Test Data
For PMP20305
June 22, 2016

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1. Design Specifications

Vin Minimum	**6VDC**
Vin Nominal	**13.5VDC**
Vin Maximum	**16VDC (24V Peak)**
Vout	**26.9VDC**
Iout	**0.4A Max.**
Nominal Switching Frequency	**≈ 2MHz**

2. Circuit Description

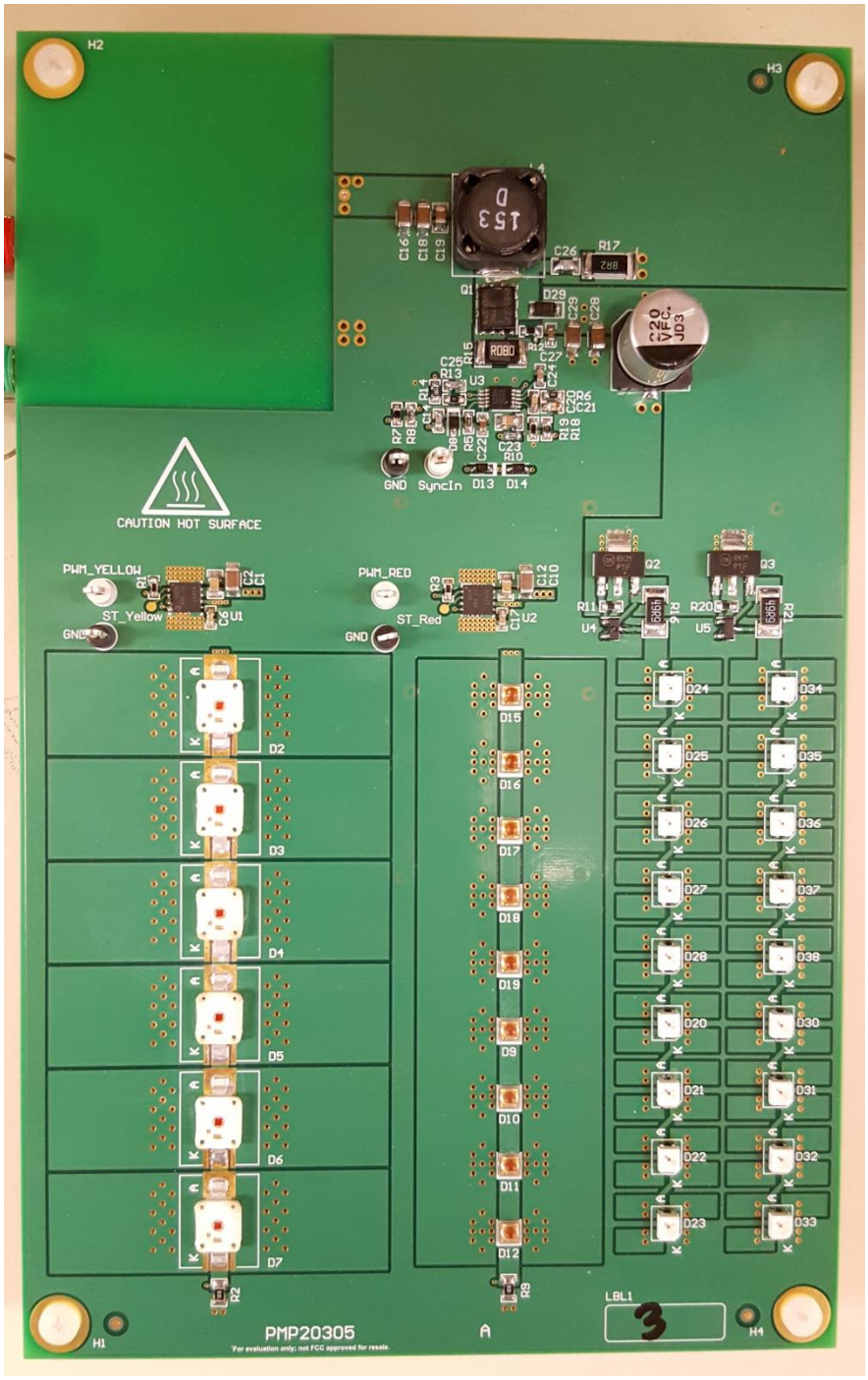
PMP20305 is an LED driver circuit using the LM5022-Q1 boost controller IC and two types of constant-current methods to drive 4 strings of LEDs. Two of the LED strings utilize the TL431 voltage reference as a driver to perform a constant current source, while the other two strings utilize the TL4242 linear LED driver IC, which also features a PWM-controlled brightness adjust scheme. The input voltage range of the circuit is 6Vin to 16Vin (24Vin Peak). The output of the LM5022-Q1 boost converter is set to 26.9Vout and is capable of supplying a total of 0.4A of current to the loads.

The design is built on a 4-layer FR-4 PCB, with 2 oz. Copper on all four layers.

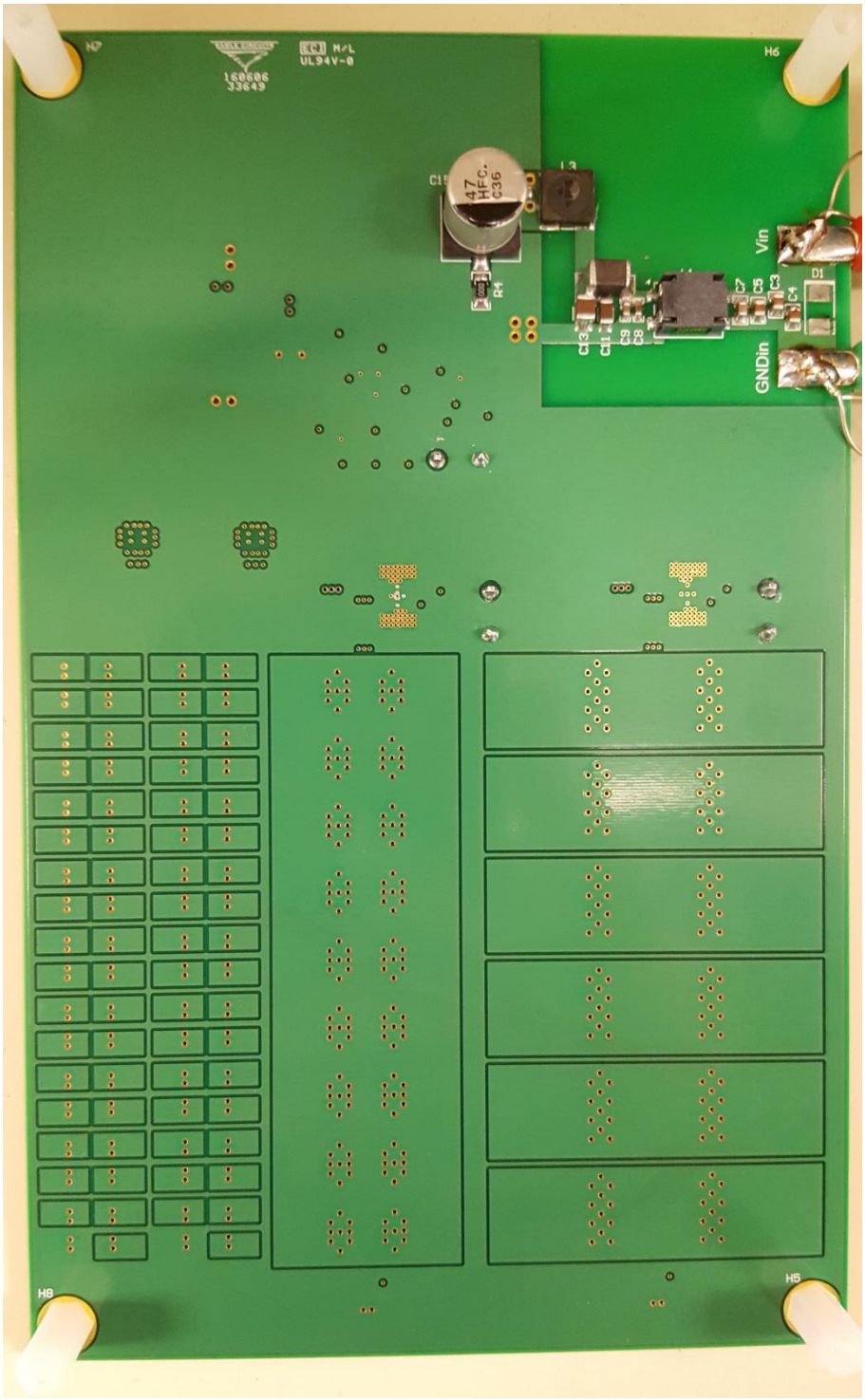
All electrical tests were performed with the LED driver circuitry disabled/disconnected (see notes on schematic sheet for details). Thermal results were taken with all LEDs enabled at their full current.

