TPS92515-Q1 LED Buck Converter

TI reference design number: PMP20178 Rev A

Input: 9V to 16V
Output: 6V or 9V @ 1A

DC – DC Test Results

Table of Contents

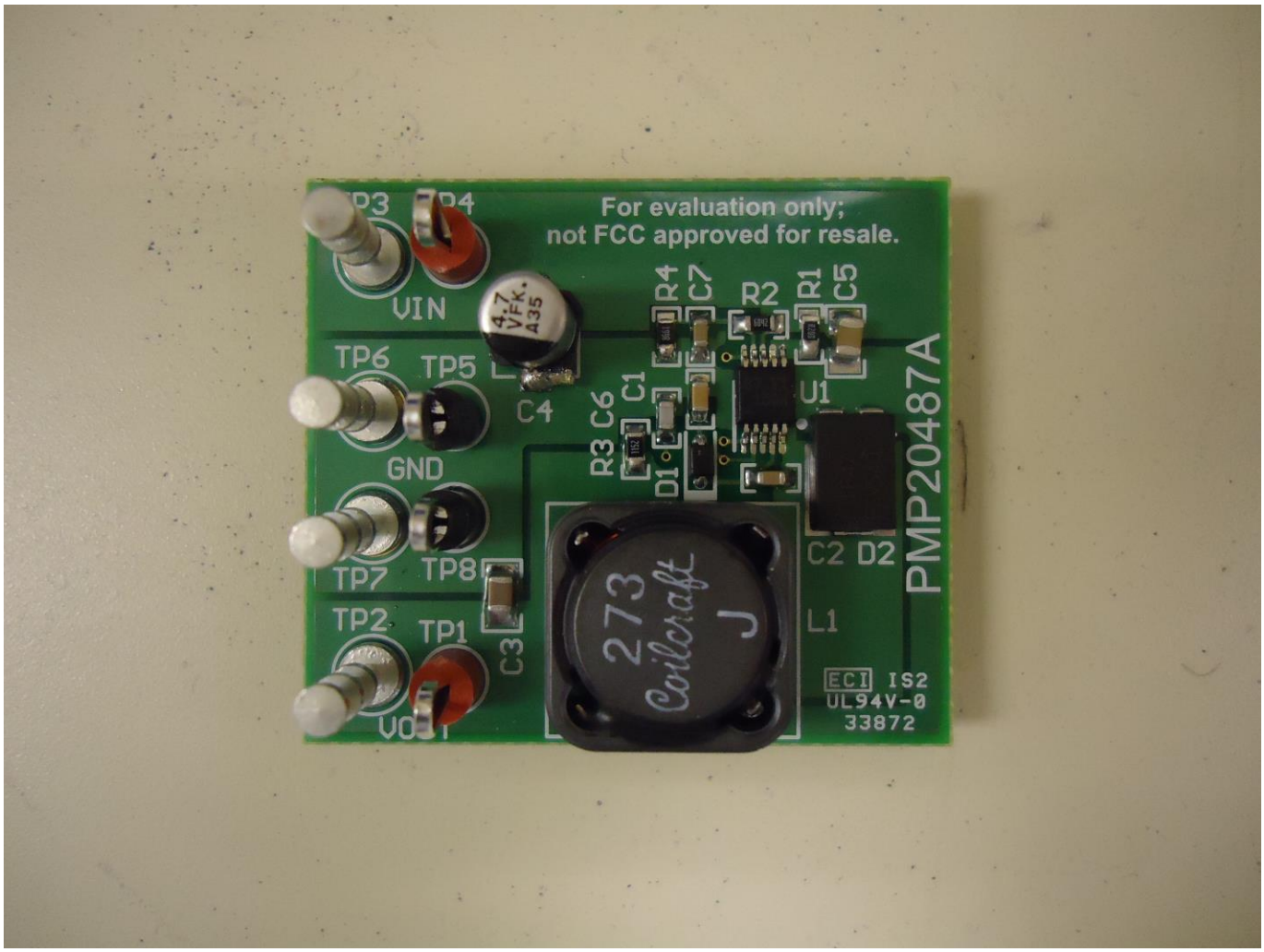
1 Circuit Description

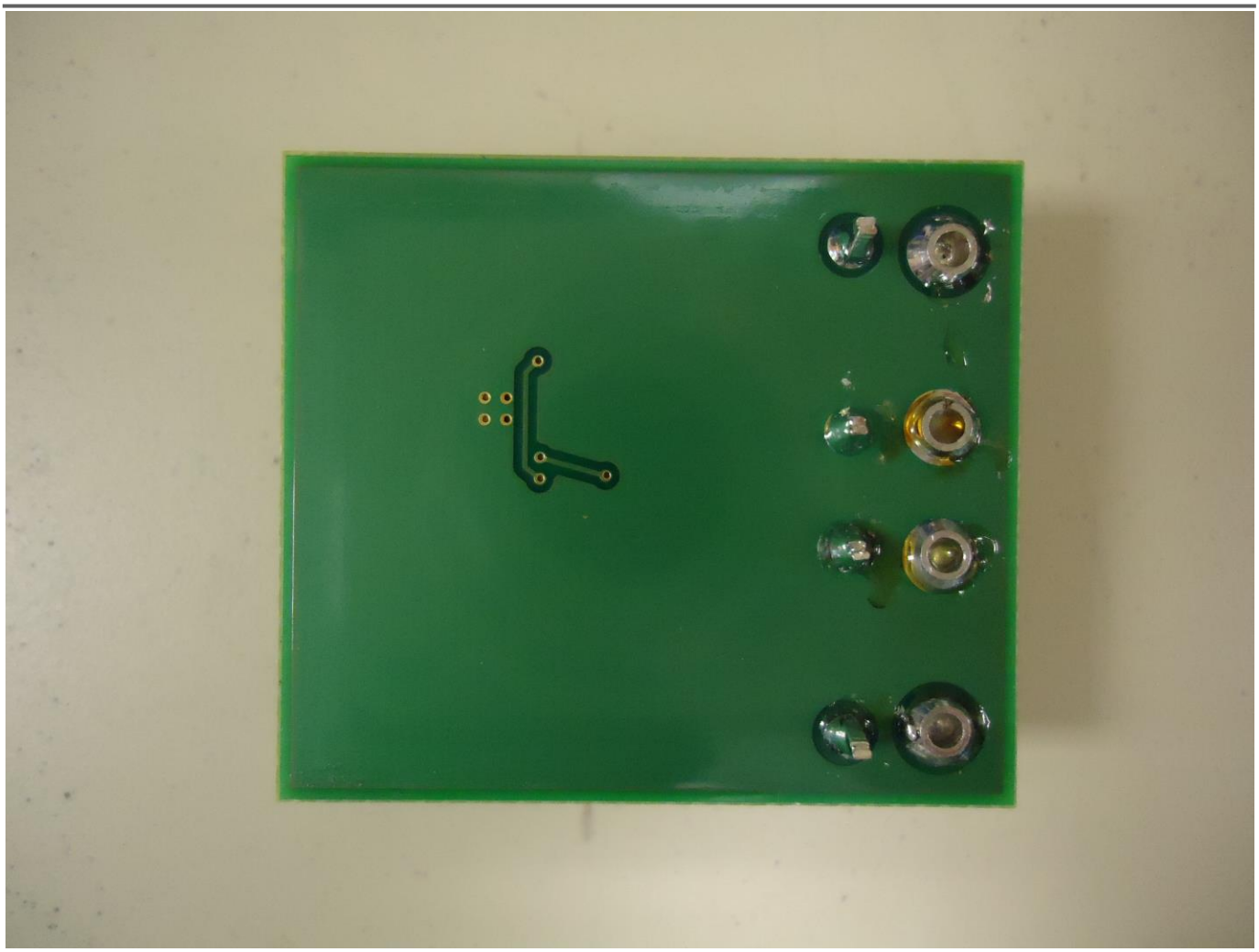
PMP20487 is a hysteretic buck converter which drives LEDs at up to 1A from an input voltage of 9V to 16V. This design uses the TPS92515-Q1 buck LED driver set for a constant off-time of 1µs. Features include integrated N-channel FET, high-side current sense, and shunt FET PWM dimming capability.

