LM5020-2 Constant Current Input Boost Converter for 2 LED Strings

TI reference design number: PMP10523 REV A

Input: 230mA Constant Current
Output: 141 VDC @ 130mA

DC – DC Test Results

Table of Contents

1 Test Specifications

Vin	**85 VDC**
Iin	**230mA Constant Current**
Vout	**141 VDC**
Iout	**130mA**

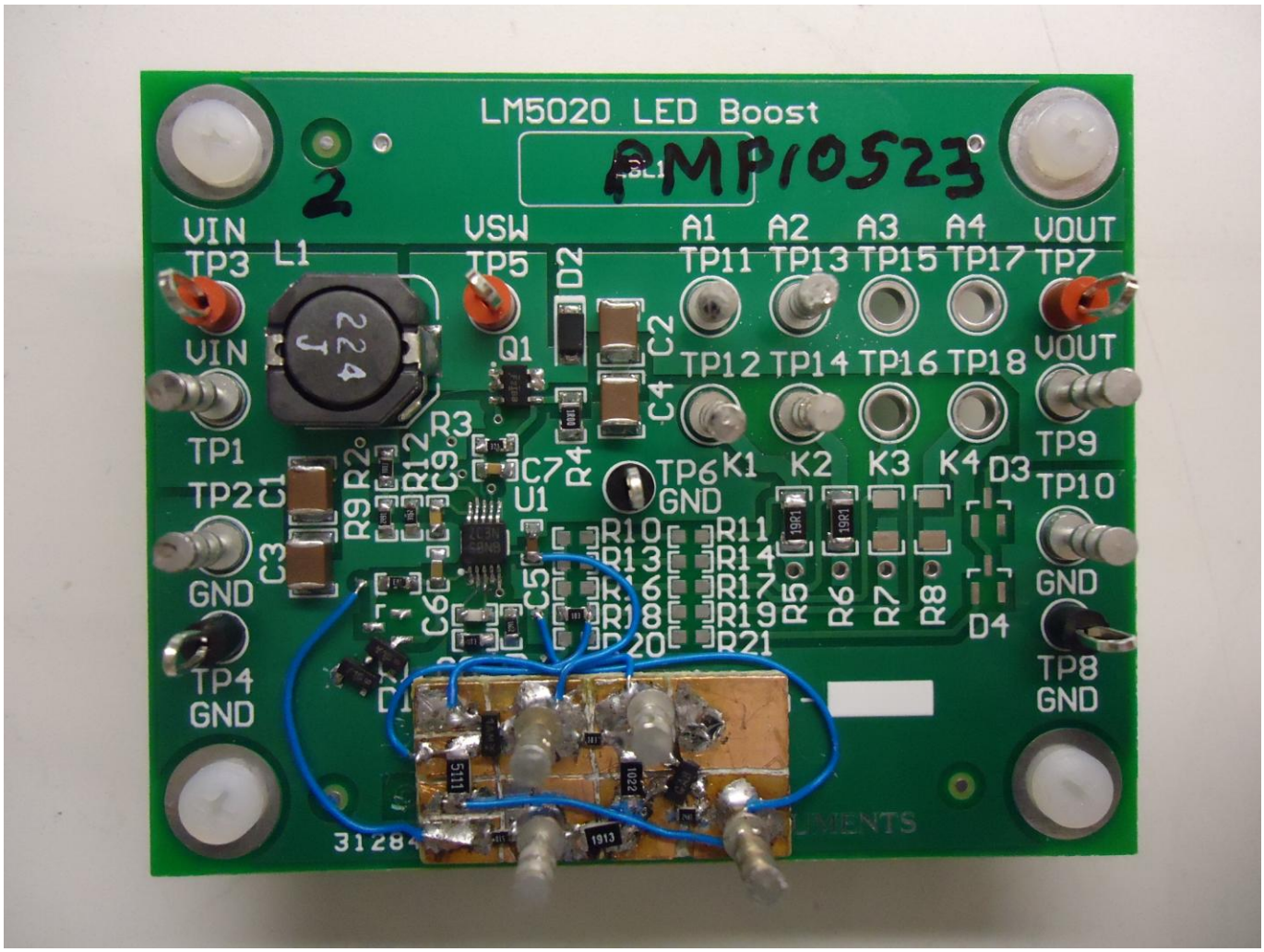
2 Circuit Description

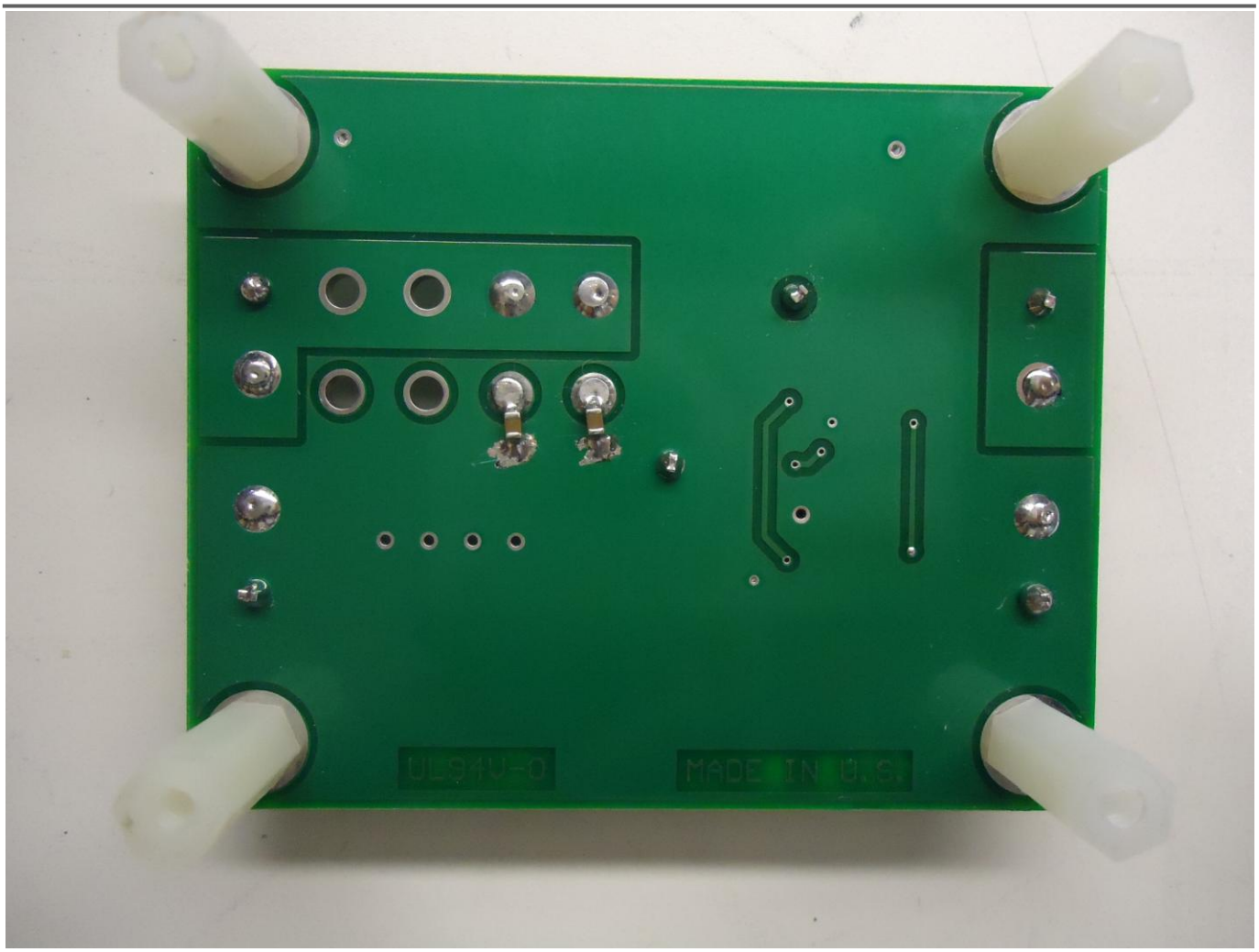
PMP10523 is a constant current input boost converter for LEDs which utilizes the LM5020-2 controller. The switching frequency is set to 100 kHz for high efficiency at a nominal output power of 18.5W. The design features switch current limiting and input under-voltage lockout. Input voltage regulation from a constant current source provides constant output power to the load. For LEDs with relatively constant output voltage, the output current is proportional to the input current.

Operating from a constant current source into the negative input impedance of a dc-dc converter creates a phase inversion of 180 degrees. The LMV431 shunt regulator is added in series with the LM5020-2 internal error amplifier. The fixed dc gain of this non-inverting feedback allows the control loop response to be determined by the dominant pole of the input capacitor. The system is unconditionally stable for any value of input capacitance.