3. PMP20305 Board Photos

Board Dimensions: 4.4” x 7”

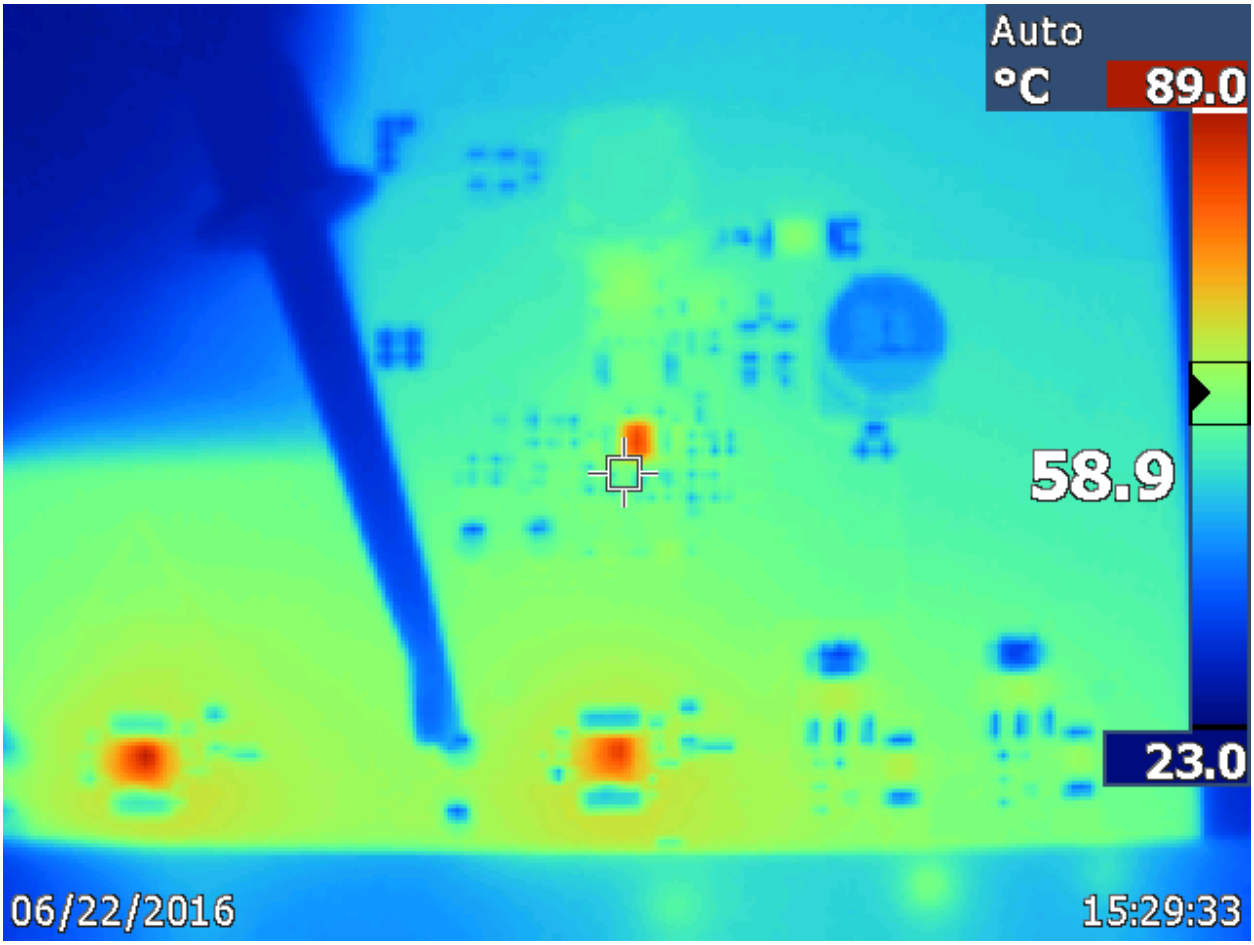


Board Photo (Top View)

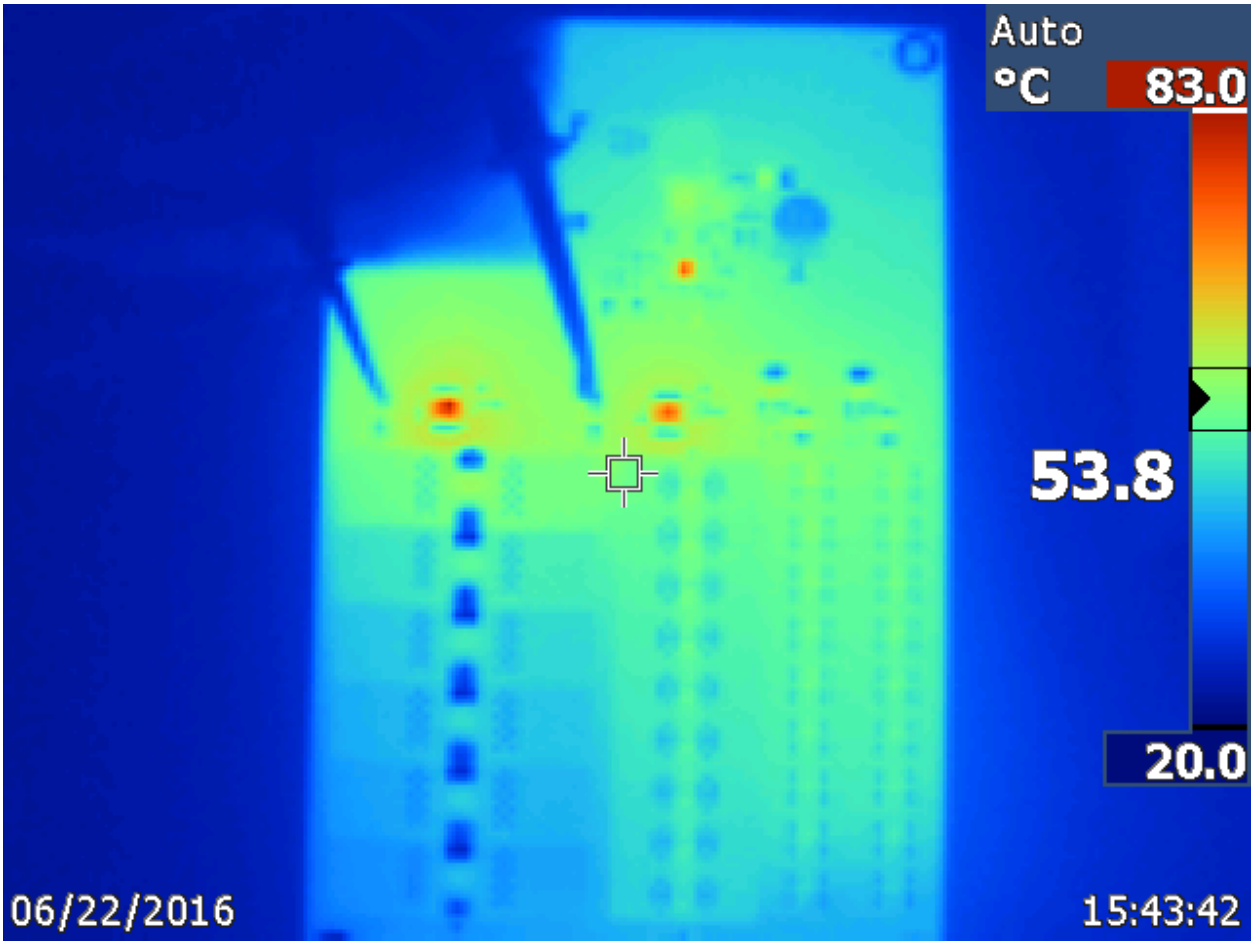


Board Photo (Bottom View)

