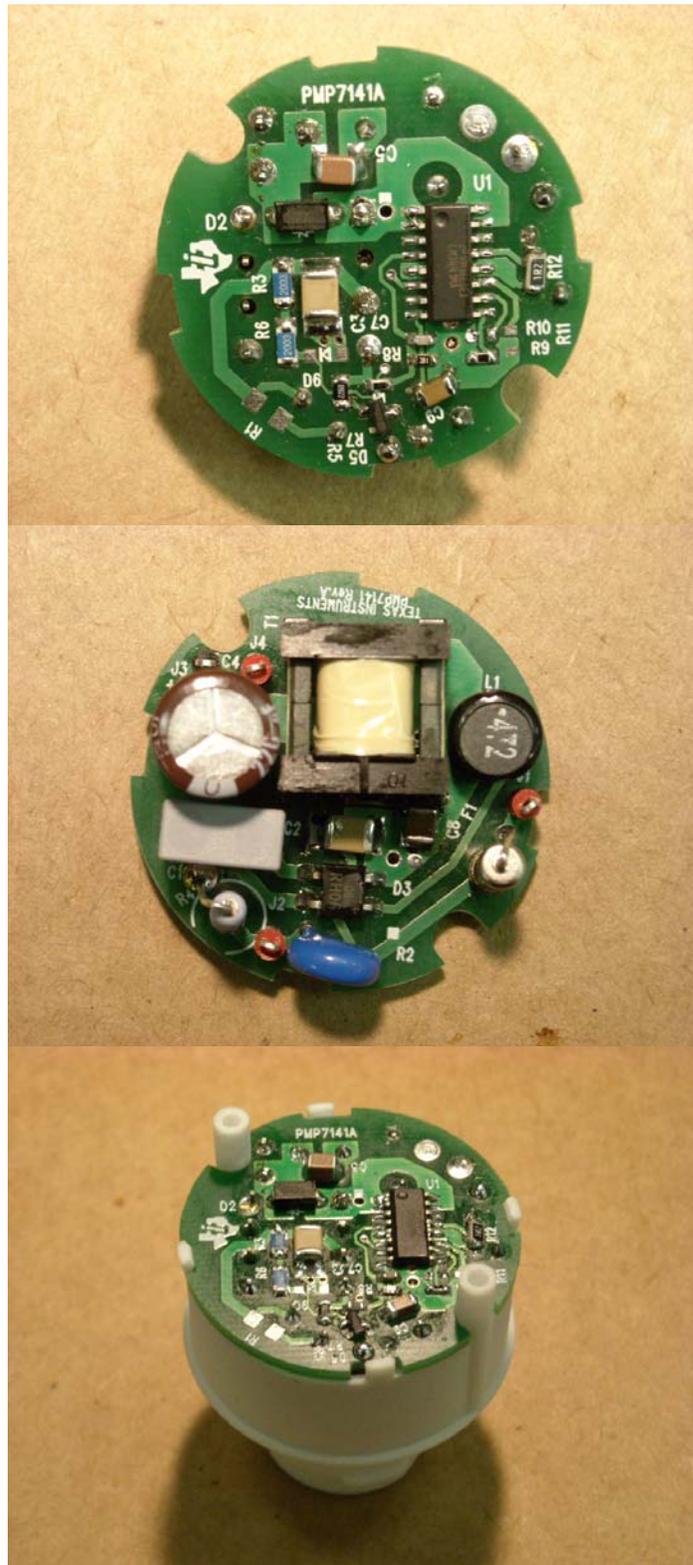


PHOTOS OF THE PROTOTYPE:

