PMP15007 Test Results

Test Data

PMP15007

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Circuit Description

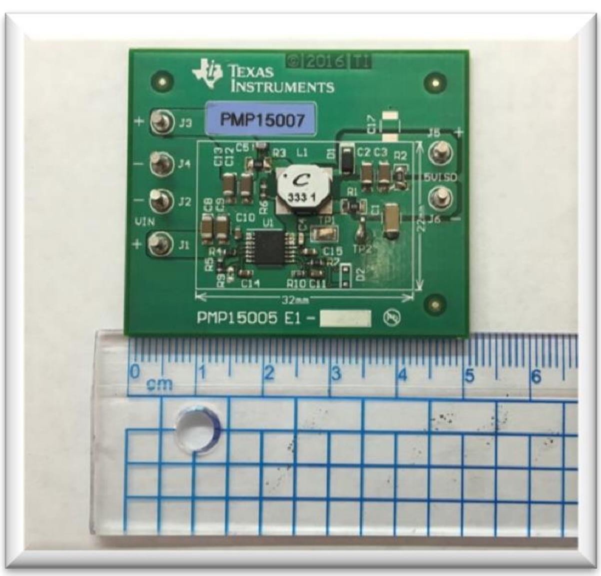
PMP15007 uses the LM5161- Q1 in a Fly-Buck topology with the primary and secondary output both set to 5V nominal. The circuit accommodates a voltage input range from 36V to 72V, ideal for the 48-V nominal input rail. While the primary side is set at 5.32V nominally, using the feedback resistors, the secondary isolated side sees 5V, based on Coilcraft's LPD8035V series coupled inductor set at a turns-ratio of 1:1. The maximum operating current on both the primary and secondary rails are set at 225mA each. The switching frequency is set at 315 kHz nominal.

The design was built on PMP15005 with a dimension of 50 x 44 mm. Two layer PCB was used for the design, 1 oz. copper on top and bottom layer.

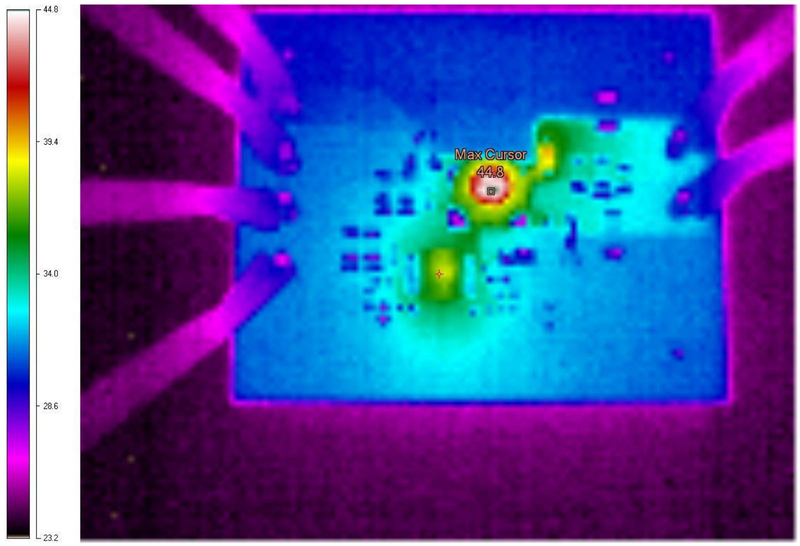
Power Specification

VIN Min.	**36-V**
VIN Max.	**72-V**
$V_{OUT,PRI}$	**5-V (±1%)**
$V_{OUT,SEC}$	**5-V (±10%)**
$I_{OUT,PRI}$	**0-A-0.225-A**
$I_{OUT,SEC}$	**0-A-0.225-A**
Approximate Switching Frequency	**≈315 KHz**

Board Photo

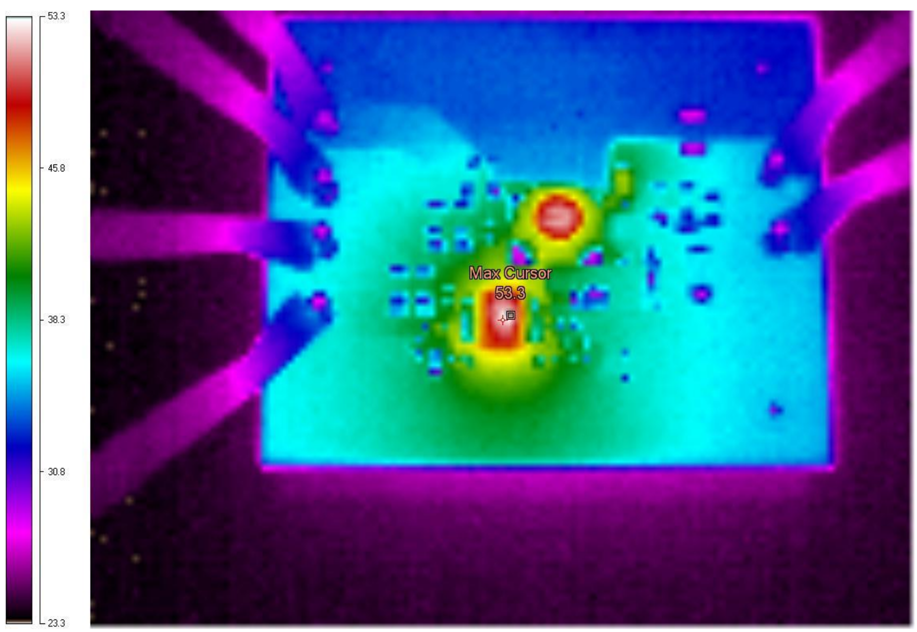


Thermal Image of the EVM at 36VIN &I_{PRI}=I_{SEC}=0.225A



The ‘Max Cursor’ in the picture above represents the surface of the coupled inductor and the (+) represents the IC. As seen in the picture the coupled inductor is the hottest part on the board during the operation.