4. Thermal Data



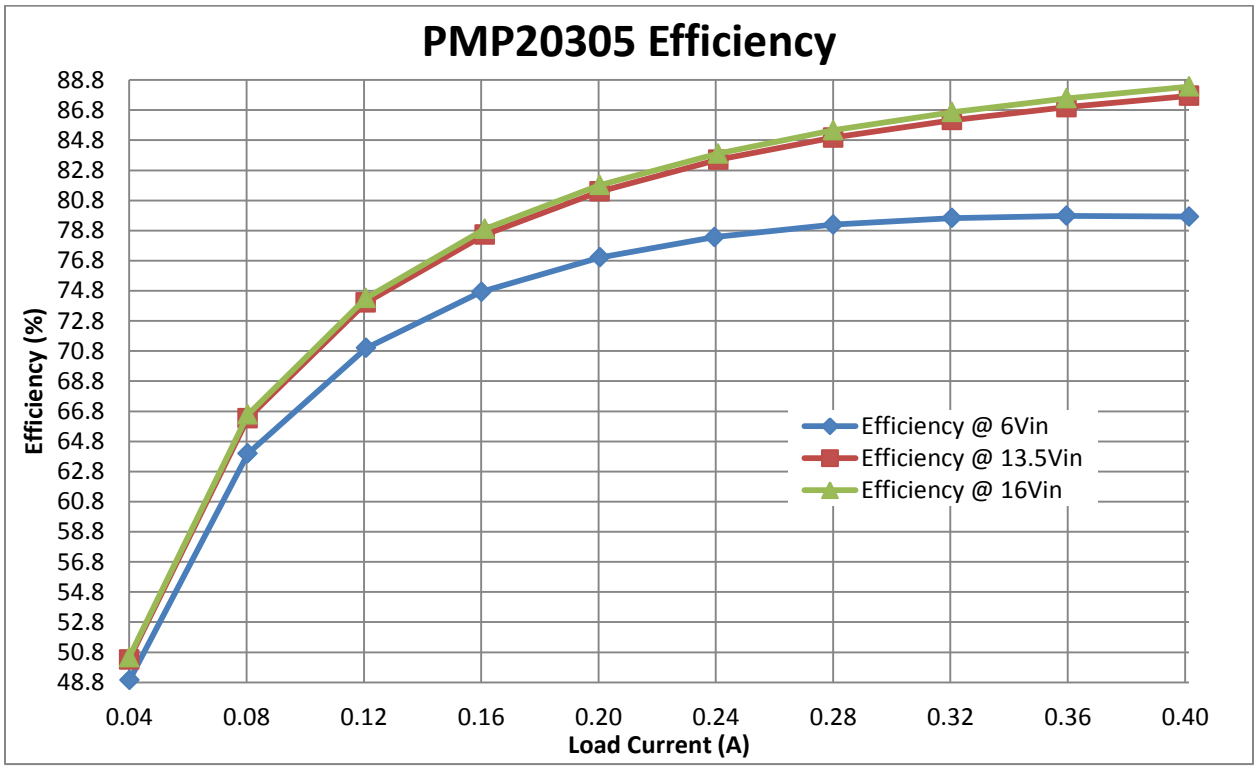
IR thermal image taken at steady state with 13.5Vin and 0.4A Load (All LED strings enabled at full current; no airflow; ambient at room temp.; View of Boost Converter and LED Drivers Only)



IR thermal image taken at steady state with 13.5Vin and 0.4A Load (All LED strings enabled at full current; no airflow; ambient at room temp.; Full Board View)

5. Efficiency

5.1 Efficiency Graph



5.2 Efficiency Data

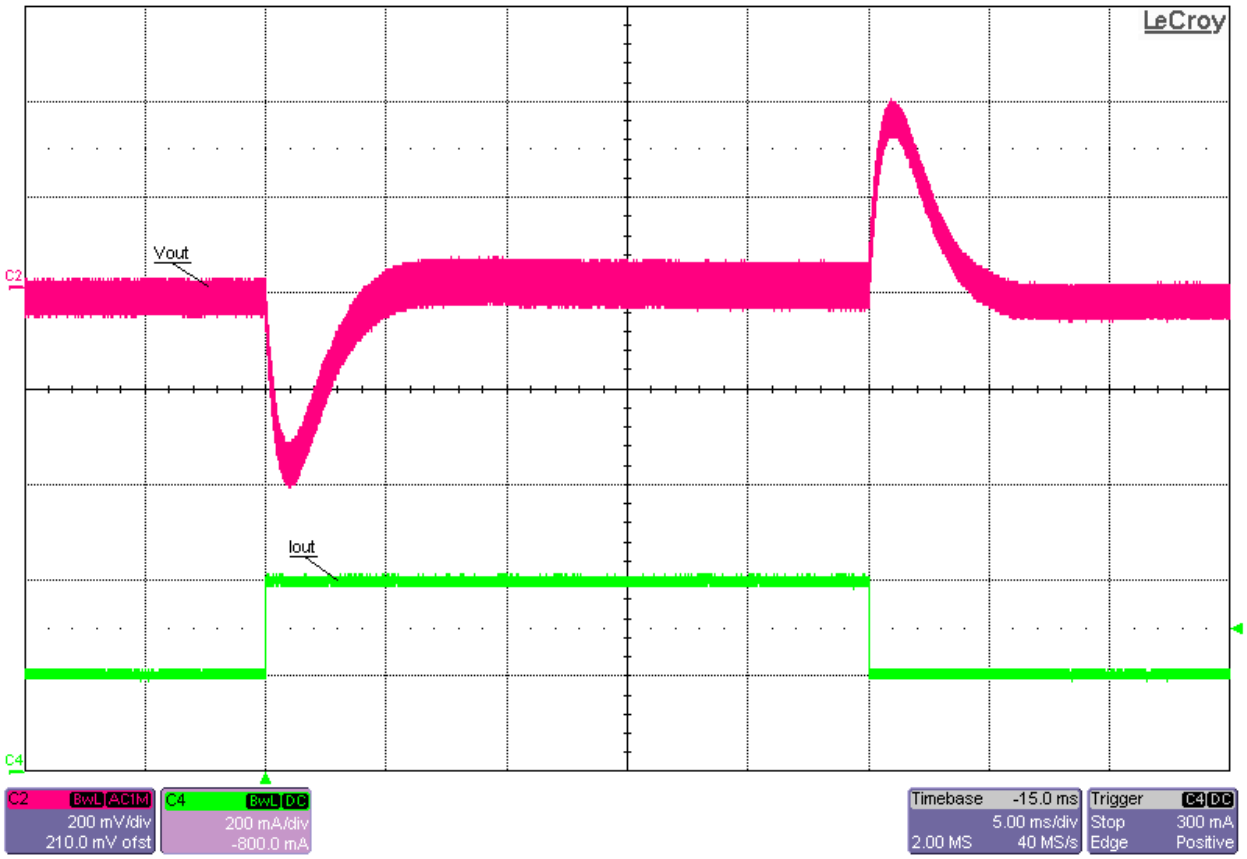
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Ploss (W)	Efficiency (%)
6	0.3650	27.0670	0.0396	2.1900	1.0719	1.1181	48.9
6	0.5632	27.0660	0.0799	3.3792	2.1626	1.2166	64.0
6	0.7643	27.0660	0.1203	4.5858	3.2560	1.3298	71.0
6	0.9634	27.0660	0.1596	5.7804	4.3197	1.4607	74.7
6	1.1714	27.0650	0.2000	7.0284	5.4130	1.6154	77.0
6	1.3763	27.0660	0.2391	8.2578	6.4715	1.7863	78.4
6	1.5926	27.0660	0.2796	9.5556	7.5677	1.9879	79.2
6	1.8133	27.0660	0.3201	10.8798	8.6638	2.2160	79.6
6	2.0305	27.0660	0.3591	12.1830	9.7194	2.4636	79.8
6	2.2684	27.0660	0.4009	13.6104	10.8508	2.7596	79.7

