

**Test Data
For PMP12003
11/12/2015**



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1. Design Specifications

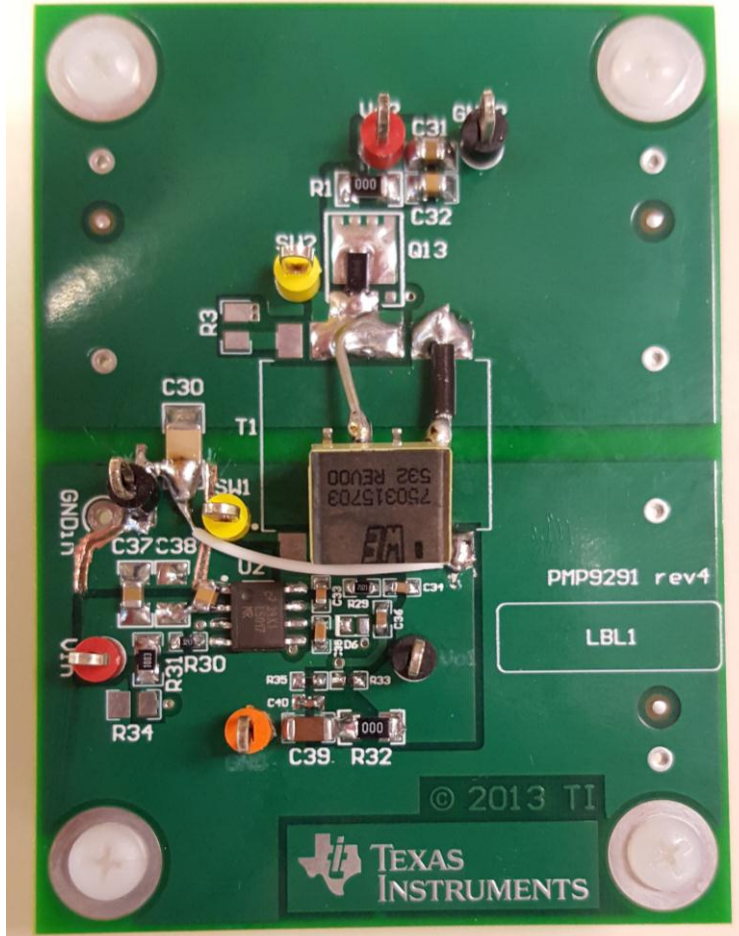
| | |
|------------------------------------|-----------------------|
| Vin Minimum | 9VDC |
| Vin Maximum | 15VDC |
| Vout | 6.5VDC +/-0.5V |
| Iout | 100mA |
| Nominal Switching Frequency | ≈ 215KHz |

2. Circuit Description

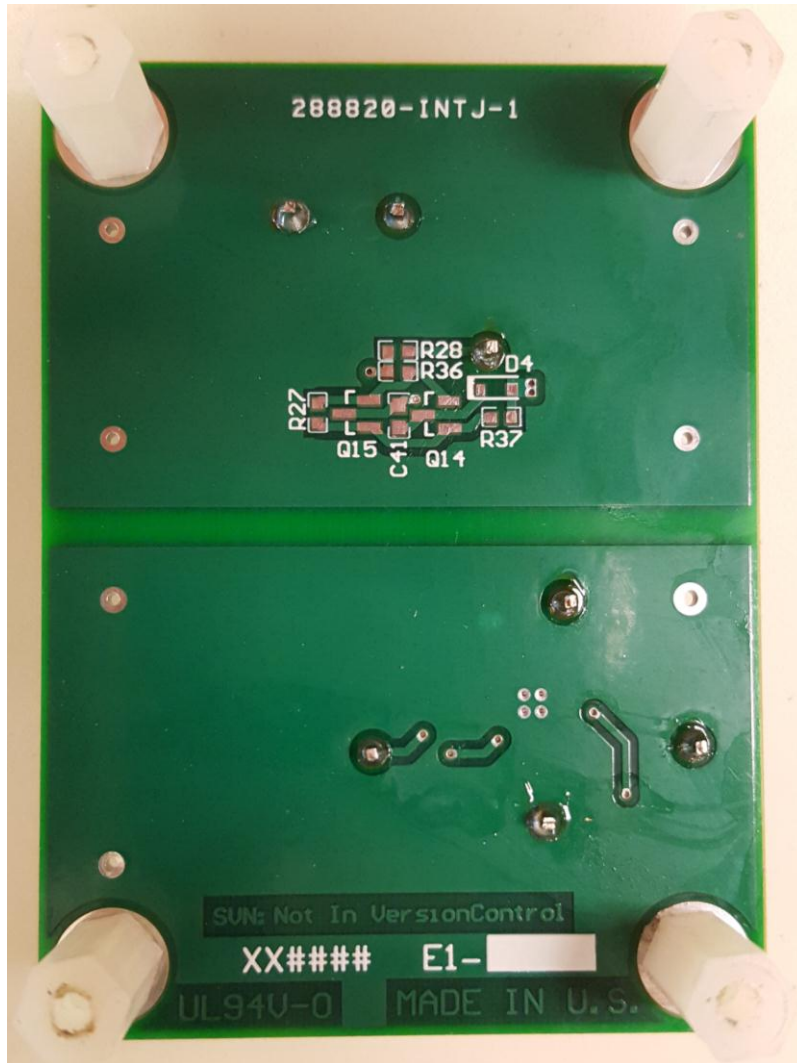
PMP12003 is an Isolated Fly-Buck-Boost Converter with the primary side configured as an inverting buck-boost, using the LM5017 synchronous buck regulator IC. The design accepts an input voltage of 9Vin to 15Vin and provides an isolated output of 6.5Vout (+/-0.5V), capable of supplying 100mA of continuous current to the load. The nominal switching frequency of the design is 215KHz. This design is built on the PMP9291 Rev4 PCB, which is a 4-layer board with 1 oz. copper for the top and bottom layers and 0.5 oz. copper for the two inner layers.

3. PMP12003 Board Photos

Board Dimensions: 2" x 2.7"

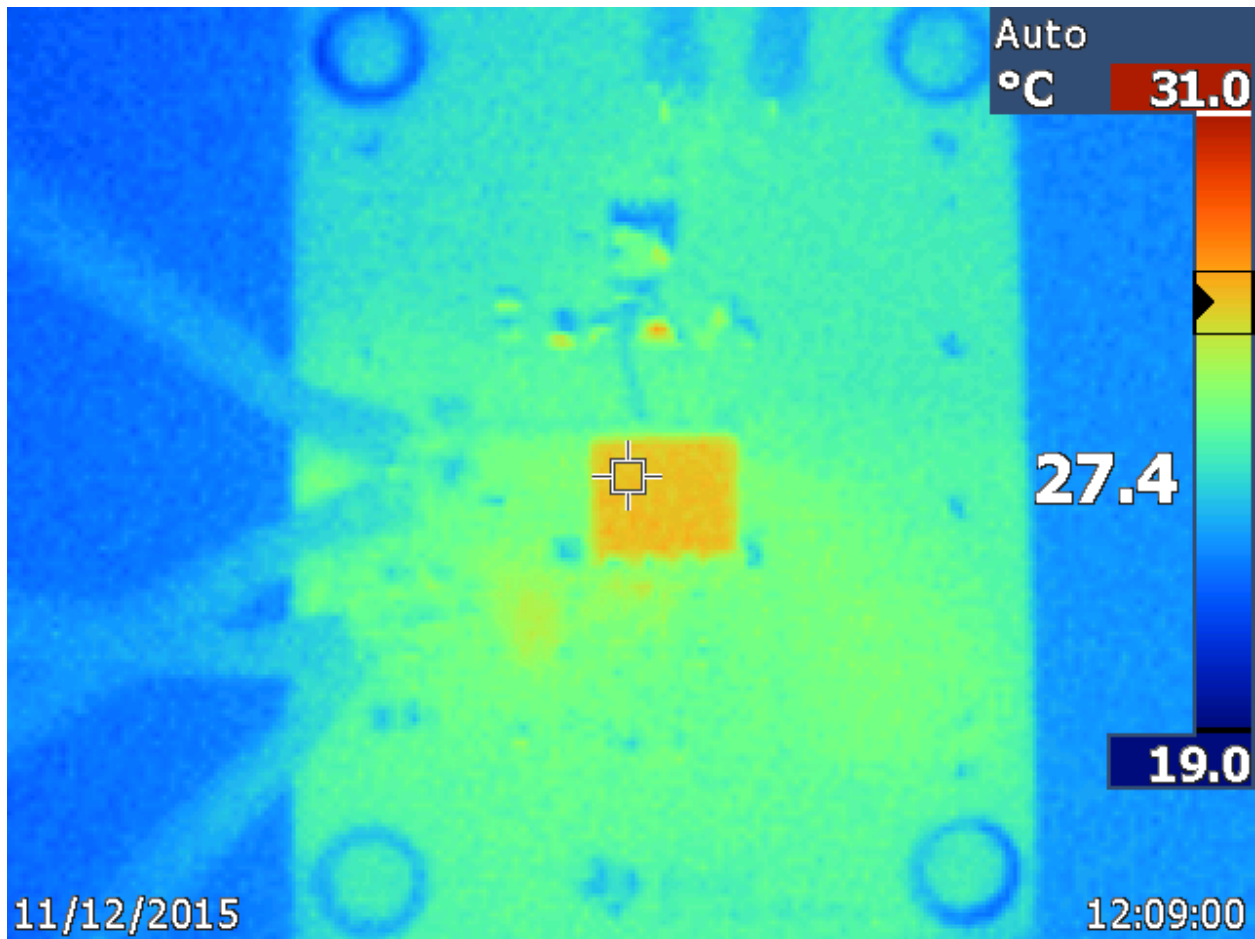


Board Photo (Top)



Board Photo (Bottom)

