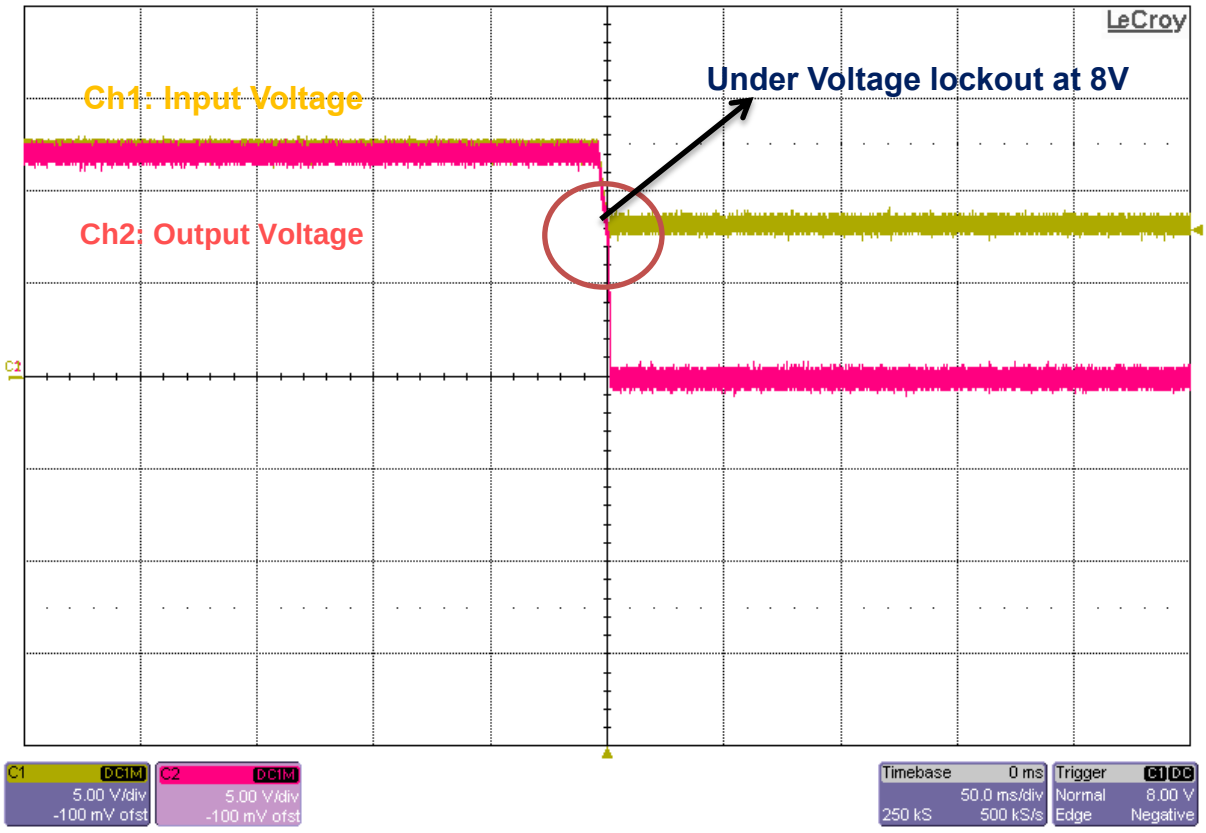
Green- V_{in}

Red- V_{out}

6. Under voltage-Lockout Test Result

The board does not have under voltage lock out populated. The function is disabled by shorting Ru to Vin and not populating Ro, but the option is available.

