Test Data
For PMP20196
April 20, 2016

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1. Design Specifications

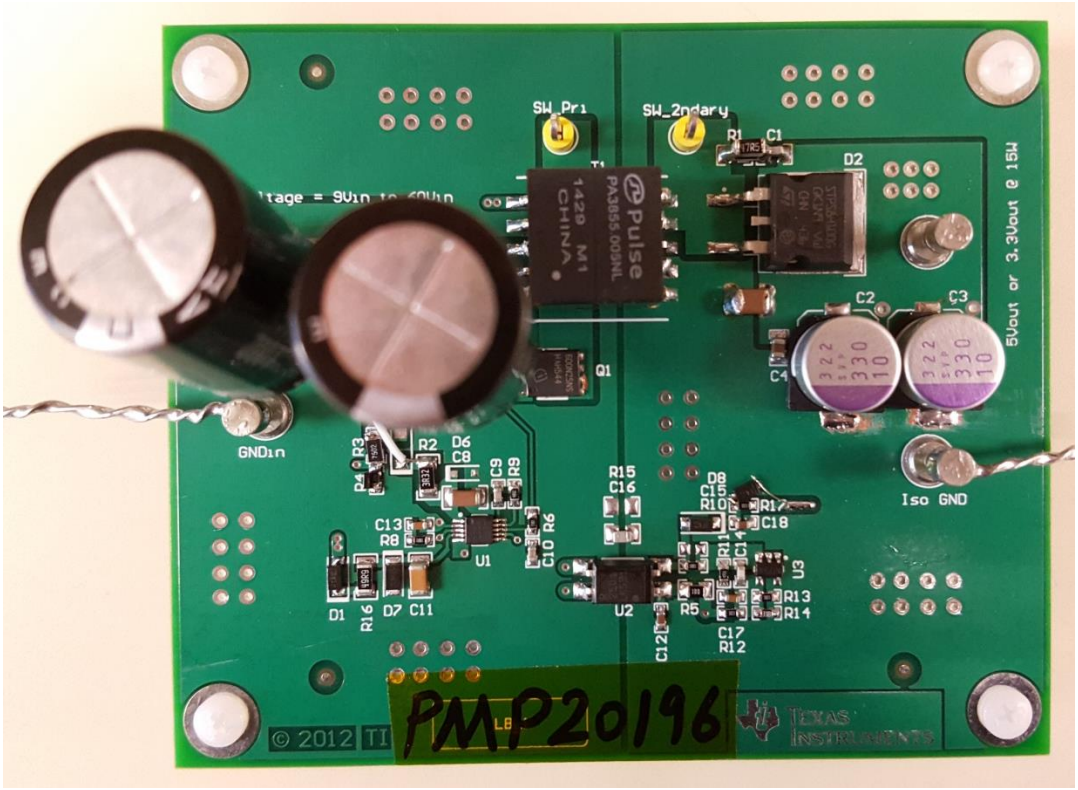
Vin Minimum	**9VDC**
Vin Maximum	**150VDC**
Vout	**5VDC**
Iout	**4A Max.**
Nominal Switching Frequency	**≈ 325KHz**

2. Circuit Description

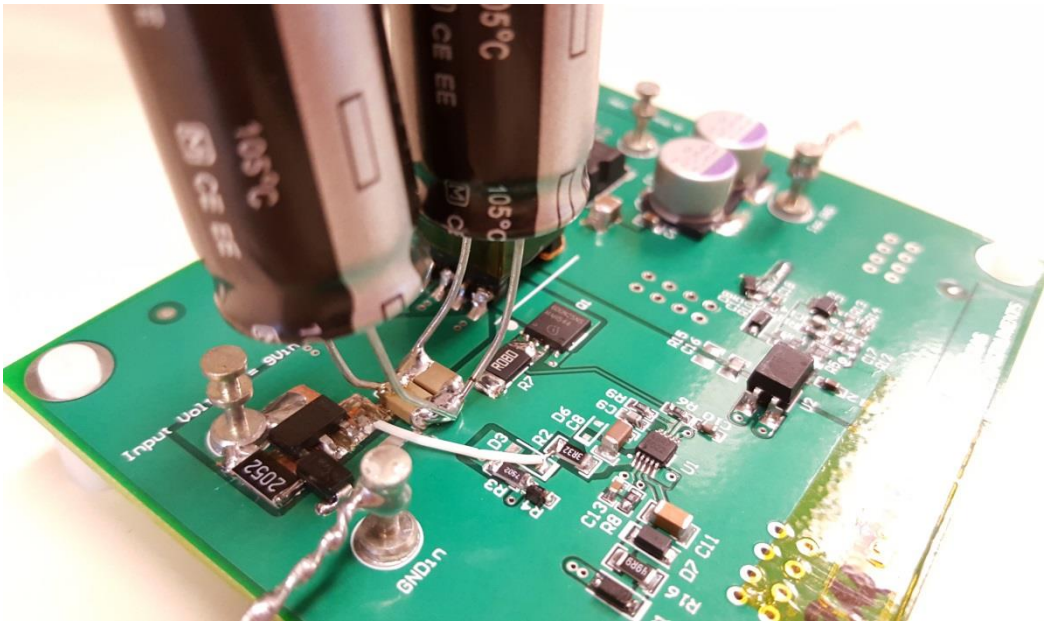
PMP20196 is an Isolated Flyback Converter using the LM5022 controller IC. The design accepts an input voltage of 9VDCin to 150VDCin and provides an output of 5Vout capable of supplying 4A of maximum current to the load. The nominal switching frequency of the design is approximately 325KHz. The design is built on the PMP9253 PCB, which is a 4-layer FR-4 board with 1 oz. copper for the top and bottom layers and 0.5 oz. copper for the two inner layers.

3. PMP20196 Board Photos

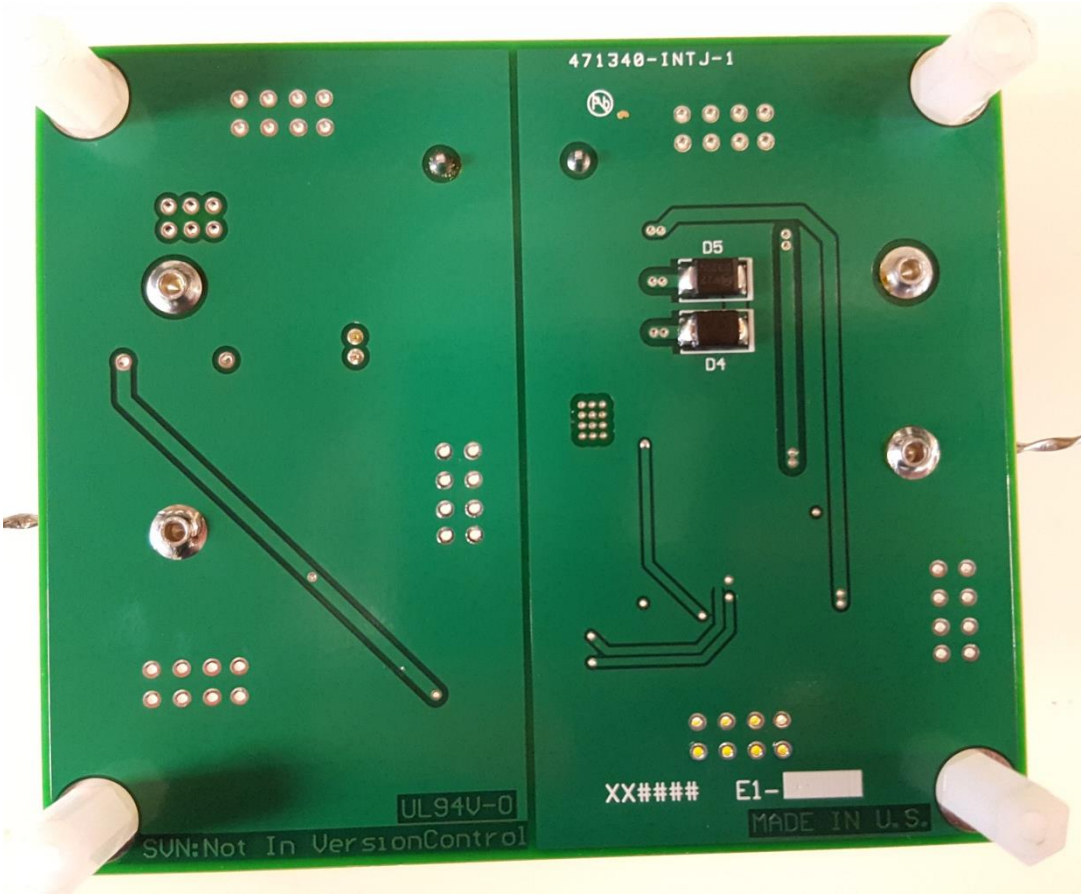
Board Dimensions: 3.7” x 3.1”



Board Photo (Top)

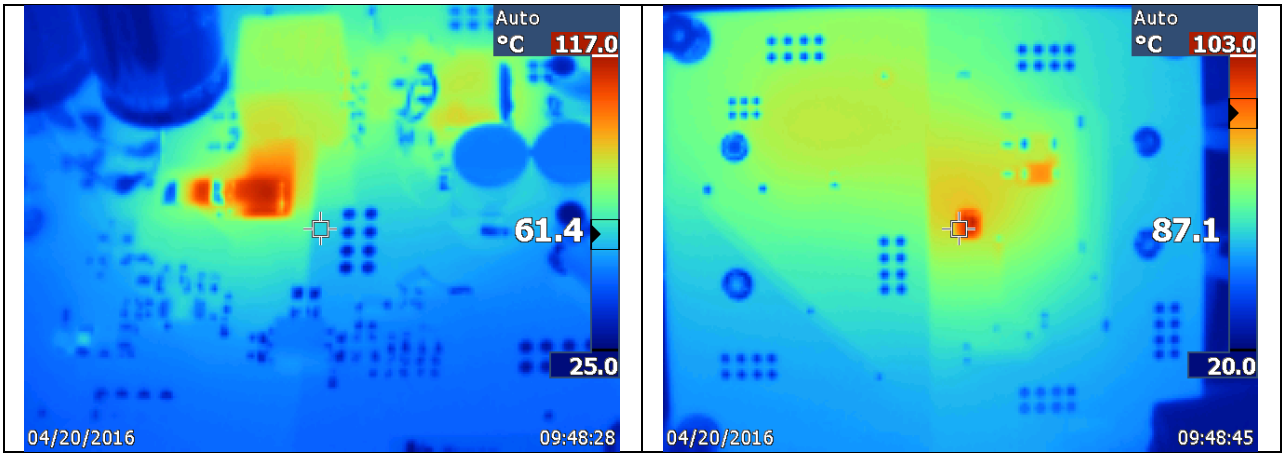


Board Photo (Top; Zoomed-in on the Zener-BJT regulator circuit)