Thermal Image of the EVM at 72VIN &I_{PRI}=I_{SEC}=0.225A



The ‘Max Cursor’ in the picture above represents the surface of the coupled inductor and the (+) represents the IC. As seen in the picture the IC gets hotter on the board during this operation.

Efficiency Data

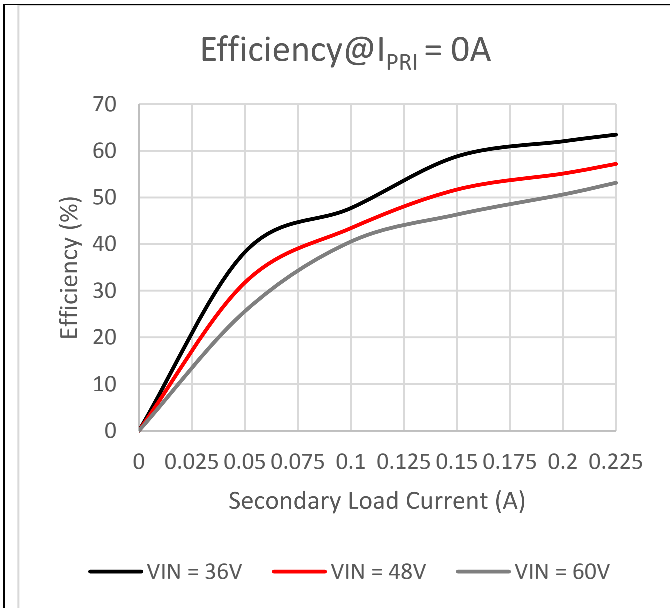


Figure 1. Efficiency with I_{PRI} set at 0A load and I_{SEC} increasing from 0A to 225mA

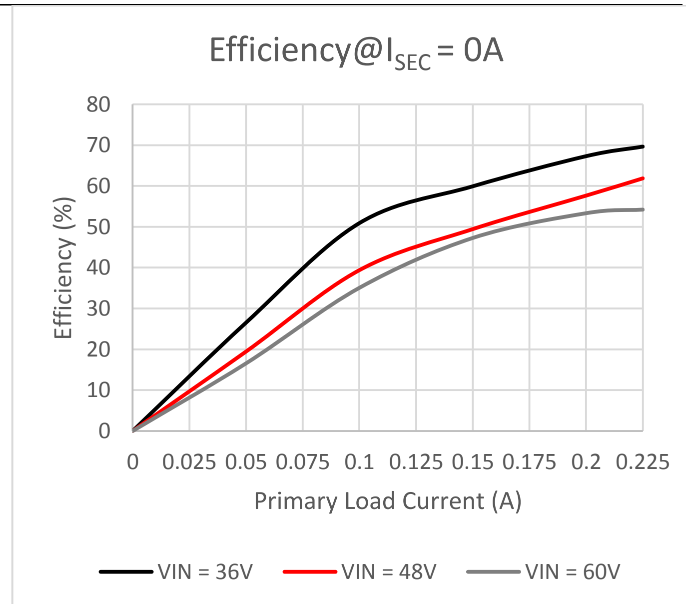


Figure 2. Efficiency with I_{SEC} set at 0A load and I_{PRI} increasing from 0A to 225mA

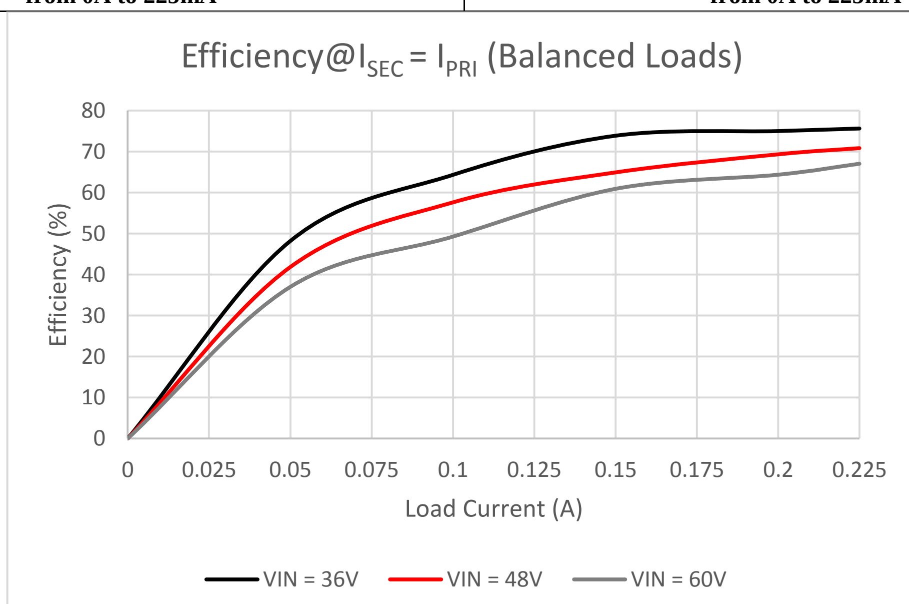


Figure 3. Efficiency with I_{PRI} = I_{SEC} = Load Current increased from 0A to 225mA on each rail