6.1 UVLO Waveform

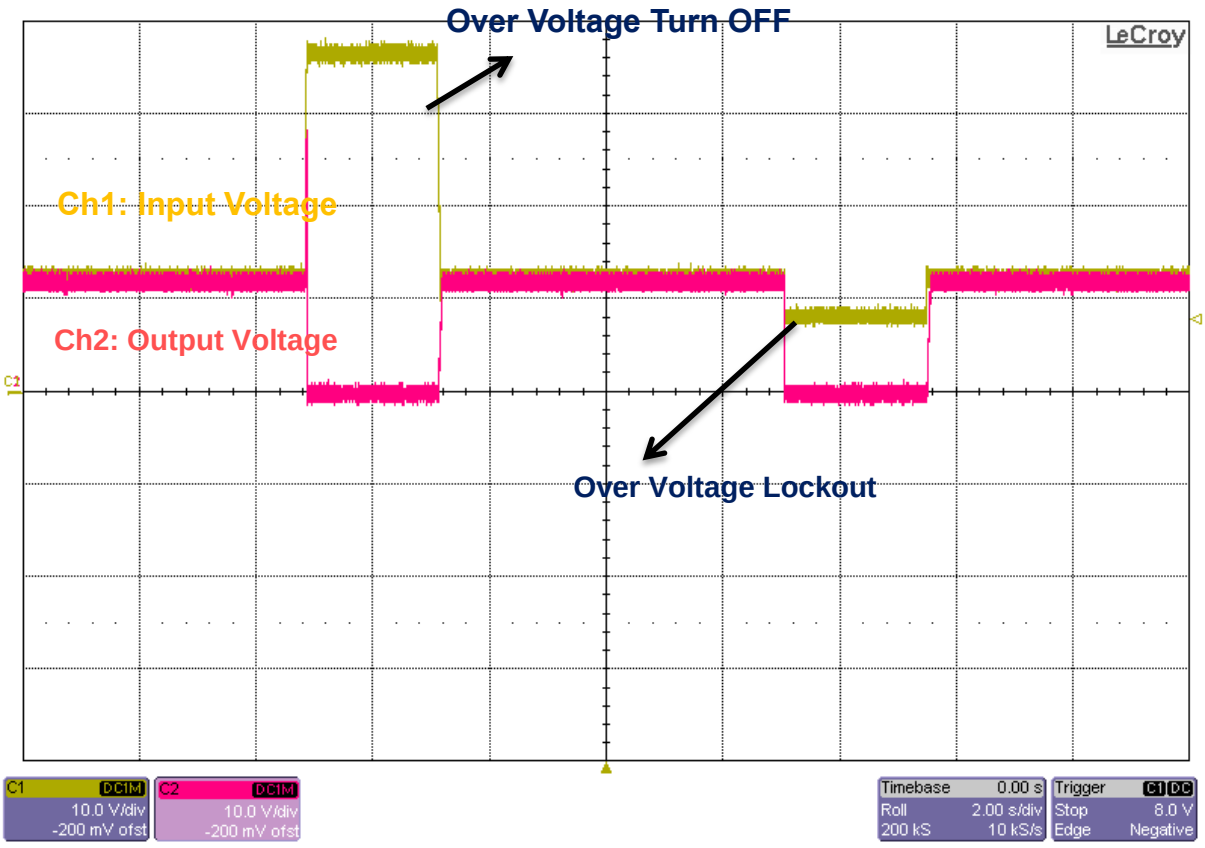


Undervoltage-Lockout Response: Voltage ramp from 12V to 8V.

Green- V_{in}

Red- V_{out}

6.2 UVLO and OVP Waveform



UVLO and OVP Response: Voltage pulse from 12V to 36V and a second pulse from 12V to 8V.