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Ploss (W)	Efficiency (%)
13.5	0.1574	27.0680	0.0395	2.1249	1.0692	1.0557	50.3
13.5	0.2415	27.0680	0.0799	3.2603	2.1627	1.0975	66.3
13.5	0.3256	27.0680	0.1202	4.3956	3.2536	1.1420	74.0
13.5	0.4103	27.0680	0.1607	5.5391	4.3498	1.1892	78.5
13.5	0.4924	27.0680	0.1999	6.6474	5.4109	1.2365	81.4
13.5	0.5772	27.0680	0.2404	7.7922	6.5071	1.2851	83.5
13.5	0.6597	27.0670	0.2796	8.9060	7.5679	1.3380	85.0
13.5	0.7451	27.0670	0.3201	10.0589	8.6641	1.3947	86.1
13.5	0.8276	27.0660	0.3591	11.1726	9.7194	1.4532	87.0
13.5	0.9160	27.0660	0.4009	12.3660	10.8508	1.5152	87.7

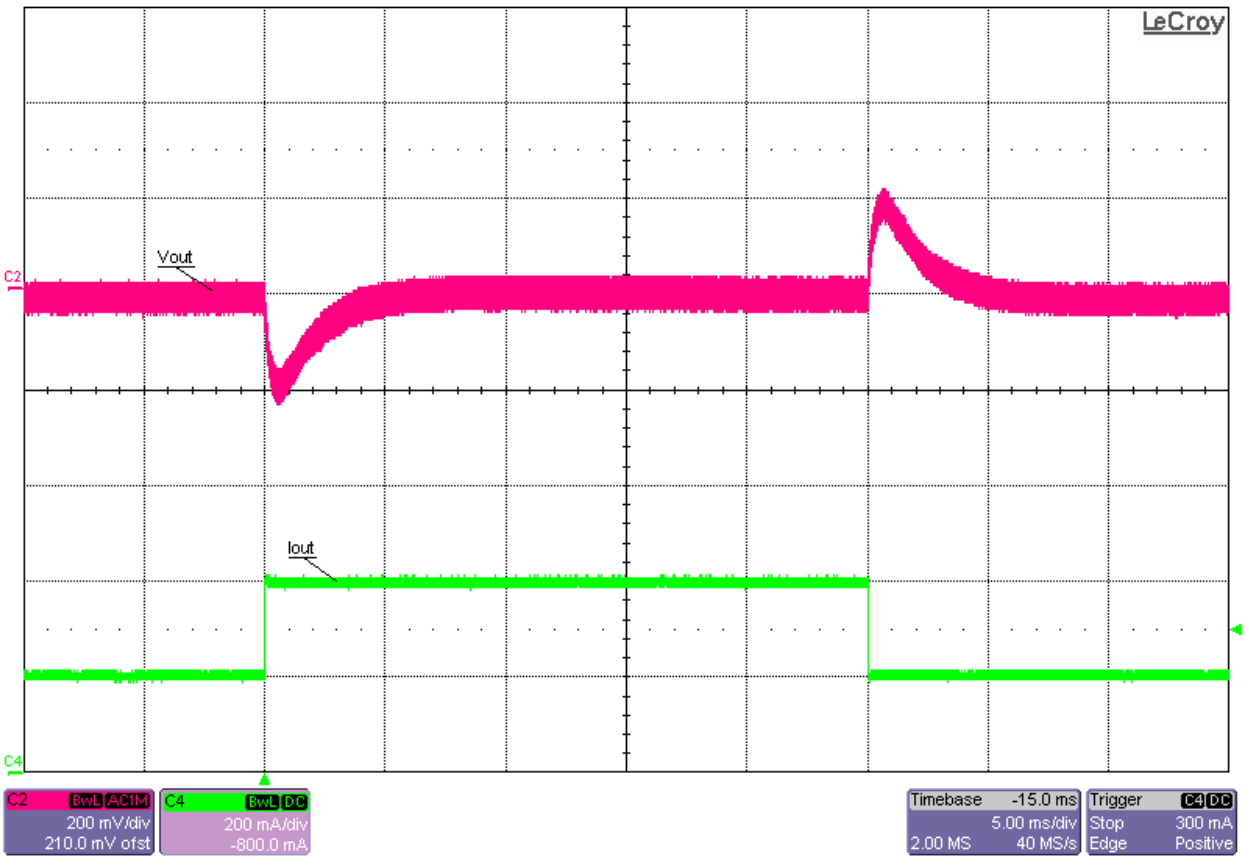
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Ploss (W)	Efficiency (%)
16	0.1324	27.0660	0.0395	2.1184	1.0691	1.0493	50.5
16	0.2030	27.0660	0.0799	3.2480	2.1626	1.0854	66.6
16	0.2736	27.0660	0.1202	4.3776	3.2533	1.1243	74.3
16	0.3445	27.0660	0.1607	5.5120	4.3495	1.1625	78.9
16	0.4133	27.0660	0.1999	6.6128	5.4105	1.2023	81.8
16	0.4844	27.0660	0.2403	7.7504	6.5040	1.2464	83.9
16	0.5534	27.0660	0.2796	8.8544	7.5677	1.2867	85.5
16	0.6248	27.0660	0.3201	9.9968	8.6638	1.3330	86.7
16	0.6936	27.0660	0.3591	11.0976	9.7194	1.3782	87.6
16	0.7675	27.0660	0.4009	12.2800	10.8508	1.4292	88.4