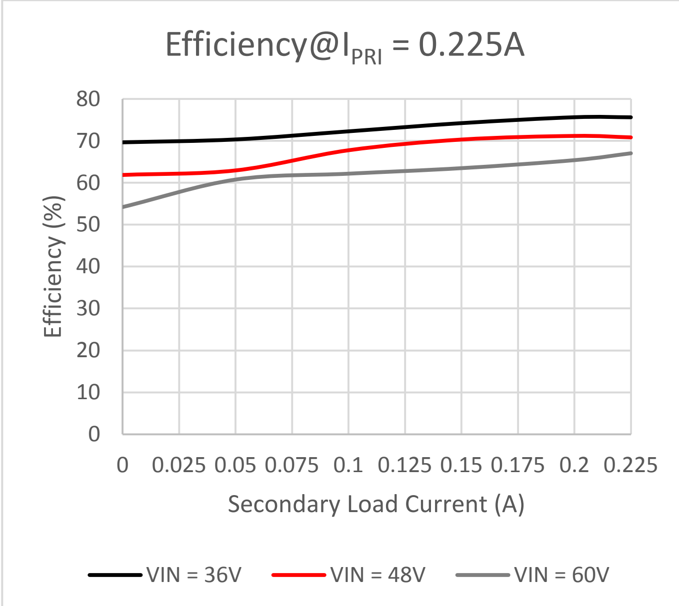


Figure 4. Efficiency with I_{PRI} set at 225mA load and I_{SEC} increasing from 0A to 225mA

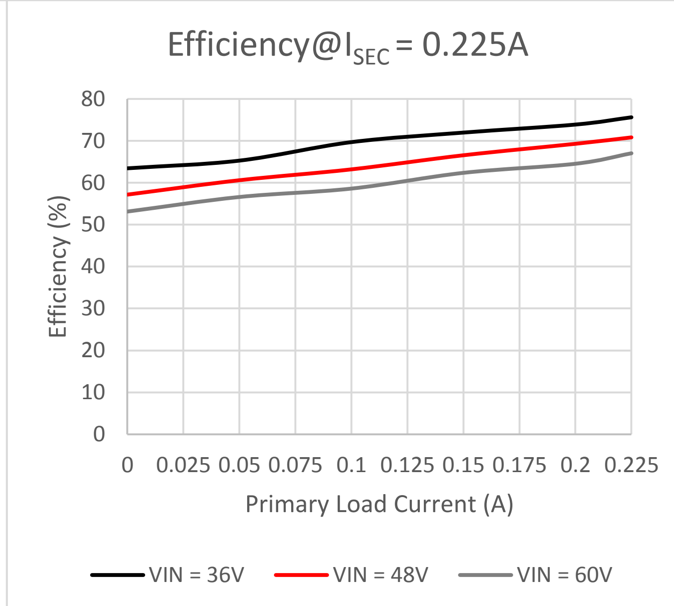


Figure 5. Efficiency with I_{SEC} set at 225mA load and I_{PRI} increasing from 0A to 225mA

Load Regulation Data

Dotted line plots (**- - - -**) show **V_{PRI}** and the solid line plots show **V_{SEC} (unless specified).**

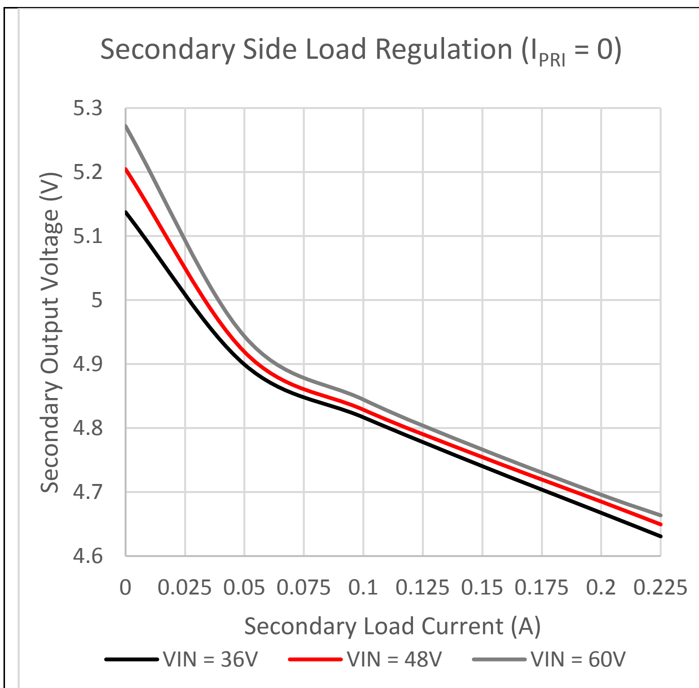


Figure 6. Load Regulation with I_{PRI} set at 0A and I_{SEC} increasing from 0A to 225mA

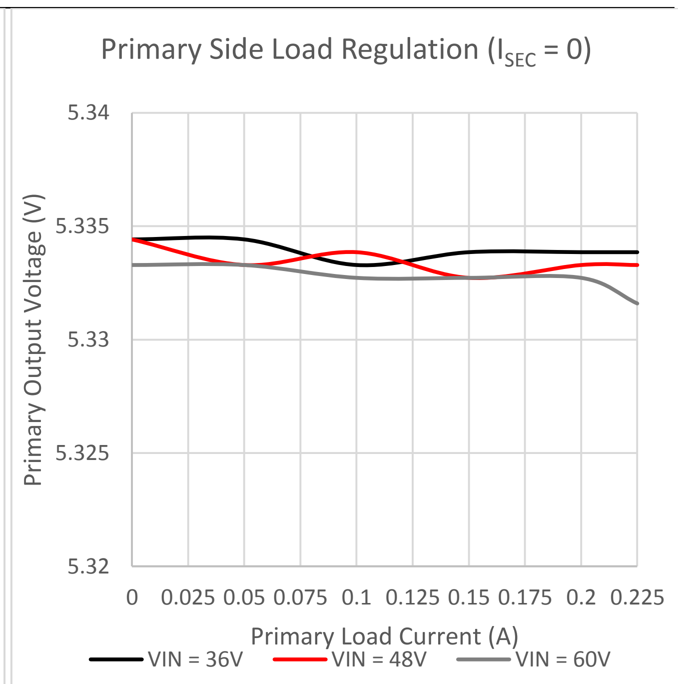


Figure 7. Load Regulation with I_{SEC} set at 0A and I_{PRI} increasing from 0A to 225mA