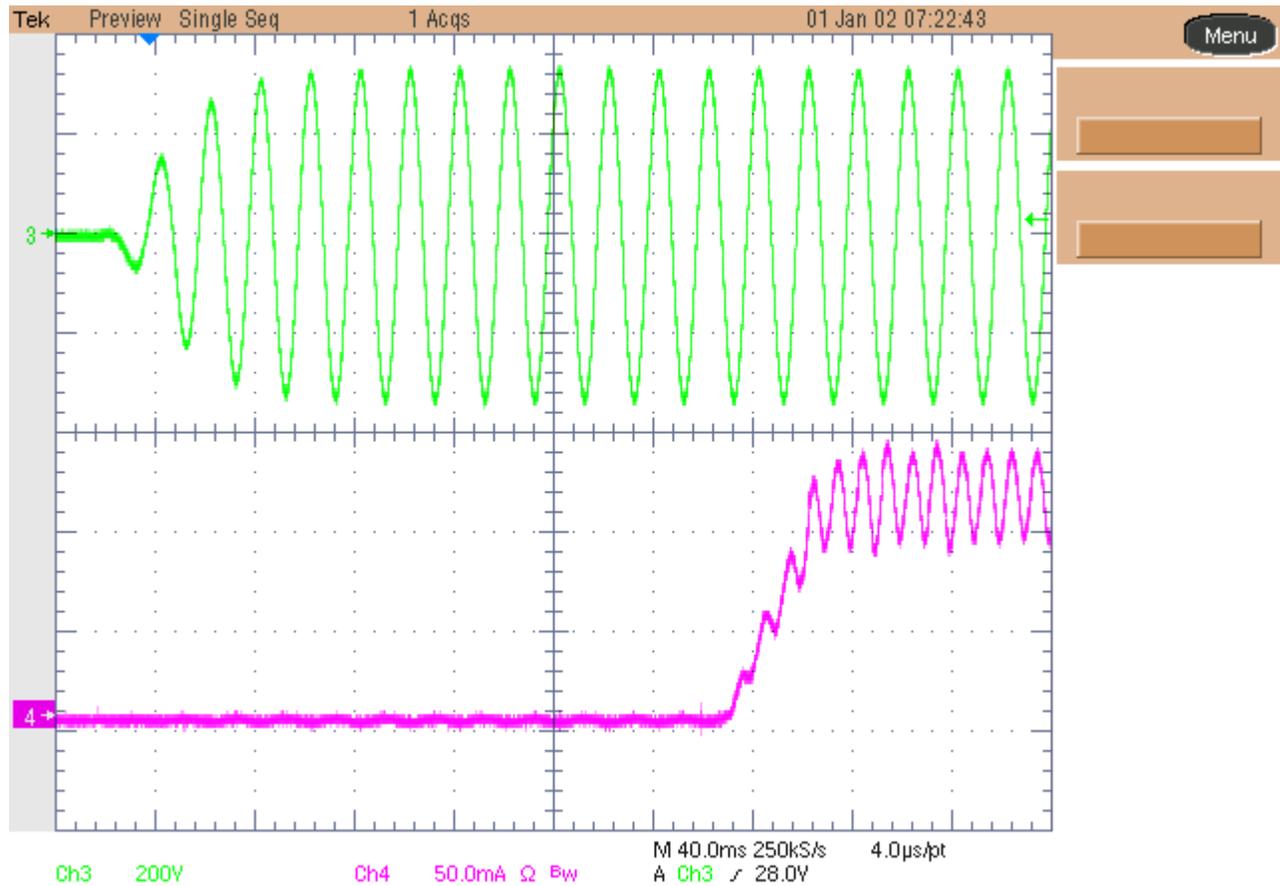


1 Startup

The input voltage and output current waveforms at startup are shown in the images below. The input voltage has been set to 230Vac, 50Hz. The output was loaded with a LED panel, 24Vnom, 4Anom.

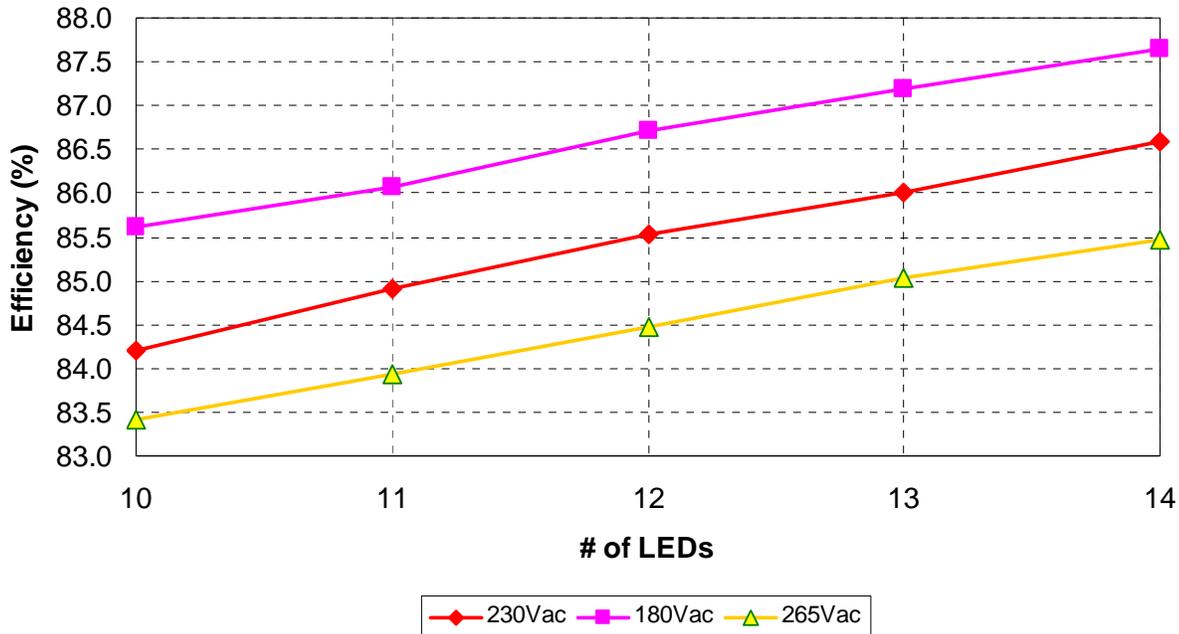
Channel 3: Input voltage (200 V/div, 40ms/div, No BWL).

Channel 4: Output current (50mA/div, 20MHz BWL).



2 Efficiency

The efficiency data versus # of LEDs connected in series is shown in the tables and graph below. The input power consumption, power factor and harmonic content has been measured by a Yokogawa power meter WT210, while a California Instruments 2100 was used as AC source.