6 Waveforms

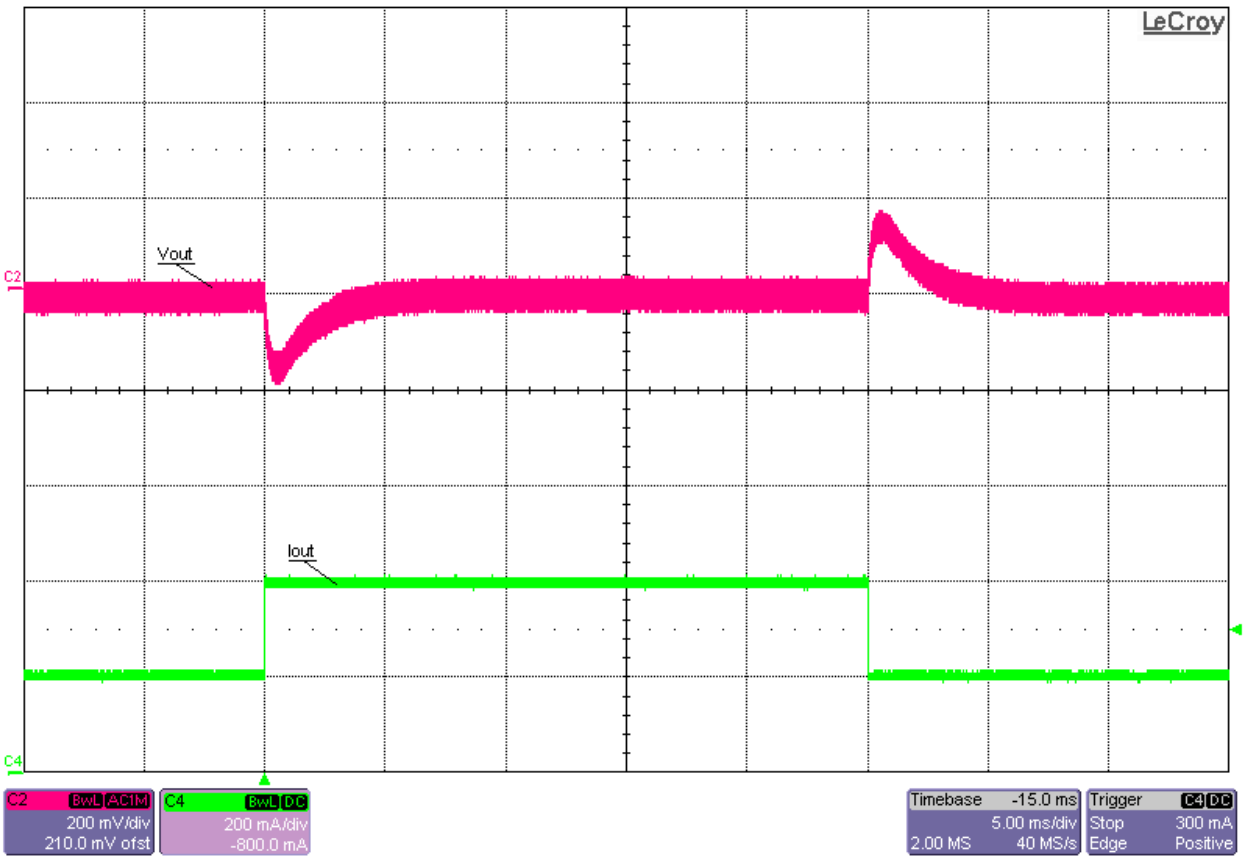
6.1 Load Transient Response



Load Transient Response at 6Vin and 0.2A-to-0.4A (50%-to-100%) Load Step

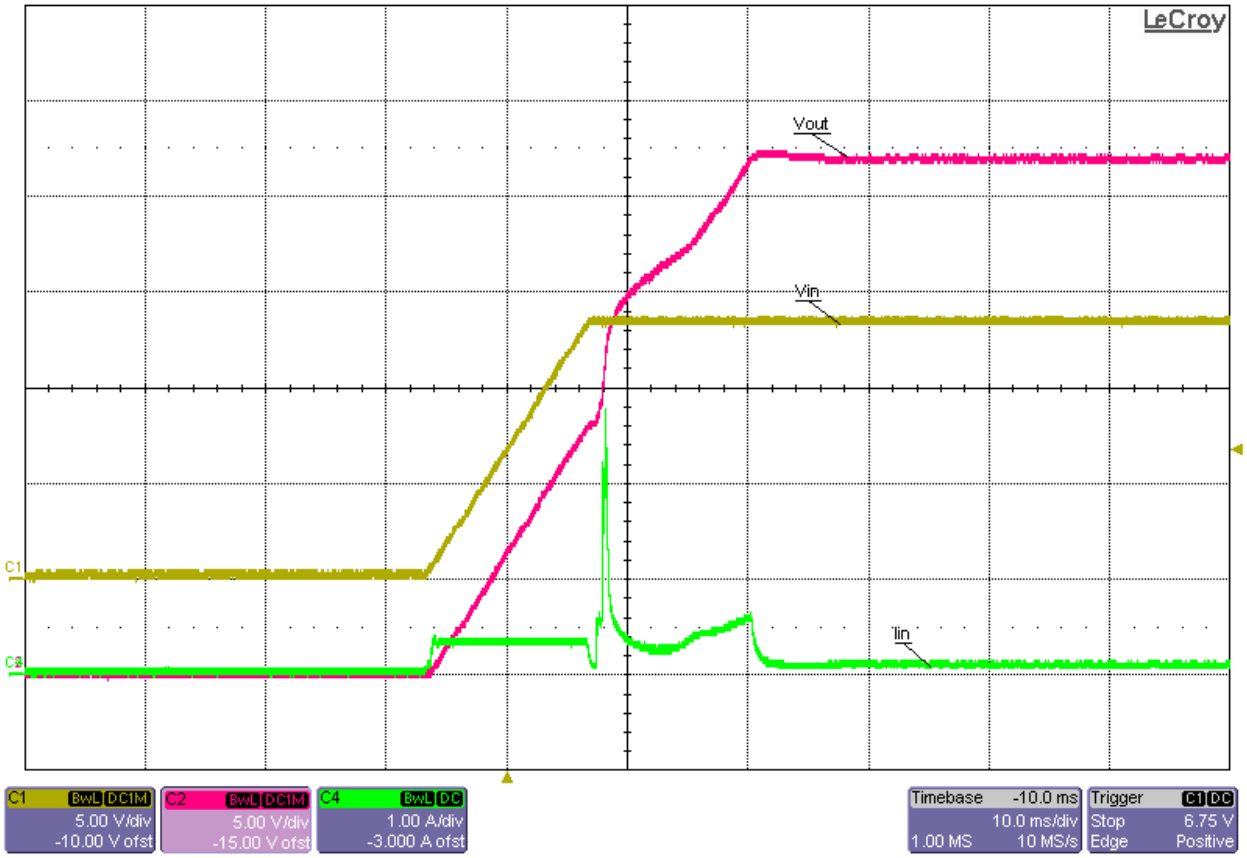


Load Transient Response at 13.5Vin and 0.2A-to-0.4A (50%-to-100%) Load Step

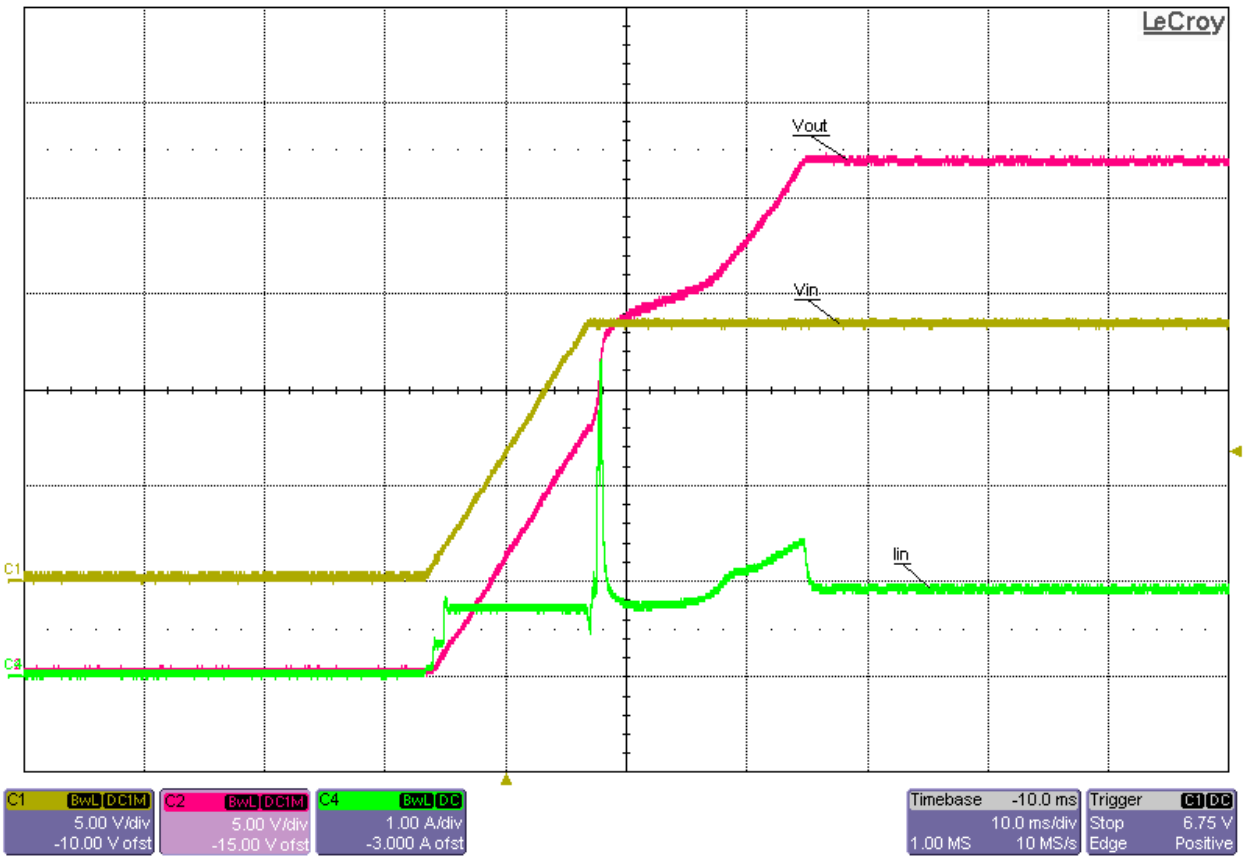