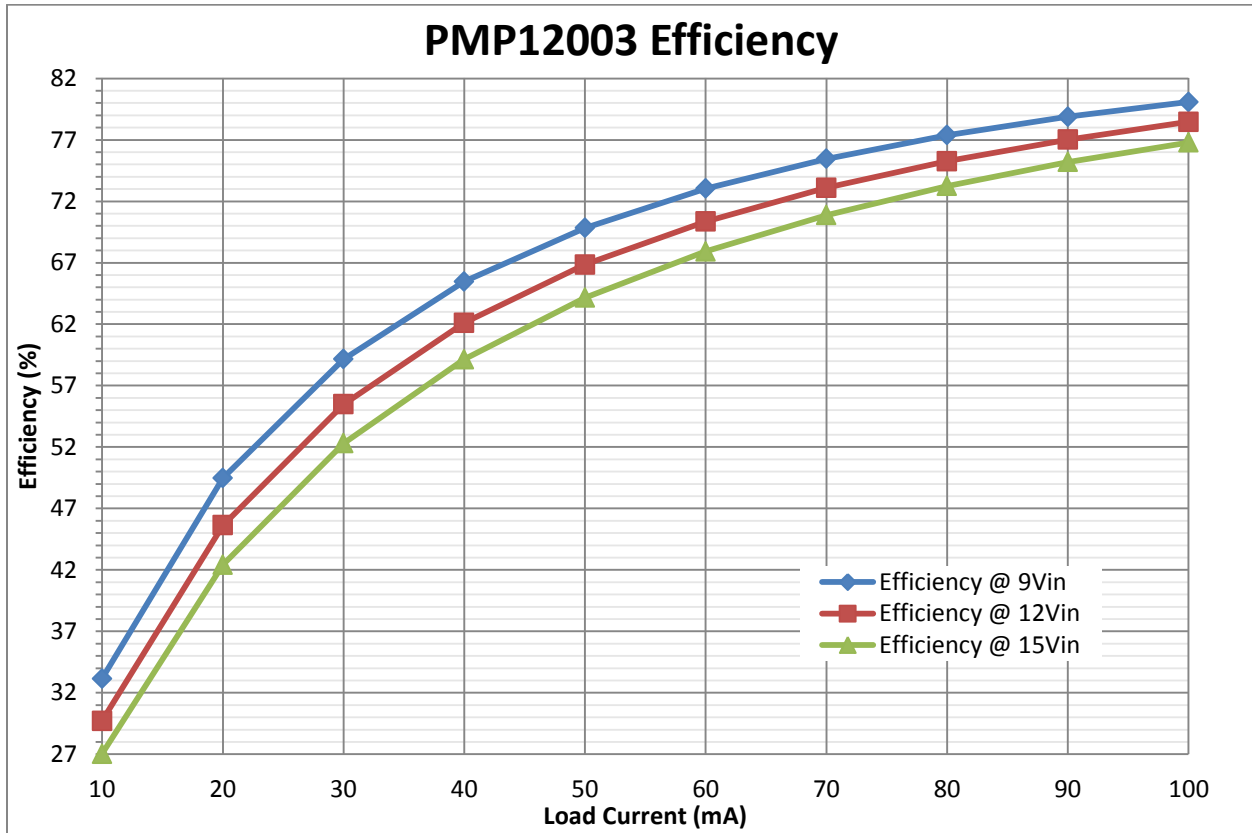
4. Thermal Data



IR Thermal Image Taken at Steady State at 15V_{in} and 100mA Load (V_{out} Primary is not loaded)

5. Efficiency

5.1 Efficiency Chart



5.2 Efficiency Data

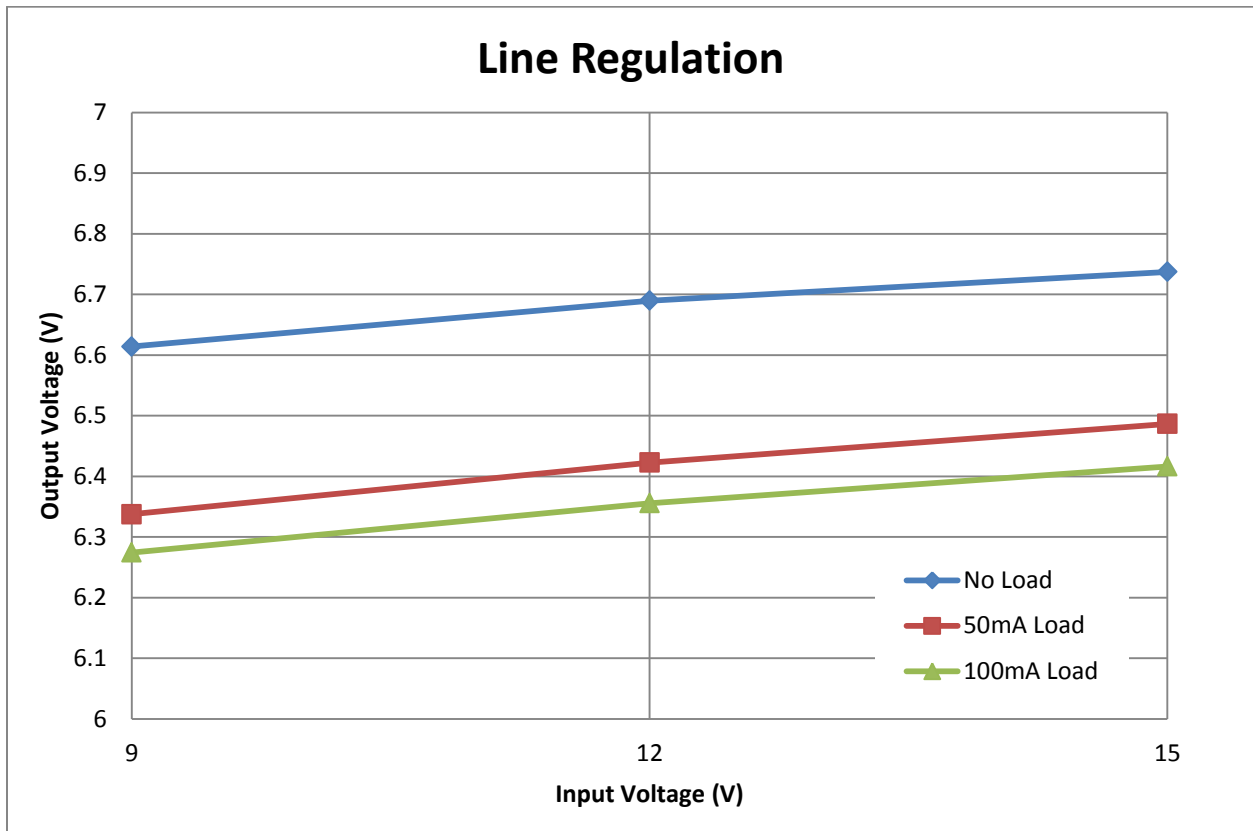
| Vin (V) | Iin (mA) | Vout (V) | Iout (mA) | Pin (mW) | Pout (mW) | Ploss (mW) | Efficiency (%) |
|---------|----------|----------|-----------|----------|-----------|------------|----------------|
| 9 | 21.664 | 6.453 | 10 | 195.0 | 64.5 | 130.4 | 33.1 |
| 9 | 28.8 | 6.4068 | 20 | 259.2 | 128.1 | 131.1 | 49.4 |
| 9 | 35.96 | 6.3767 | 30 | 323.6 | 191.3 | 132.3 | 59.1 |
| 9 | 43.18 | 6.3556 | 40 | 388.6 | 254.2 | 134.4 | 65.4 |
| 9 | 50.45 | 6.3375 | 50 | 454.1 | 316.9 | 137.2 | 69.8 |
| 9 | 57.75 | 6.3223 | 60 | 519.8 | 379.3 | 140.4 | 73.0 |
| 9 | 65.068 | 6.3089 | 70 | 585.6 | 441.6 | 144.0 | 75.4 |
| 9 | 72.37 | 6.2965 | 80 | 651.3 | 503.7 | 147.6 | 77.3 |
| 9 | 79.72 | 6.285 | 90 | 717.5 | 565.7 | 151.8 | 78.8 |
| 9 | 87.105 | 6.2744 | 100 | 783.9 | 627.4 | 156.5 | 80.0 |

| Vin (V) | Iin (mA) | Vout (V) | Iout (mA) | Pin (mW) | Pout (mW) | Ploss (mW) | Efficiency (%) |
|---------|----------|----------|-----------|----------|-----------|------------|----------------|
| 12 | 18.375 | 6.542 | 10 | 220.5 | 65.4 | 155.1 | 29.7 |
| 12 | 23.75 | 6.4961 | 20 | 285.0 | 129.9 | 155.1 | 45.6 |
| 12 | 29.162 | 6.4656 | 30 | 349.9 | 194.0 | 156.0 | 55.4 |
| 12 | 34.6 | 6.442 | 40 | 415.2 | 257.7 | 157.5 | 62.1 |
| 12 | 40.058 | 6.4227 | 50 | 480.7 | 321.1 | 159.6 | 66.8 |
| 12 | 45.558 | 6.4062 | 60 | 546.7 | 384.4 | 162.3 | 70.3 |
| 12 | 51.04 | 6.392 | 70 | 612.5 | 447.4 | 165.0 | 73.1 |
| 12 | 56.54 | 6.3788 | 80 | 678.5 | 510.3 | 168.2 | 75.2 |
| 12 | 62.04 | 6.367 | 90 | 744.5 | 573.0 | 171.5 | 77.0 |
| 12 | 67.542 | 6.3556 | 100 | 810.5 | 635.6 | 174.9 | 78.4 |

| Vin (V) | Iin (mA) | Vout (V) | Iout (mA) | Pin (mW) | Pout (mW) | Ploss (mW) | Efficiency (%) |
|---------|----------|----------|-----------|----------|-----------|------------|----------------|
| 15 | 16.323 | 6.6065 | 10 | 244.8 | 66.1 | 178.8 | 27.0 |
| 15 | 20.648 | 6.5611 | 20 | 309.7 | 131.2 | 178.5 | 42.4 |
| 15 | 24.995 | 6.5303 | 30 | 374.9 | 195.9 | 179.0 | 52.3 |
| 15 | 29.36 | 6.5065 | 40 | 440.4 | 260.3 | 180.1 | 59.1 |
| 15 | 33.73 | 6.4864 | 50 | 506.0 | 324.3 | 181.6 | 64.1 |
| 15 | 38.126 | 6.4693 | 60 | 571.9 | 388.2 | 183.7 | 67.9 |
| 15 | 42.528 | 6.4544 | 70 | 637.9 | 451.8 | 186.1 | 70.8 |
| 15 | 46.932 | 6.4406 | 80 | 704.0 | 515.2 | 188.7 | 73.2 |
| 15 | 51.322 | 6.4278 | 90 | 769.8 | 578.5 | 191.3 | 75.1 |
| 15 | 55.739 | 6.4163 | 100 | 836.1 | 641.6 | 194.5 | 76.7 |