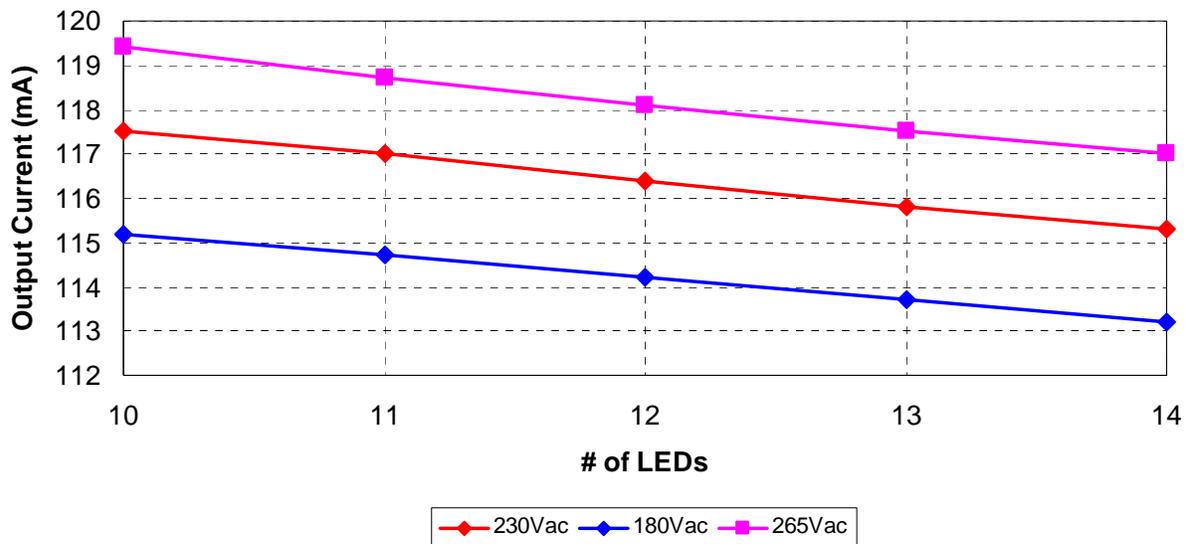
Power Factor (%)	Iout (mA)	Vout (Vdc)	Pout (W)	Vin (Vac)	Pin (W)	Ploss (W)	Eff (%)	# of LEDs
74.87	117.5	30.41	3.57	230	4.244	0.67	84.2	10
76.38	117.0	33.36	3.90	230	4.597	0.69	84.9	11
77.96	116.4	36.18	4.21	230	4.924	0.71	85.5	12
79.13	115.8	39.31	4.55	230	5.292	0.74	86.0	13
80.26	115.3	42.20	4.87	230	5.619	0.75	86.6	14

Power Factor (%)	Iout (mA)	Vout (Vdc)	Pout (W)	Vin (Vac)	Pin (W)	Ploss (W)	Eff (%)	# of LEDs
81.20	115.2	30.43	3.51	180	4.095	0.59	85.6	10
82.73	114.7	33.37	3.83	180	4.447	0.62	86.1	11
84.04	114.2	36.38	4.15	180	4.791	0.64	86.7	12
85.13	113.7	39.29	4.47	180	5.124	0.66	87.2	13
86.04	113.2	42.17	4.77	180	5.447	0.67	87.6	14

Power Factor (%)	Iout (mA)	Vout (Vdc)	Pout (W)	Vin (Vac)	Pin (W)	Ploss (W)	Eff (%)	# of LEDs
71.12	119.4	30.14	3.60	265	4.314	0.72	83.4	10
72.96	118.7	33.22	3.94	265	4.698	0.75	83.9	11
74.39	118.1	36.28	4.28	265	5.072	0.79	84.5	12
76.03	117.5	39.27	4.61	265	5.426	0.81	85.0	13
77.25	117.0	42.24	4.94	265	5.783	0.84	85.5	14