Load Transient Response at 16Vin and 0.2A-to-0.4A (50%-to-100%) Load Step

6.2 Startup

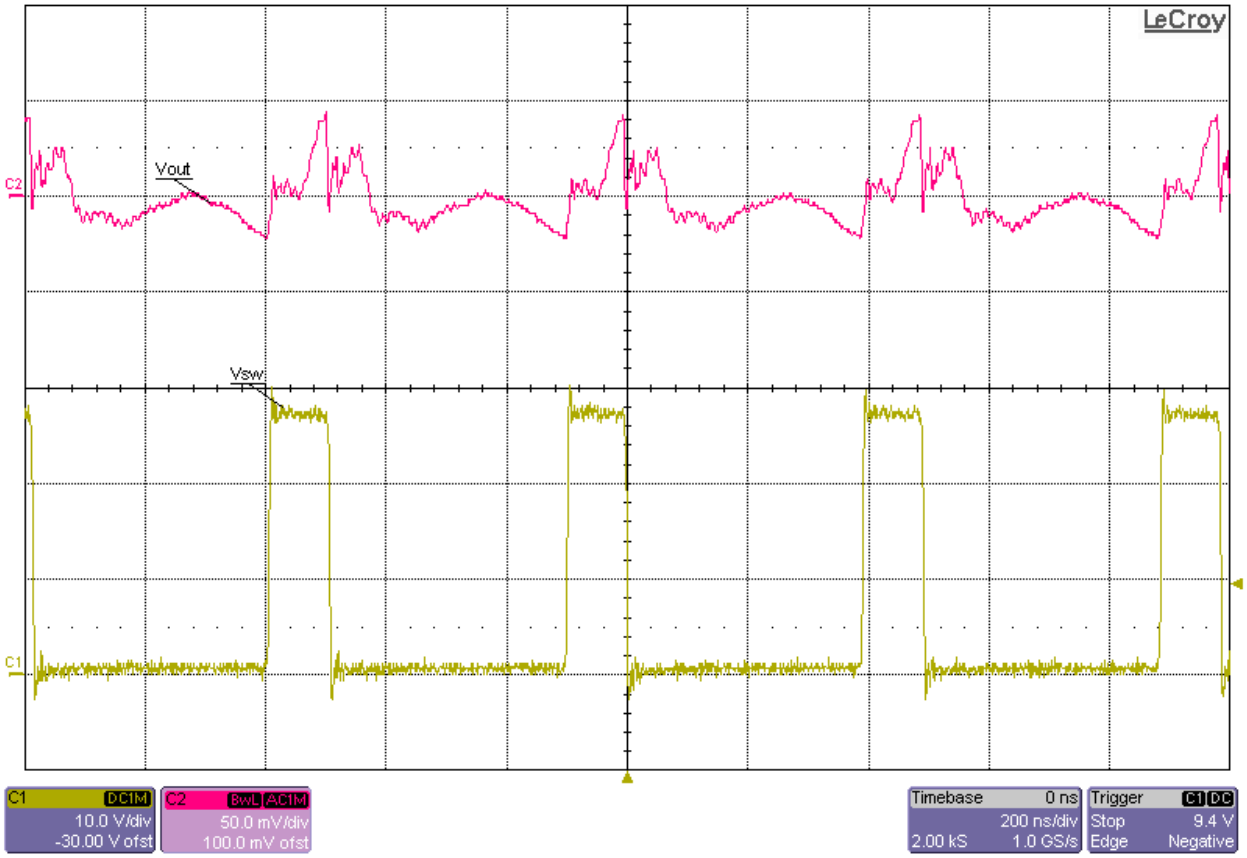


Startup into No Load at 13.5Vin

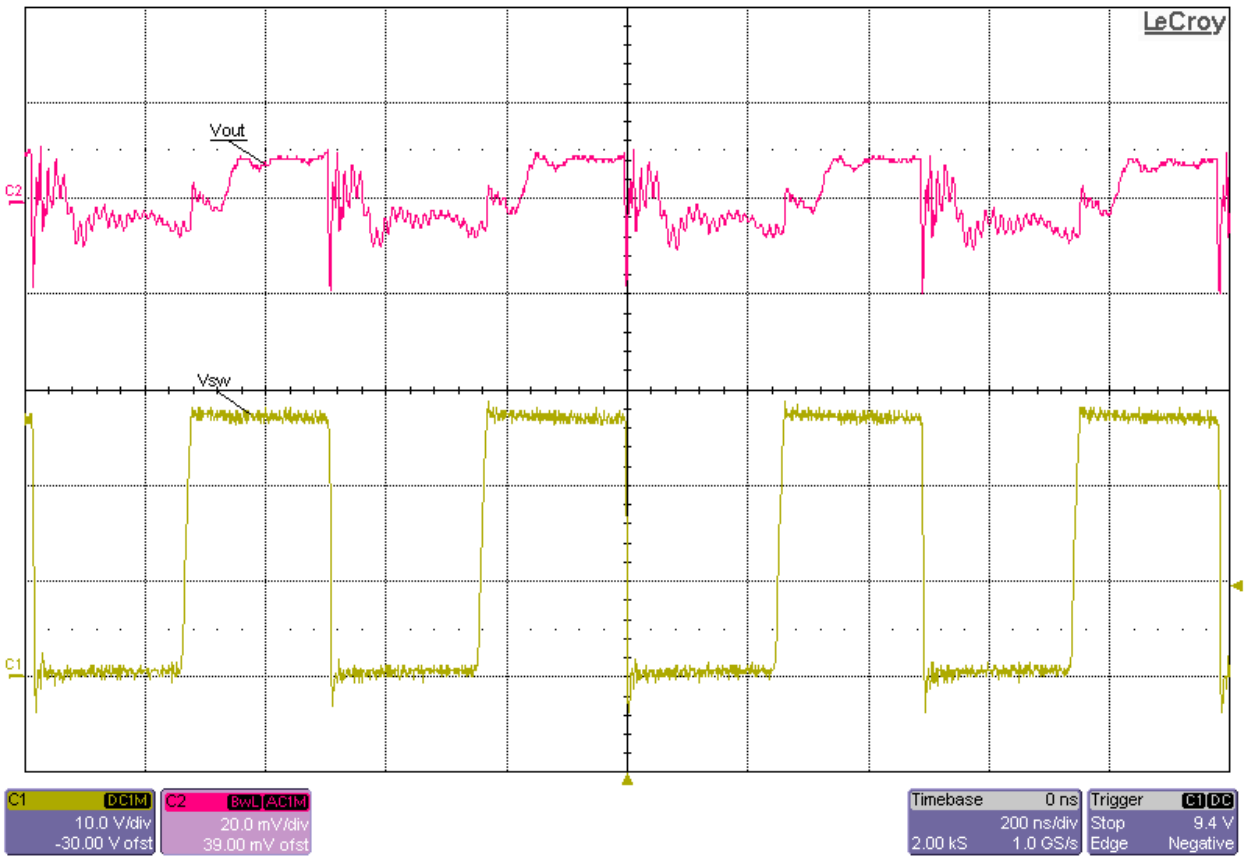


Startup into 0.4A Constant-Current Load at 13.5Vin

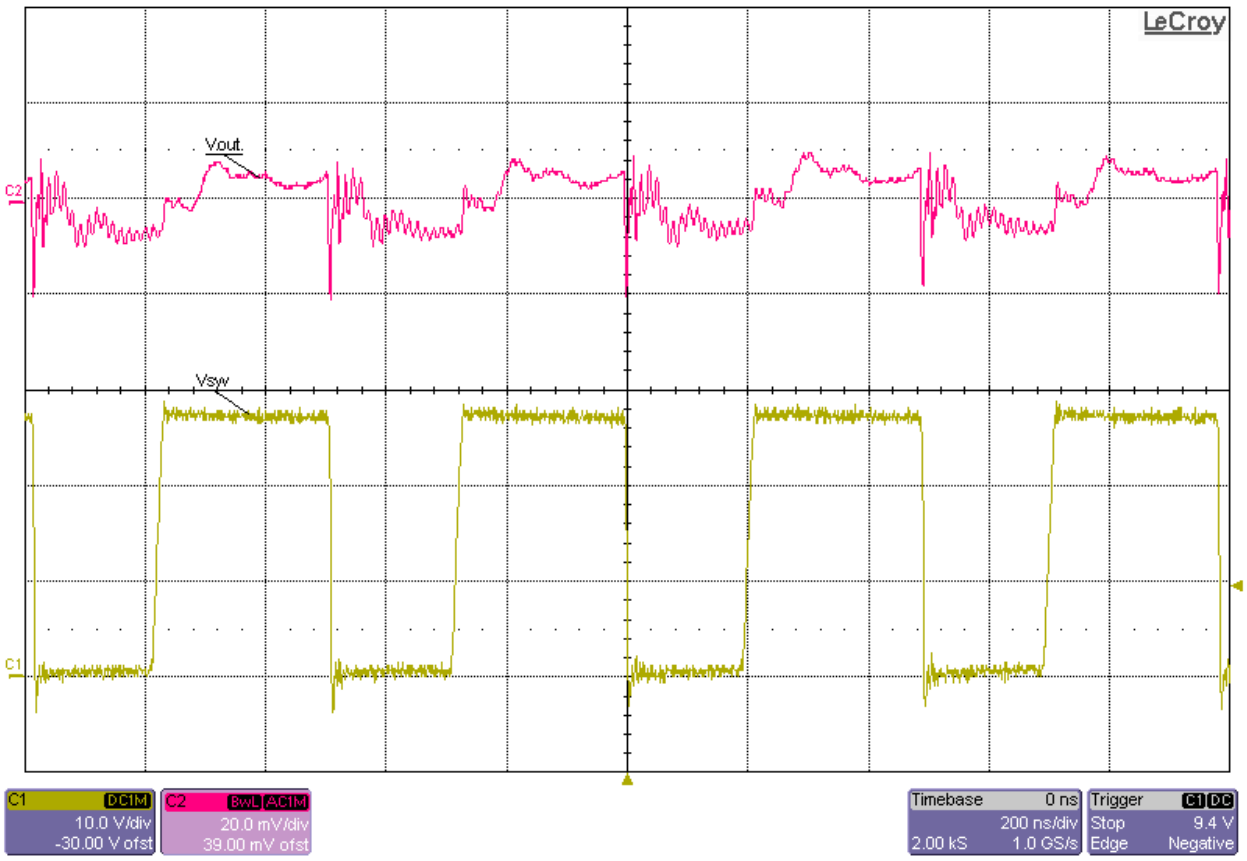
6.3 Output Voltage Ripple and Switch Node Voltages



