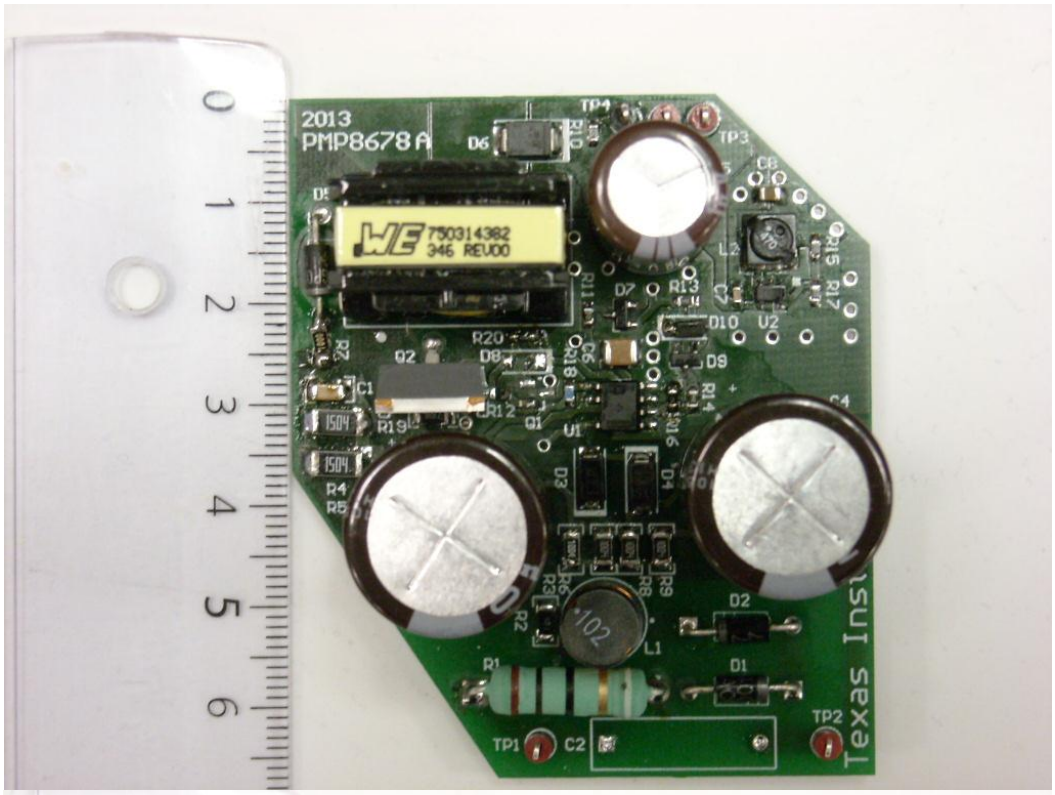
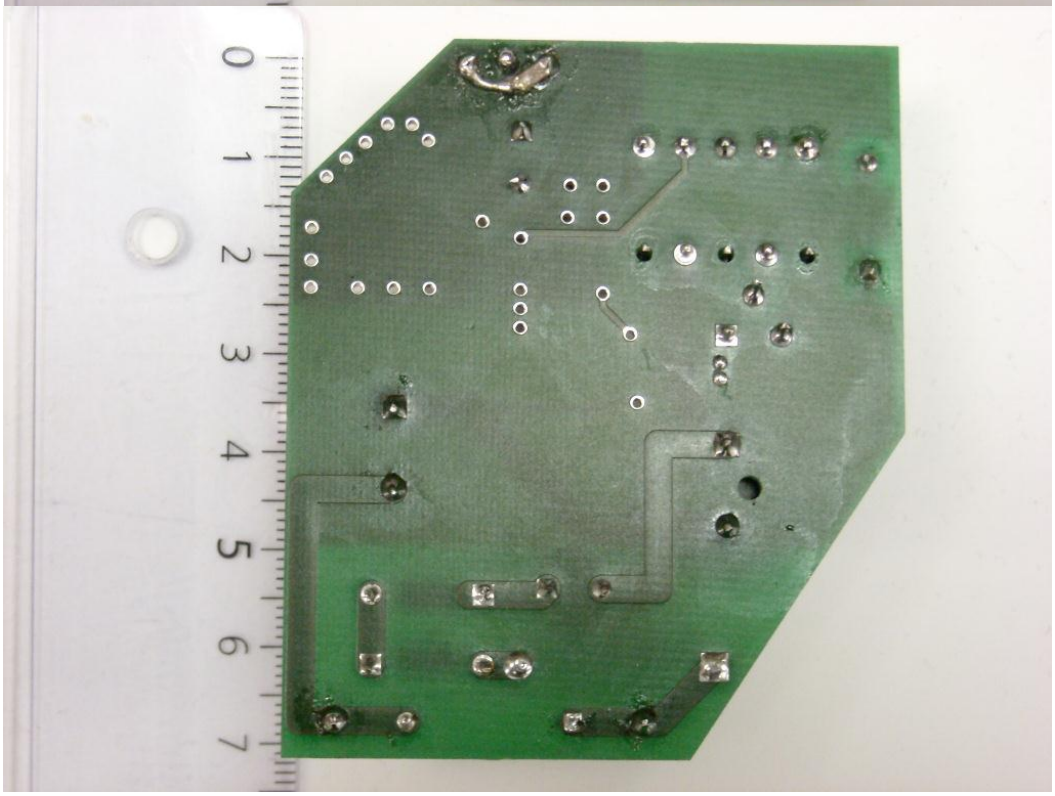
PHOTO OF THE PROTOTYPE