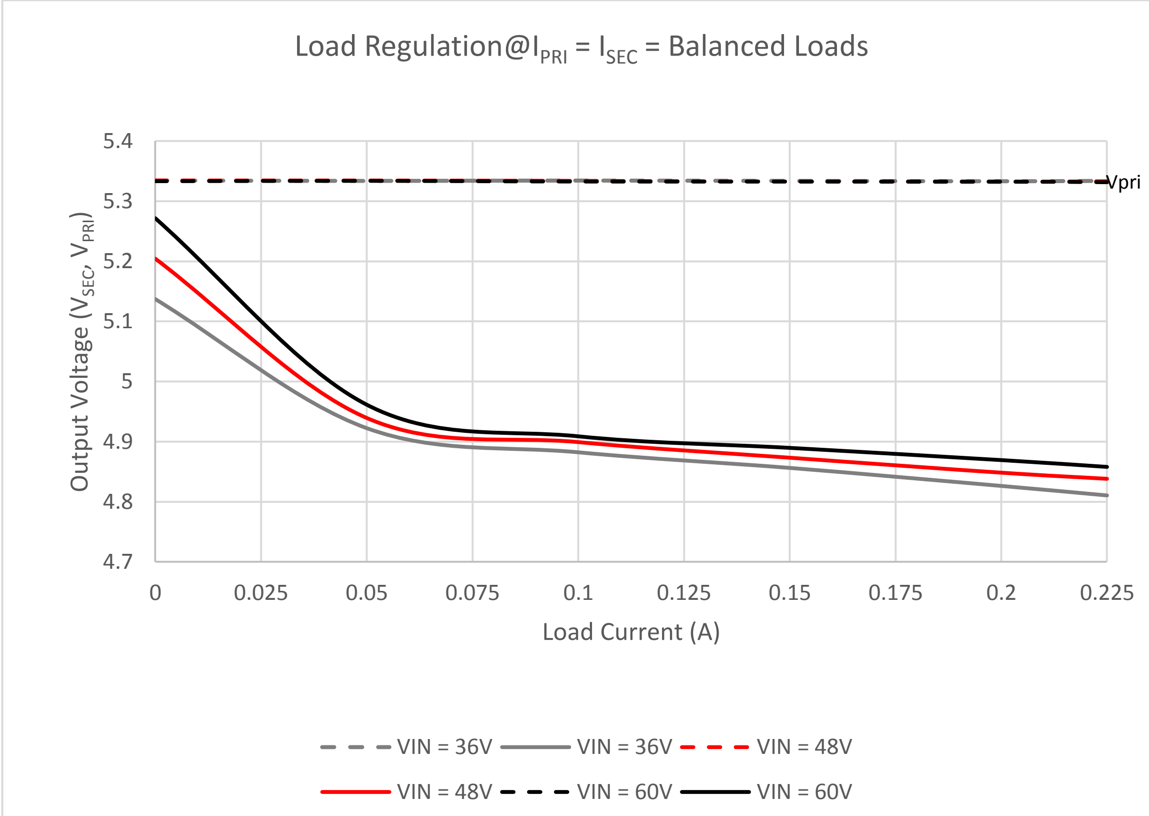


Figure 8. Load Regulation with I_{PRI} = I_{SEC} = Load Current increased from 0A to 225mA on each rail

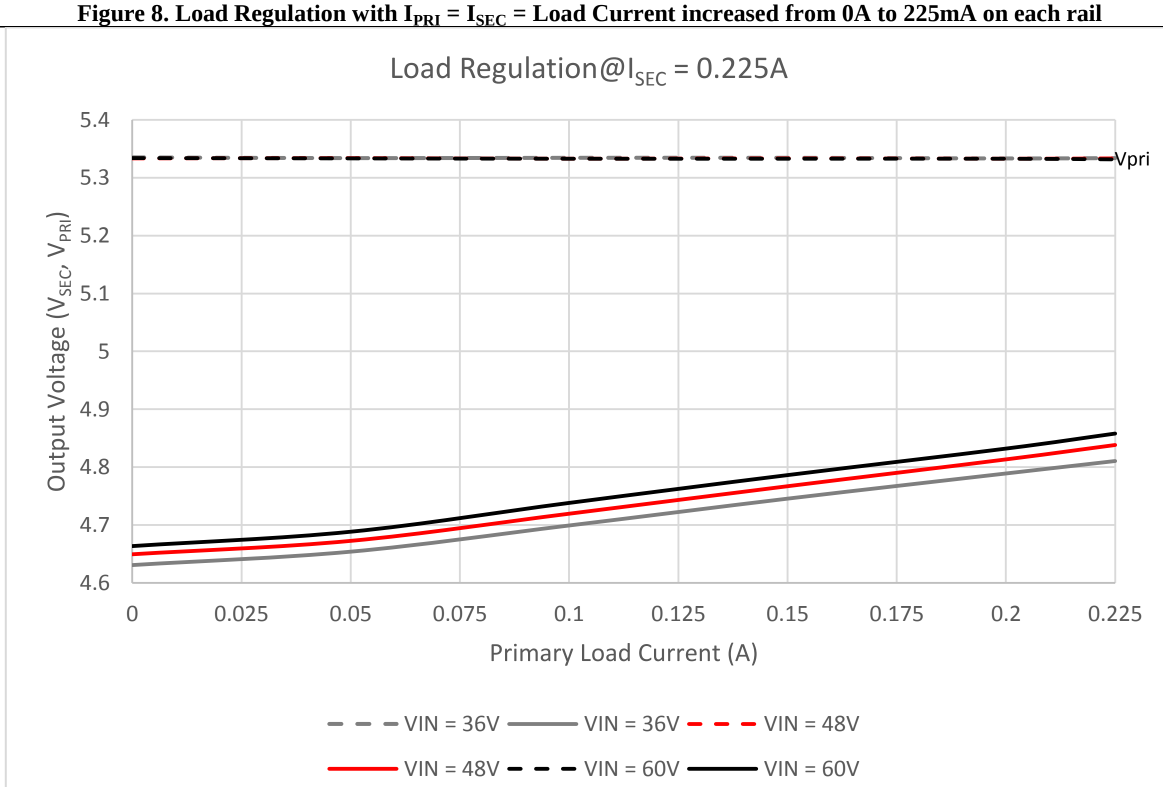


Figure 9. Load Regulation with I_{SEC} set at 225mA load and I_{PRI} increasing from 0A to 225mA