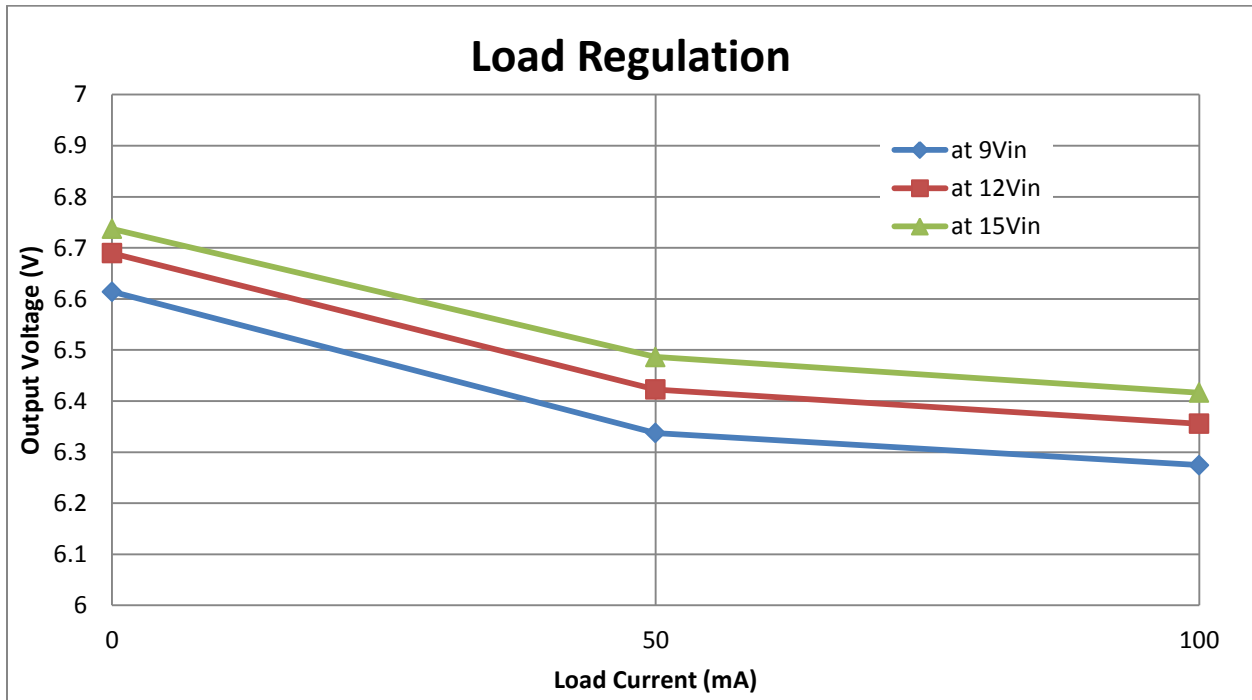
6 Output Voltage Regulation

6.1 Line Regulation



| Line Regulation Data | | | |
|----------------------|----------|-----------|------------|
| | No Load | 50mA Load | 100mA Load |
| Vin (V) | Vout (V) | Vout (V) | Vout (V) |
| 9 | 6.614 | 6.3375 | 6.2744 |
| 12 | 6.6896 | 6.4227 | 6.3556 |
| 15 | 6.7371 | 6.4864 | 6.4163 |

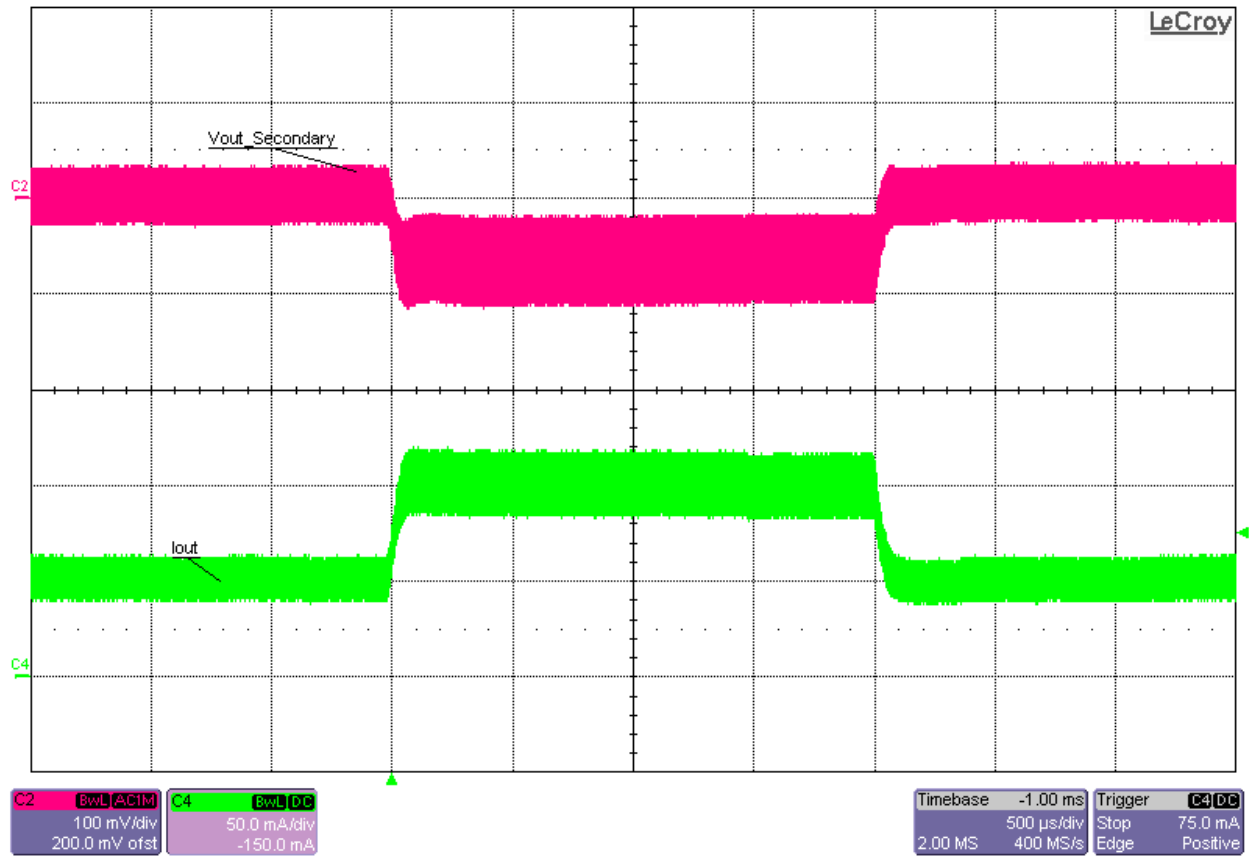
6.2 Load Regulation



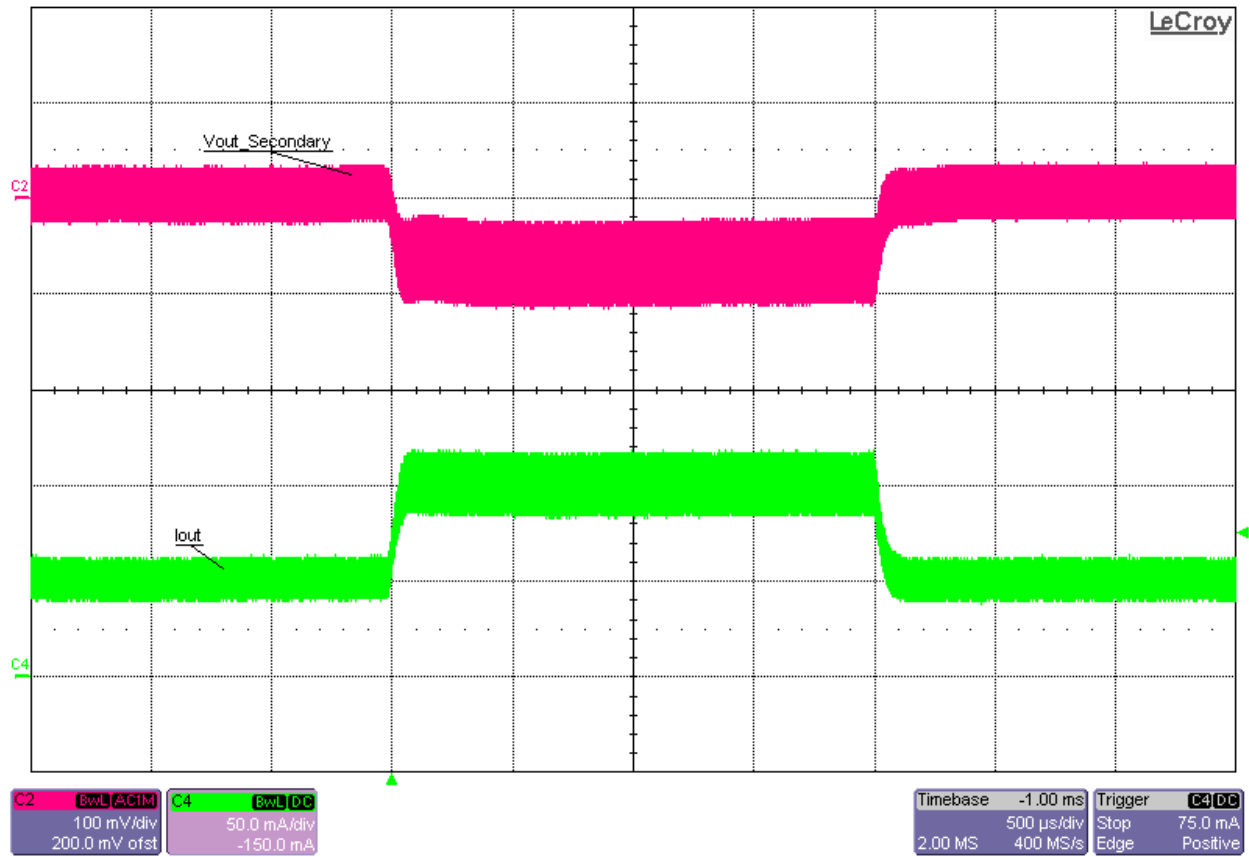
| Load Regulation Data | | | |
|----------------------|----------|----------|----------|
| | 9Vin | 12Vin | 15Vin |
| Load (mA) | Vout (V) | Vout (V) | Vout (V) |
| 0 | 6.614 | 6.6896 | 6.7371 |
| 50 | 6.3375 | 6.4227 | 6.4864 |
| 100 | 6.2744 | 6.3556 | 6.4163 |