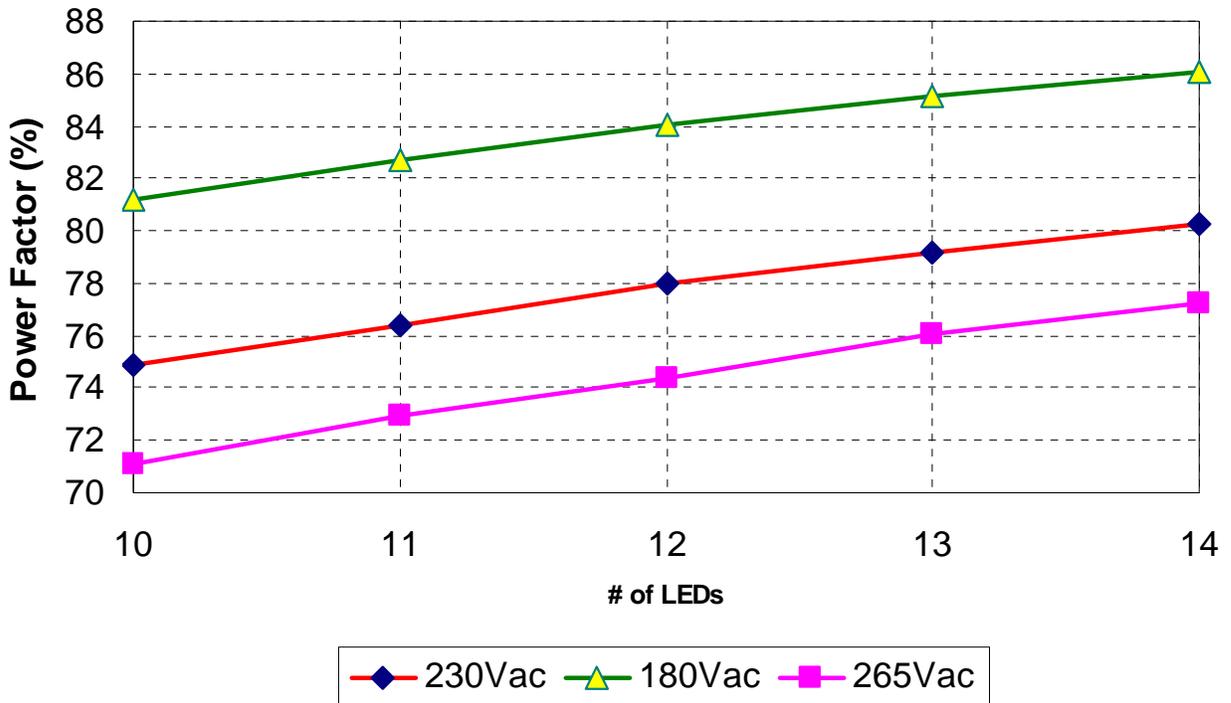
3 Output Current Regulation

The output current regulation versus # of LEDs is plotted below. The input AC voltage has been set to minimum, nominal and maximum value.



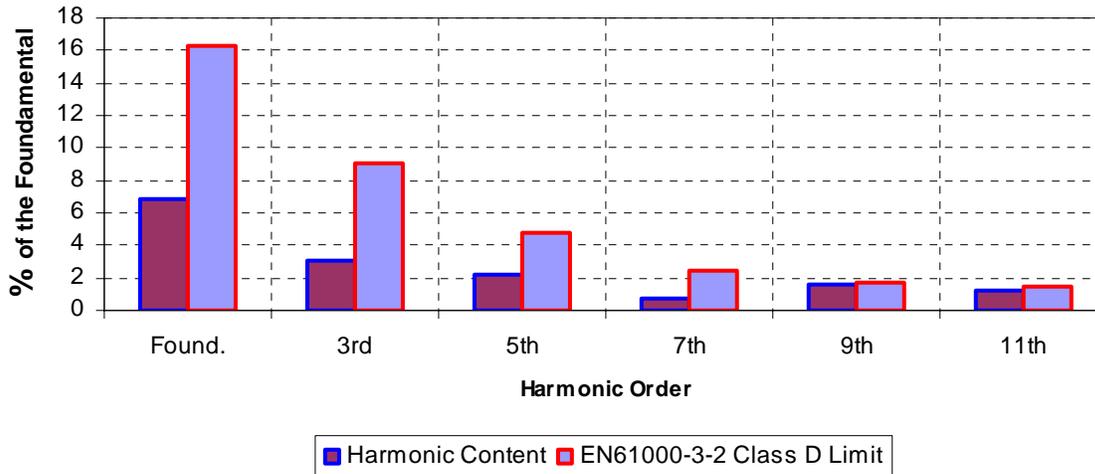
4 Power Factor

The Power Factor graph for the three input voltages is shown below. The nominal voltage, 40V, has been reached when 13LEDs were connected in series; the exact value in this case is 39.3V.



5 Harmonic Content

The harmonic content and the EN61000-3-2 Class D limits (lighting equipments for power less than 25W) are shown below; the input voltage was set to 230Vac, and the output loaded with the 13 LEDs (nominal power).



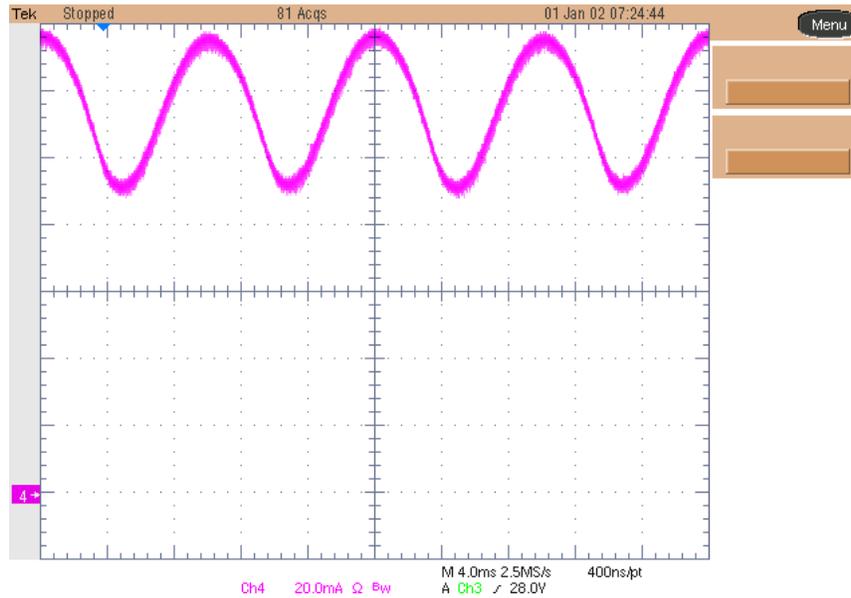
We see that the limit comes from EN61000-3-2 Class D table, column two, and is normalized in mA/W. The nominal power of the PSU is 4.8W.

Harmonic Order	Measure (mA)	EN61000-3-2 Class D Limit (mA/W)	Absolute limit (Pn=4.8W)
Found.	//	//	//
3rd	6.85	3.40	16.32
5th	3.11	1.90	9.12
7th	2.26	1.00	4.80
9th	0.70	0.50	2.40
11th	1.56	0.35	1.68
13th	1.27	0.296	1.42

6 Output Ripple Current

The output ripple current is shown in the plot below. The input was set to 230Vac and the converter loaded with 13 LEDs.