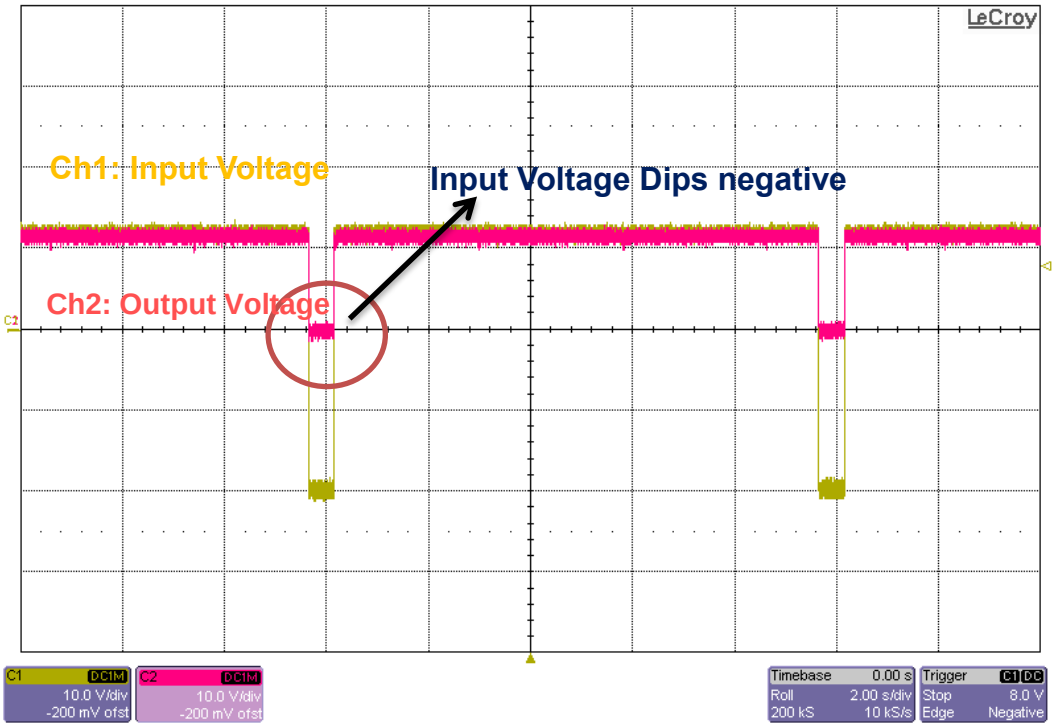
Green- V_{in}

Red- V_{out}

7. Reverse Polarity Protection Test Result

Using the LM74610-Q1 Smart diode in series with LM5060 the board is also given the ability to protect against reverse polarity.