At tests were performed at room temperature on an open bench. LED loads were CITILIGHT series 773F, three strings of 2 or 3 series LEDs with a 1 ohm ballast resistor in each string.

2 Photos

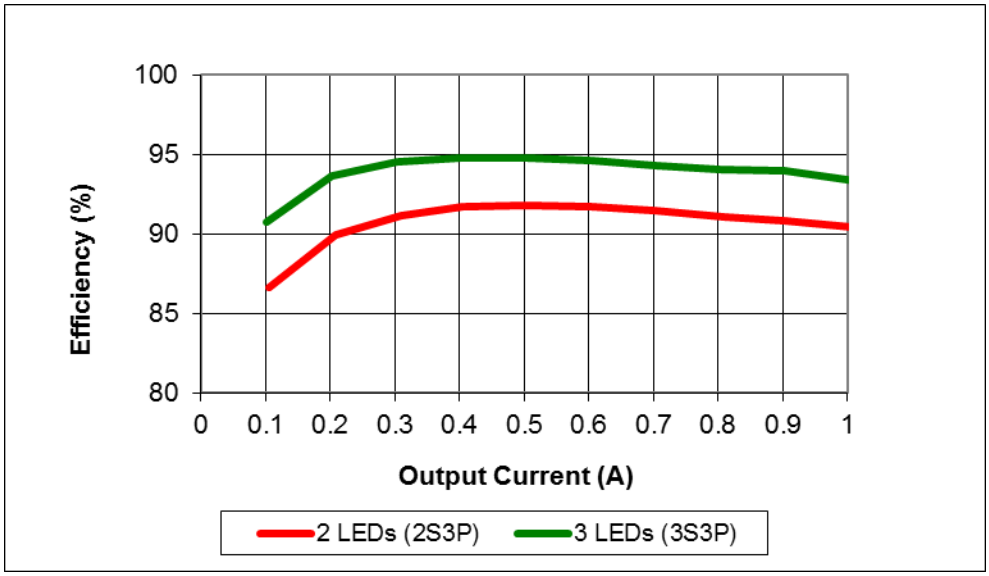
The photographs below show the PMP20487 Rev A printed circuit board assembly. This is a 2 layer board using 1 ounce copper. The overall board dimensions are 30.0 mm x 34.3 mm.





3 Efficiency

The efficiency data is shown in the tables and graph below for 12V input. A 10k linear pot at the IADJ pin was used to set the current.



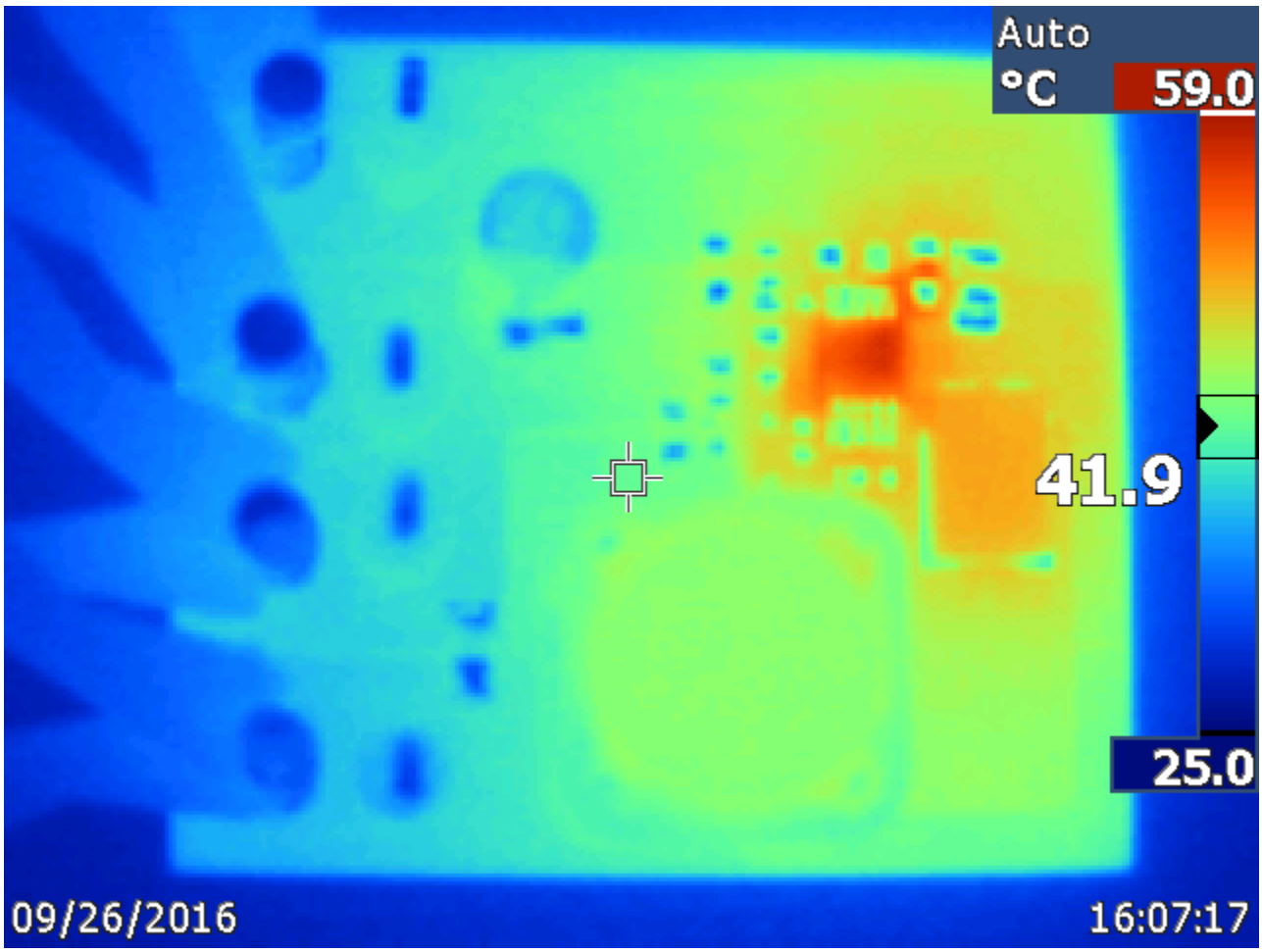
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Efficiency (%)	Pin (W)	Pout (W)	Losses (W)
12.006	0.0547	5.366	0.1060	86.61	0.657	0.569	0.088
12.006	0.1063	5.527	0.2076	89.91	1.276	1.147	0.129
12.005	0.1603	5.662	0.3099	91.18	1.924	1.755	0.170
12.005	0.2124	5.771	0.4053	91.73	2.550	2.339	0.211
12.005	0.2668	5.874	0.5006	91.81	3.203	2.941	0.262
12.005	0.3281	5.976	0.6043	91.68	3.939	3.611	0.328
12.005	0.3869	6.066	0.7005	91.48	4.645	4.249	0.396
12.004	0.4558	6.158	0.8094	91.10	5.471	4.984	0.487
12.004	0.5166	6.238	0.9031	90.84	6.201	5.634	0.568
12.003	0.6176	6.359	1.0517	90.22	7.413	6.688	0.725