3 Board Photos

The design is built on PMP10505 Rev A printed circuit board. This is a 2-layer PCB with 1 oz. copper. PCB dimensions are 2.75 x 2.2 inch.

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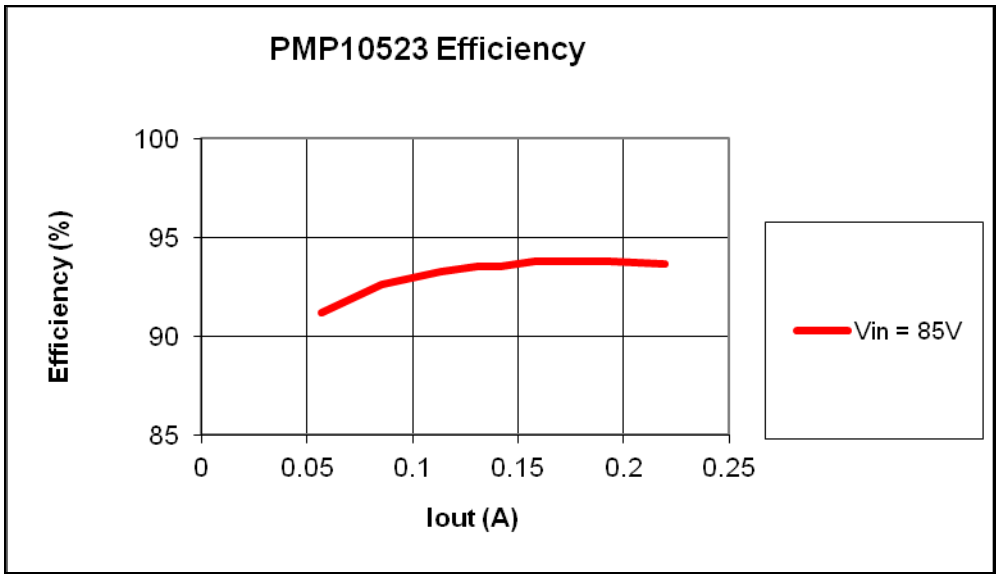
4 Efficiency

4.1 Efficiency Results



4.2 Efficiency Data

Test using 133V constant voltage load and 50Ω series resistor.

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Pdis (W)	Efficiency (%)
84.84	0.1000	136.48	0.0567	8.48	7.74	0.75	91.212
84.91	0.1500	138.17	0.0854	12.74	11.80	0.94	92.645
84.99	0.2002	139.82	0.1135	17.01	15.87	1.15	93.268
85.05	0.2304	140.80	0.1302	19.60	18.33	1.26	93.553
85.09	0.2504	141.44	0.1409	21.31	19.93	1.38	93.534
85.15	0.2806	142.40	0.1573	23.89	22.40	1.49	93.749
85.19	0.3004	143.01	0.1678	25.59	24.00	1.59	93.771
85.29	0.3505	144.56	0.1940	29.89	28.04	1.85	93.813
85.40	0.4006	146.05	0.2193	34.21	32.03	2.18	93.621