7.1 Reverse Polarity Protection Waveform 1

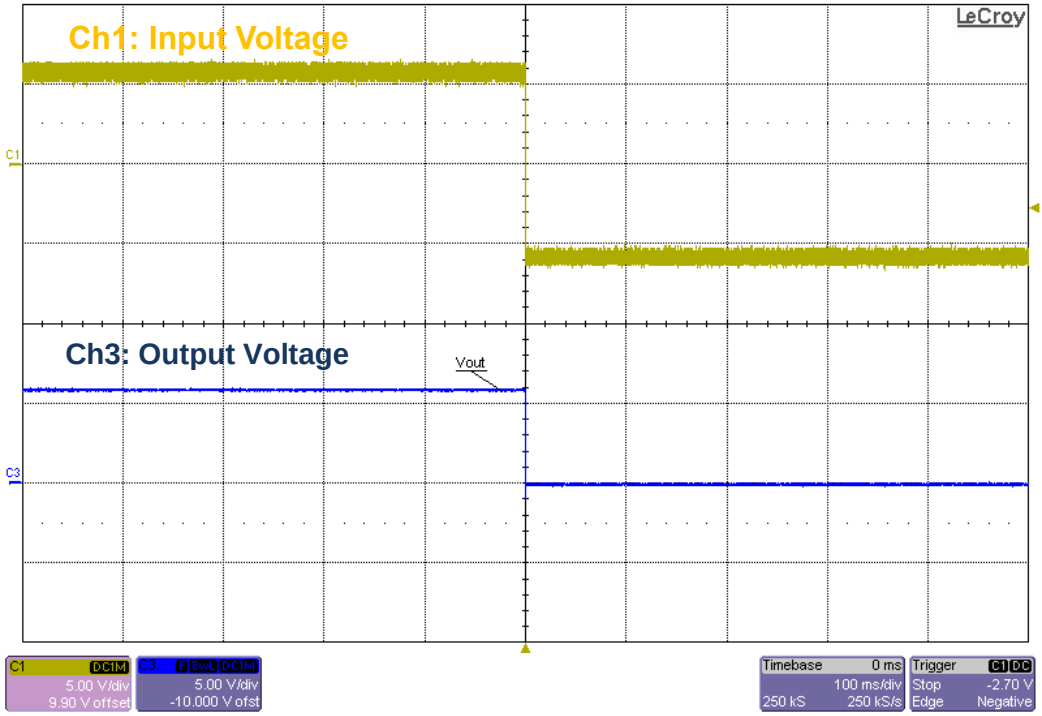


Reverse Polarity Protection Response: Voltage pulse from 12V to -20V.

Green- V_{in}

Red- V_{out}

7.2 Reverse Polarity Protection Waveform 2



Reverse Polarity Protection Response: Voltage pulse from 6V to -6V.

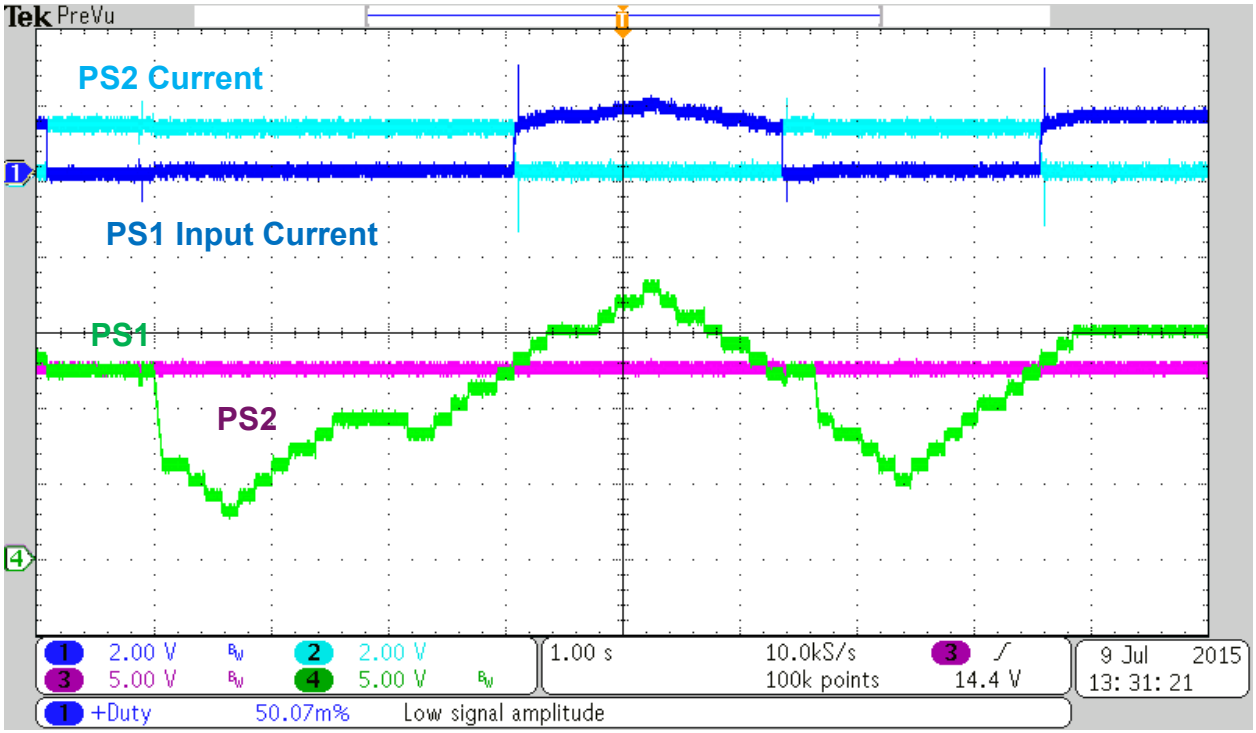
Green- V_{in}

Blue- V_{out}

8. OR-ing Solution with LM74610-Q1

8.1 Waveform 1

The following scope plot shows that changing the PS1 (Green) and PS2 (Pink) doesn't get affected. The output current is 1.5A for the following test. As the PS1 voltage increases, the input Current through PS2(light blue) immediately becomes zero after a negative current spike.