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Efficiency (%)	Pin (W)	Pout (W)	Losses (W)
12.005	0.0754	8.044	0.1021	90.73	0.905	0.821	0.084
12.005	0.1499	8.279	0.2035	93.62	1.800	1.685	0.115
12.005	0.2256	8.458	0.3026	94.50	2.708	2.559	0.149
12.005	0.3039	8.636	0.4003	94.76	3.648	3.457	0.191
12.004	0.3901	8.782	0.5053	94.76	4.683	4.438	0.245
12.003	0.4750	8.908	0.6054	94.59	5.701	5.393	0.309
12.002	0.5620	9.023	0.7050	94.31	6.745	6.361	0.384
12.002	0.6510	9.126	0.8051	94.04	7.813	7.347	0.466
12.002	0.7416	9.255	0.9036	93.96	8.901	8.363	0.538
12.003	0.8861	9.379	1.0553	93.06	10.636	9.898	0.738

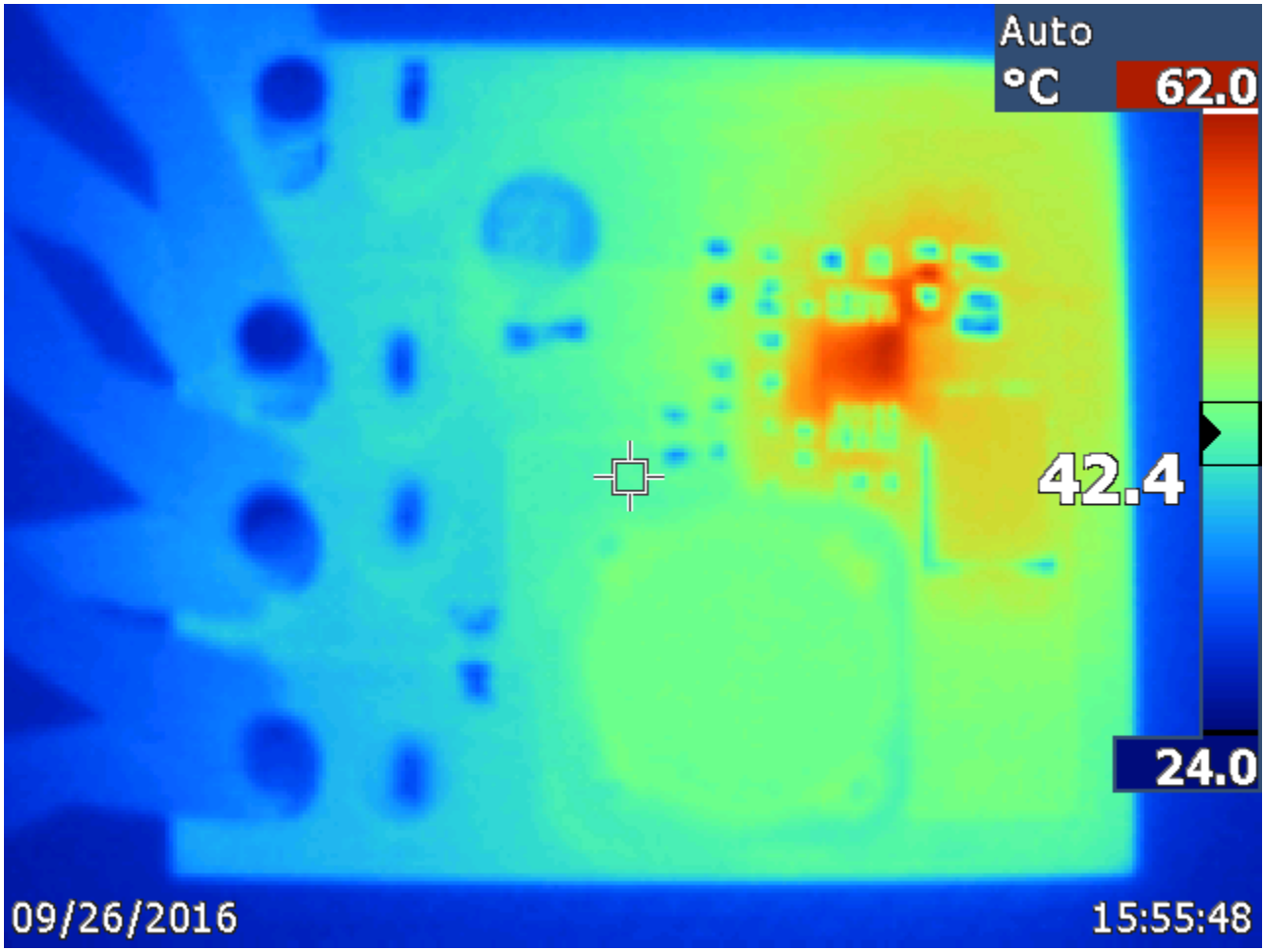
4 Thermal Tests

All tests were performed at room temperature on an open bench.

4.1 12V in, 2 LEDs at 1A



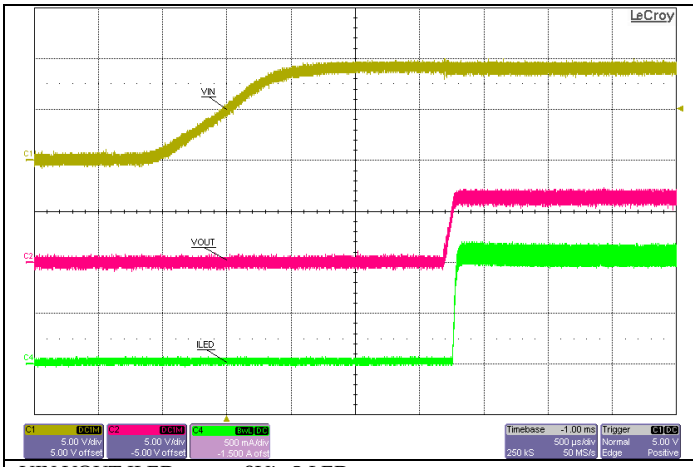
4.2 12V in, 3 LEDs at 1A



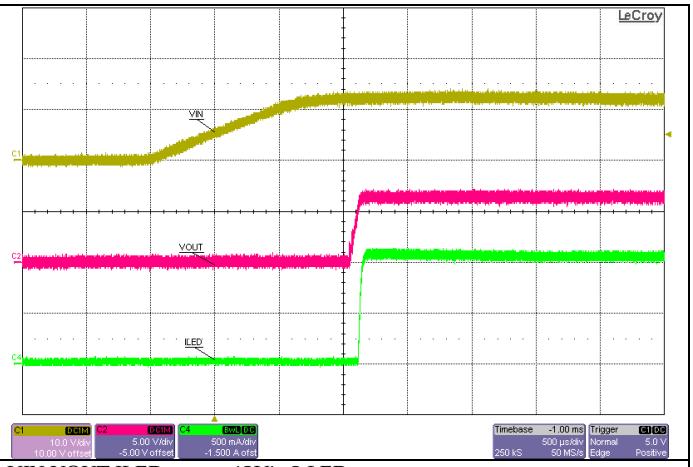
5 Startup and Shutdown Behavior

5.1 Turn-on from Vin

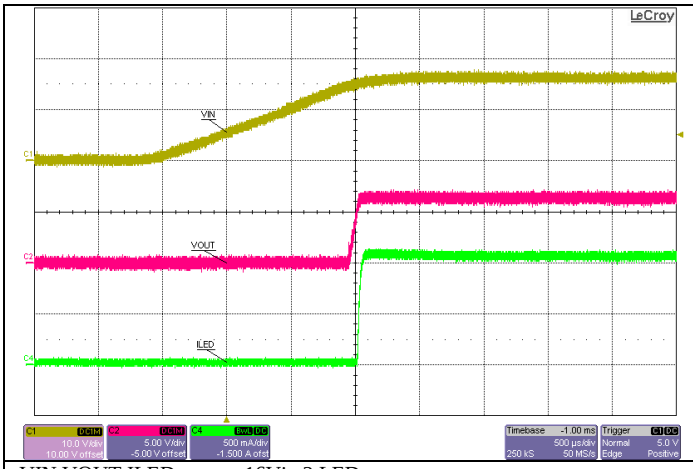
The output voltage and current is well controlled at turn-on.