4.3 Constant Current Ballast and LED Data

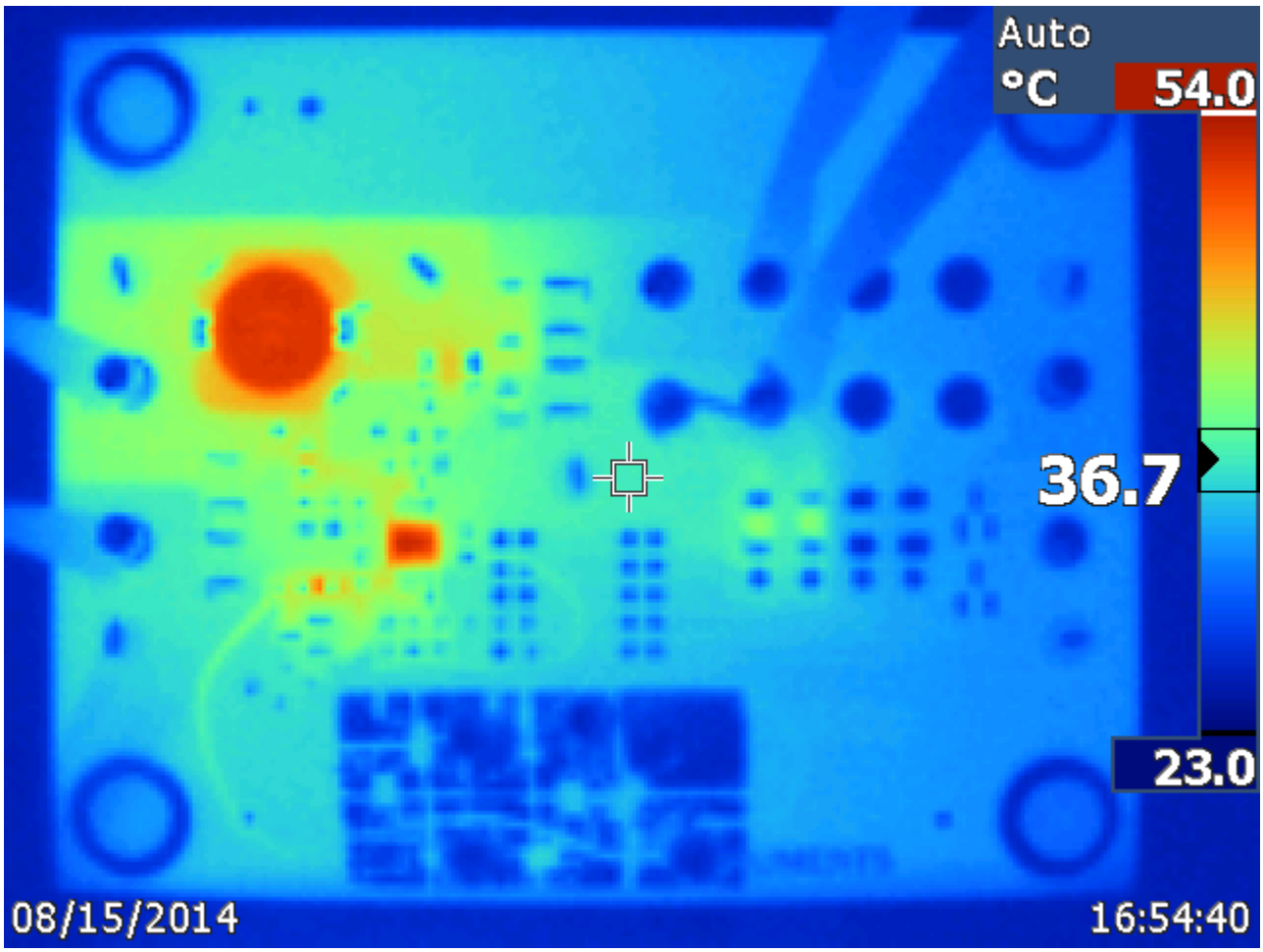
Test using ac ballast, bridge rectifier into 3.3µF 250V film capacitor at input and 2 strings of 24 LEDs.

Vac (V)	Iac (A)	Pac (W)	Power Factor	Vin (V)	Iin (A)	Vout (V)	Vs1 (V)	Vs2 (V)
120	0.19	23.3	0.999	89.2	0.2023	136.4	1.153	1.205

5 Thermal

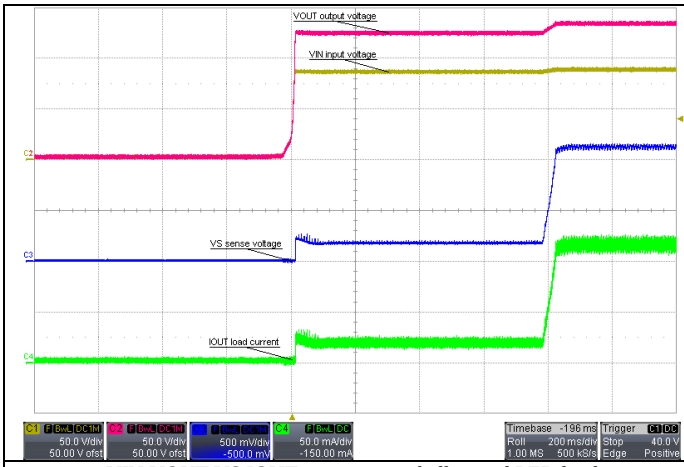
5.1 Thermal Image

85V input 230mA to 141V output 130mA load.