7 Waveforms

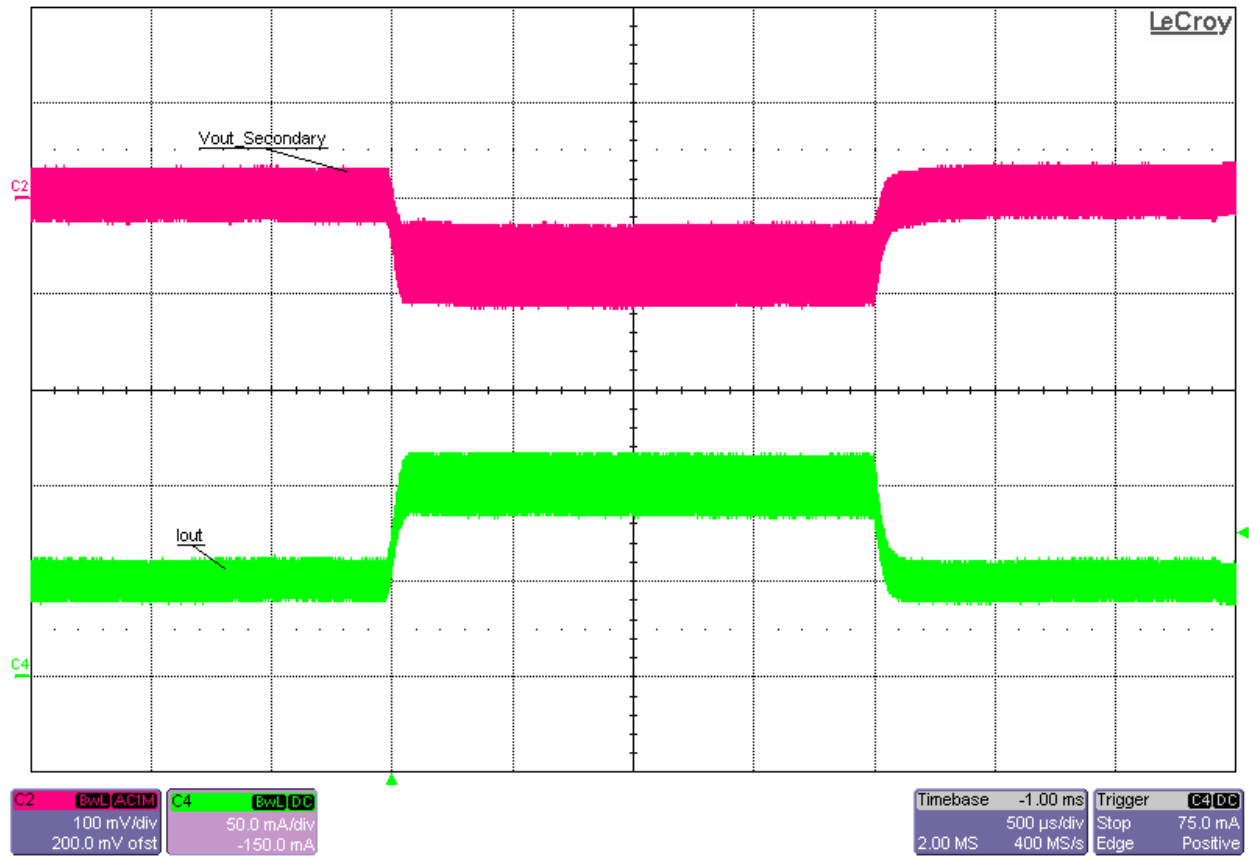
7.1 Load Transient Response



Load Transient Response of Secondary-Side Output Undergoing a 50% to 100% (50mA-to-100mA) Load Step at 9Vin

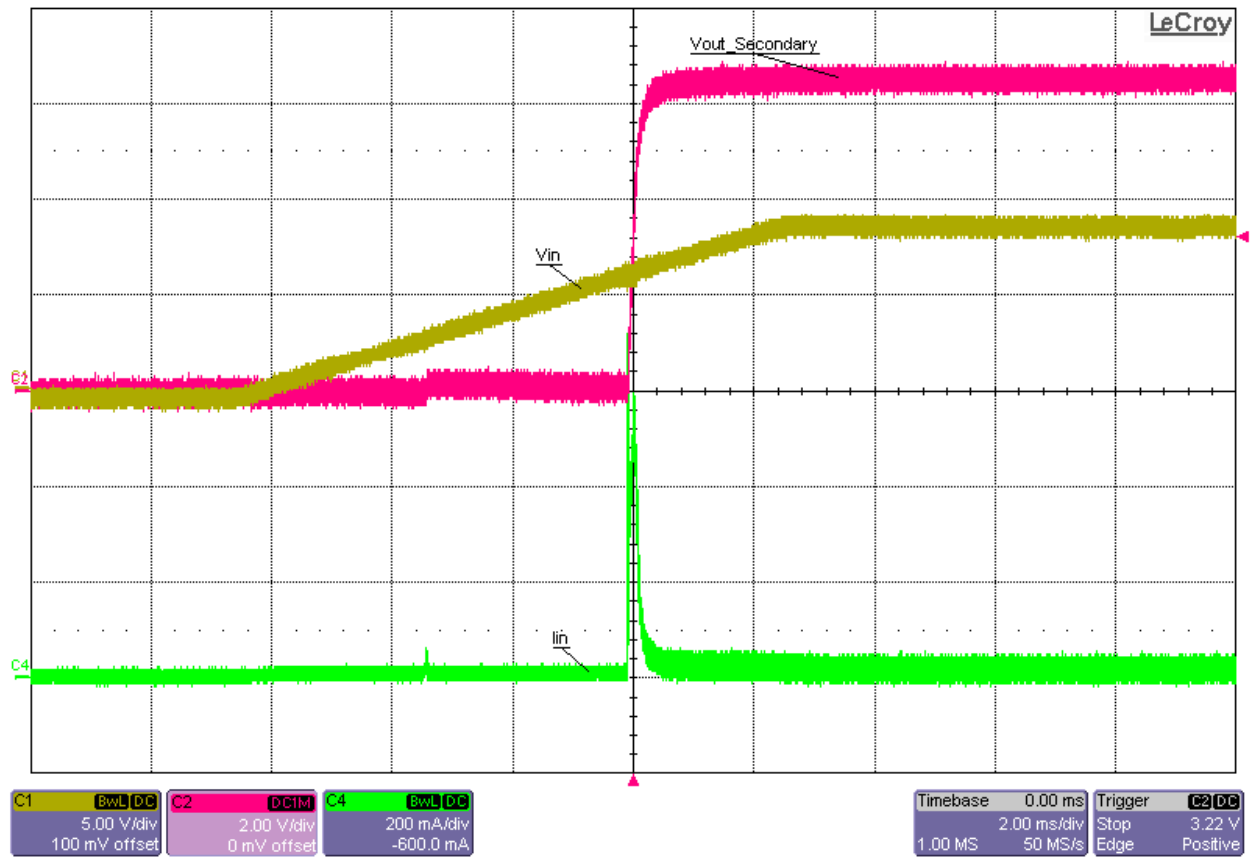


Load Transient Response of Secondary-Side Output Undergoing a 50% to 100% (50mA-to-100mA) Load Step at 12Vin

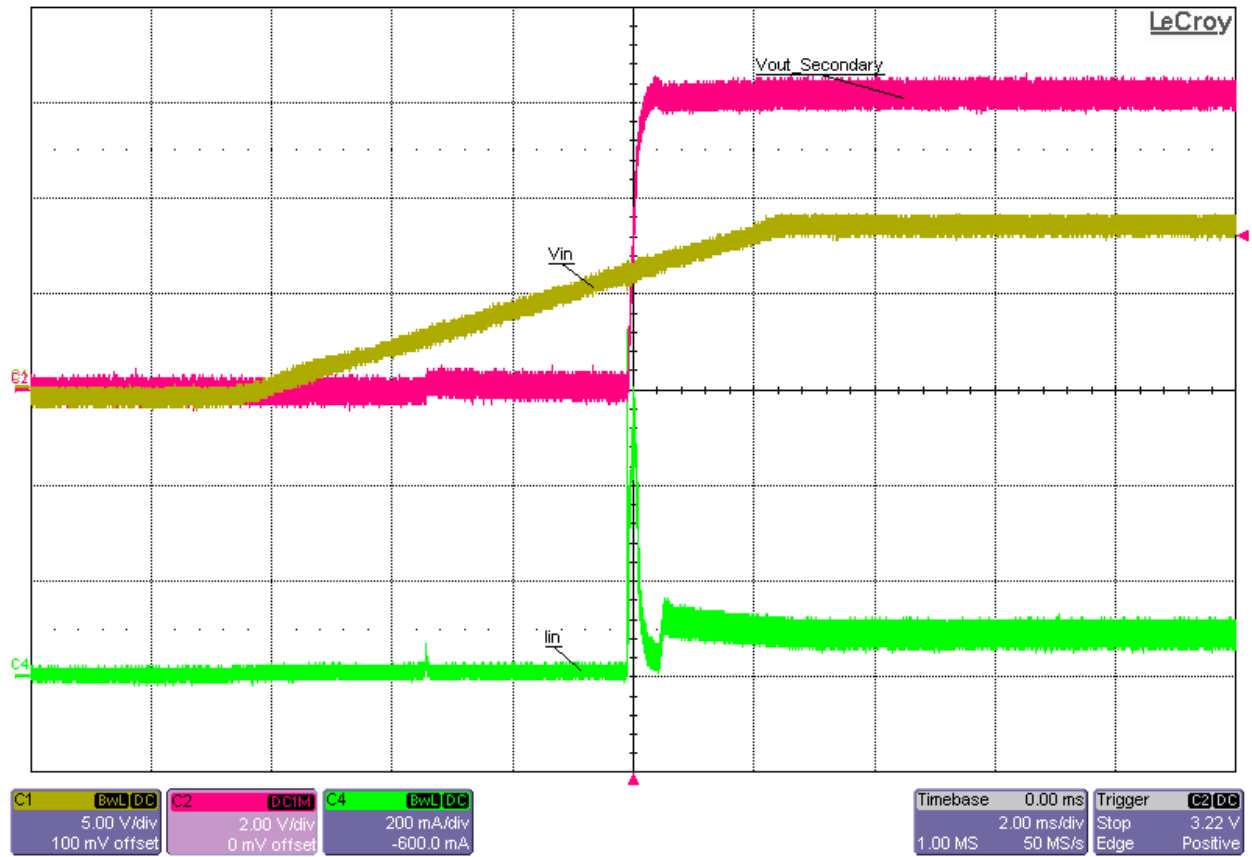


Load Transient Response of Secondary-Side Output Undergoing a 50% to 100% (50mA-to-100mA) Load Step at 15Vin