Power Supply OR-ing with PMP10748

Green- Supply 1

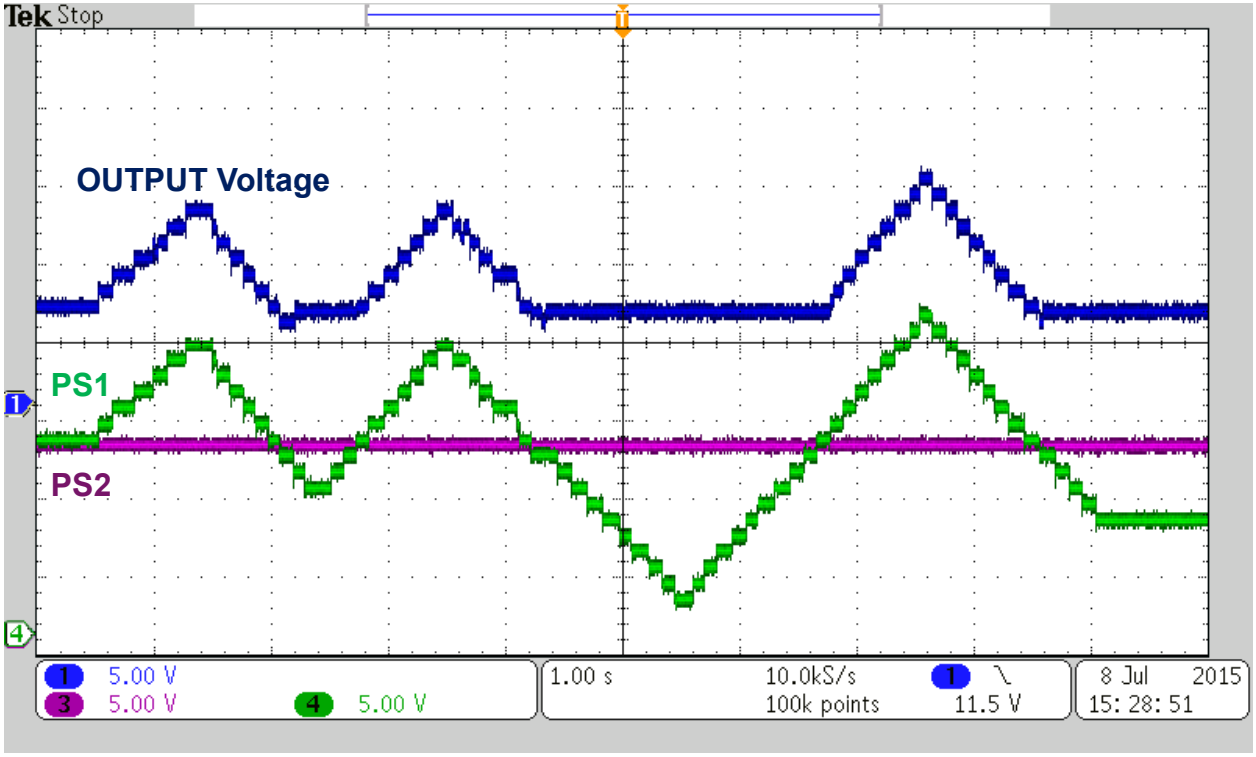
Pink- Supply 2

Blue- PS1 Input Current

Teal- PS3 Input Current

8.1 Waveform 2

The following scope plot shows that voltage interruption at PS1 (Green) and PS2 (Pink) doesn't get affected. The output Voltage (Blue) follows the higher supply voltage similar to the diode ORing device. The output current is 1.5A for the following test.



Green- Supply 1

Pink- Supply 2

Blue- Output Voltage

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