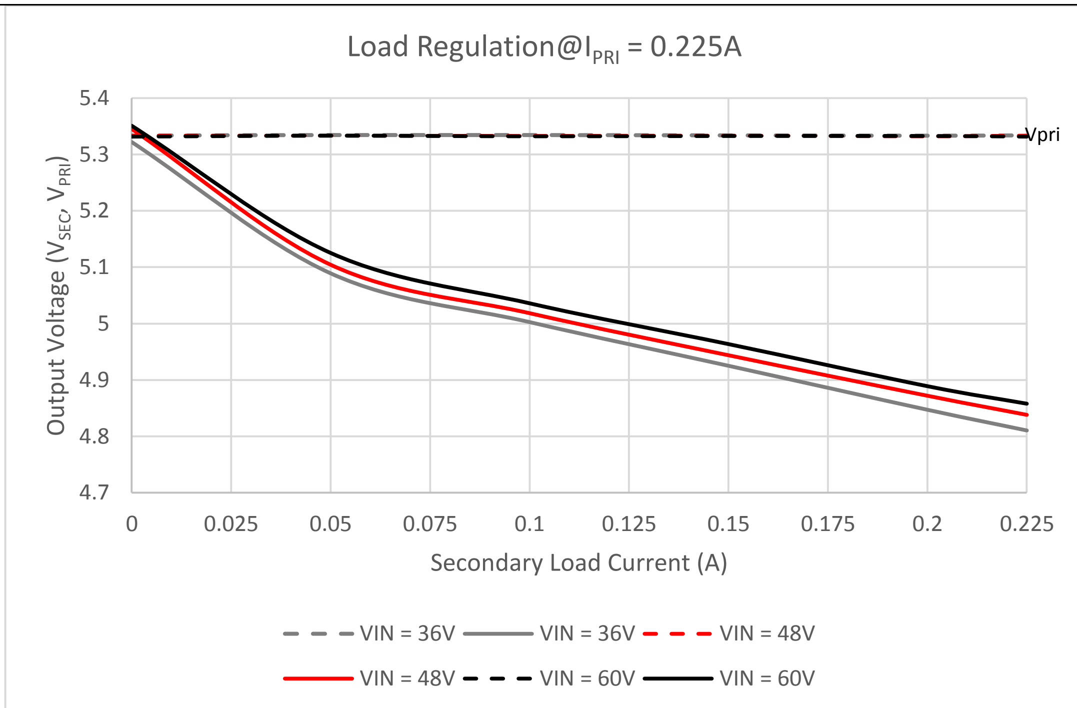
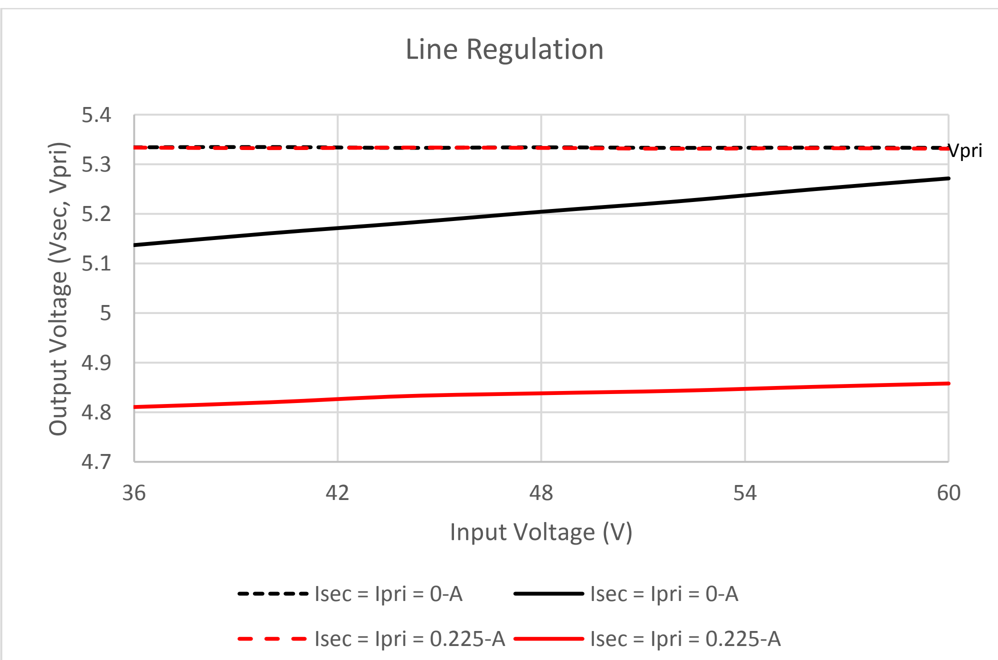
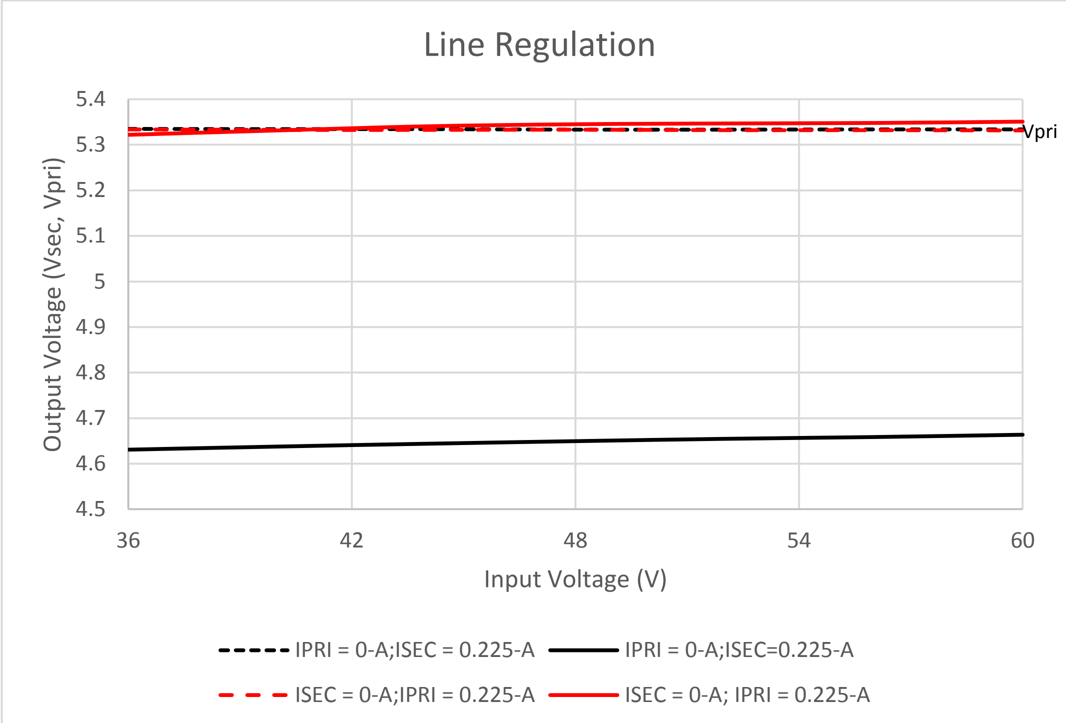