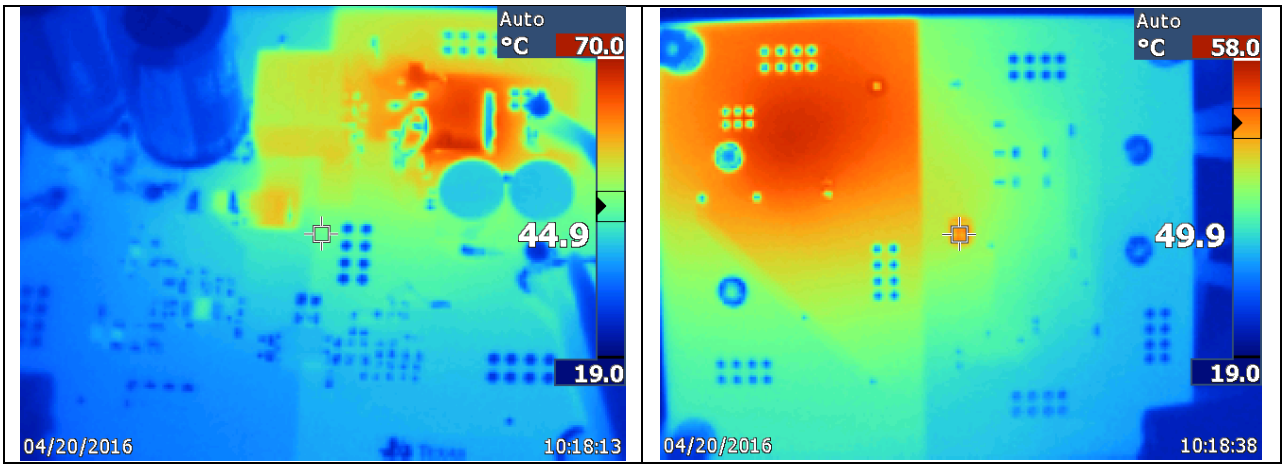


Board Photo (Bottom)

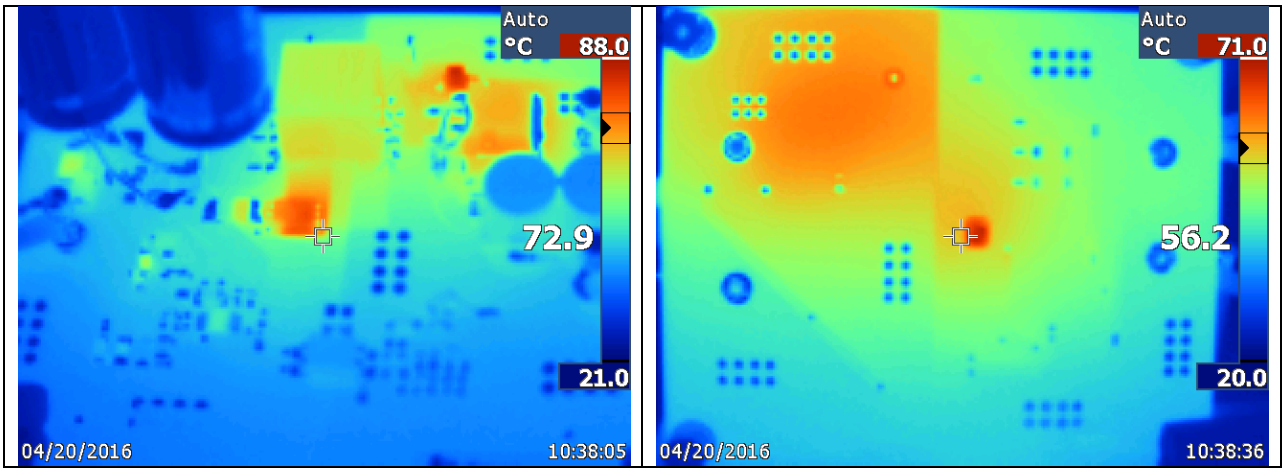
4. Thermal Data



IR Thermal Image Taken at Steady State at 9Vin and 4A Load (Left Image = Board Top; Right Image = Board Bottom; ambient at room temp.; no airflow)



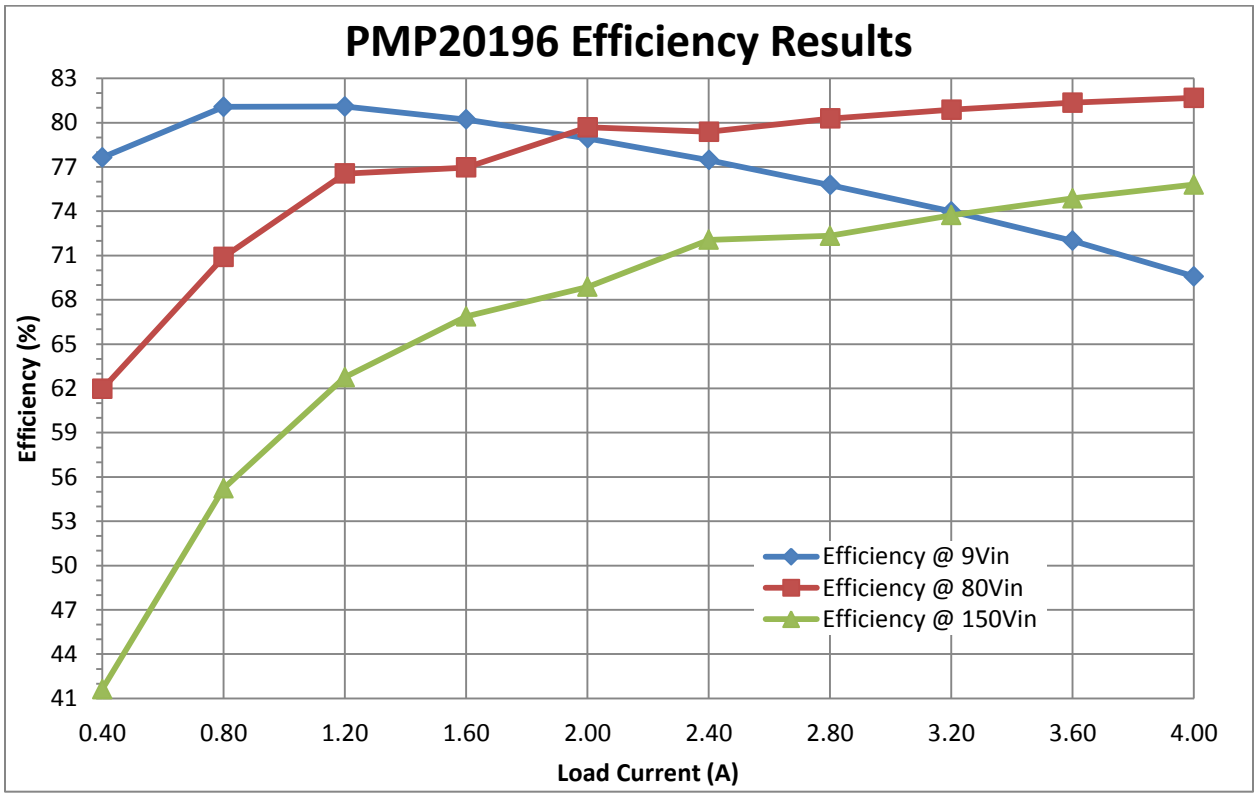
IR Thermal Image Taken at Steady State at 80Vin and 4A Load (Left Image = Board Top; Right Image = Board Bottom; ambient at room temp.; no airflow)



IR Thermal Image Taken at Steady State at 150Vin and 4A Load (Left Image = Board Top; Right Image = Board Bottom; ambient at room temp.; no airflow)

5. Efficiency

5.1 Efficiency Chart



5.2 Efficiency Data

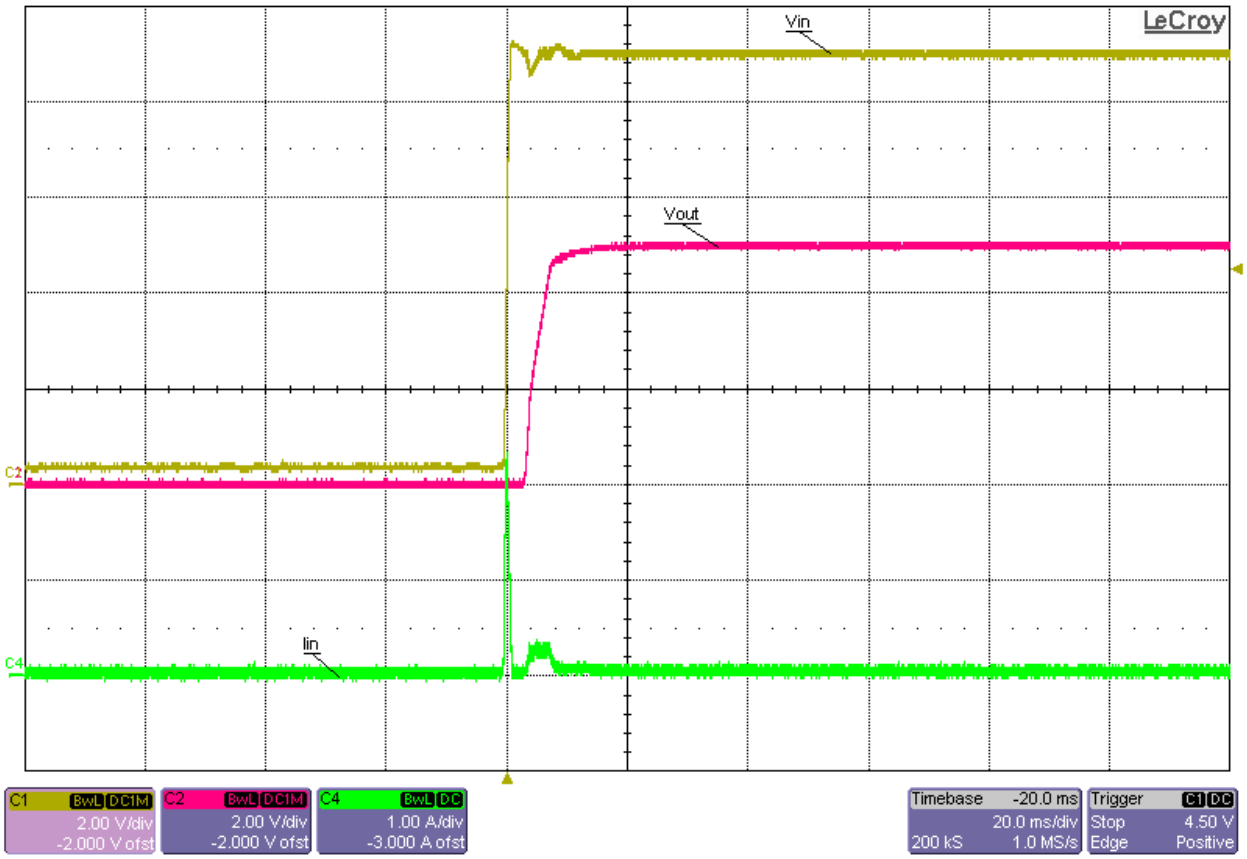
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Ploss (W)	Efficiency (%)
9	0.2864	4.9988	0.4004	2.578	2.002	0.576	77.7
9	0.5481	4.9983	0.8001	4.933	3.999	0.934	81.1
9	0.8216	4.9976	1.1999	7.394	5.997	1.398	81.1
9	1.1071	4.9965	1.5997	9.964	7.993	1.971	80.2
9	1.407	4.9954	2.001	12.663	9.996	2.667	78.9
9	1.7198	4.9944	2.4007	15.478	11.990	3.488	77.5
9	2.0509	4.9934	2.8009	18.458	13.986	4.472	75.8
9	2.3998	4.9922	3.2006	21.598	15.978	5.620	74.0
9	2.7727	4.9904	3.6005	24.954	17.968	6.986	72.0
9	3.186	4.9876	4.0005	28.674	19.953	8.721	69.6