VIN VOUT ILED startup 9Vin 2 LEDs

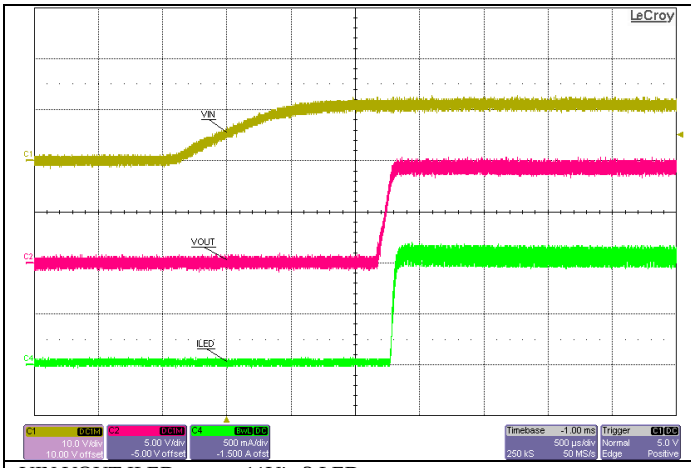


VIN VOUT ILED startup 12Vin 2 LEDs

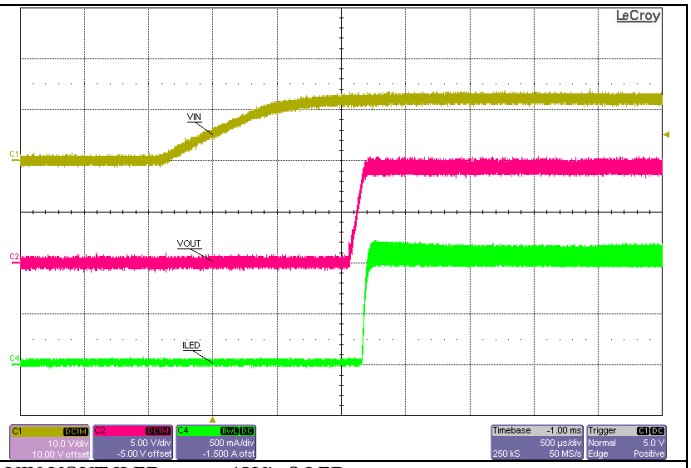


VIN VOUT ILED startup 16Vin 2 LEDs

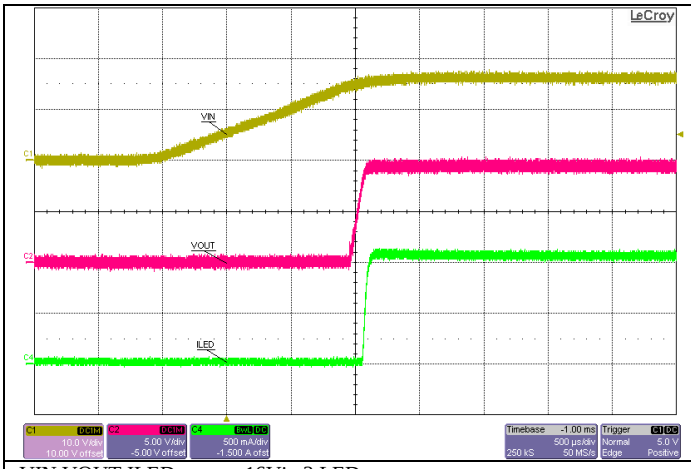
PMP20487 Rev A Test Results



VIN VOUT ILED startup 11Vin 3 LEDs



VIN VOUT ILED startup 12Vin 3 LEDs

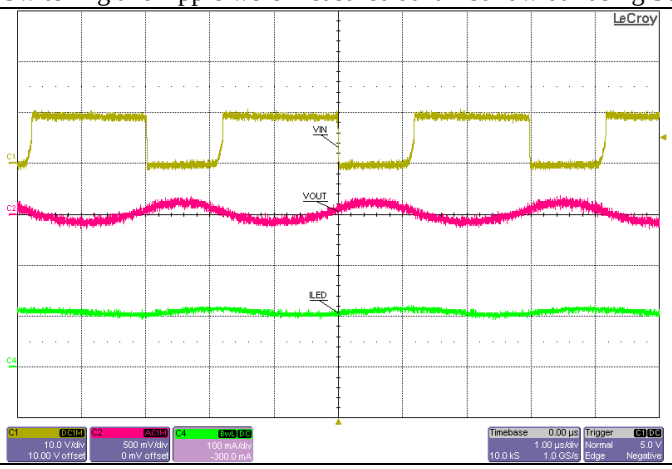


VIN VOUT ILED startup 16Vin 3 LEDs

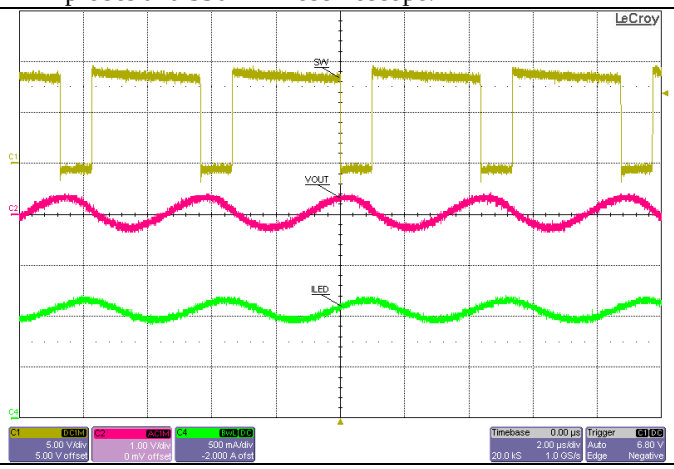
6 Switching and Ripple

6.1 Switching and Ripple

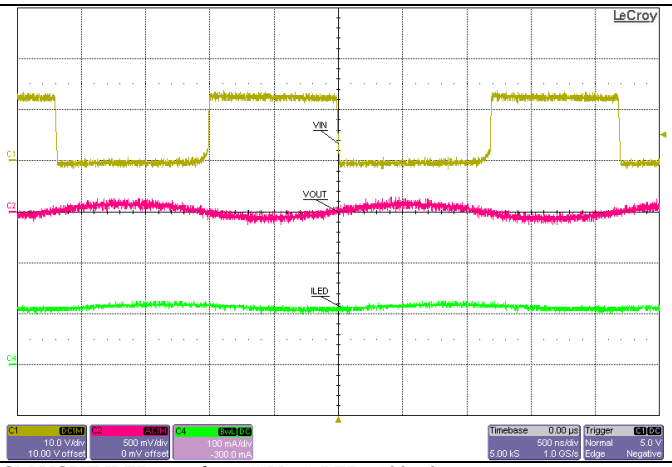
Switching and ripple were measured at full bandwidth using 500 MHz probes and 350 MHz oscilloscope.