Figure 10. Load Regulation with I_{PRI} set at 225mA load and I_{SEC} increasing from 0A to 225mA

Line Regulation Data

Dotted line plots (- - - -) = **V_{PRI}** and the solid line plots = **V_{SEC} (unless specified).**





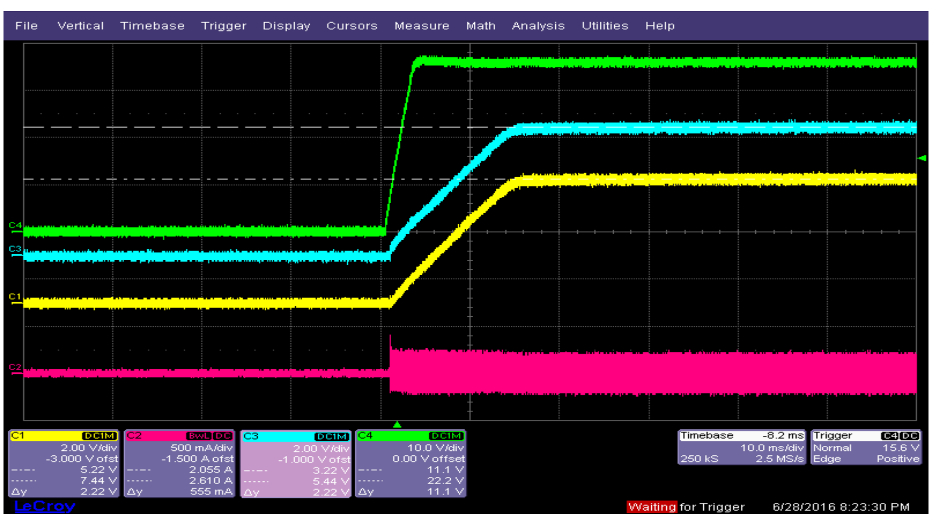
Start Up

Test condition: VIN = 36 V, both outputs set at No load (0mA on Primary and Secondary).
C1 (Yellow) – V_{SEC} (5.3 V)

C2 (Pink) – I_{PRI} – Current through primary side of coupled inductor.

C3 (Blue) –V_{PRI} (5.4 V)

C4 (Green) –V_{IN}

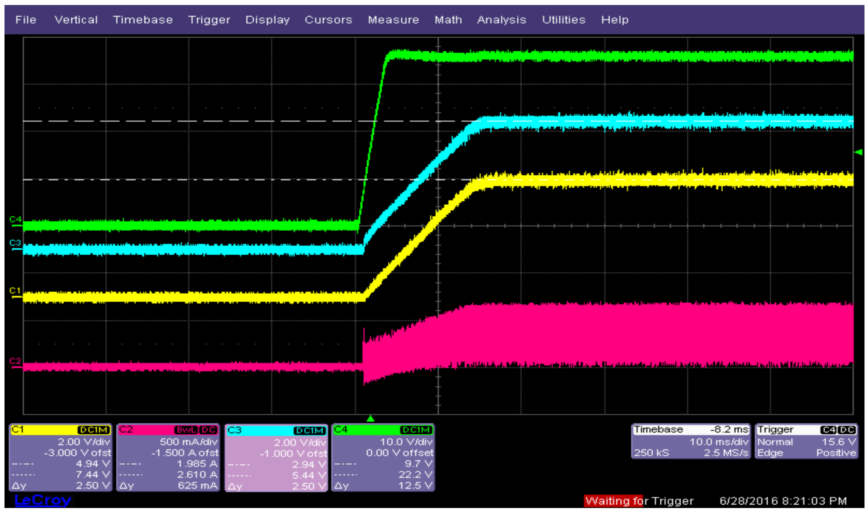


Test condition: VIN = 36V, both primary and secondary set at full load (225mA).
C1 (Yellow) – V_{SEC} (5 V)

C2 (Pink) – I_{PRI} – Current through primary side of coupled inductor.