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Ploss (W)	Efficiency (%)
80	0.0403	4.9903	0.4004	3.224	1.998	1.226	62.0
80	0.0704	4.9907	0.8001	5.632	3.993	1.639	70.9
80	0.0978	4.9918	1.1999	7.824	5.990	1.834	76.6
80	0.1297	4.992	1.5997	10.376	7.986	2.390	77.0
80	0.1567	4.992	2.001	12.536	9.989	2.547	79.7
80	0.1887	4.9918	2.4007	15.096	11.984	3.112	79.4
80	0.2177	4.9915	2.8009	17.416	13.981	3.435	80.3
80	0.2469	4.9911	3.2007	19.752	15.975	3.777	80.9
80	0.2761	4.9906	3.6005	22.088	17.969	4.119	81.4
80	0.3055	4.9898	4.0005	24.440	19.962	4.478	81.7

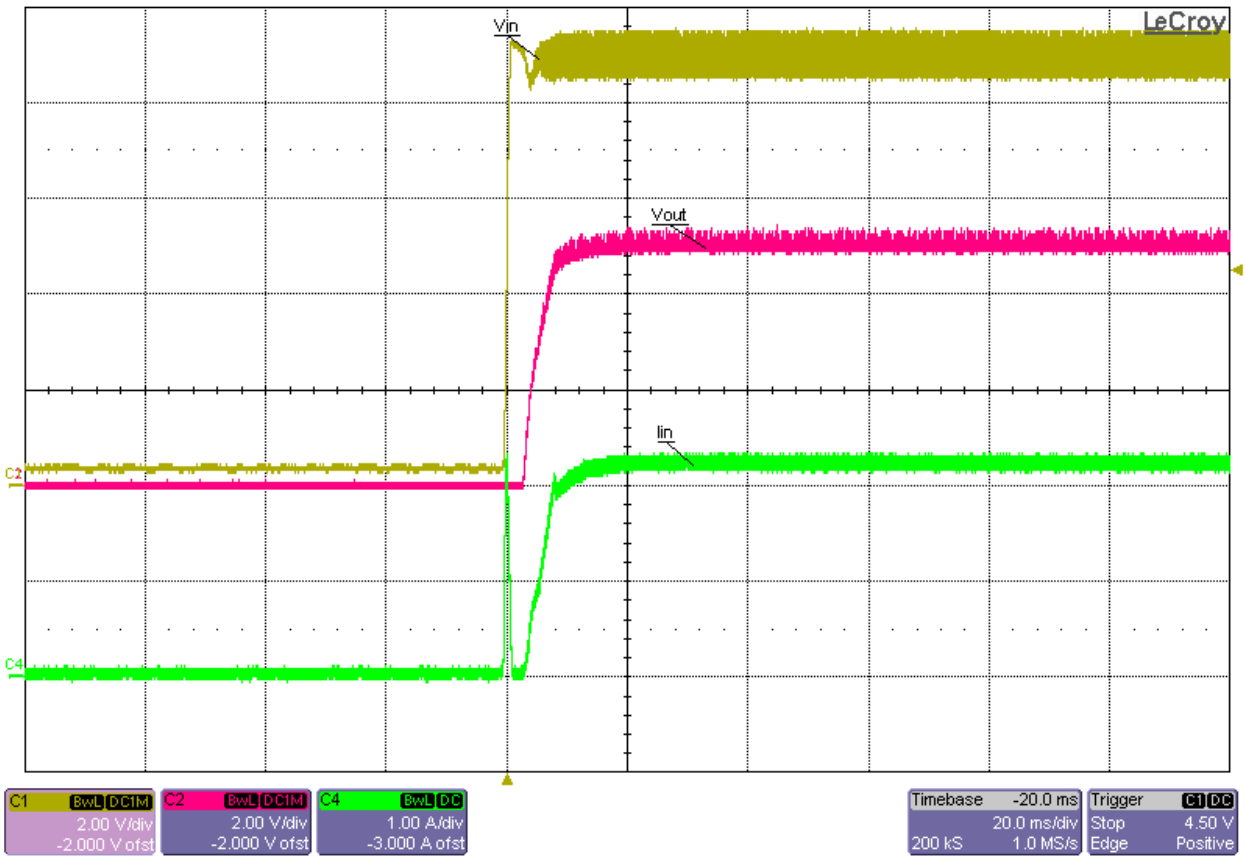
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Ploss (W)	Efficiency (%)
150	0.0320	4.9975	0.4	4.804	1.999	2.805	41.6
150	0.0483	4.9965	0.8	7.239	3.997	3.242	55.2
150	0.0637	4.9953	1.2	9.553	5.994	3.558	62.8
150	0.0797	4.994	1.6001	11.949	7.991	3.958	66.9
150	0.0967	4.9926	2.0002	14.498	9.986	4.511	68.9
150	0.1108	4.9916	2.4001	16.625	11.980	4.644	72.1
150	0.1288	4.9895	2.8	19.313	13.971	5.342	72.3
150	0.1444	4.9889	3.2001	21.654	15.965	5.689	73.7
150	0.1599	4.9884	3.6002	23.987	17.959	6.027	74.9
150	0.1755	4.9878	4	26.321	19.951	6.369	75.8