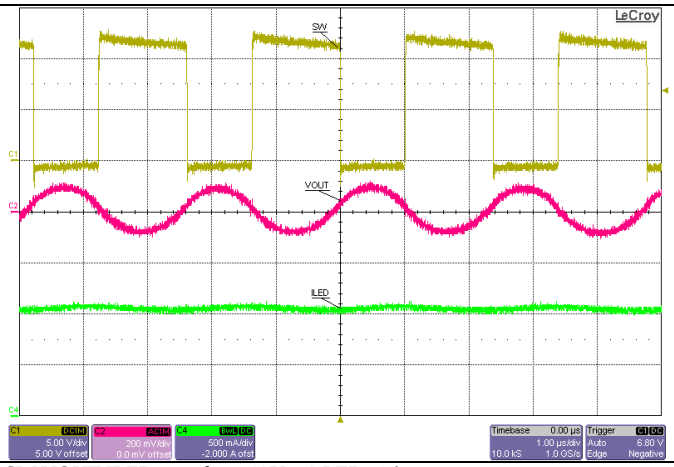
SW VOUT ILED switching 9Vin 2 LEDs 100mA



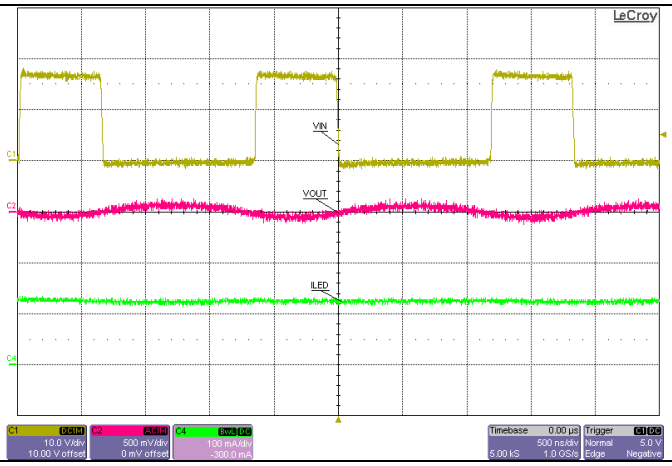
SW VOUT ILED switching 9Vin 2 LEDs 1A



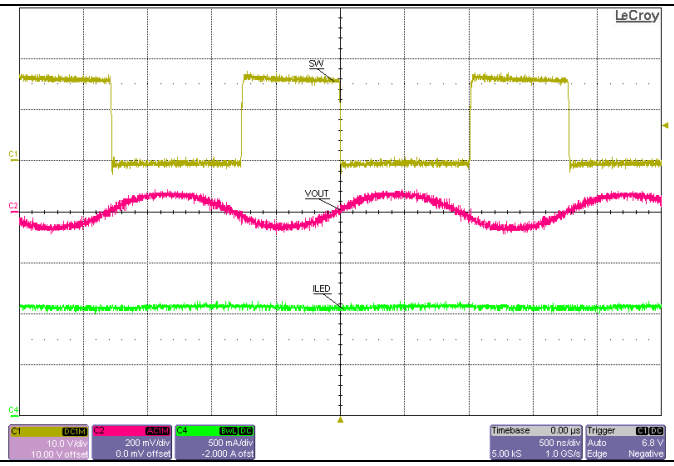
SW VOUT ILED switching 12Vin 2 LEDs 100mA



SW VOUT ILED switching 12Vin 2 LEDs 1A

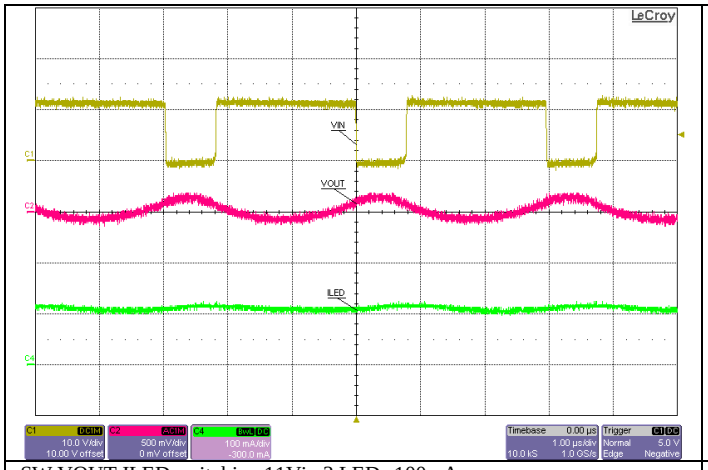


SW VOUT ILED switching 16Vin 2 LEDs 100mA

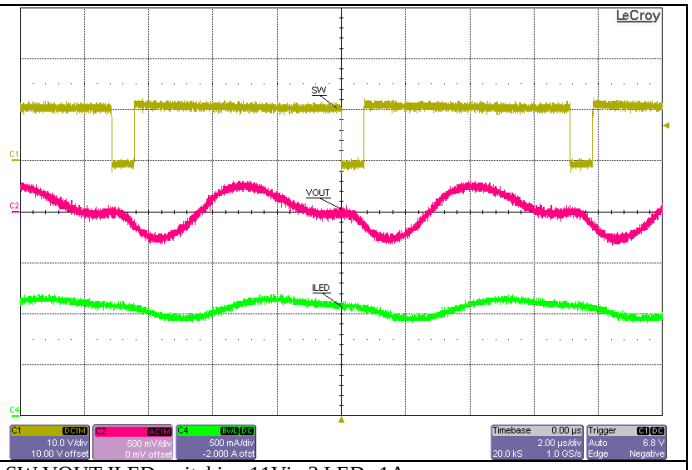


SW VOUT ILED switching 16Vin 2 LEDs 1A

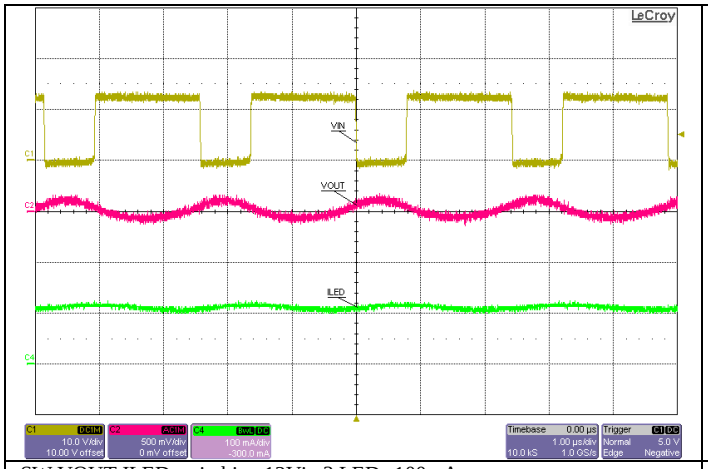
PMP20487 Rev A Test Results



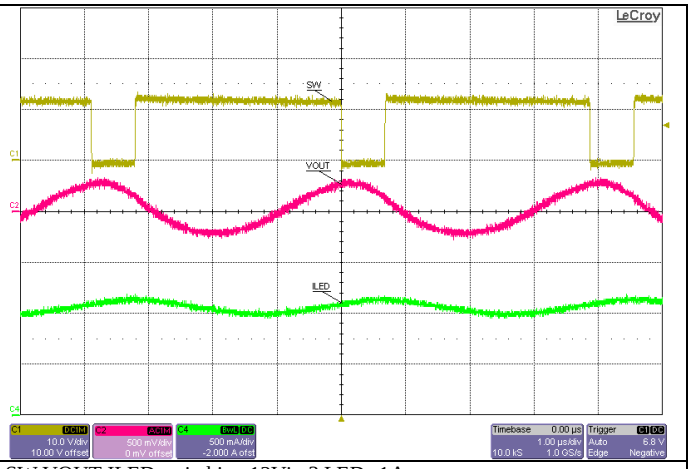
SW VOUT ILED switching 11Vin 3 LEDs 100mA