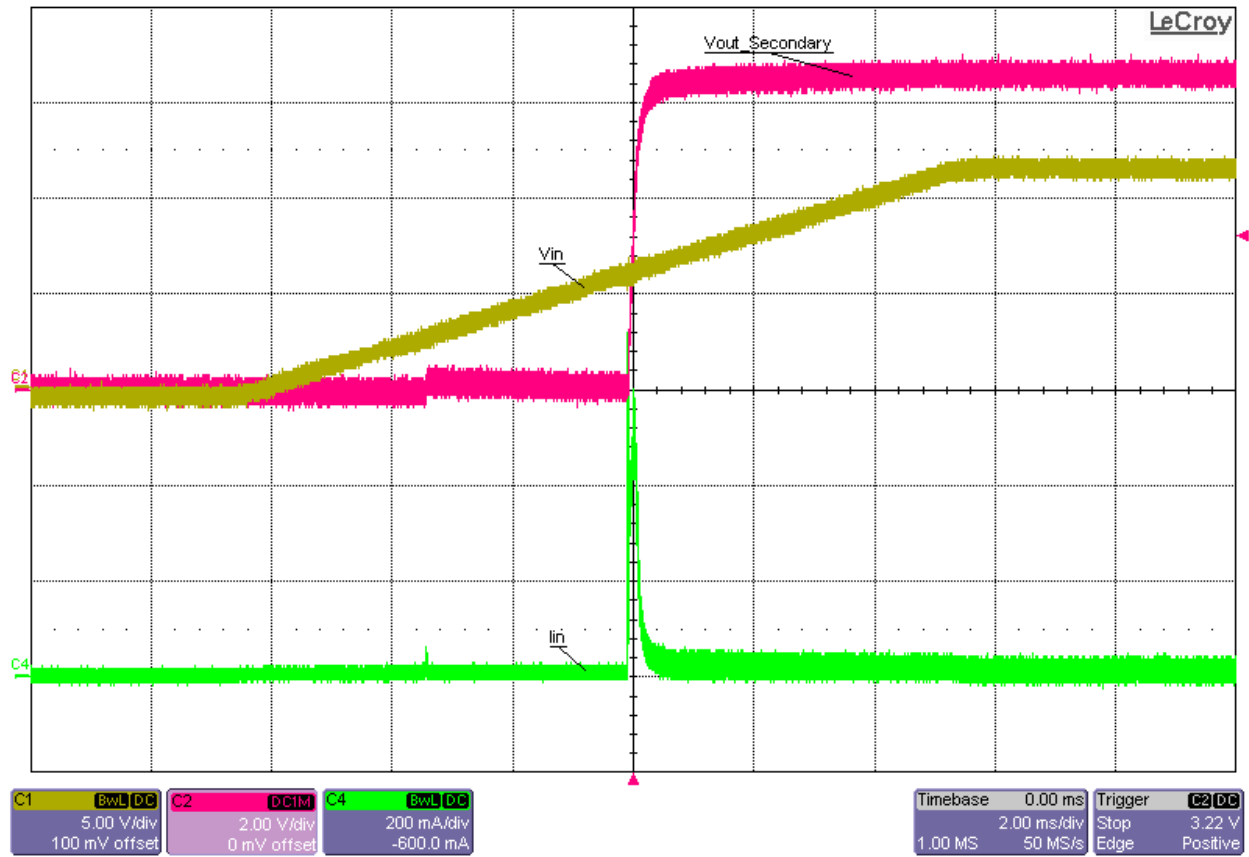
7.2 Startup



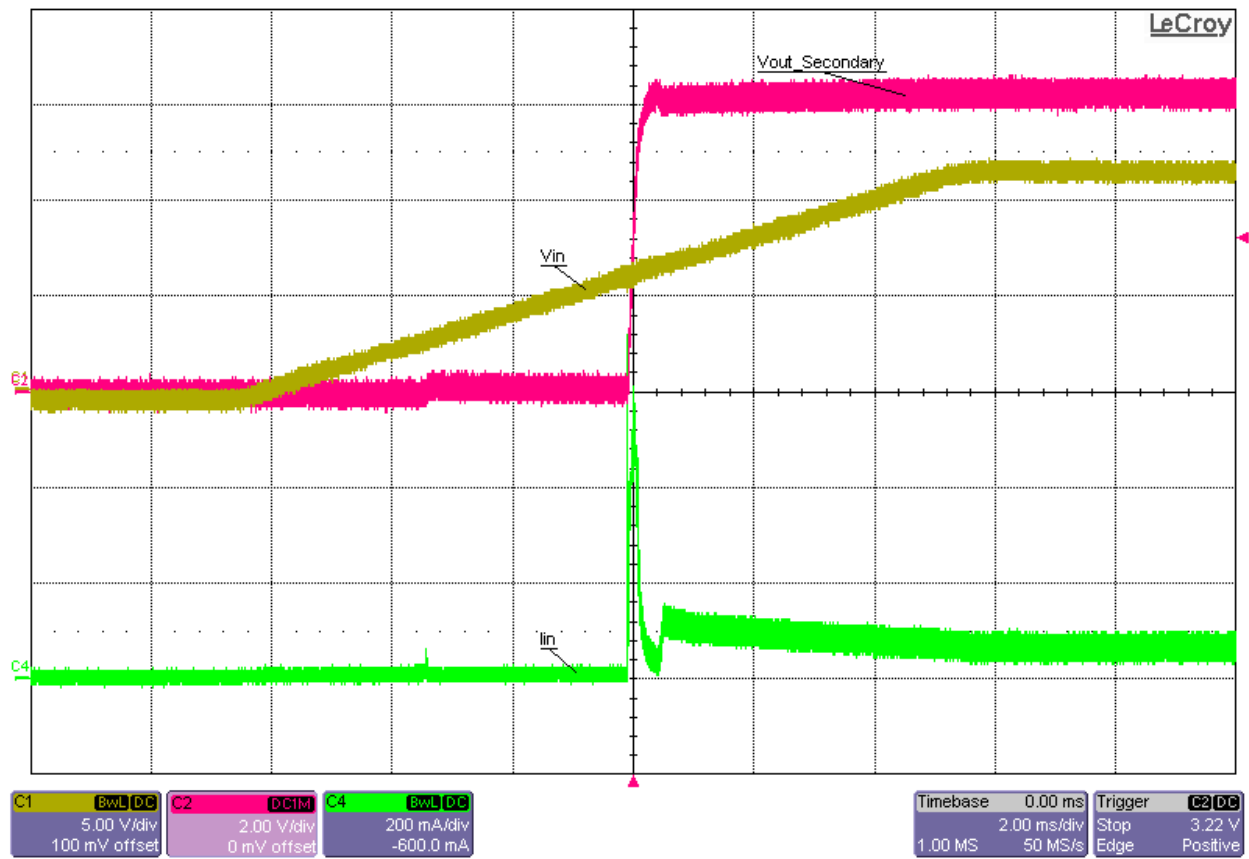
Startup into No Load at 9Vin



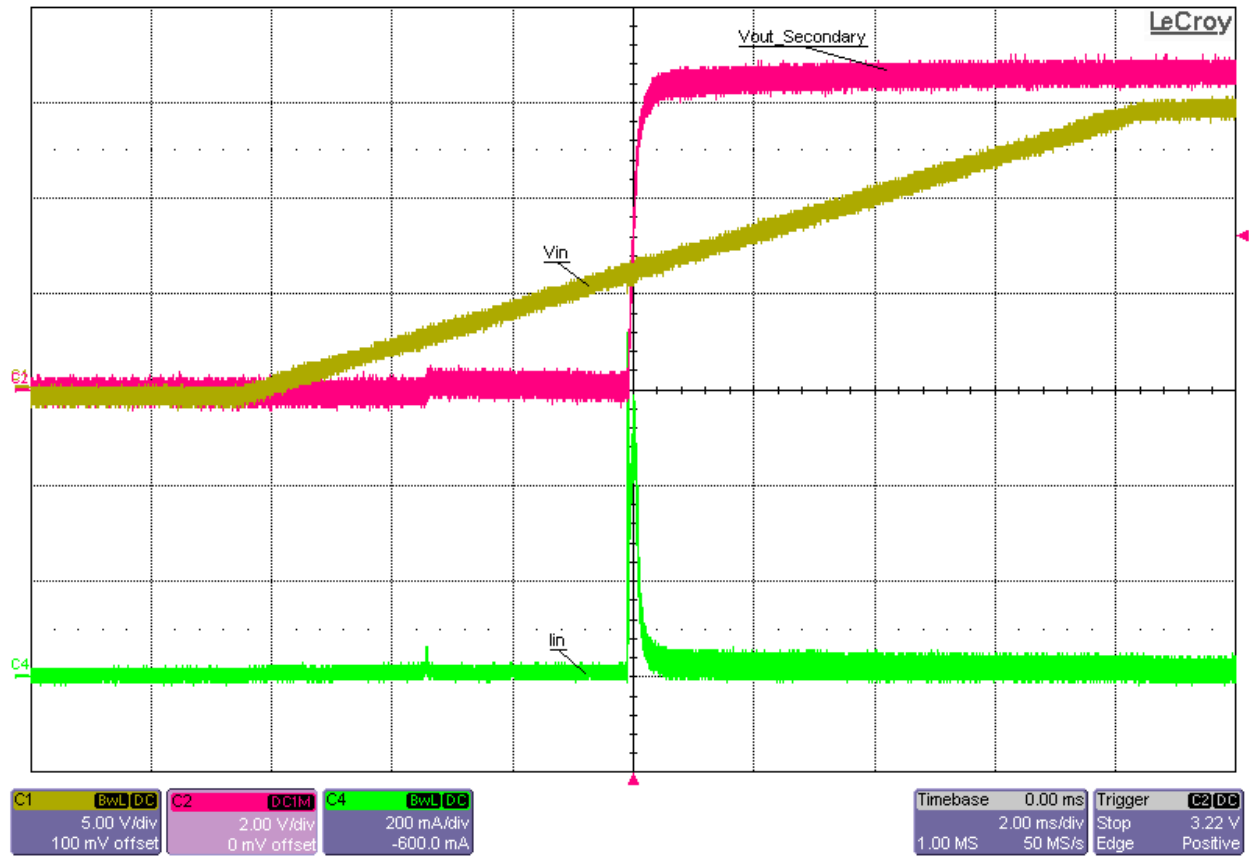
Startup into 100mA Constant-Current Load at 9Vin