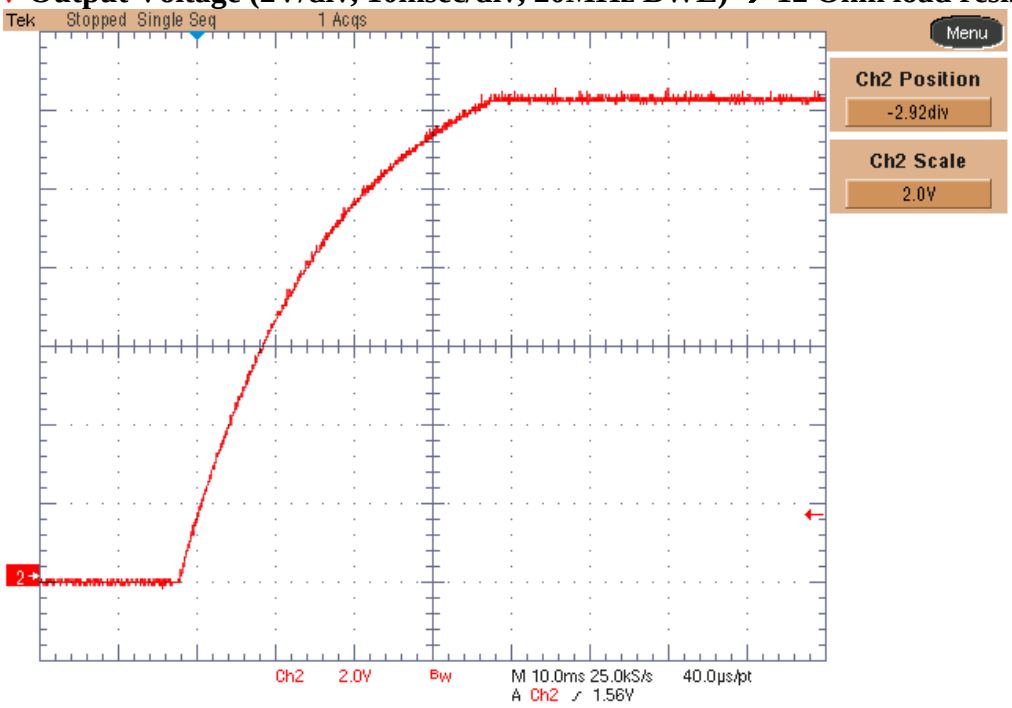




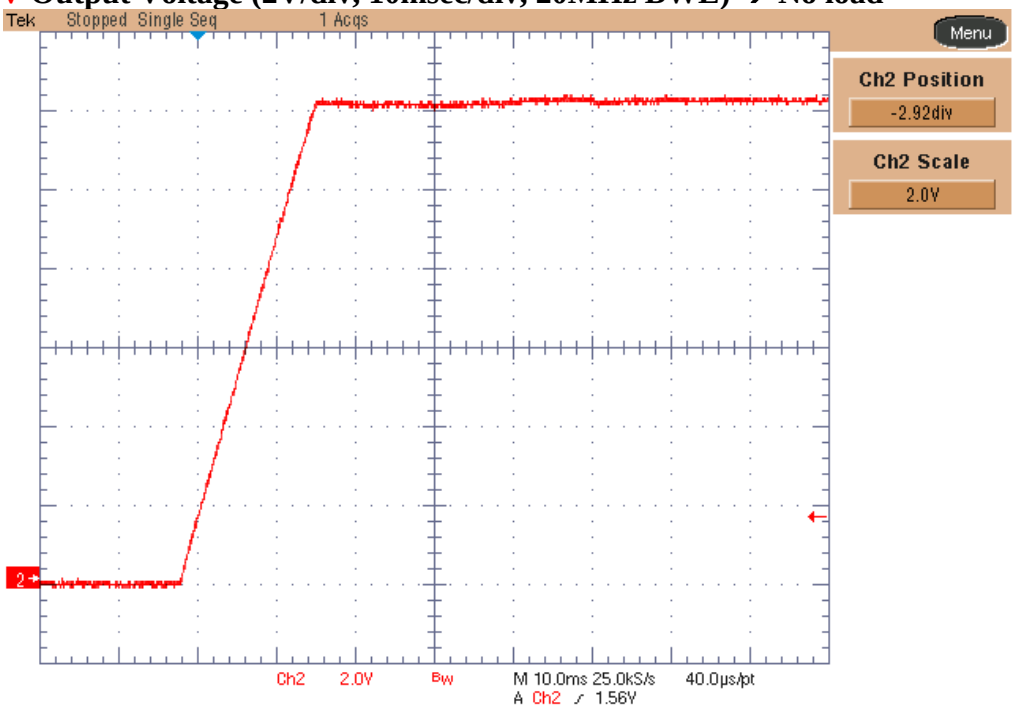
1 Output Voltage at Startup

The output voltage ramp-up behavior for the 12Vout and 3.3Vout is shown in the images below. The input voltage has been set to 