6 Waveforms

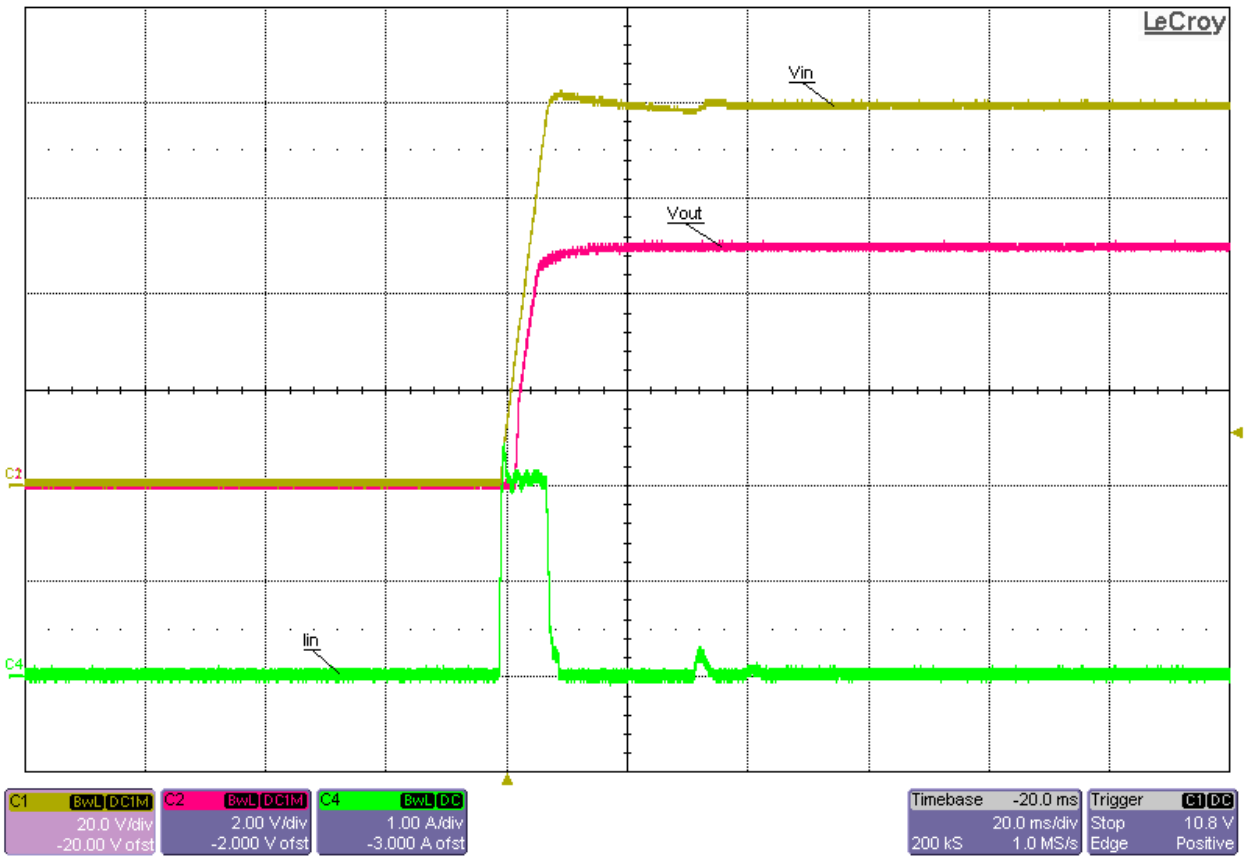
6.1 Startup



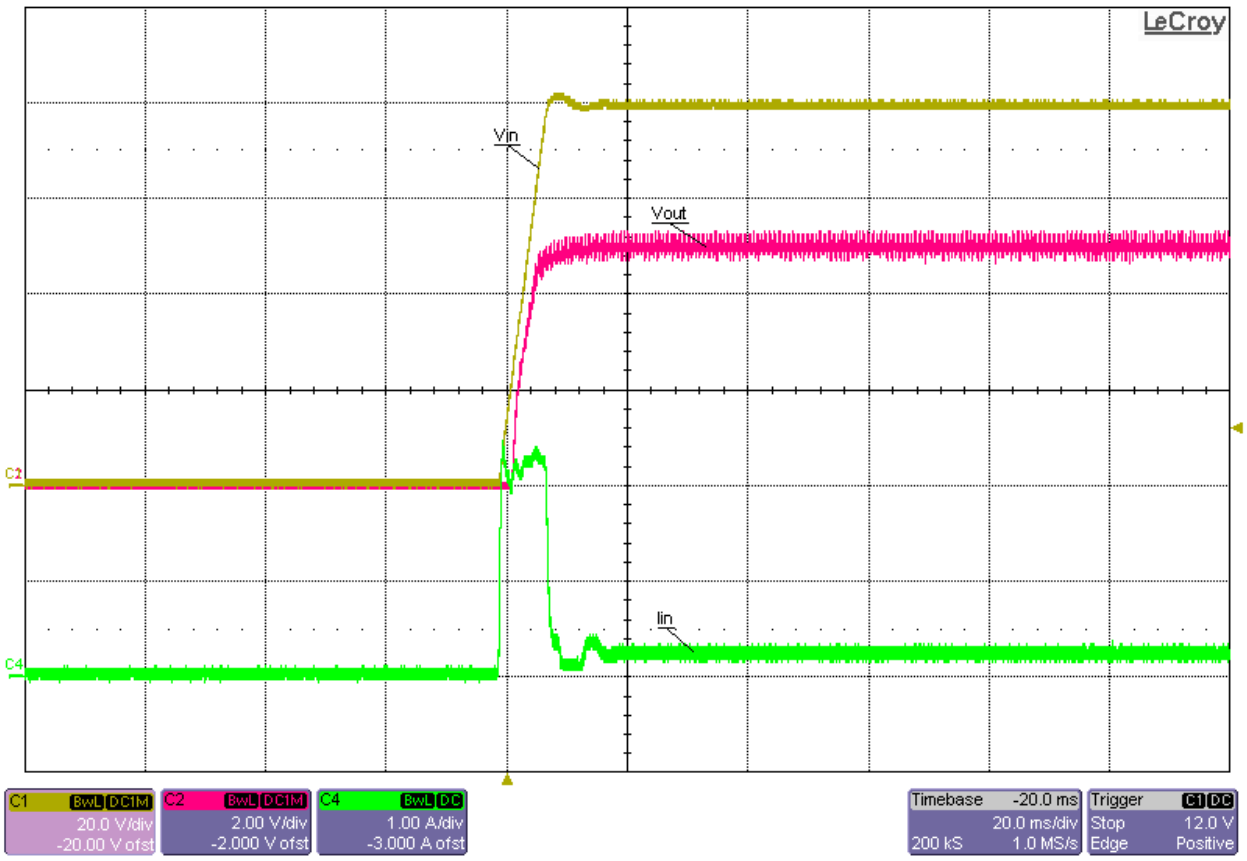
Startup into No Load at 9Vin



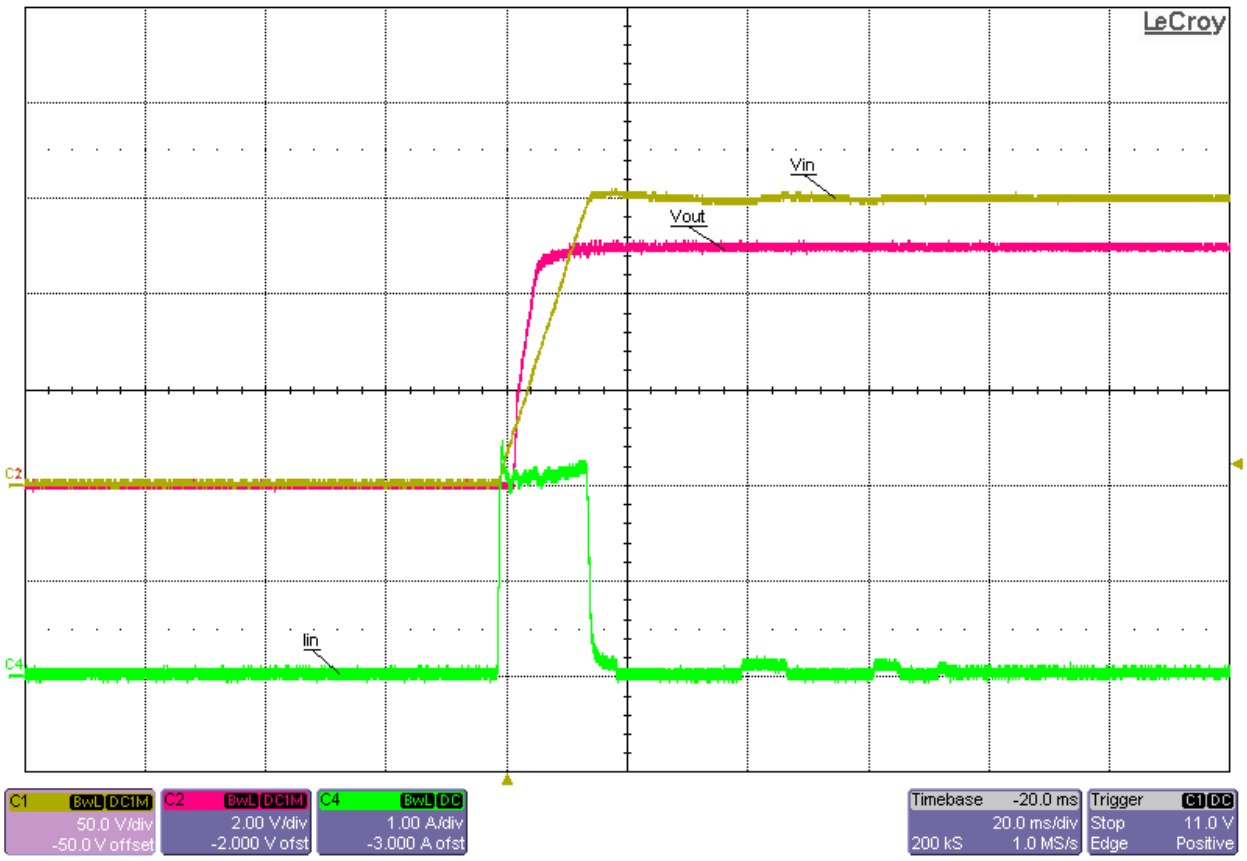
Startup into 4A Resistive Load at 9Vin



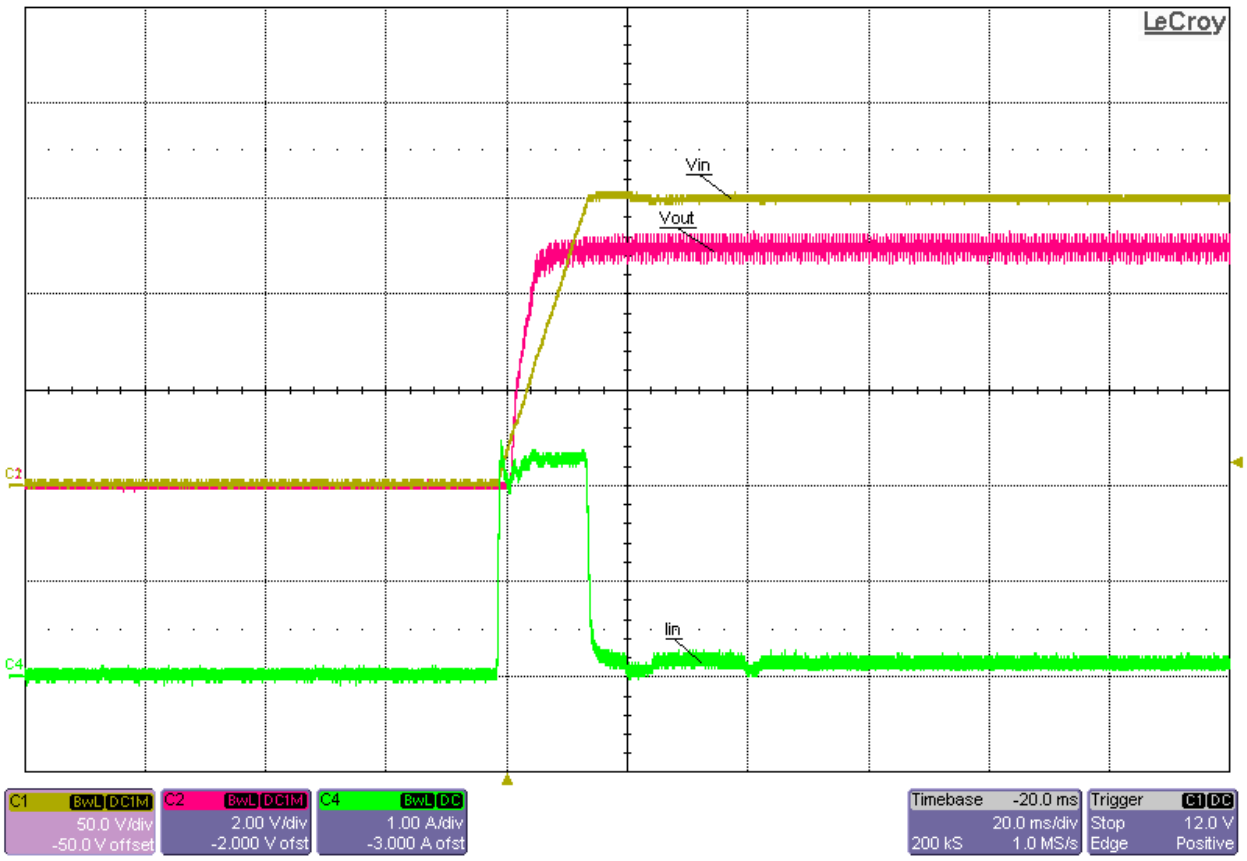
Startup into No Load at 80Vin



Startup into 4A Resistive Load at 80Vin