C3 (Blue) –V_{PRI} (5.4 V)

C4 (Green) –V_{IN}

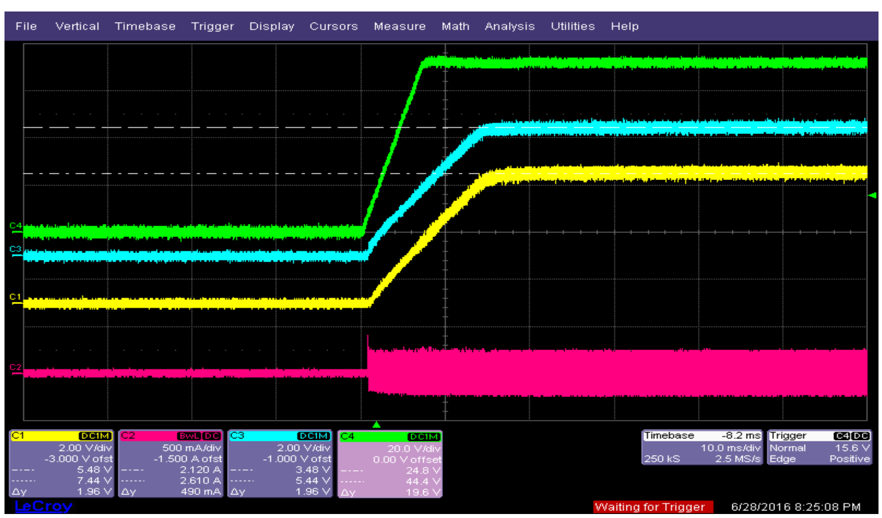


Test condition: VIN = 72V, both outputs set at No load (0mA on Primary and Secondary).
C1 (Yellow) – V_{SEC} (5.3 V)

C2 (Pink) – I_{PRI} – Current through primary side of coupled inductor.

C3 (Blue) –V_{PRI} (5.4 V)

C4 (Green) –V_{IN}



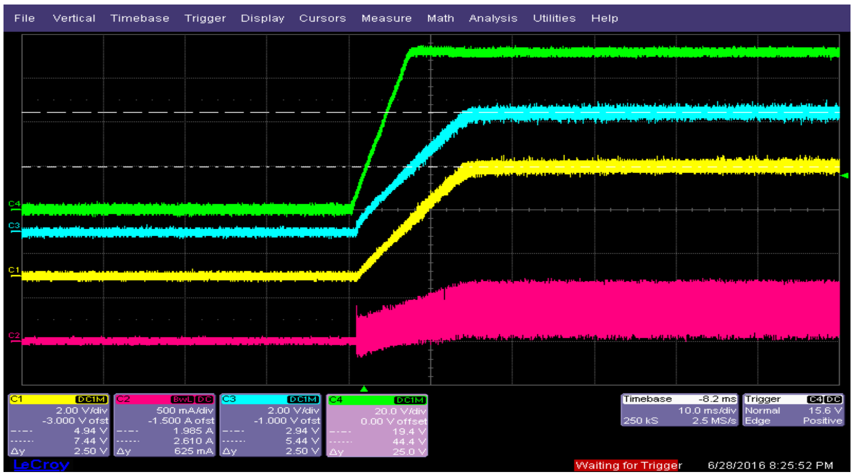
Test condition: VIN = 72V, both primary and secondary fully loaded.

C1 (Yellow) – V_{SEC} (5 V)

C2 (Pink) – I_{PRI} – Current through primary side of coupled inductor.

C3 (Blue) –V_{PRI} (5.4 V)

C4 (Green) –V_{IN}



Load Transients

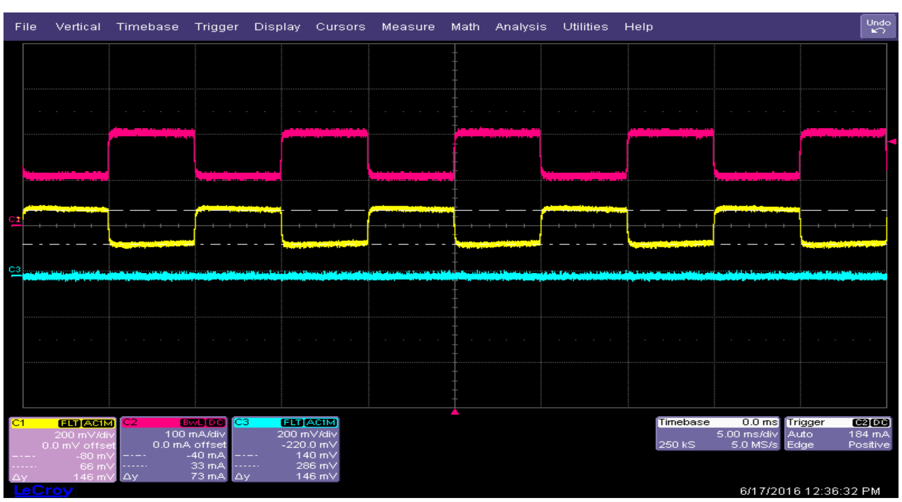
Load Step on Secondary Side

Test condition: VIN = 48V with I_{PRI} set to 0A

CH1 (Yellow) – V_{SEC} (AC coupled); ΔV_{SEC} = 146mV peak to peak

CH2 (Pink) - I_{SEC} = load step from 100mA to 200mA with slew rate set to 500mA/us