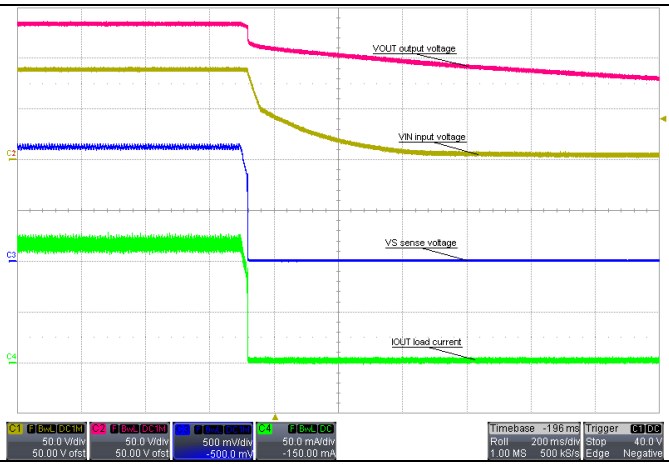


6 Startup and Shut Down

6.1 Startup and Shut Down using Ballast and LEDs

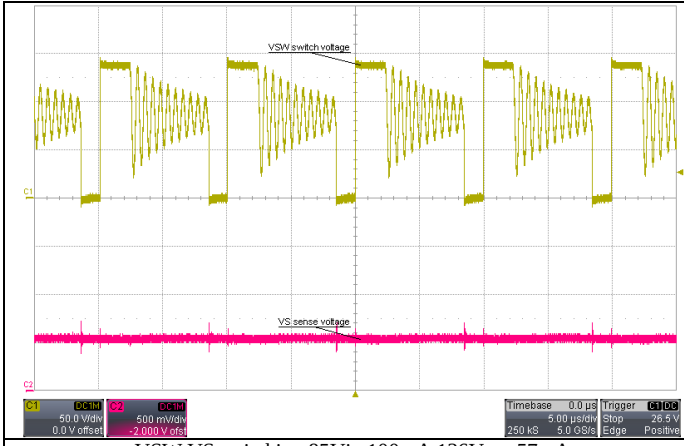


VIN VOUT VS IOUT startup using ballast and LED load

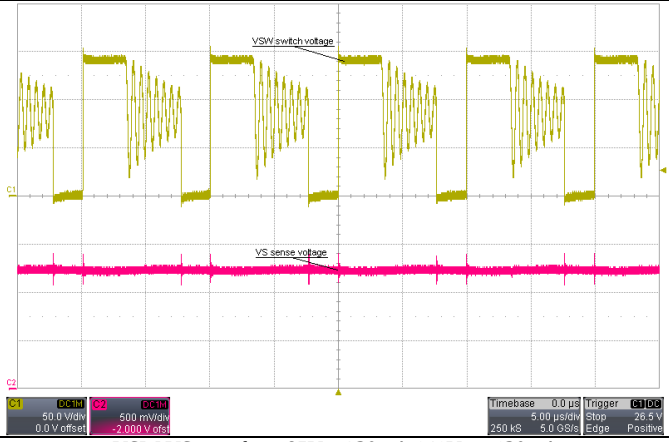


VIN VOUT VS IOUT shut down using ballast and LED load

7 Switch Voltage and Sense Voltage Ripple

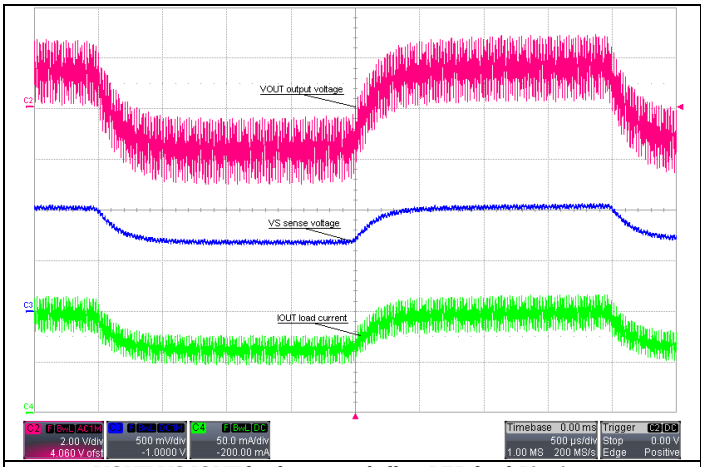


VSW VS switching 85Vin 100mA 136Vout 57mA

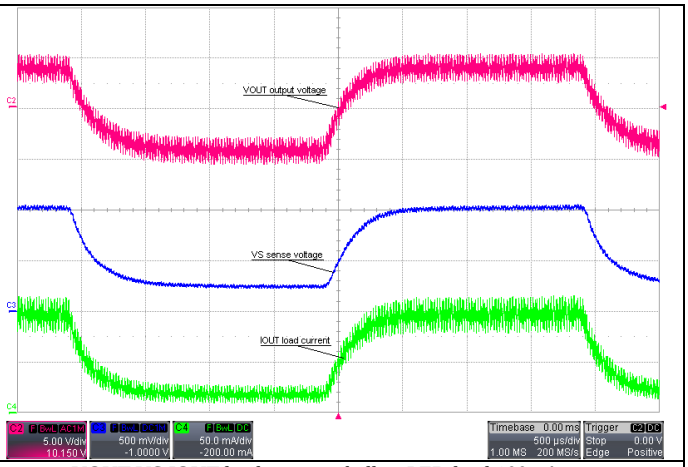


VSW VS switching 85Vin 230mA 141Vout 130mA

8 Load Transient Response



VOUT VS IOUT load transient ballast LED load 50mA step