320Vdc. The load was a 12 Ohm resistor (equivalent to 1A load) for the top picture and not connected in the bottom one.

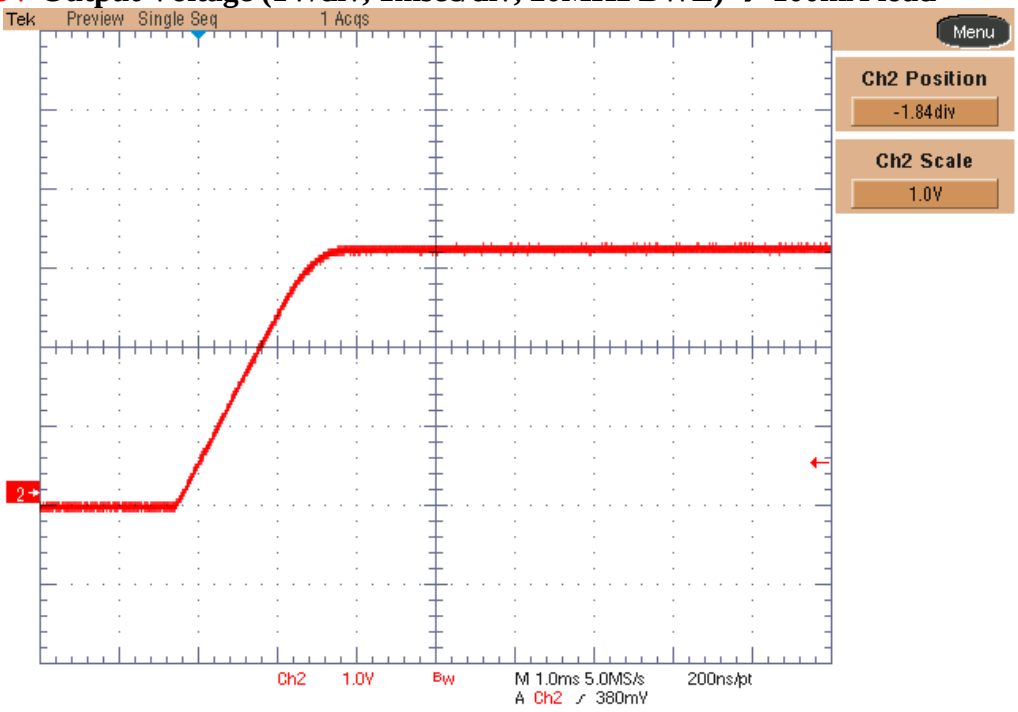
Ch.2: 12V Output Voltage (2V/div, 10msec/div, 20MHz BWL) → 12 Ohm load resistor