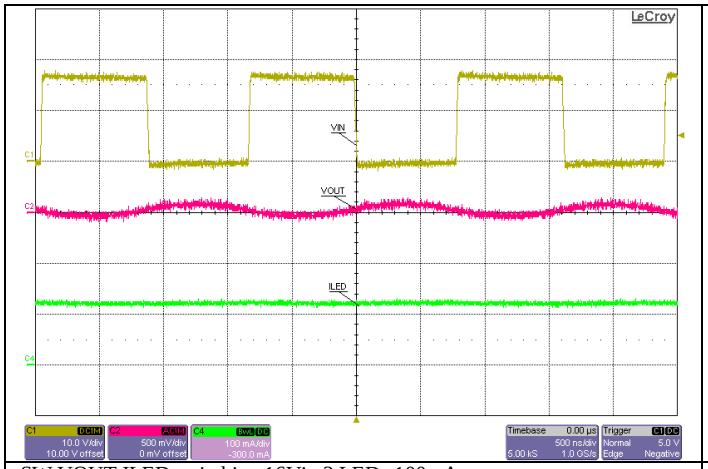
SW VOUT ILED switching 11Vin 3 LEDs 1A



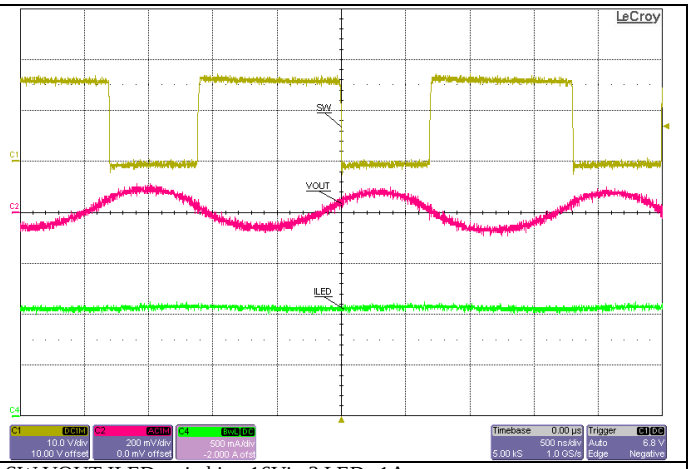
SW VOUT ILED switching 12Vin 3 LEDs 100mA



SW VOUT ILED switching 12Vin 3 LEDs 1A



SW VOUT ILED switching 16Vin 3 LEDs 100mA

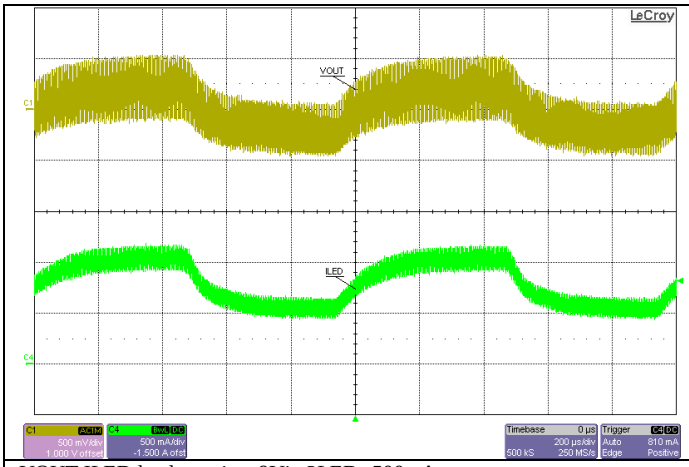


SW VOUT ILED switching 16Vin 3 LEDs 1A

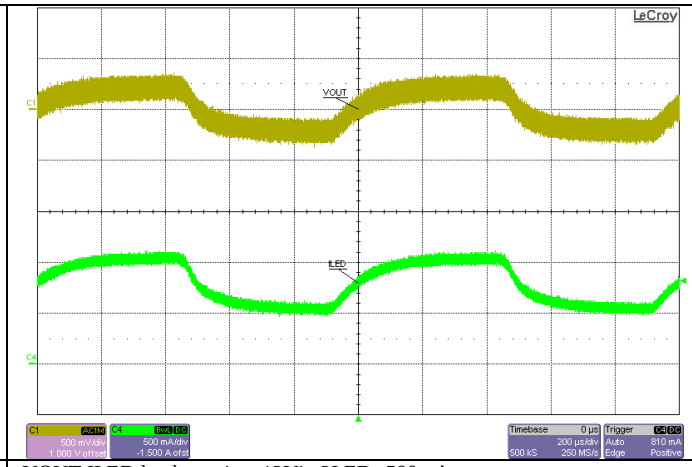
7 Load Transient Response

7.1 Load Transient Response

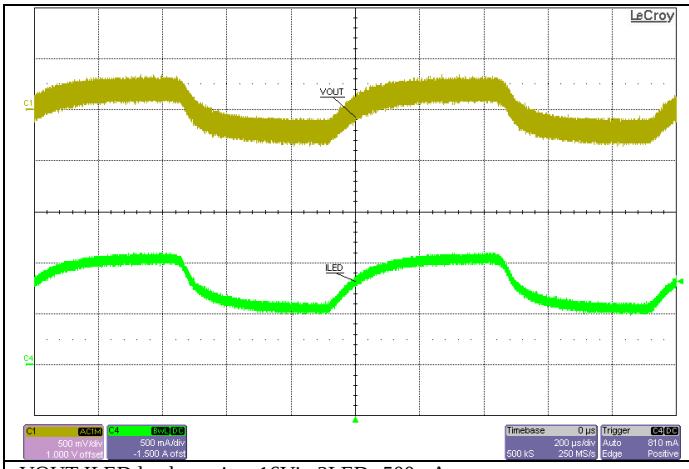
A constant current load in parallel with the LEDs was used to step the current.