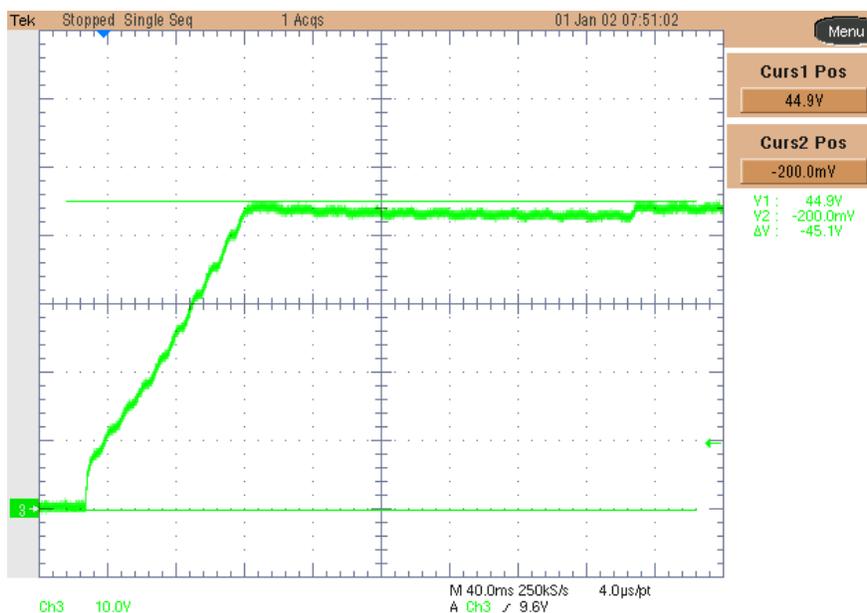
Channel 4: Output current (20mA/div, 4msec/div, 20MHz BWL, DC coupling).



7 Overvoltage protection (LED string open)

The output voltage behavior during open string condition is shown below. The converter started when the output capacitor was fully discharged, and the input voltage was set to 230Vac.

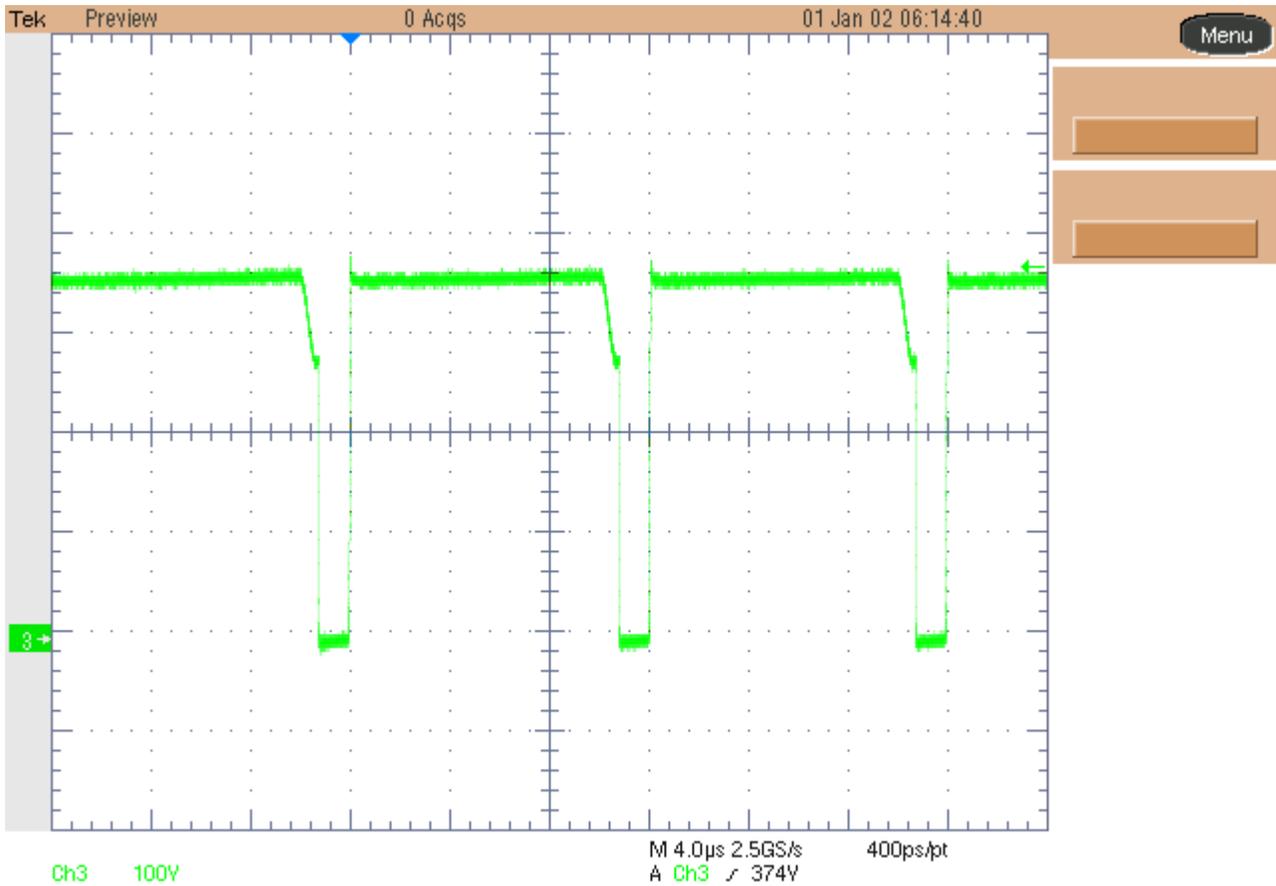
Channel 4: Output voltage (10V/div, 40msec/div, No BWL); **Peak overvoltage = 44.9V**



8 Switching Node Waveform

The image below shows the voltage on pins 1, 2, 15, 16 of U1 while the AC voltage was 230Vac and 13 LEDs were connected to the output.