Switch Node Voltage and Output Voltage Ripple at 6Vin and 0.4A Load (Vripple ≈ 60mVp-p)

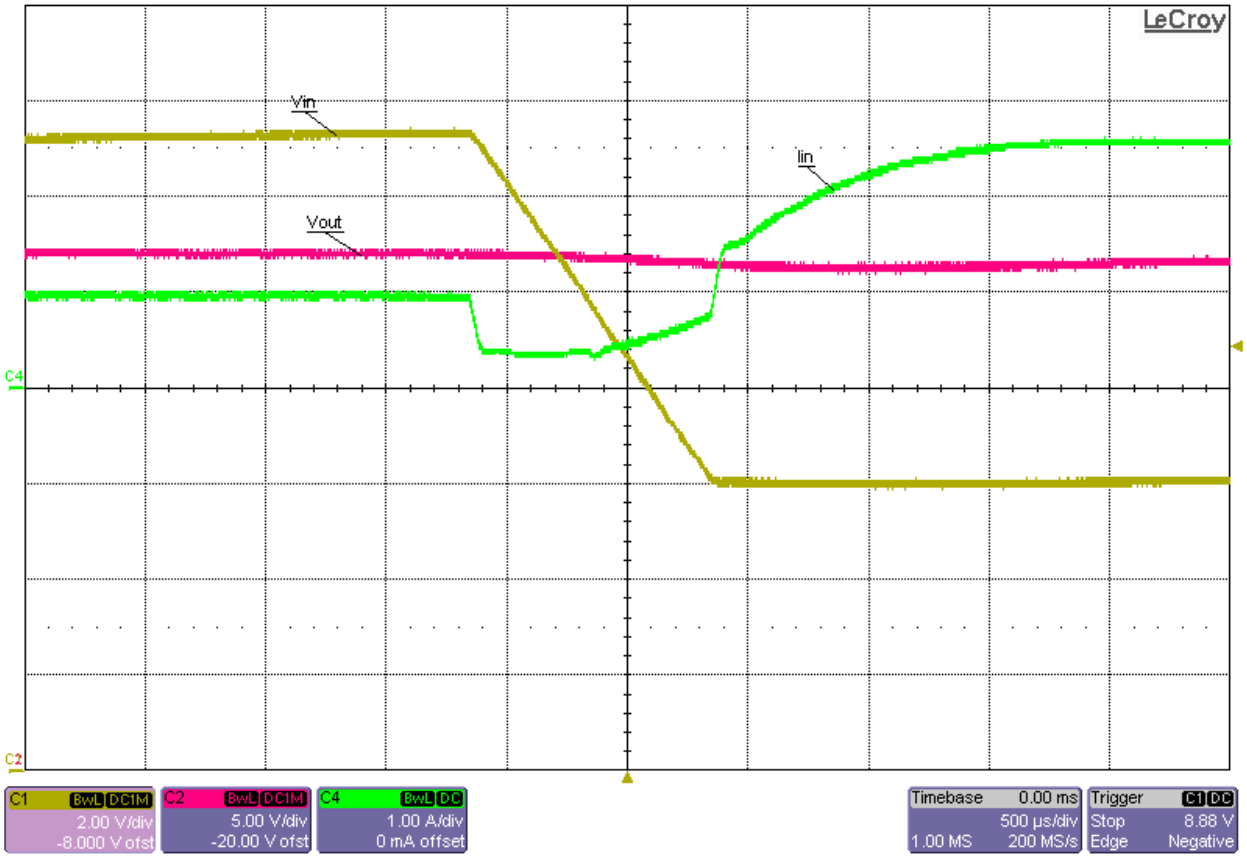


Switch Node Voltage and Output Voltage Ripple at 13.5Vin and 0.4A Load (Vripple ≈ 30mVp-p)

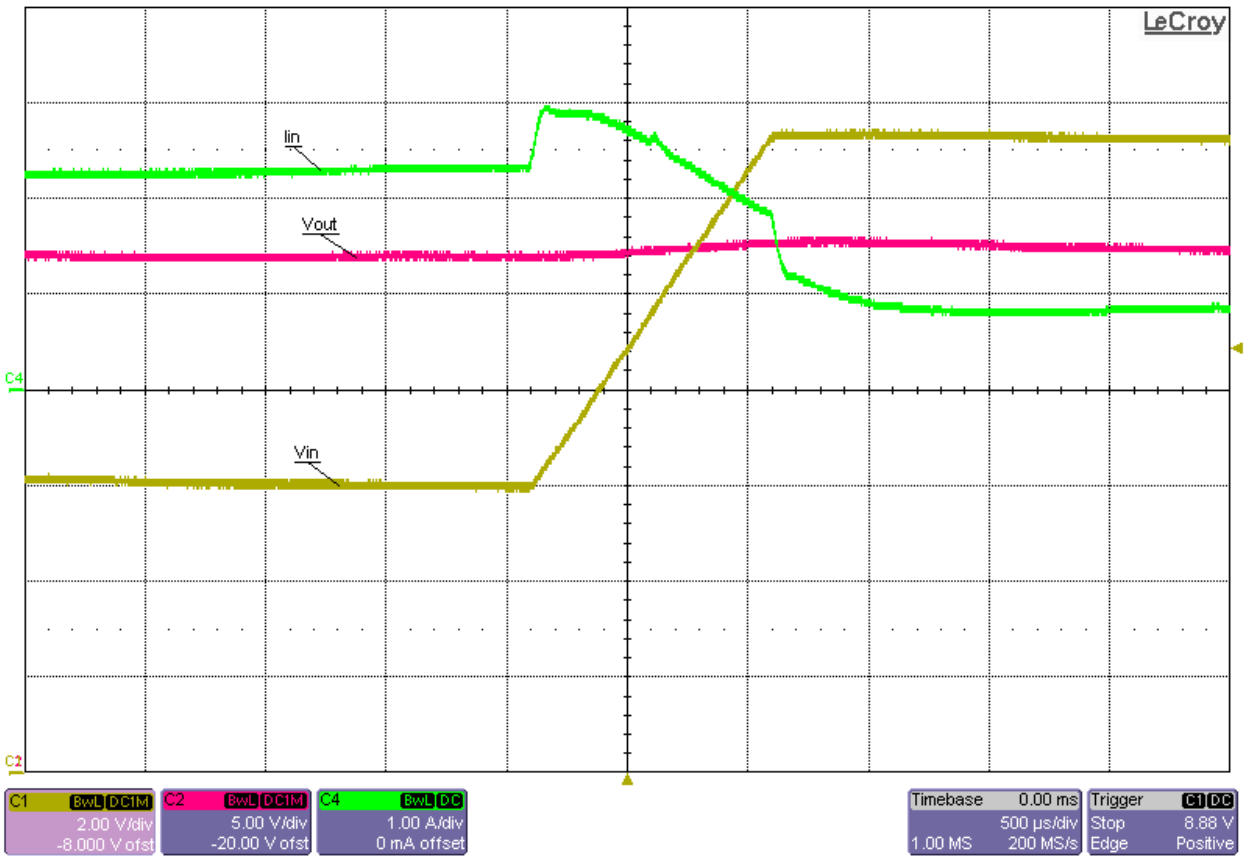


Switch Node Voltage and Output Voltage Ripple at 16Vin and 0.4A Load (Vripple ≈ 30mVp-p)