Ch.2: 12V Output Voltage (2V/div, 10msec/div, 20MHz BWL) → No load

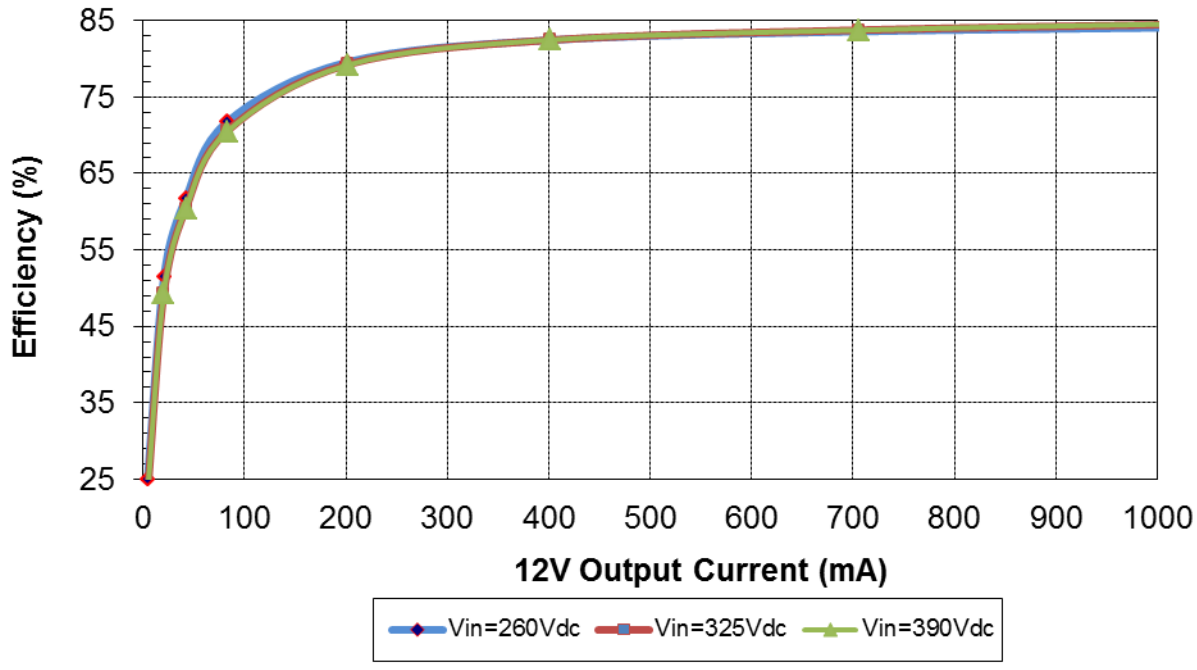


Ch.2: 3.3V Output Voltage (1V/div, 1msec/div, 20MHz BWL) → 100mA load



2 Efficiency

The efficiency data are shown in the tables and graphs below. Only the 12Vout has been loaded, therefore the 3.3Vout has been left unconnected. The load has been varied between 0 and 1A. The input voltage has been set to 260Vdc, 325Vdc and 390V (equivalent to the rectified 184Vac, 230Vac and 275Vac).