VOUT ILED load transient 9Vin 2LEDs 500mA step

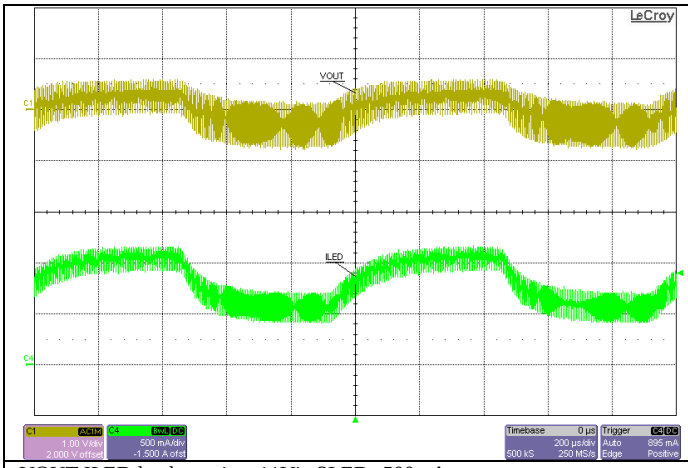


VOUT ILED load transient 12Vin 2LEDs 500mA step

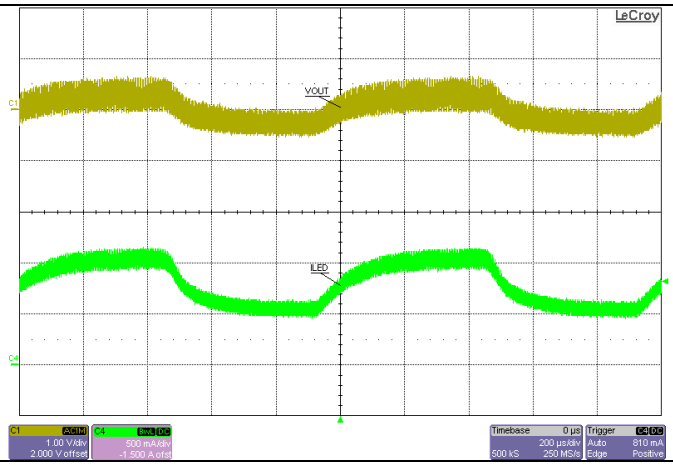


VOUT ILED load transient 16Vin 2LEDs 500mA step

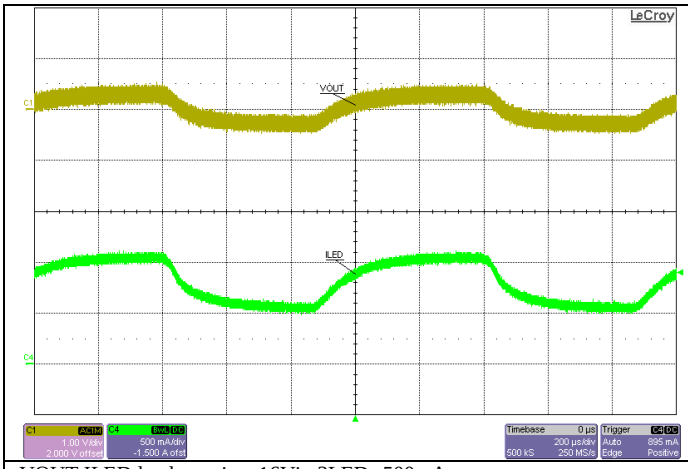
PMP20487 Rev A Test Results



VOUT ILED load transient 11Vin 3LEDs 500mA step



VOUT ILED load transient 12Vin 3LEDs 500mA step

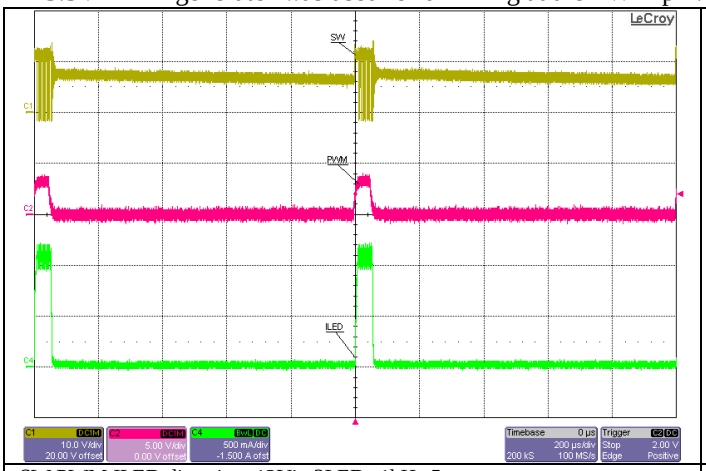


VOUT ILED load transient 16Vin 3LEDs 500mA step

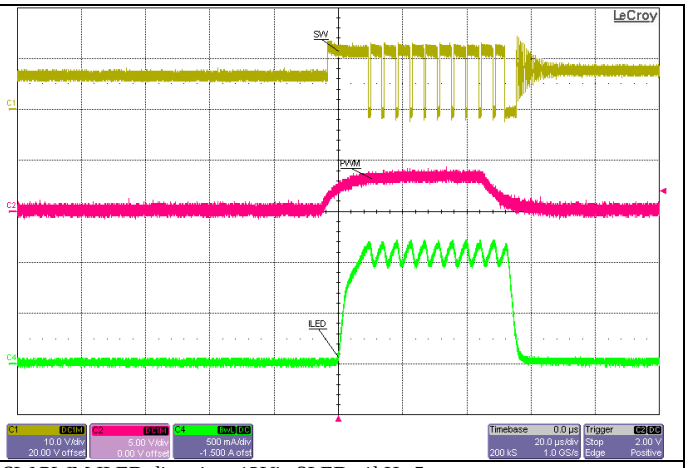
8 PWM Dimming

8.1 PWM Dimming

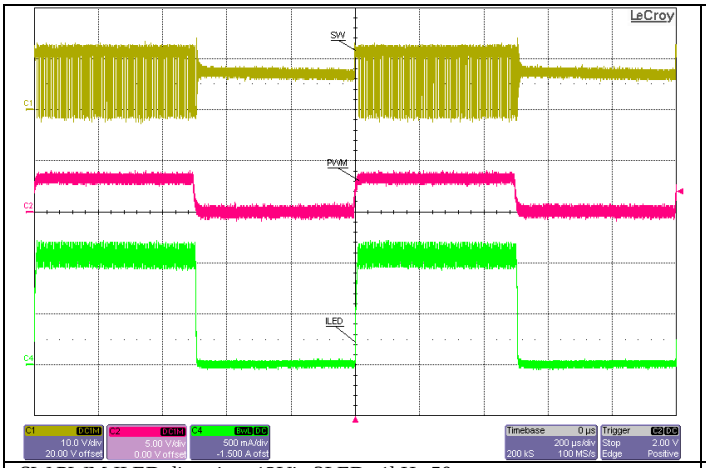
A 3.3V 1 kHz generator was used for dimming at the PWM pin.



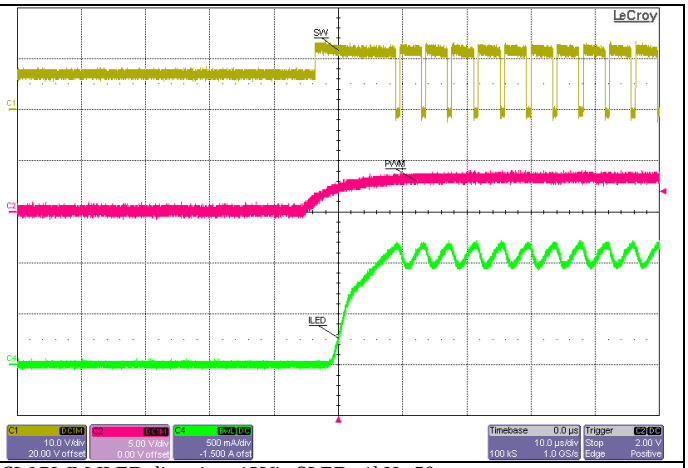
SW PWM ILED dimmimg 12Vin 3LEDs 1kHz 5pct



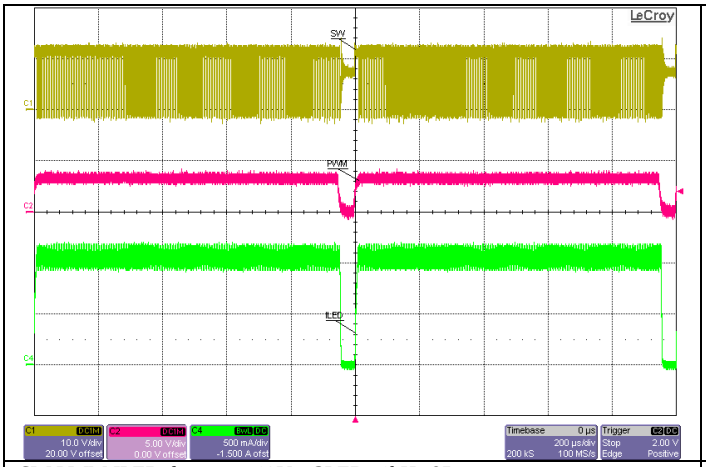
SW PWM ILED dimmimg 12Vin 3LEDs 1kHz 5pct