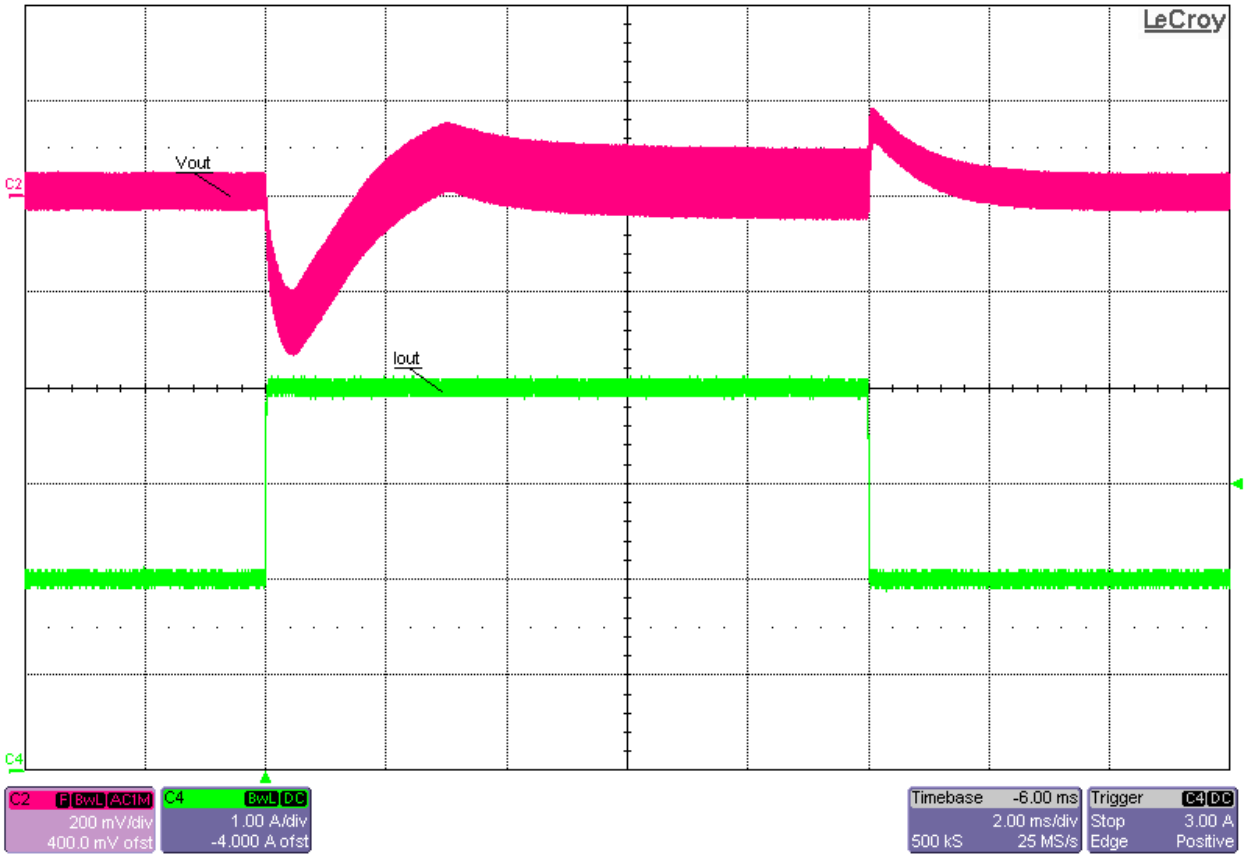


Startup into No Load at 150Vin

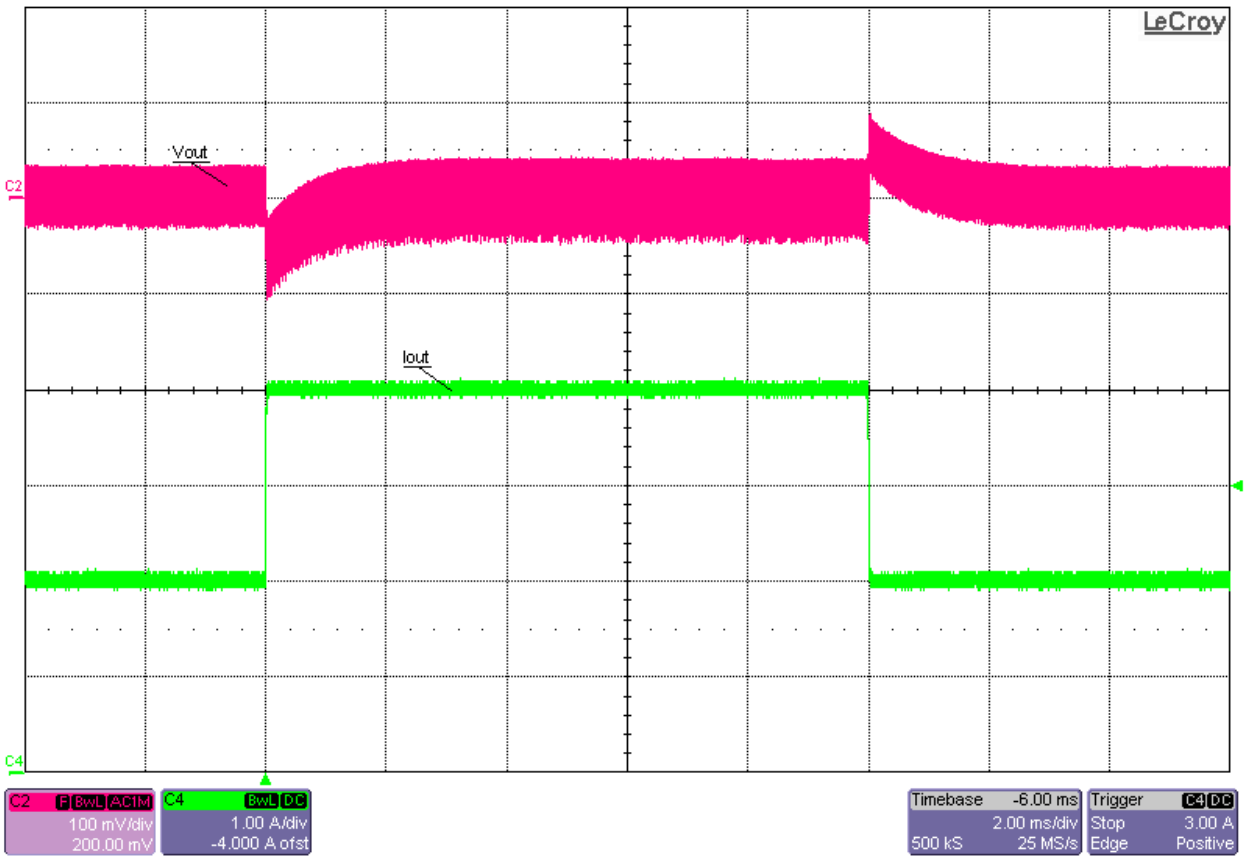


Startup into 4A Resistive Load at 150Vin

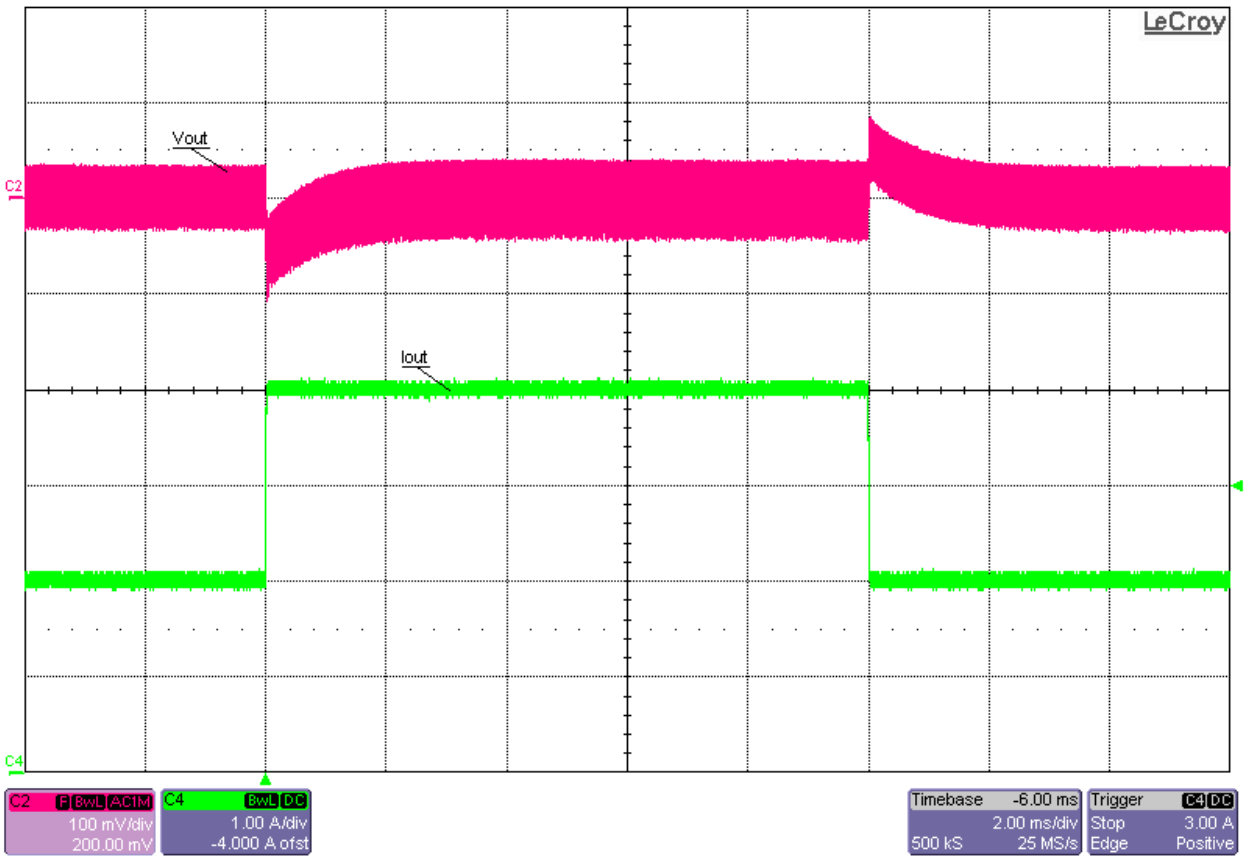
6.2 Load Transient Response



Load Transient Response of Output Undergoing a 50% to 100% (2A-to-4A) Load Step at 9Vin