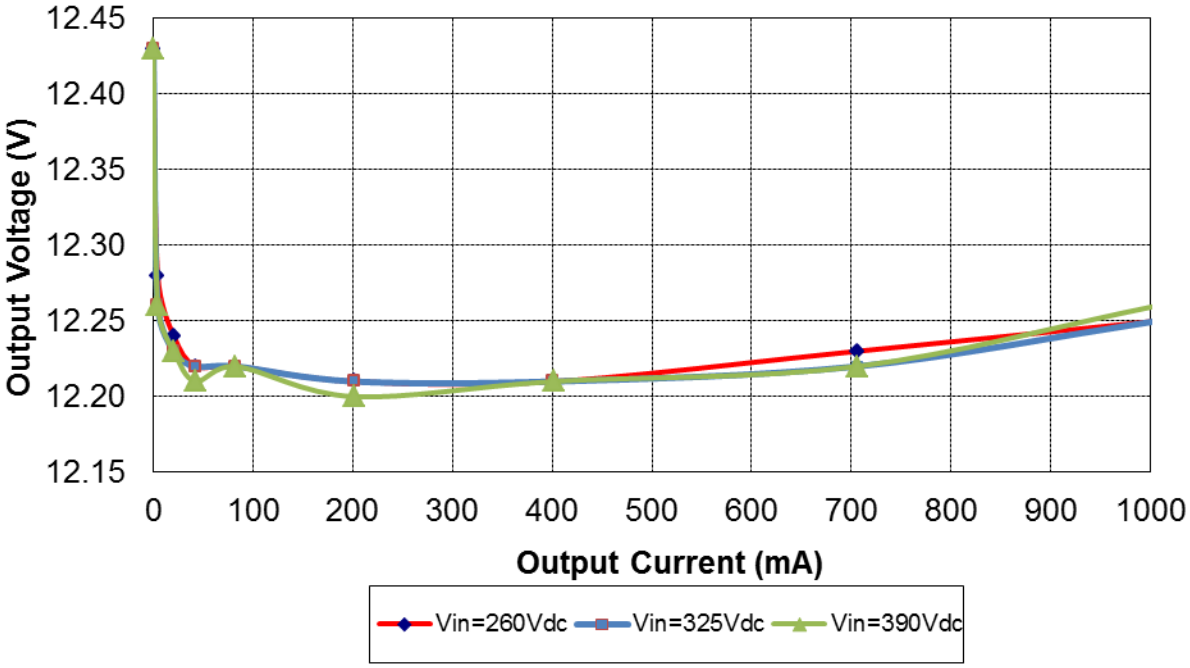
Iout (mA)	Vout (V)	Pout (W)	Iin (mA)	Vin (V)	Pin (W)	Ploss (W)	Eff (%)
0.0	12.43	0.000	0.445	260	0.116	0.116	0.0
4.4	12.28	0.054	0.831	260	0.216	0.162	25.0
20.6	12.24	0.252	1.883	260	0.490	0.237	51.5
42.2	12.22	0.516	3.212	260	0.835	0.319	61.7
82.7	12.22	1.01	5.420	260	1.409	0.399	71.7
201.4	12.21	2.46	11.89	260	3.091	0.632	79.5
401.1	12.21	4.90	22.85	260	5.941	1.044	82.4
706.2	12.23	8.64	39.76	260	10.338	1.701	83.5
1006	12.25	12.32	56.4	260	14.664	2.341	84.0

Iout (mA)	Vout (V)	Pout (W)	Iin (mA)	Vin (V)	Pin (W)	Ploss (W)	Eff (%)
0.0	12.43	0.000	0.339	325	0.110	0.110	0.0
4.4	12.26	0.054	0.719	325	0.234	0.180	23.1
20.5	12.23	0.251	1.564	325	0.508	0.258	49.3
42.2	12.22	0.516	2.626	325	0.853	0.338	60.4
82.7	12.22	1.01	4.410	325	1.433	0.423	70.5
201.4	12.21	2.46	9.55	325	3.104	0.645	79.2
401.1	12.21	4.90	18.28	325	5.941	1.044	82.4
706.2	12.22	8.63	31.71	325	10.306	1.676	83.7
1006	12.25	12.32	44.9	325	14.593	2.269	84.5