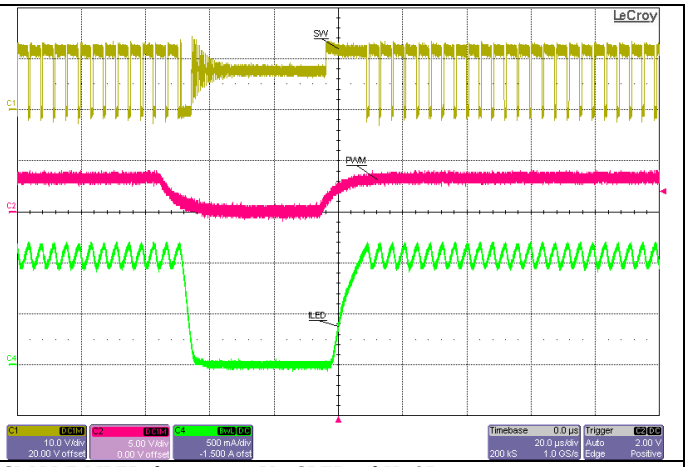
SW PWM ILED dimmimg 12Vin 3LEDs 1kHz 50pct



SW PWM ILED dimmimg 12Vin 3LEDs 1kHz 50pct



SW PWM ILED dimmimg 12Vin 3LEDs 1kHz 95pct

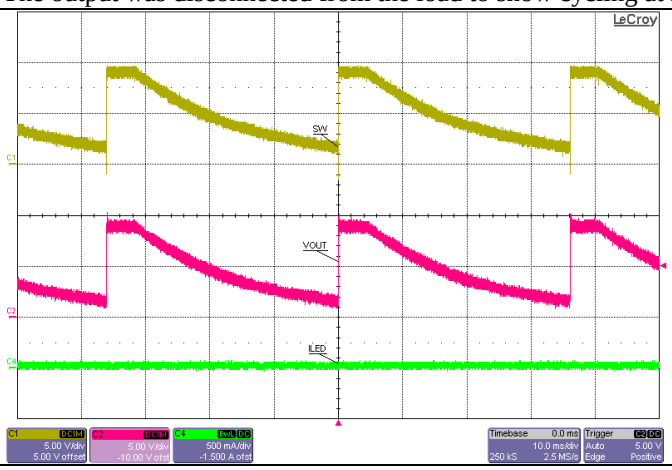


SW PWM ILED dimmimg 12Vin 3LEDs 1kHz 95pct

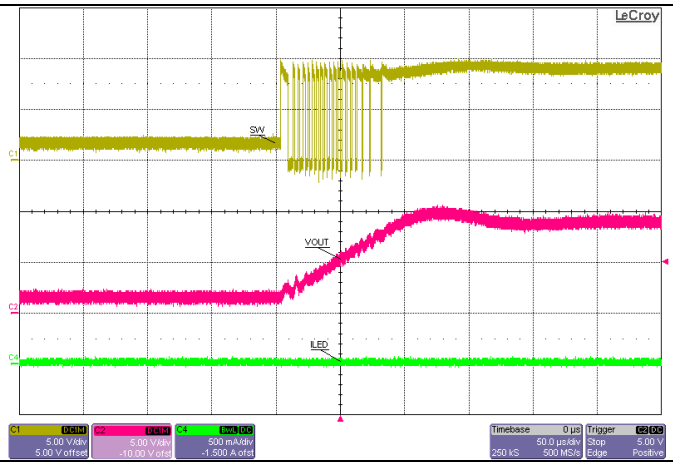
9 No Load Cycling

9.1 No load cycling

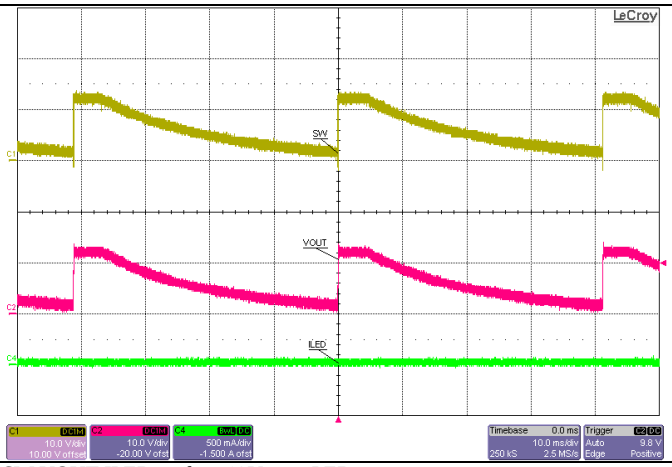
The output was disconnected from the load to show cycling at no load.



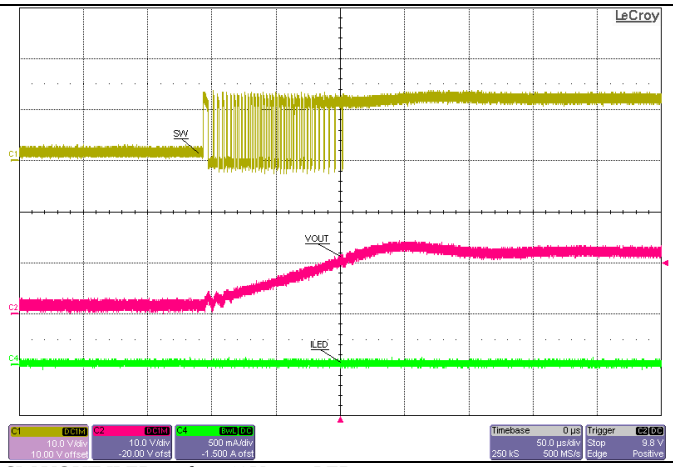
SW VOUT ILED cycling 9Vin no LEDs



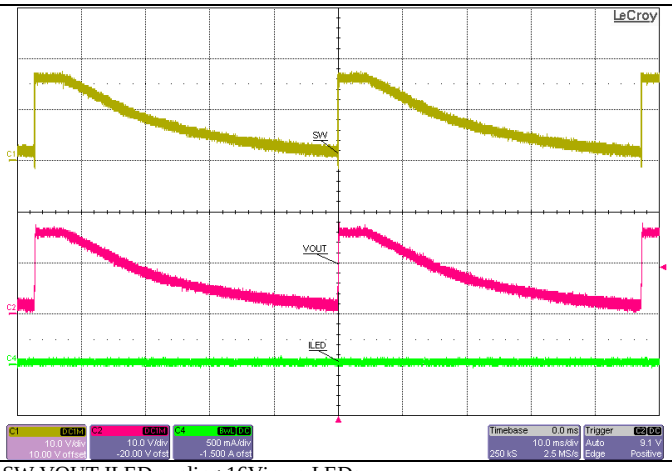
SW VOUT ILED cycling 9Vin no LEDs



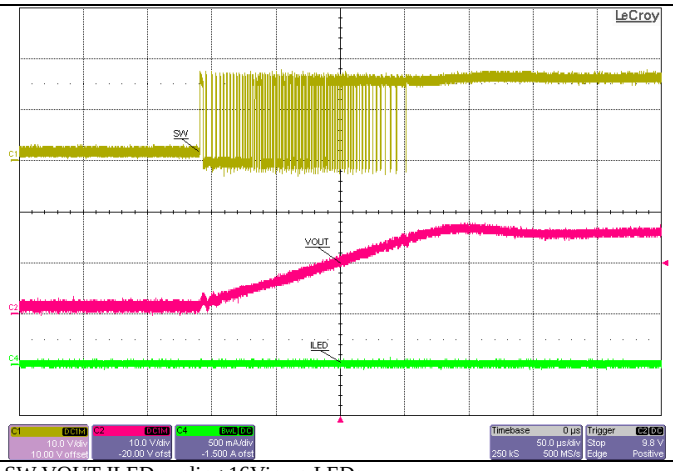
SW VOUT ILED cycling 12Vin no LEDs



SW VOUT ILED cycling 12Vin no LEDs



SW VOUT ILED cycling 16Vin no LEDs



SW VOUT ILED cycling 16Vin no LEDs

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