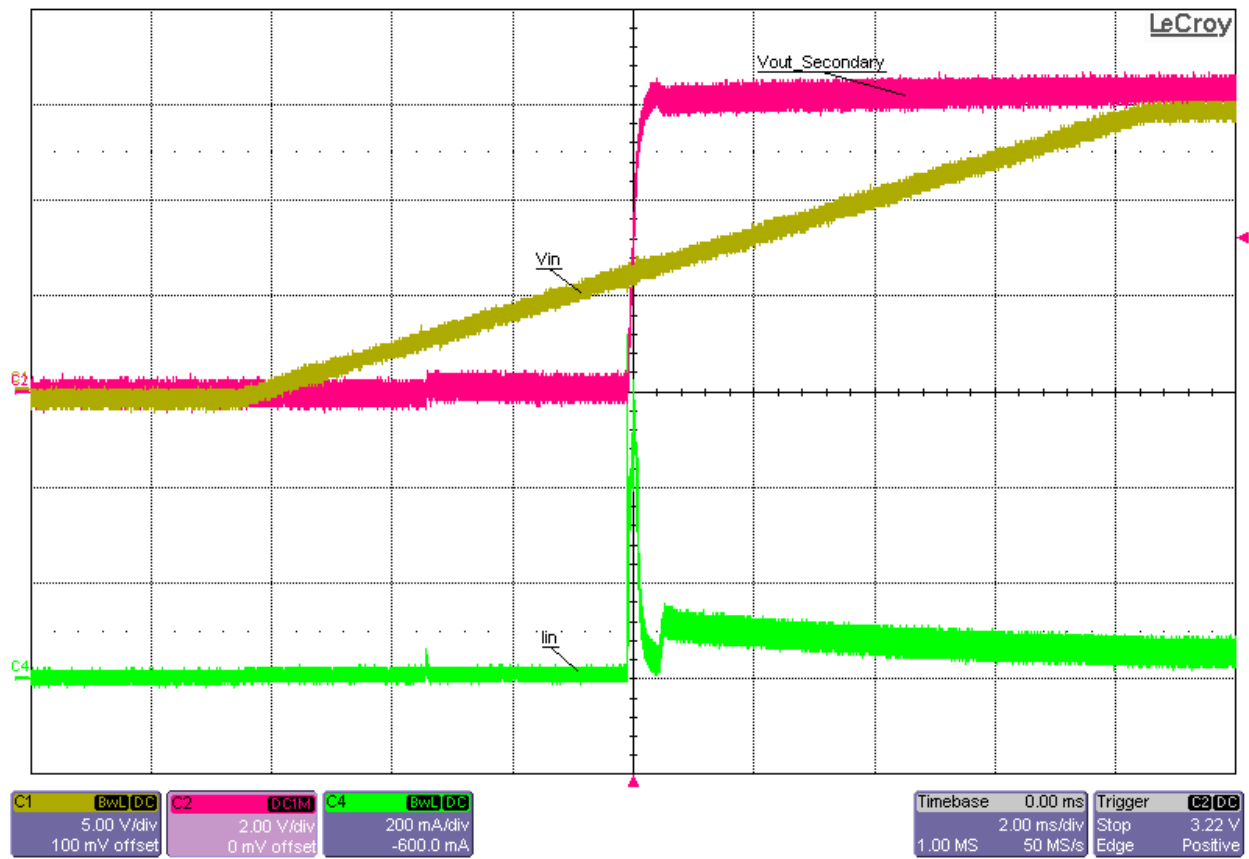
Startup into No Load at 12Vin



Startup into 100mA Constant-Current Load at 12Vin

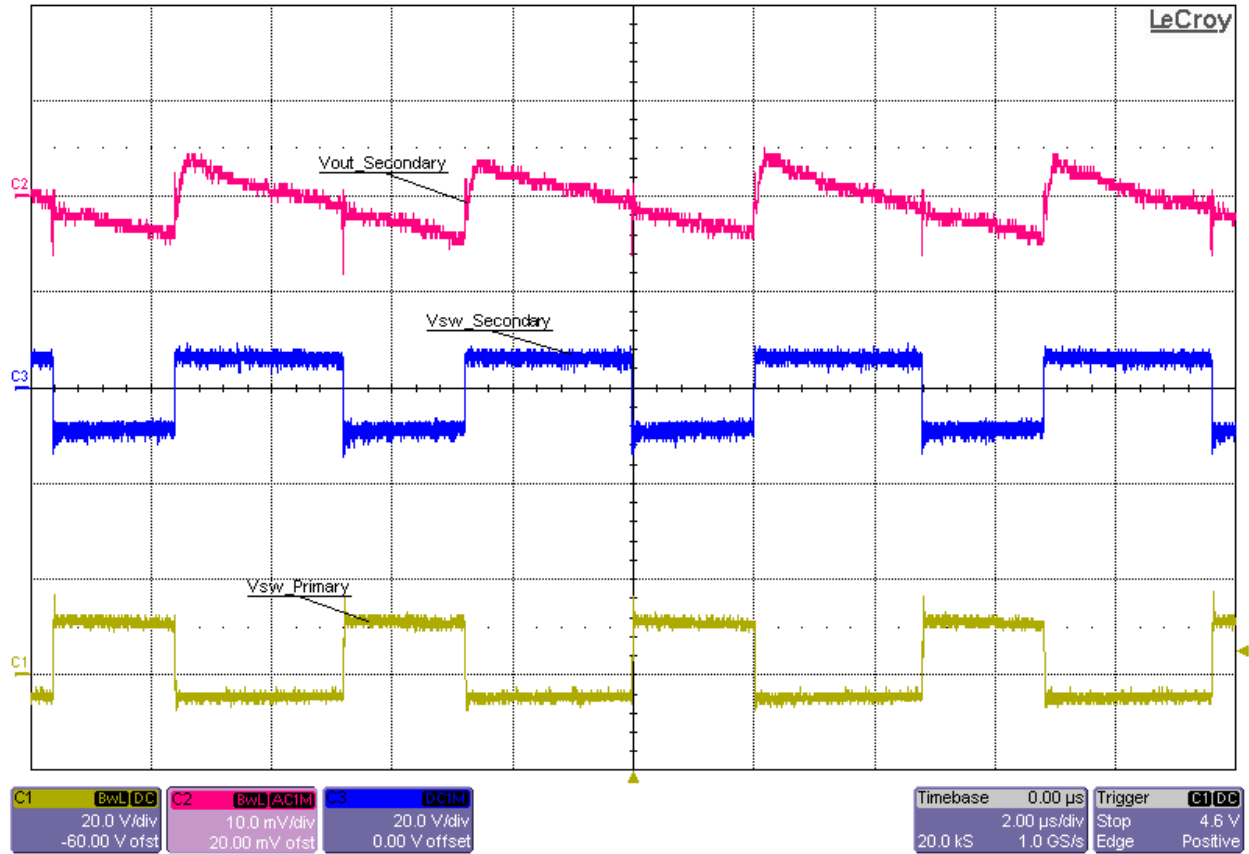


Startup into No Load at 15Vin

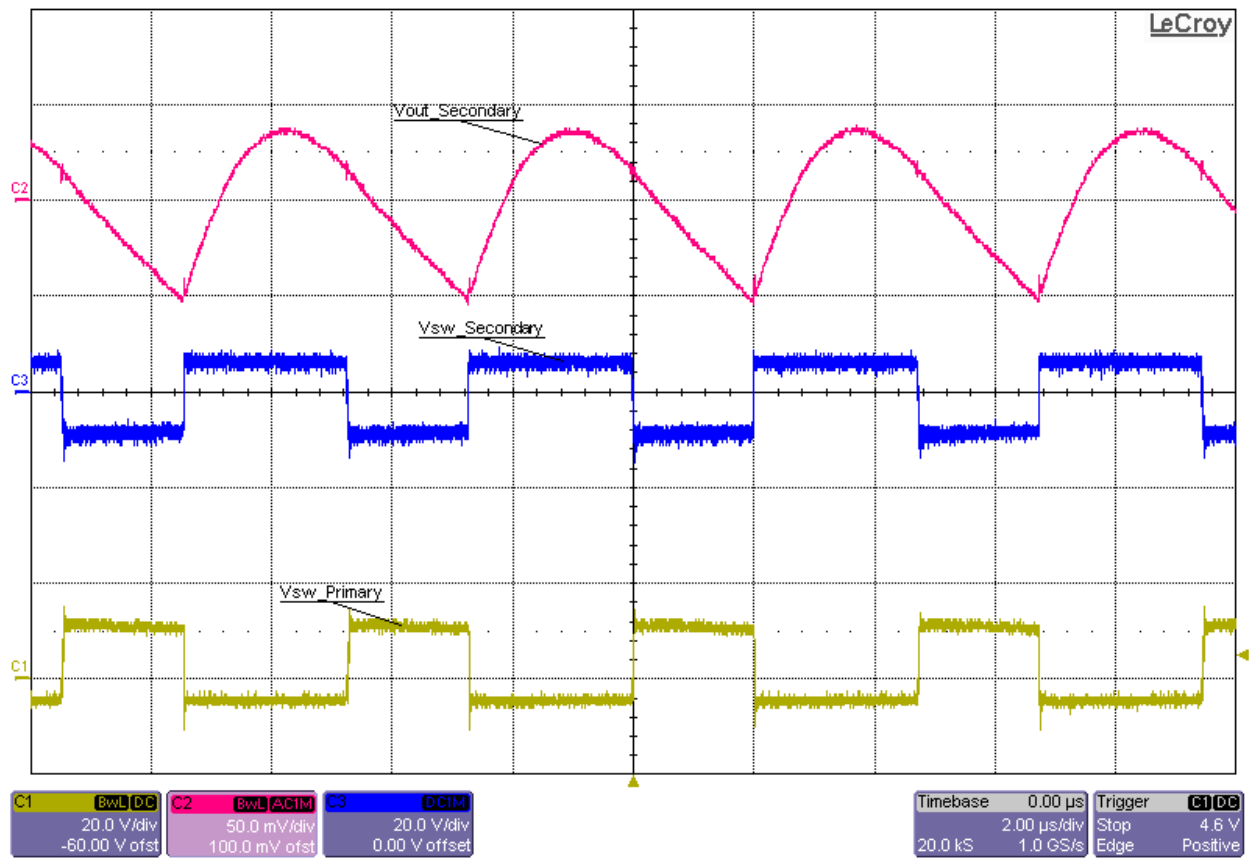


Startup into 100mA Constant-Current Load at 15Vin

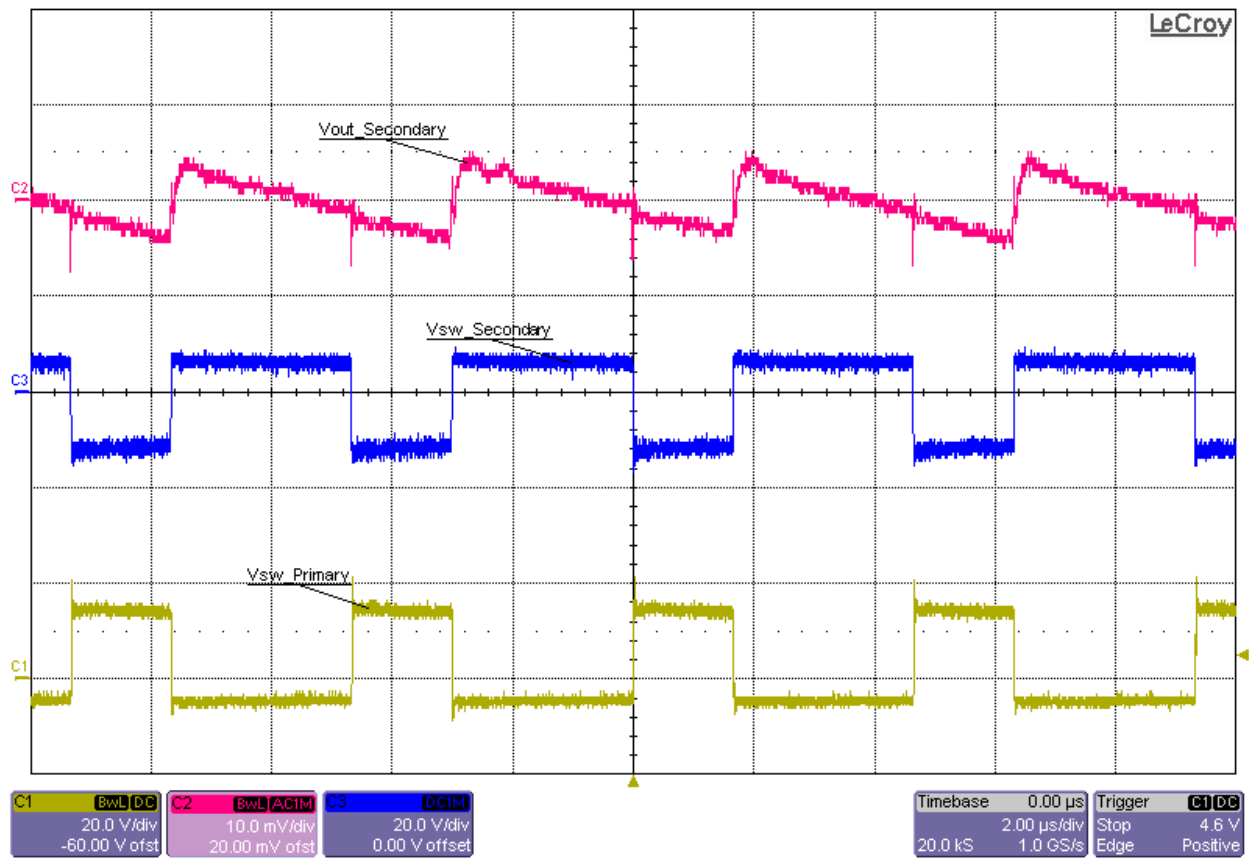
7.3 Output Voltage Ripple and Switch Node Voltage