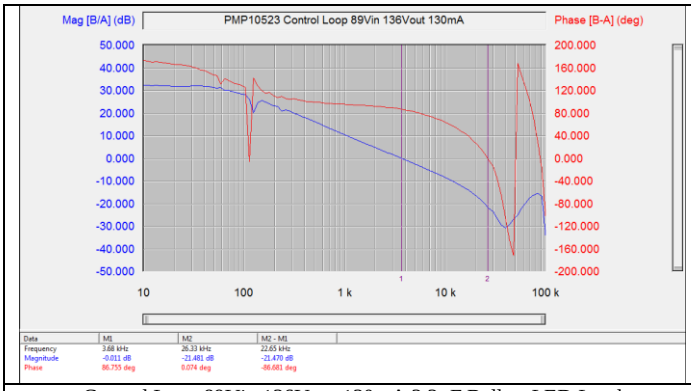


VOUT VS IOUT load transient ballast LED load 100mA step

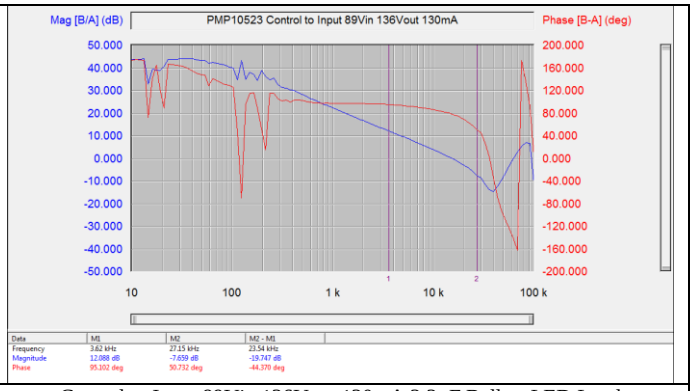
9 Control Loop Frequency Response

9.1 Constant Current Ballast and LED Load

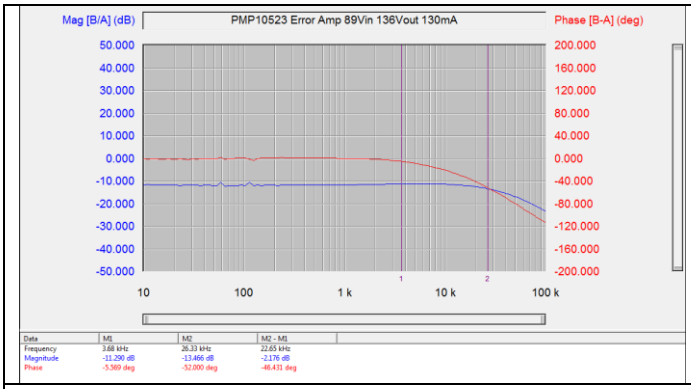
Test using ac ballast, bridge rectifier into 3.3µF 250V film capacitor at input and 2 strings of 24 LEDs.



Control Loop 89Vin 136Vout 130mA 3.3µF Ballast LED Load



Control to Input 89Vin 136Vout 130mA 3.3µF Ballast LED Load



Error Amp 89Vin 136Vout 130mA 3.3µF Ballast LED Load

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