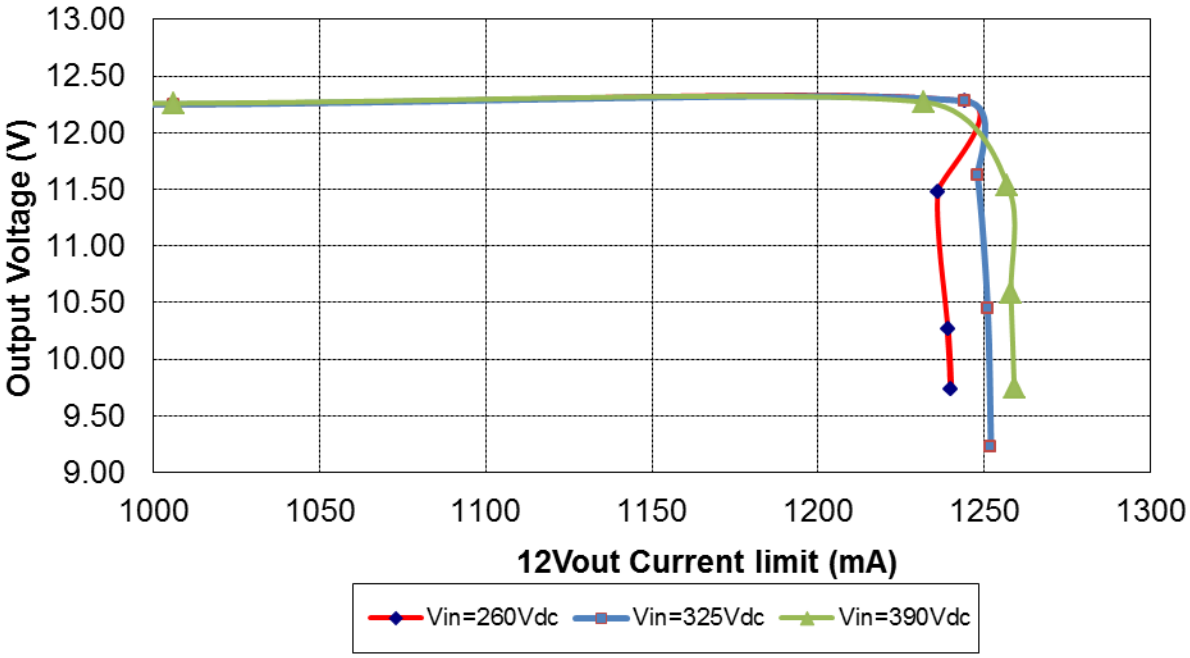
Iout (mA)	Vout (V)	Pout (W)	Iin (mA)	Vin (V)	Pin (W)	Ploss (W)	Eff (%)
0.0	12.43	0.000	0.339	325	0.110	0.110	0.0
4.4	12.26	0.054	0.719	325	0.234	0.180	23.1
20.5	12.23	0.251	1.564	325	0.508	0.258	49.3
42.2	12.21	0.515	2.626	325	0.853	0.338	60.4
82.6	12.22	1.01	4.410	325	1.433	0.424	70.4
201.4	12.20	2.46	9.55	325	3.104	0.647	79.2
401.2	12.21	4.90	18.28	325	5.941	1.042	82.5
706.2	12.22	8.63	31.71	325	10.306	1.676	83.7
1006	12.26	12.33	44.9	325	14.593	2.259	84.5

3 12V Output Voltage Regulation vs. Load

The 12V output voltage variation as function of output current is shown below.



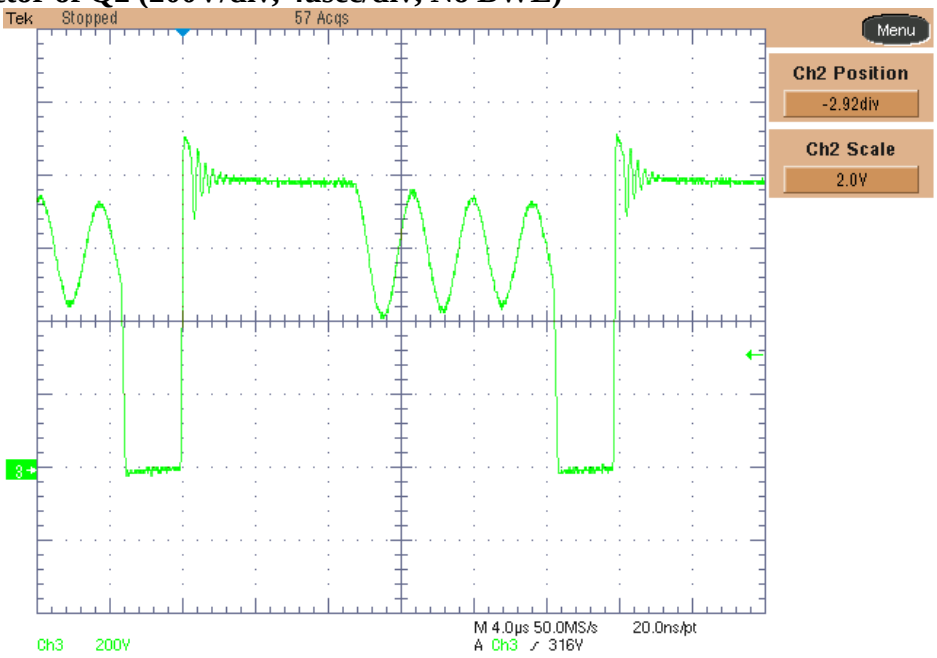
After reaching 1.24A, the output V-I characteristic turned into a constant current generator, as shown in the following picture:



4 Switching Node Waveforms

The image below shows the voltage on switch node collector of Q2 at 600Vdc input voltage and full load conditions.

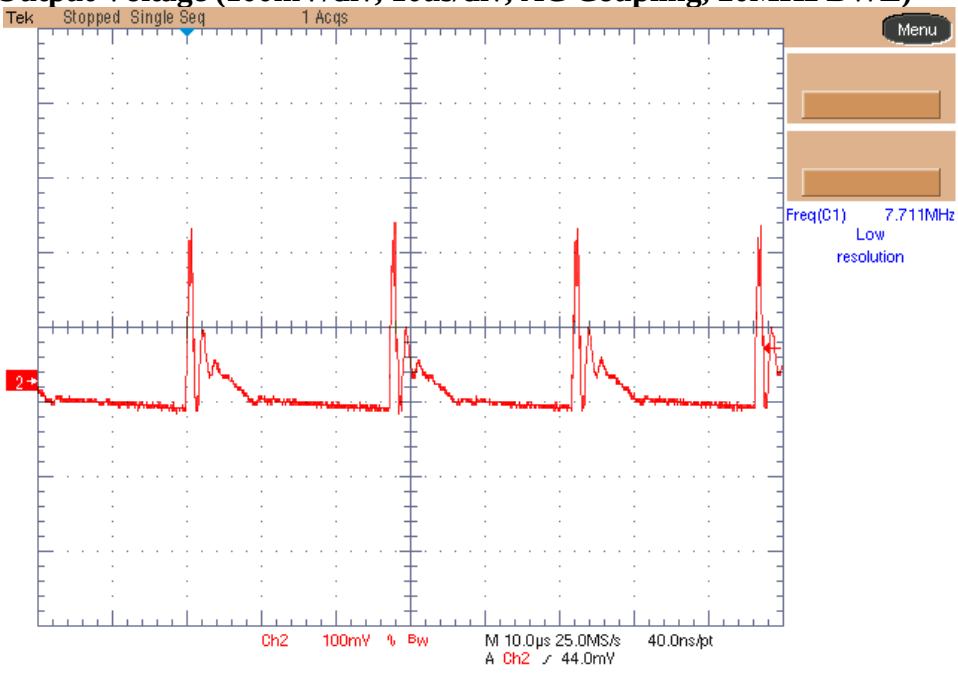
Ch3: Collector of Q2 (200V/div, 4usec/div, No BWL)