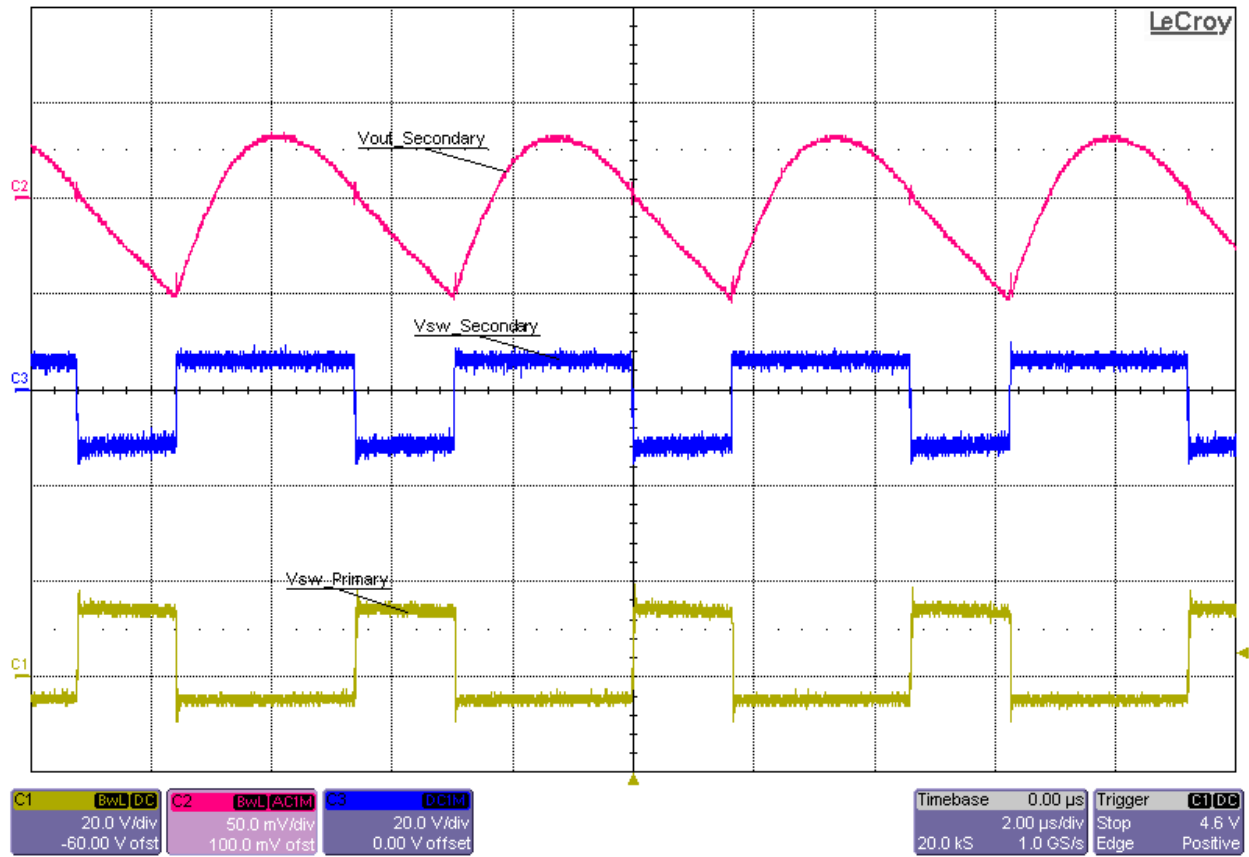
Primary-Side and Secondary-Side Switch Node Voltages and Secondary-Side Output Voltage Ripple at 9Vin and No Load (Vripple \approx 10mVp-p)



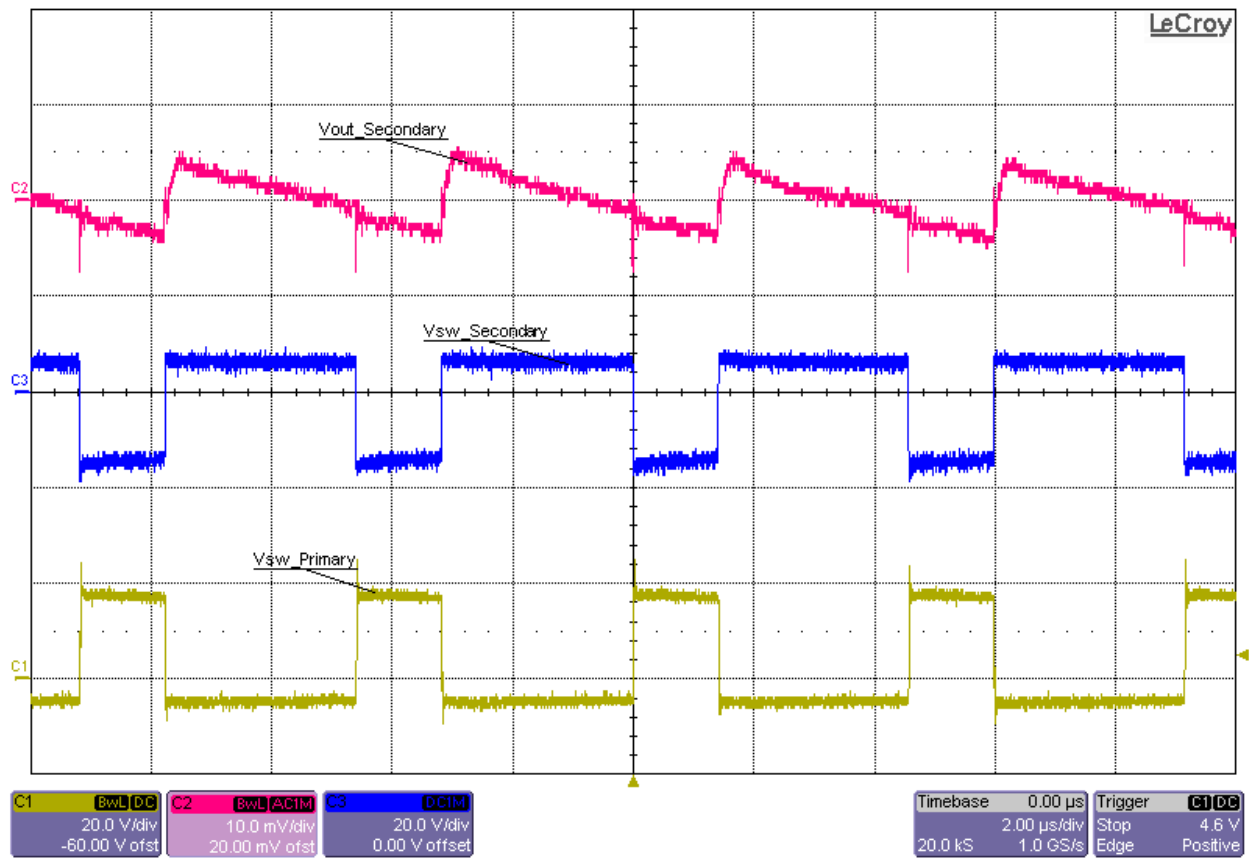
Primary-Side and Secondary-Side Switch Node Voltages and Secondary-Side Output Voltage Ripple at 9Vin and 100mA Load ($V_{ripple} \approx 85mVp-p$)



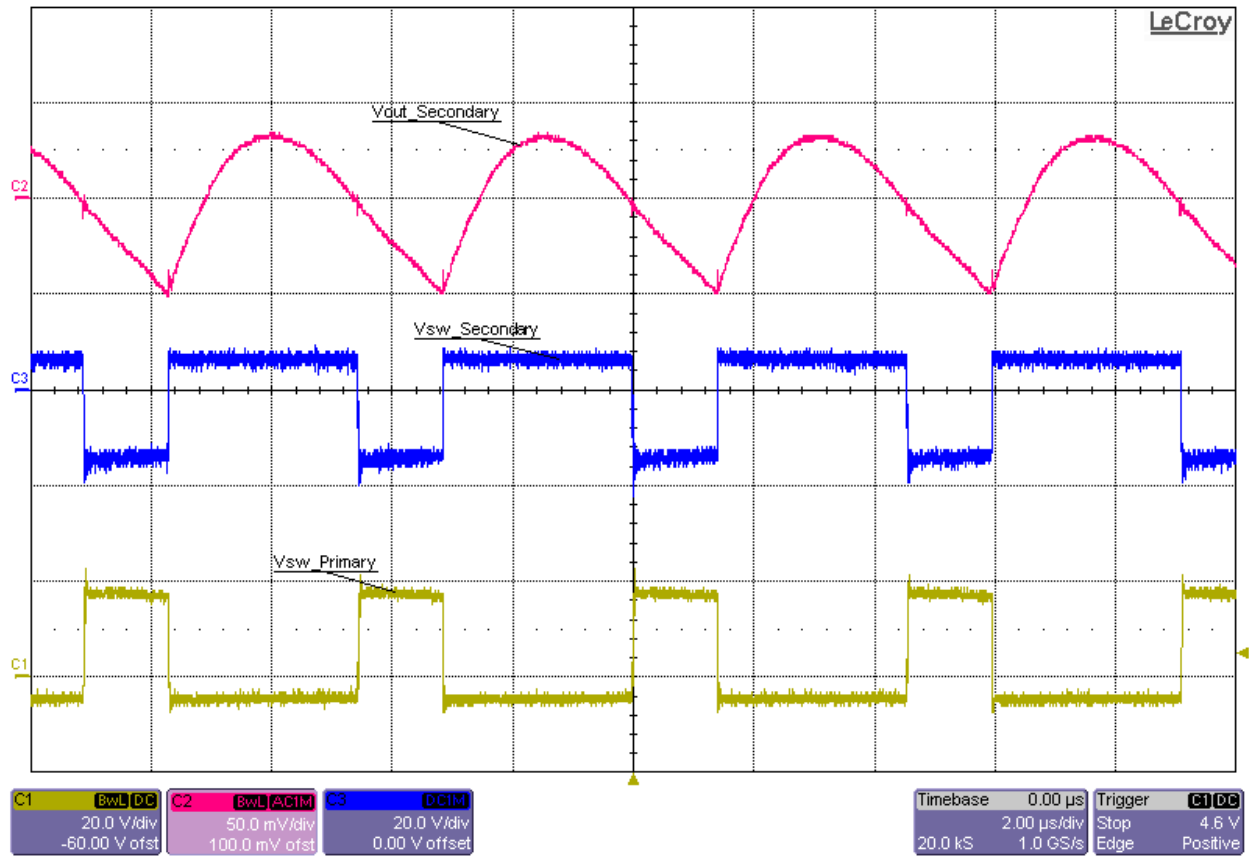
Primary-Side and Secondary-Side Switch Node Voltages and Secondary-Side Output Voltage Ripple at 12Vin and No Load ($V_{ripple} \approx 11mVp-p$)



Primary-Side and Secondary-Side Switch Node Voltages and Secondary-Side Output Voltage Ripple at 12Vin and 100mA Load ($V_{ripple} \approx 82mV_{p-p}$)