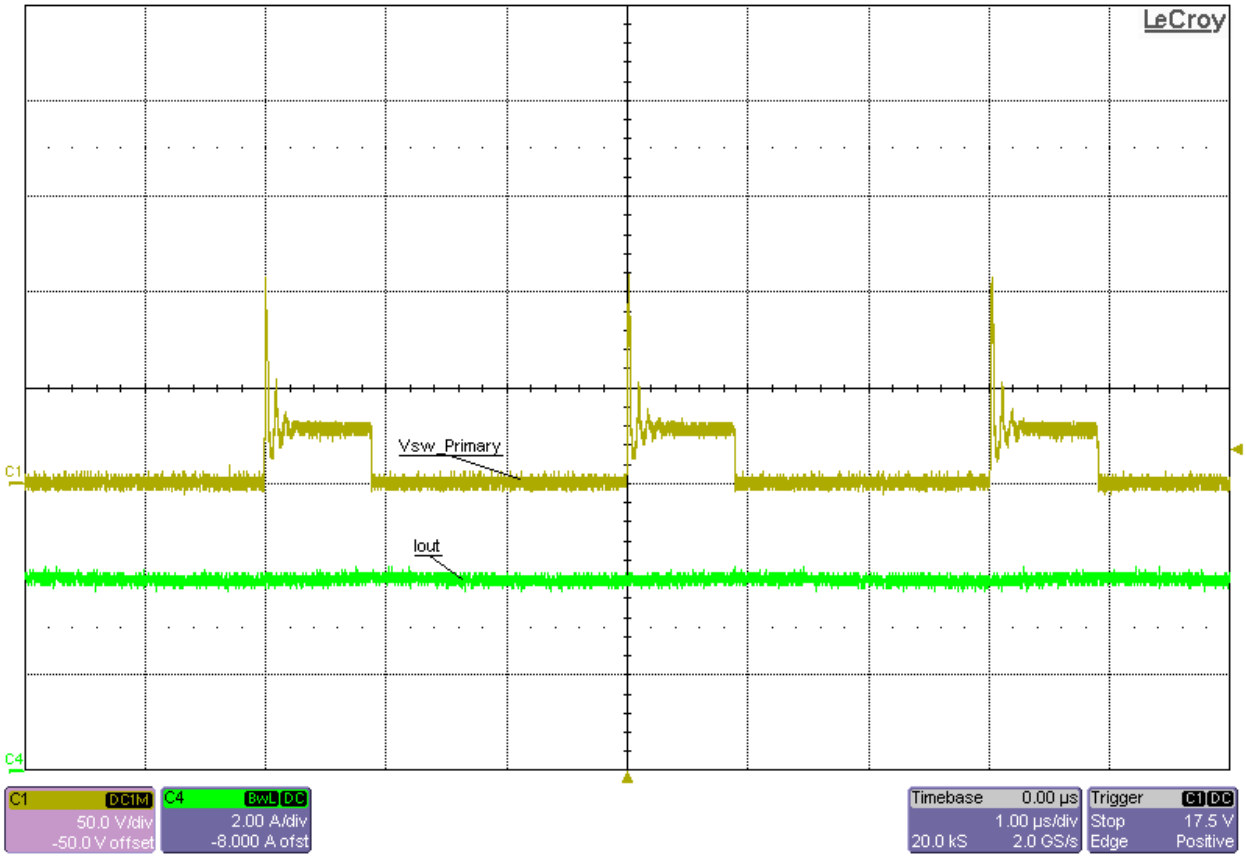


Load Transient Response of Output Undergoing a 50% to 100% (2A-to-4A) Load Step at 80Vin

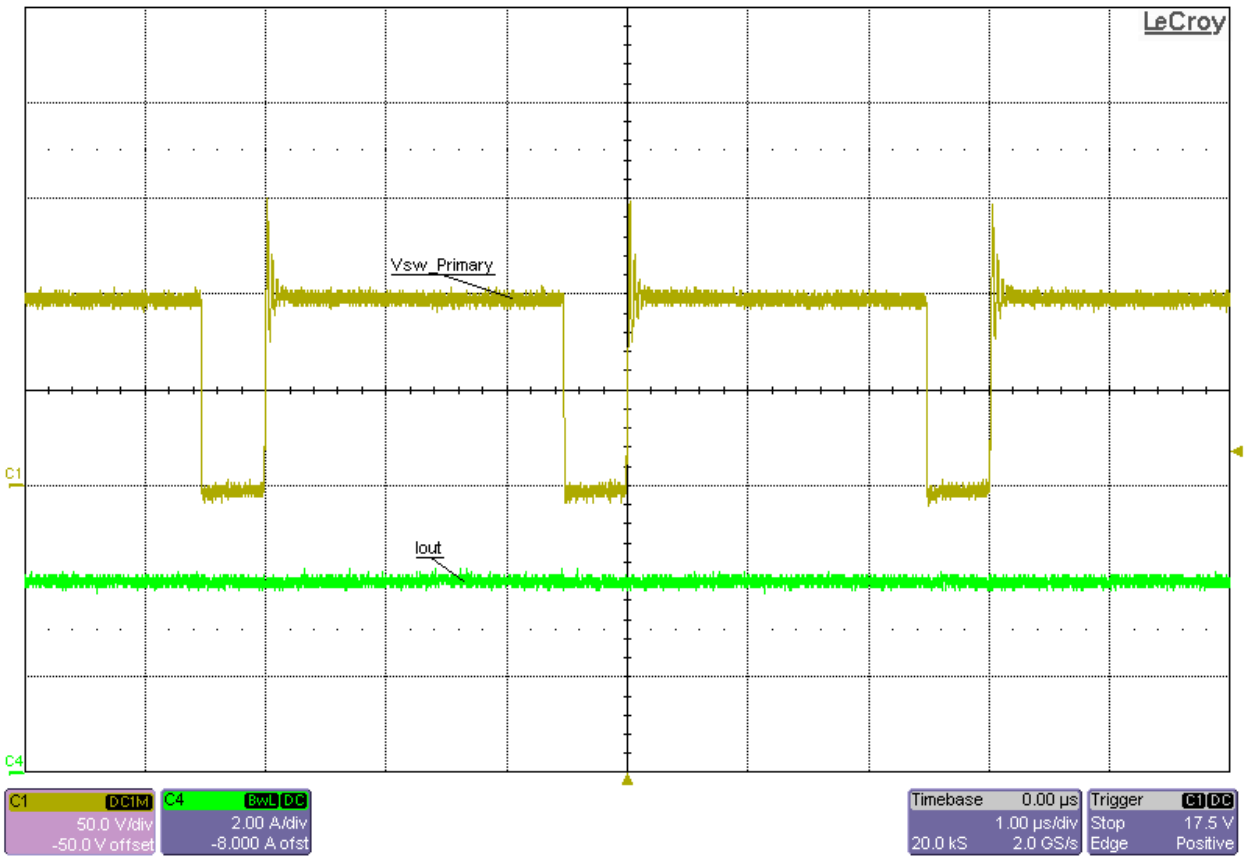


Load Transient Response of Output Undergoing a 50% to 100% (2A-to-4A) Load Step at 150Vin

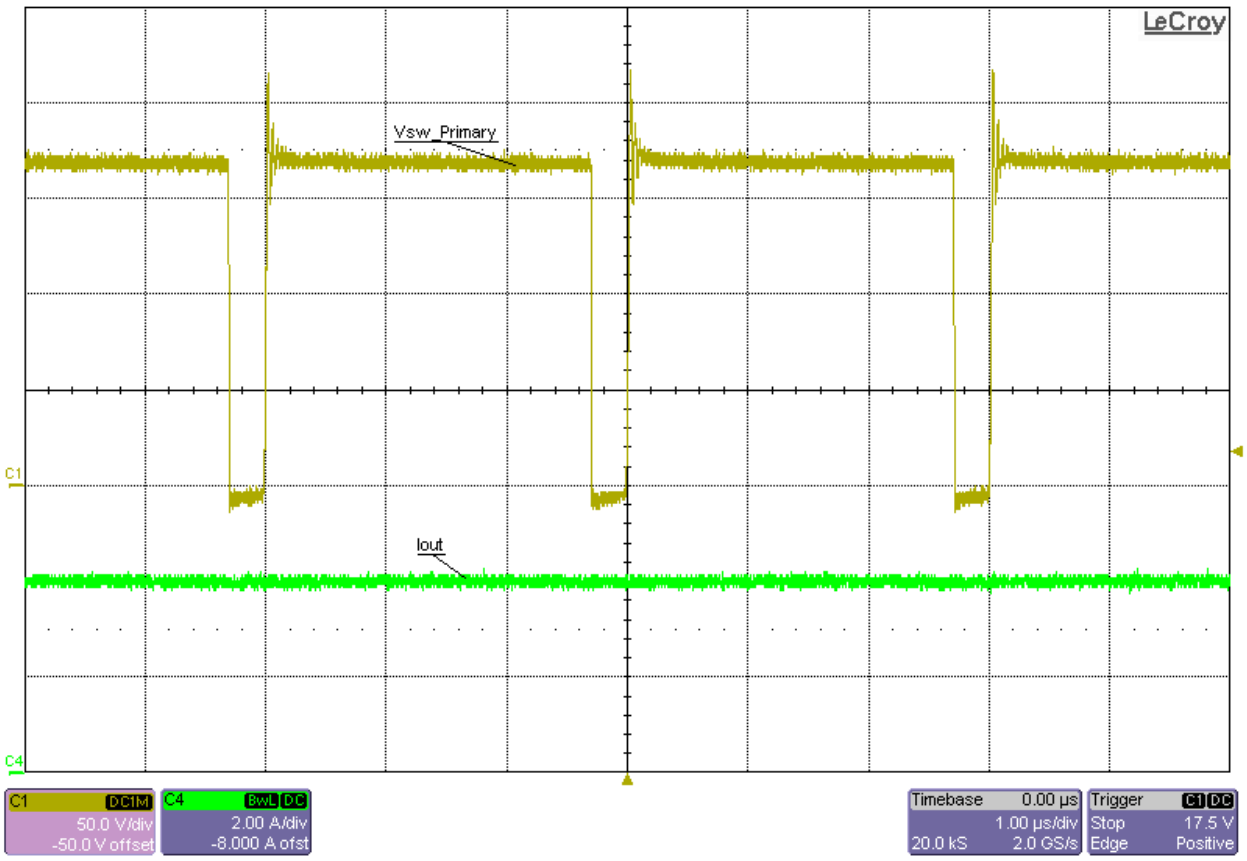
6.3 Output Voltage Ripple and Switch Node Voltages