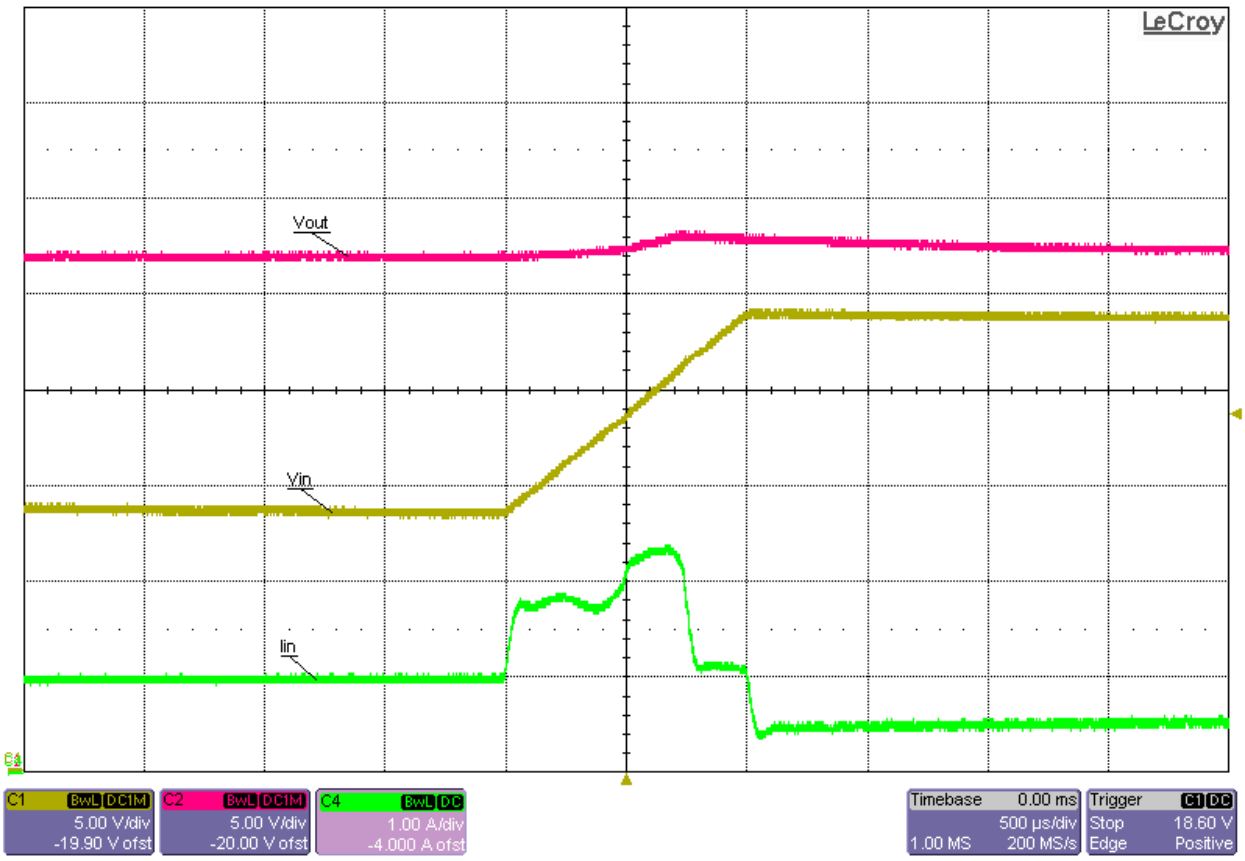
6.4 Line Transient



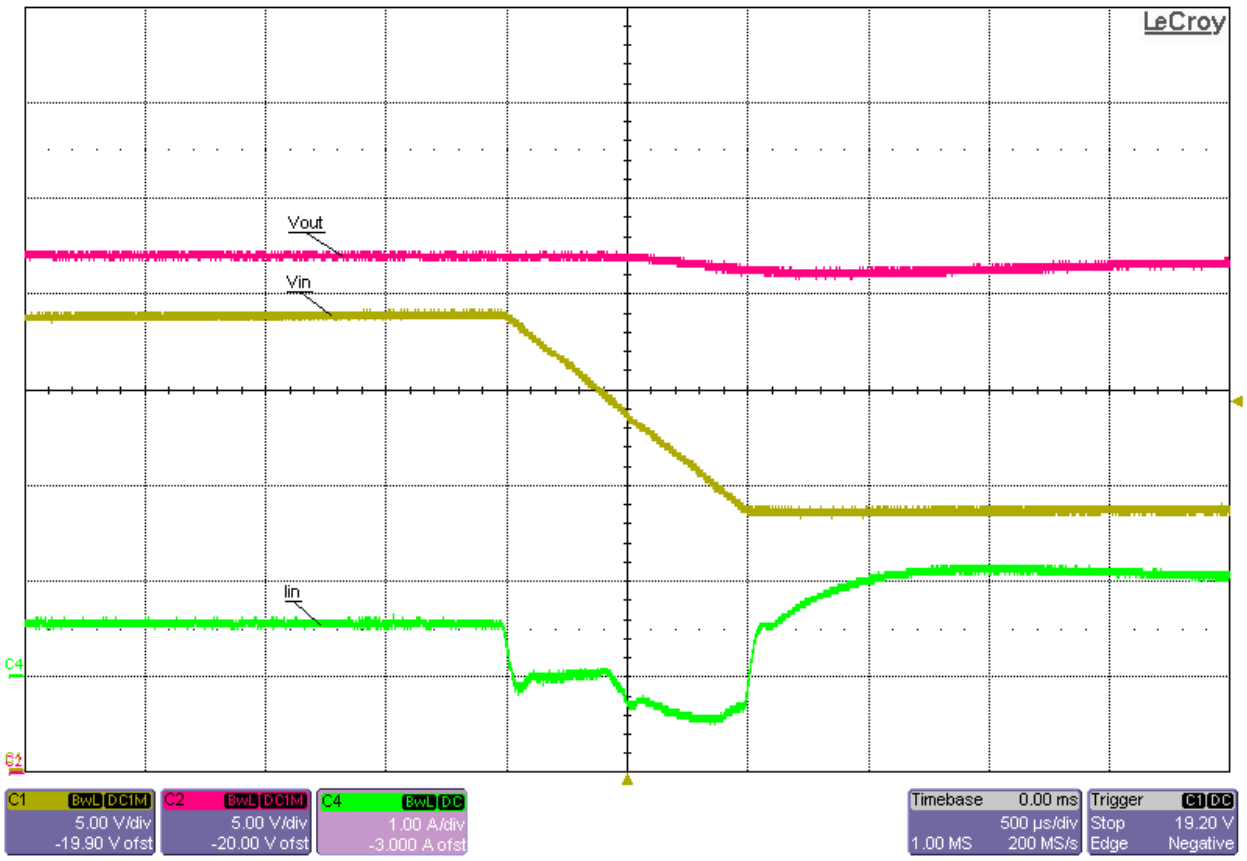
Line Transient from 13.5Vin to 6Vin (0.4A Constant-Current Load on the output)



Line Transient from 6Vin to 13.5Vin (0.4A Constant-Current Load on the output)



Line Transient from 13.5Vin to 24Vin (0.4A Constant-Current Load on the output)



Line Transient from 24Vin to 13.5Vin (0.4A Constant-Current Load on the output)

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