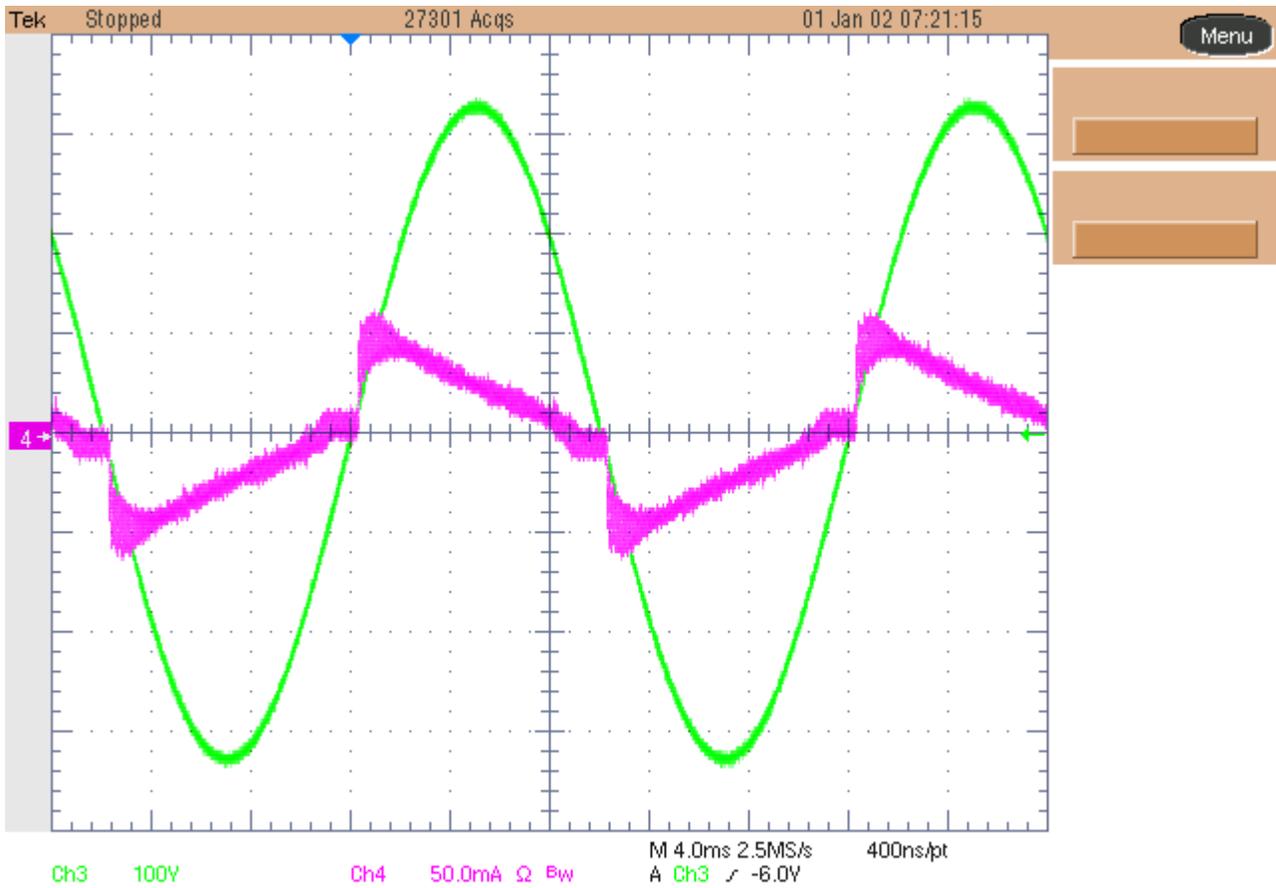
Channel 3: Voltage on U1 switchnode (100 V/div, 4us/div, No BWL).



9 Input Voltage and Current Waveforms

The image below shows the input waveforms of input voltage and current; the output was fully loaded, 40V @ 120mA, and the input set to 230Vac, 50Hz.

Channel 3: Input voltage (100 V/div, 4ms/div),
Channel 4: Input current (50mA/div, 20MHz BWL)



10 Thermal Analysis

Below are shown the thermal pictures of the board, respectively bottom and top side, when loaded with the 13 LEDs and supplied with 230Vac power source. The board was placed horizontal on the bench, with no air flow (still air conditions).