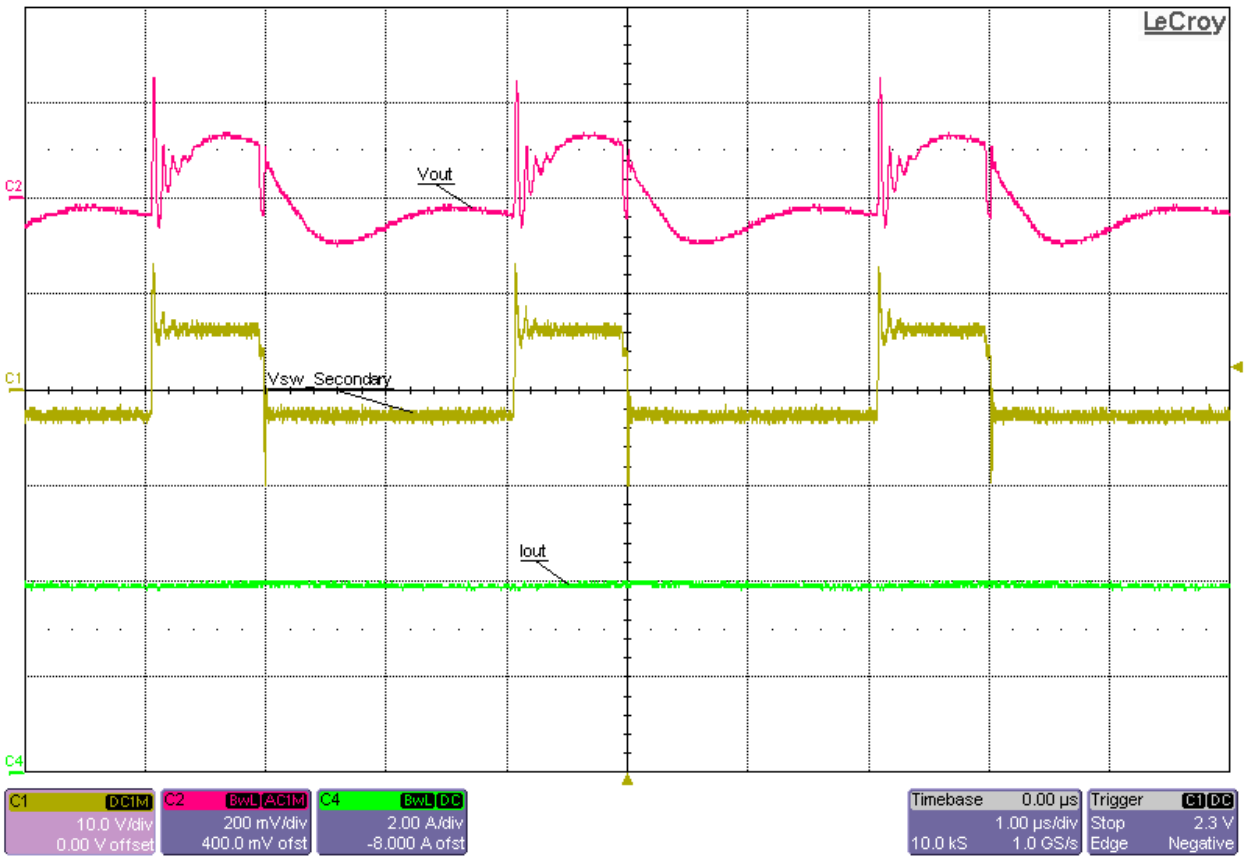
Primary-Side Switch Node Voltage at 9Vin and 4A Constant-Current Load



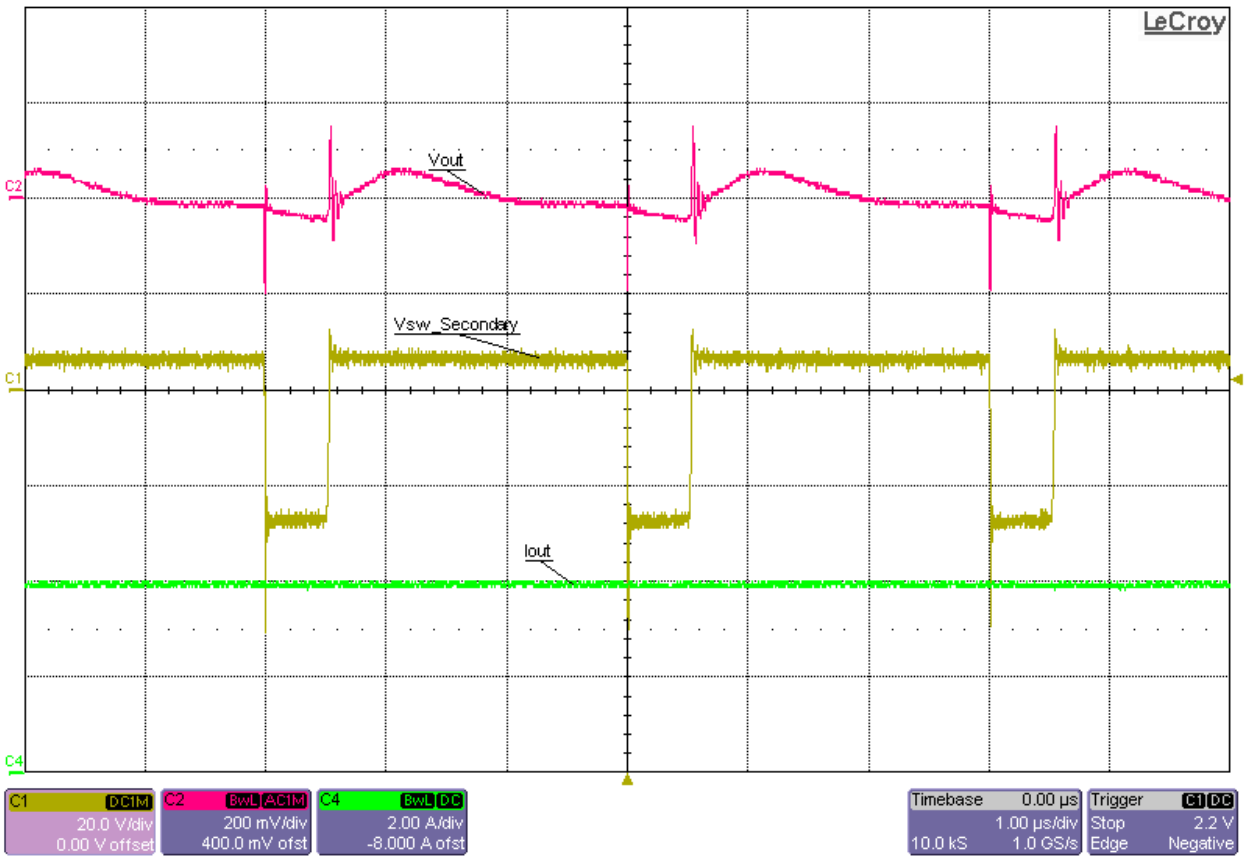
Primary-Side Switch Node Voltage at 80Vin and 4A Constant-Current Load



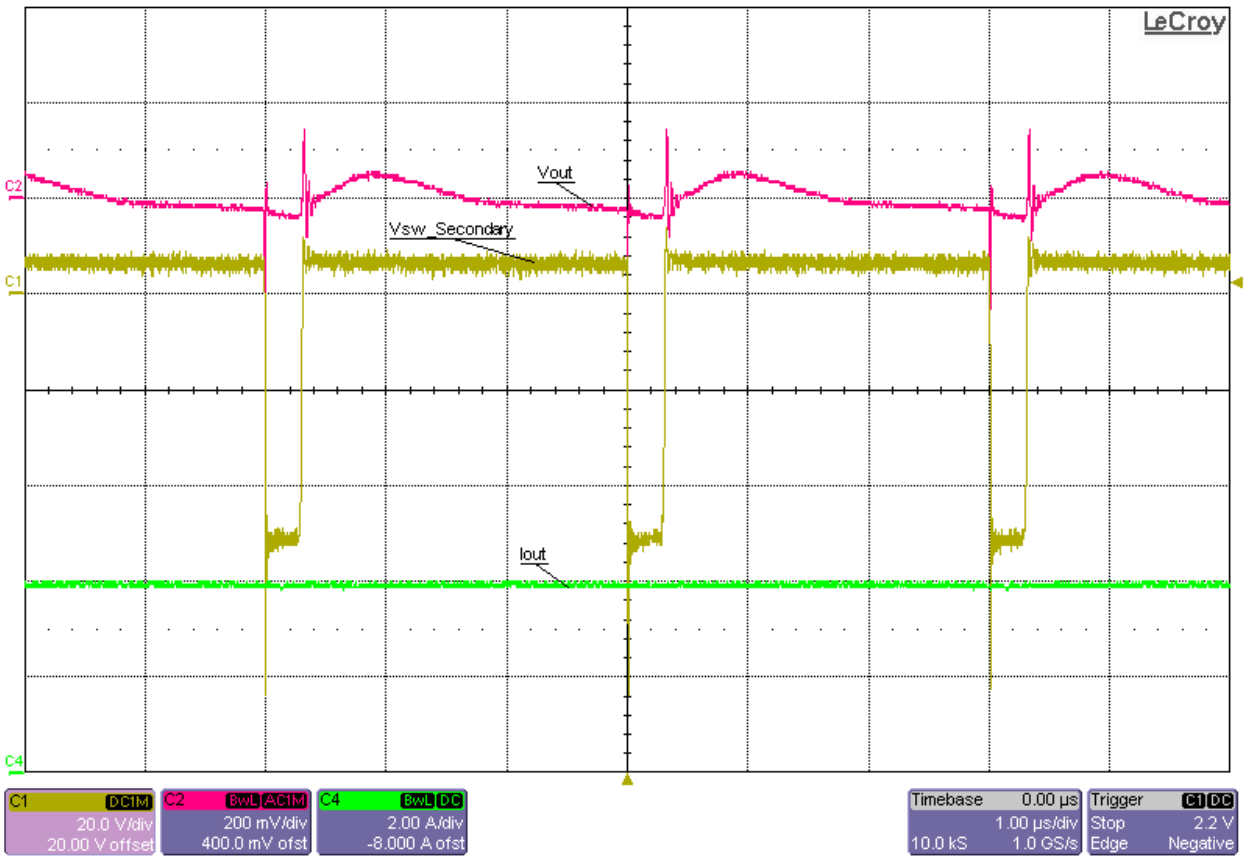
Primary-Side Switch Node Voltage at 150Vin and 4A Constant-Current Load



Secondary-Side Switch Node Voltage and Output Voltage Ripple at 9Vin and 4A Constant-Current Load (Vripple ≈ 250mVp-p)