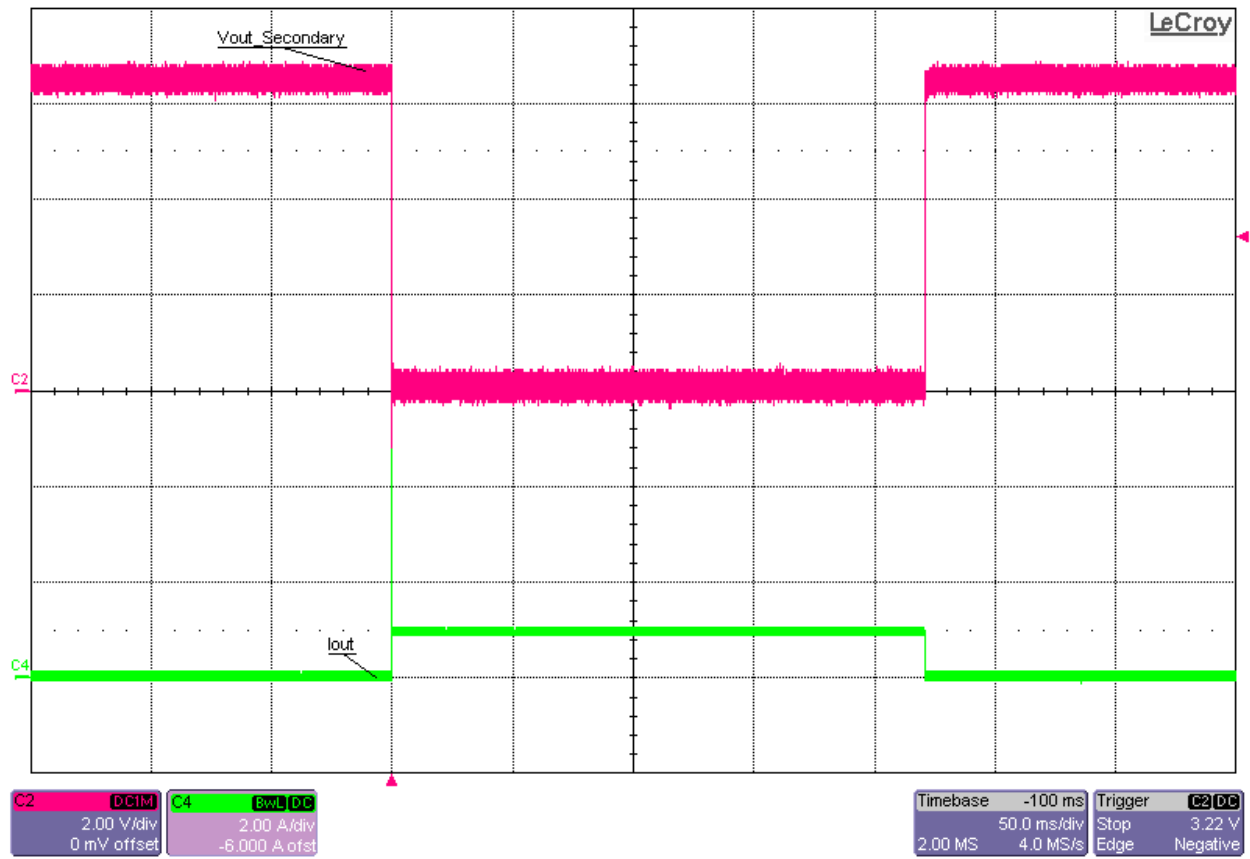


Primary-Side and Secondary-Side Switch Node Voltages and Secondary-Side Output Voltage Ripple at 15Vin and No Load ($V_{ripple} \approx 12mV_{p-p}$)

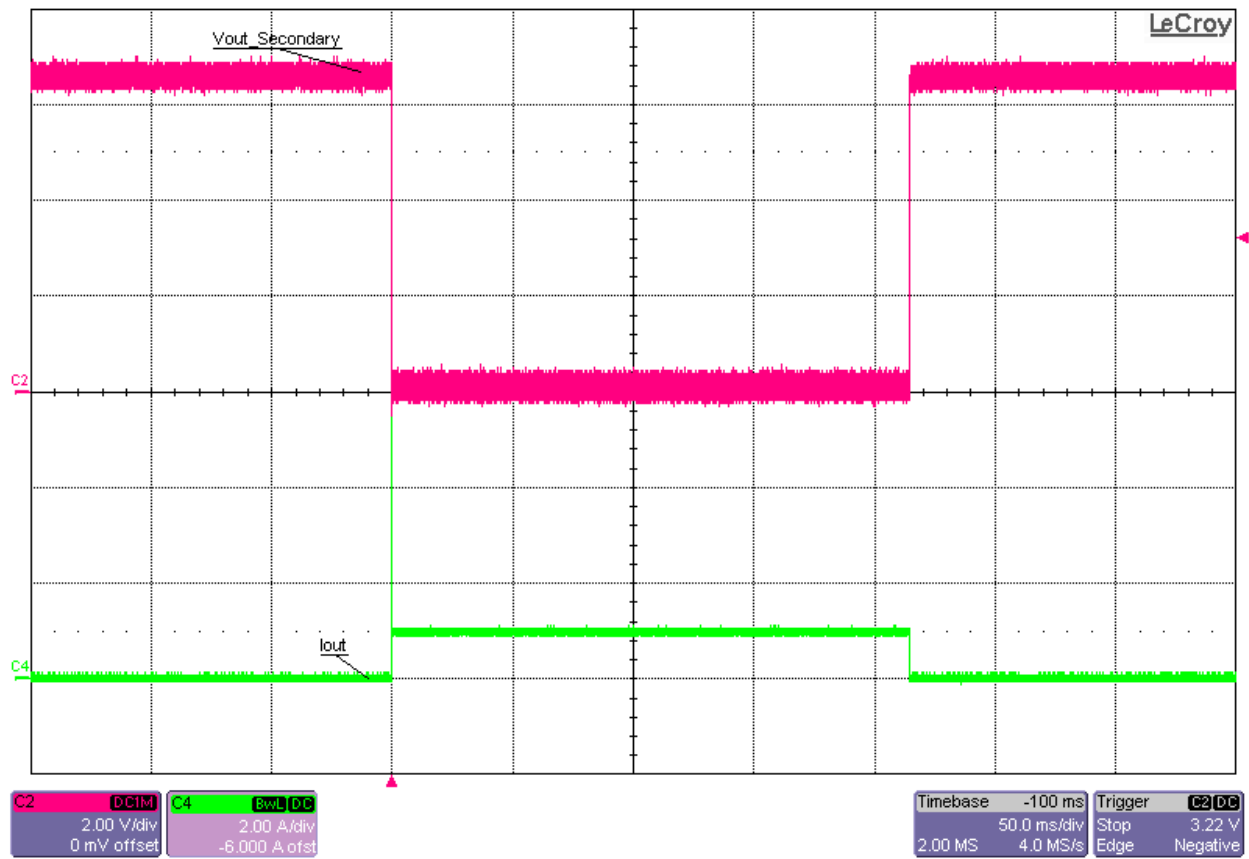


Primary-Side and Secondary-Side Switch Node Voltages and Secondary-Side Output Voltage Ripple at 15Vin and 100mA Load (Vripple ≈ 83mVp-p)

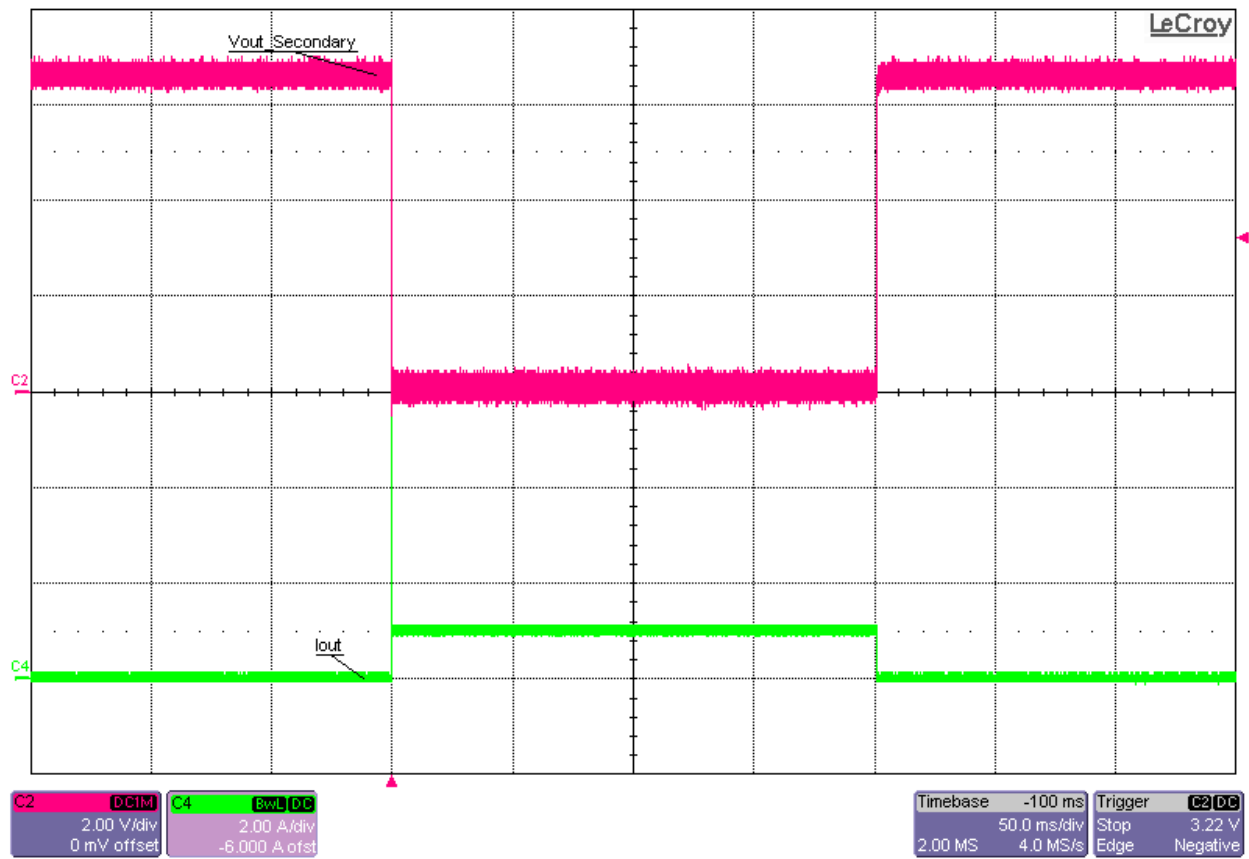
7.4 Short Circuit Testing



Short Circuit Applied to Secondary-Side Output Rail While Unloaded with Input Voltage at 9V



Short Circuit Applied to Secondary-Side Output Rail While Unloaded with Input Voltage at 12V



Short Circuit Applied to Secondary-Side Output Rail While Unloaded with Input Voltage at 15V

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