CH3 (Blue) - V_{PRI} (AC coupled); ΔV_{PRI} < 10mV peak to peak



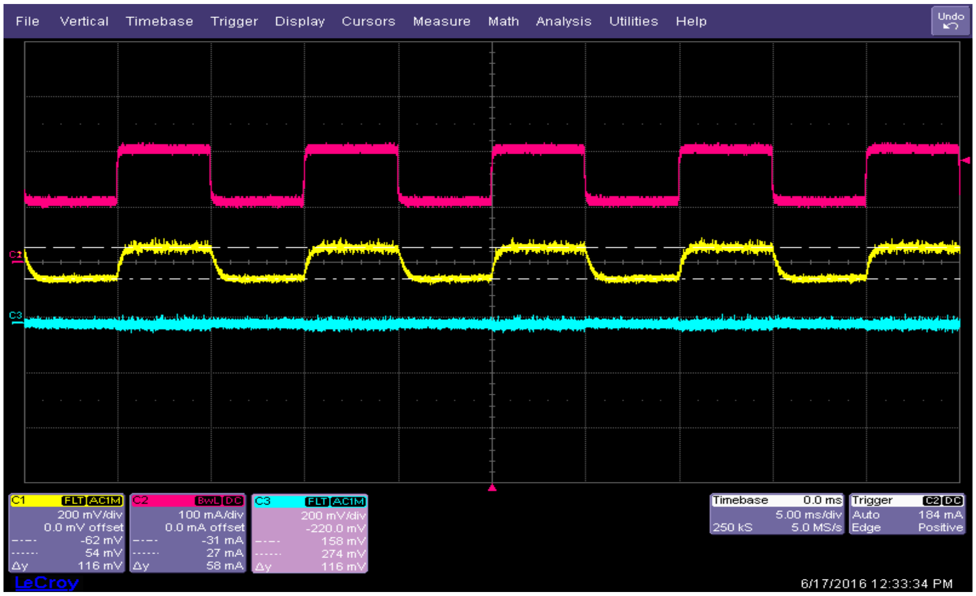
Load Step on Primary Side

Test condition: VIN = 48V with I_{SEC} set to 0A

CH1 (Yellow) – V_{SEC} (AC coupled) ΔV_{SEC} = 116mV peak to peak

CH2 (Pink) - I_{PRI} = load step from 100mA to 200mA with slew rate set to 500mA/us

CH3 (Blue) - V_{PRI} (AC coupled); ΔV_{PRI} <50mV peak to peak



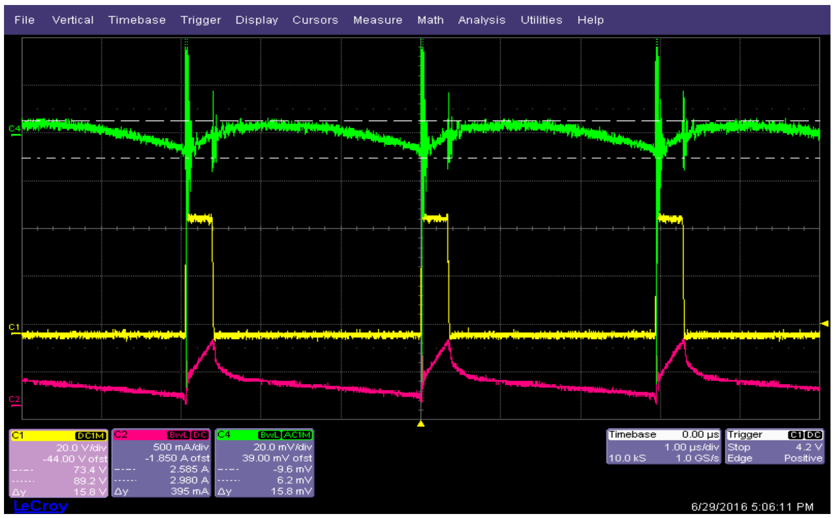
SW Node Waveforms and Output Voltage Ripple and Current Waveforms

Test condition: VIN = 48V, both primary and secondary have 225mA load.

C1 (Yellow) - Switch node

C2 (Pink) – I_{PRI} = Current through primary side of coupled inductor.

C4 (Green) – V_{PRI} (AC coupled), ΔV_{PRI} = 20mV

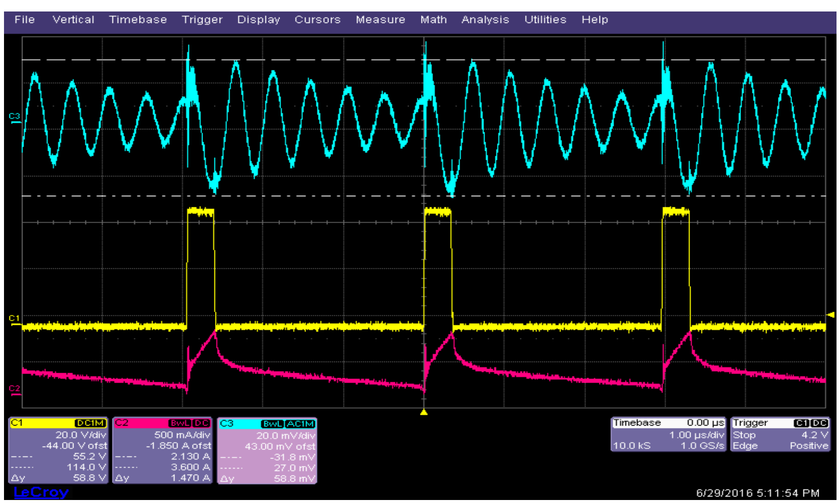


Test condition: VIN = 48V, both primary and secondary have 225mA load.

C1 (Yellow) - Switch node

C2 (Pink) – I_{PRI} = Current through primary side of coupled inductor.

C3 (Blue) – V_{SEC} (AC coupled), ΔV_{SEC} = 60mV



Short Circuit Test

A short circuit on either output may result in failure to the LM5161-Q1. The saturation current rating of the coupled inductor used is lower than the typical current limit of the IC. Should a short circuit occur, this will result in saturation of the coupled inductor. For applications that require short circuit protection, it is strongly recommended that a coupled inductor with higher saturating currents above 1.6A, be used.

IMPORTANT NOTICE AND DISCLAIMER

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