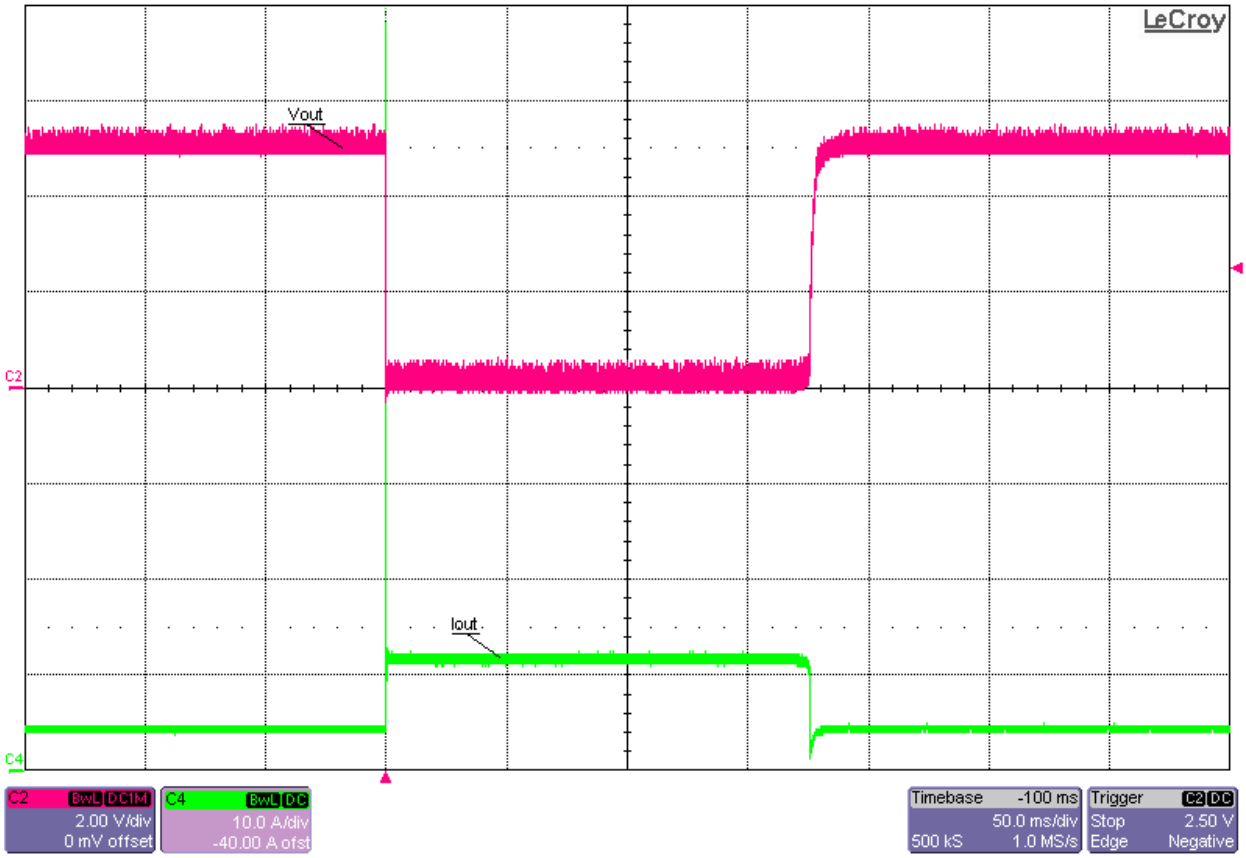


Secondary-Side Switch Node Voltage and Output Voltage Ripple at 80Vin and 4A Constant-Current Load (Vripple ≈ 120mVp-p)

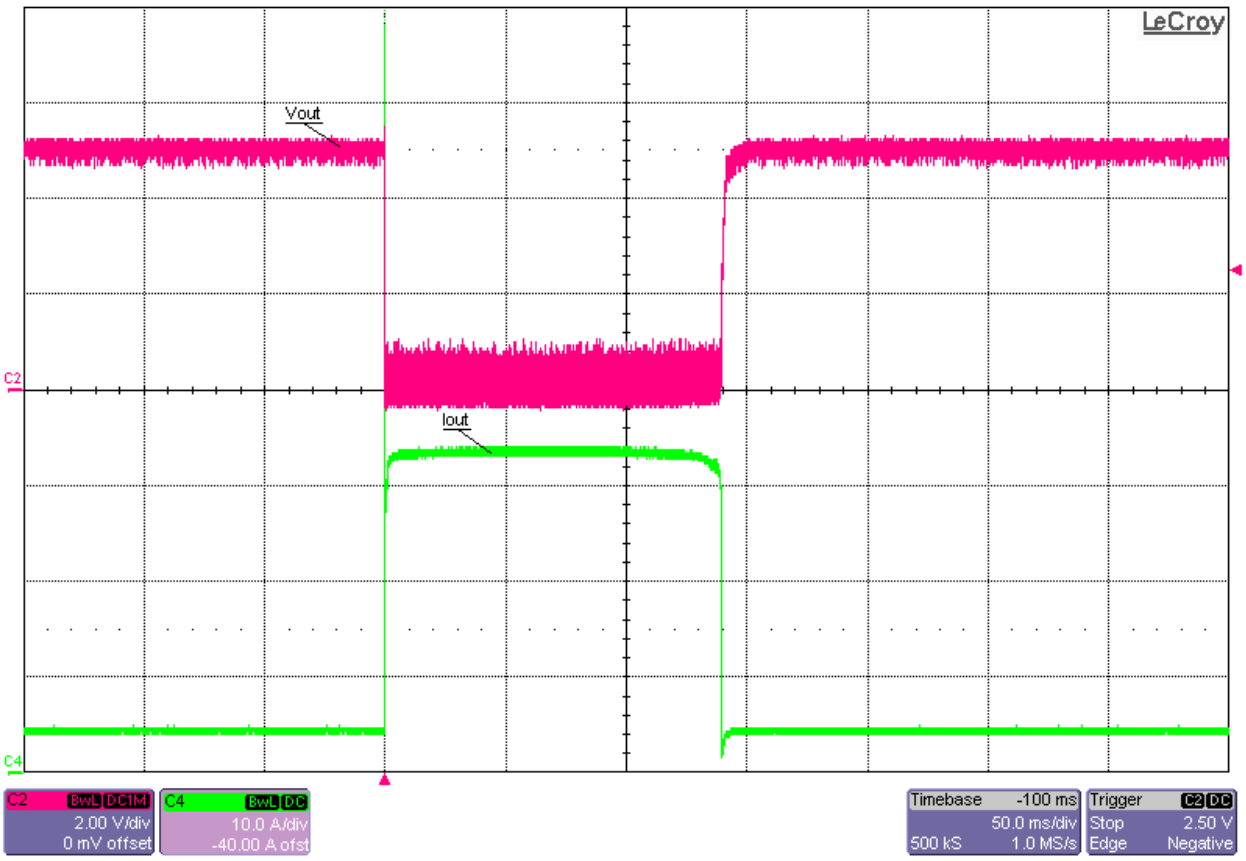


Secondary-Side Switch Node Voltage and Output Voltage Ripple at 150Vin and 4A Constant-Current Load (Vripple ≈ 120mVp-p)

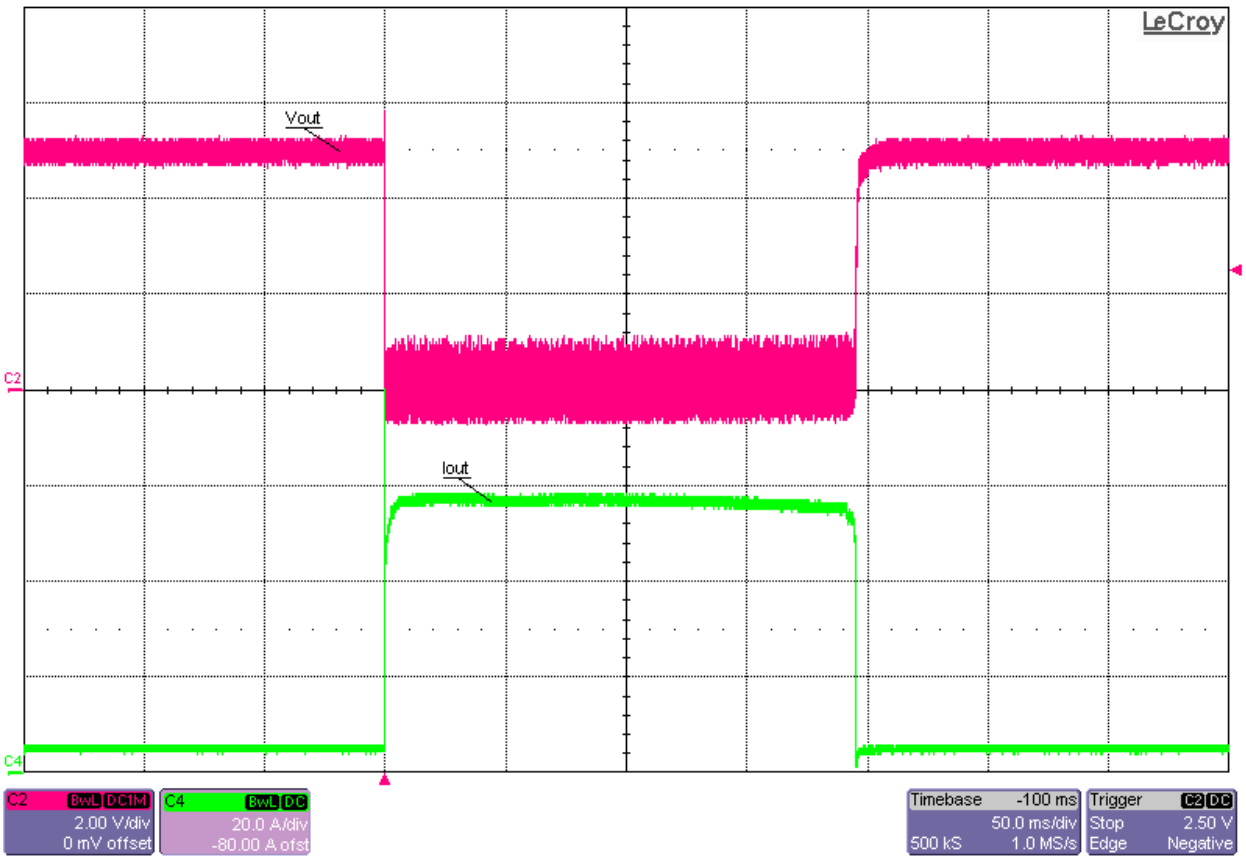
6.4 Short Circuit Testing



Short Circuit Applied and Released on Output Rail While Having an 4A Constant-Current Load with Input Voltage at 9V (momentary short-circuit protection only)



Short Circuit Applied and Released on Output Rail While Having an 4A Constant-Current Load with Input Voltage at 80V (momentary short-circuit protection only)



Short Circuit Applied and Released on Output Rail While Having an 4A Constant-Current Load with Input Voltage at 150V (momentary short-circuit protection only)

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265