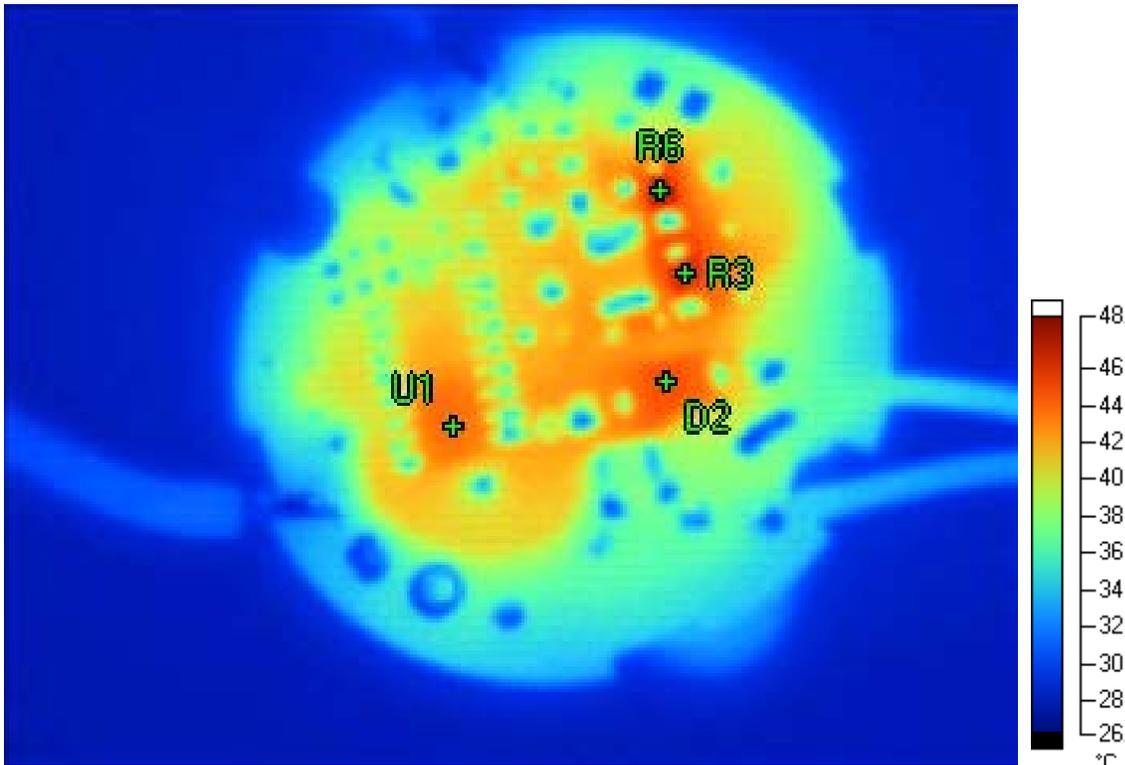


Image Info

Emissivity	0.95
Background	23.0 °C
Average Temperature	32.5 °C
Calibration Range	-20.0 °C to 350.0 °C
Camera Model	Ti40FT
Image Range	27.3 °C to 48.0 °C
Lens Serial #	40948-4409
Manufacturer	Fluke
Camera Serial Number	Ti40FT-070263

Markers

Label	Temperature	Emissivity	Background
U1	43.8 °C	0.95	23.0 °C
D2	45.1 °C	0.95	23.0 °C
R6	48.0 °C	0.95	23.0 °C
R3	46.8 °C	0.95	23.0 °C

TOP SIDE:

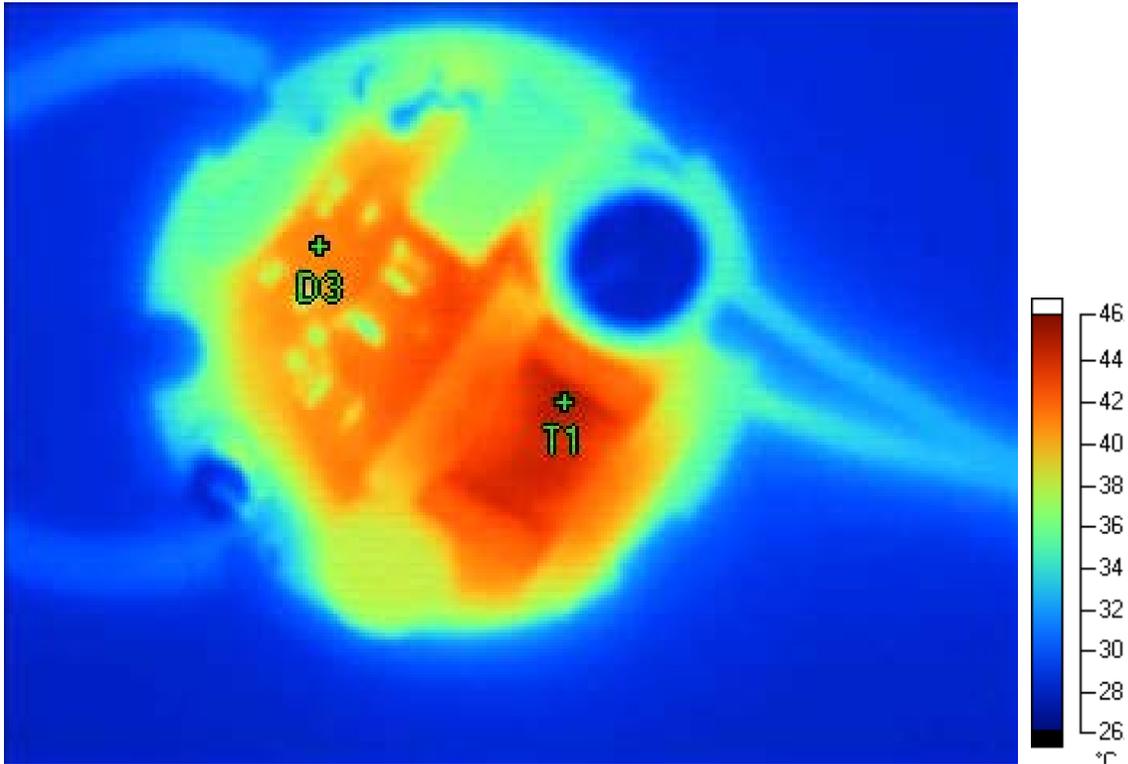


Image Info

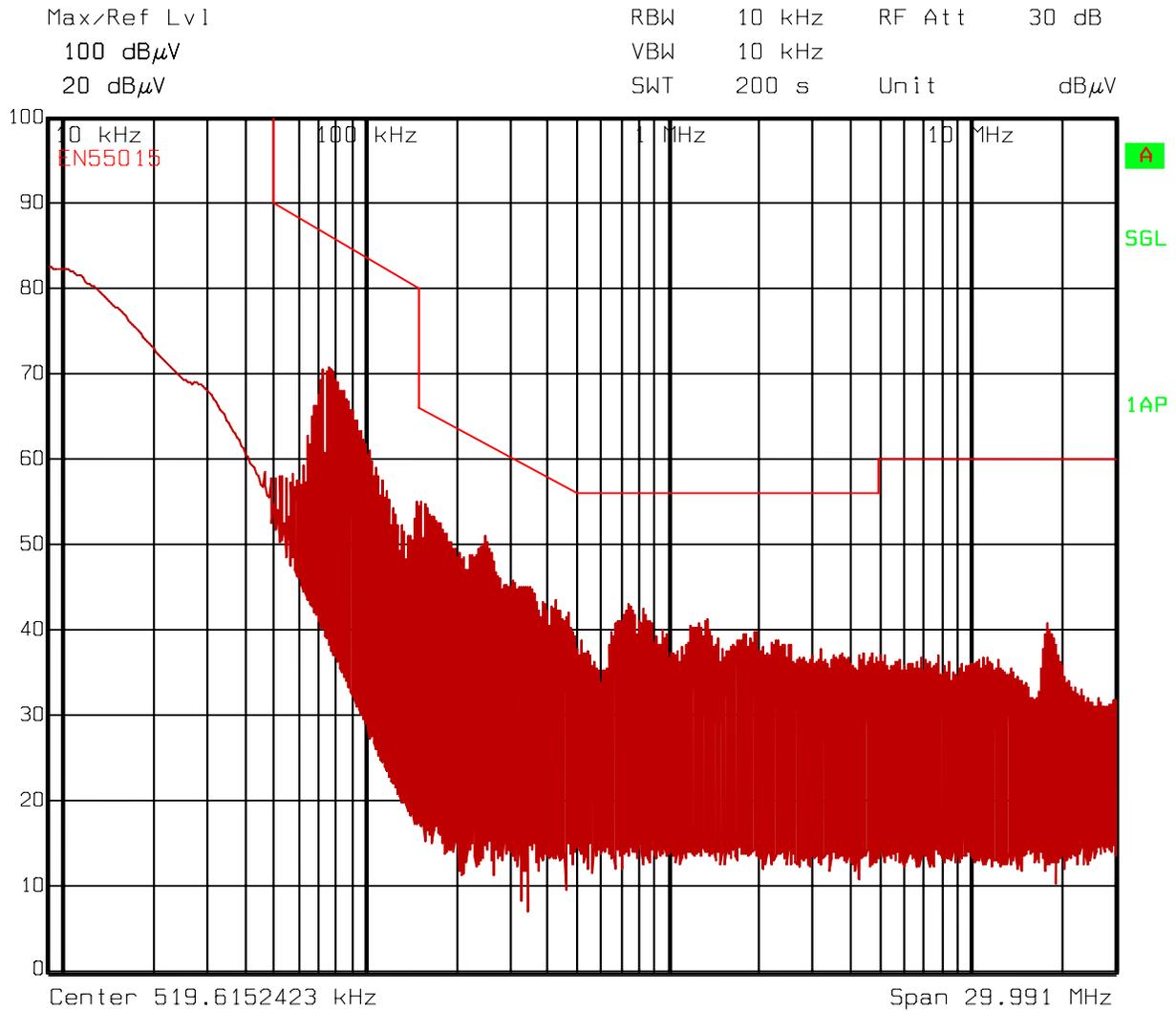
Emissivity	0.95
Background	23.0 °C
Average Temperature	32.3 °C
Image Range	27.5 °C to 45.3 °C
Image Time	4/19/2012 6:32:43 PM

Markers

Label	Temperature	Emissivity	Background
T1	45.3 °C	0.95	23.0 °C
D3	41.3 °C	0.95	23.0 °C

11 EMI Measurement: Conducted emissions

The plot below shows the EMI scan of the prototype loaded with a LED metal panel 250mm x 80mm. The panel and the driver were placed 35cm over the ground plane. A 600W isolation transformer and a Hameg HM6050-2 LISN have been used as AC source. The receiver was a Rohde & Schwarz, 9 KHz...3.5 GHz, set to measure the noise in “quasi-peak” mode. The solid red line shows the EN55015 (lighting equipments) limits.



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Date: 19.APR.2012 12:32:55

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3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.

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