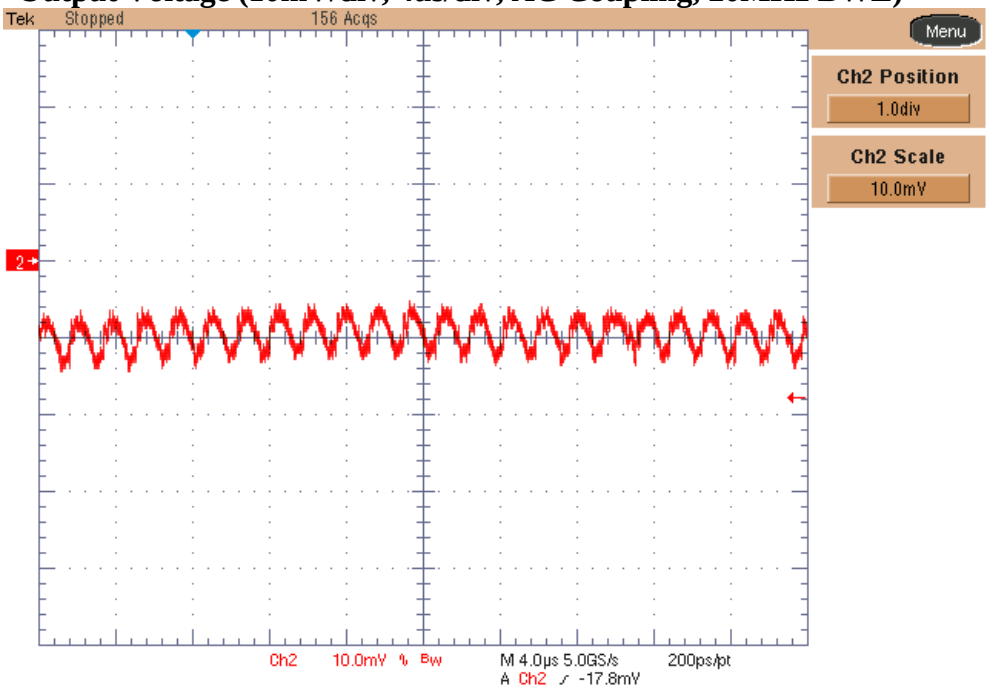
5 Output Ripple Voltage

The output ripple voltage on the 12Vout and 3.3Vout, @ 320Vdc input voltage, is shown in the pictures below.

Ch2: 12V Output Voltage (100mV/div, 10us/div, AC Coupling, 20MHz BWL)



Ch2: 3.3V Output Voltage (10mV/div, 4us/div, AC Coupling, 20MHz BWL)

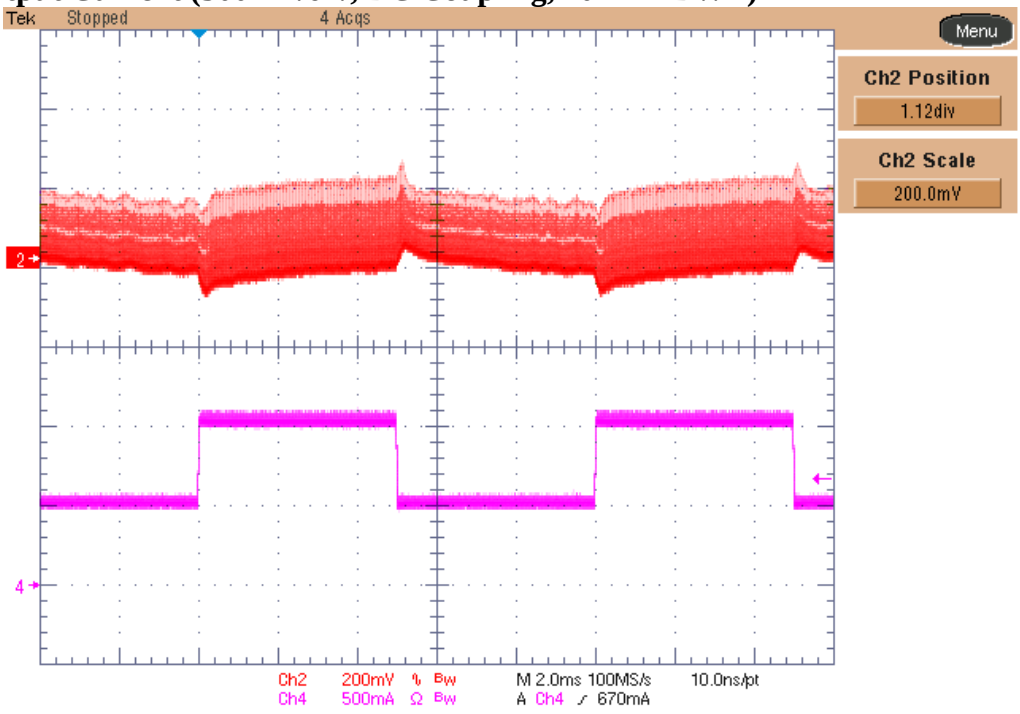


6 Transient Response on 12Vout

The 12V output voltage variation versus transient load is shown below. The input voltage has been set to 320Vdc and the load switched between 500mA and 1A (50%...100% of load).

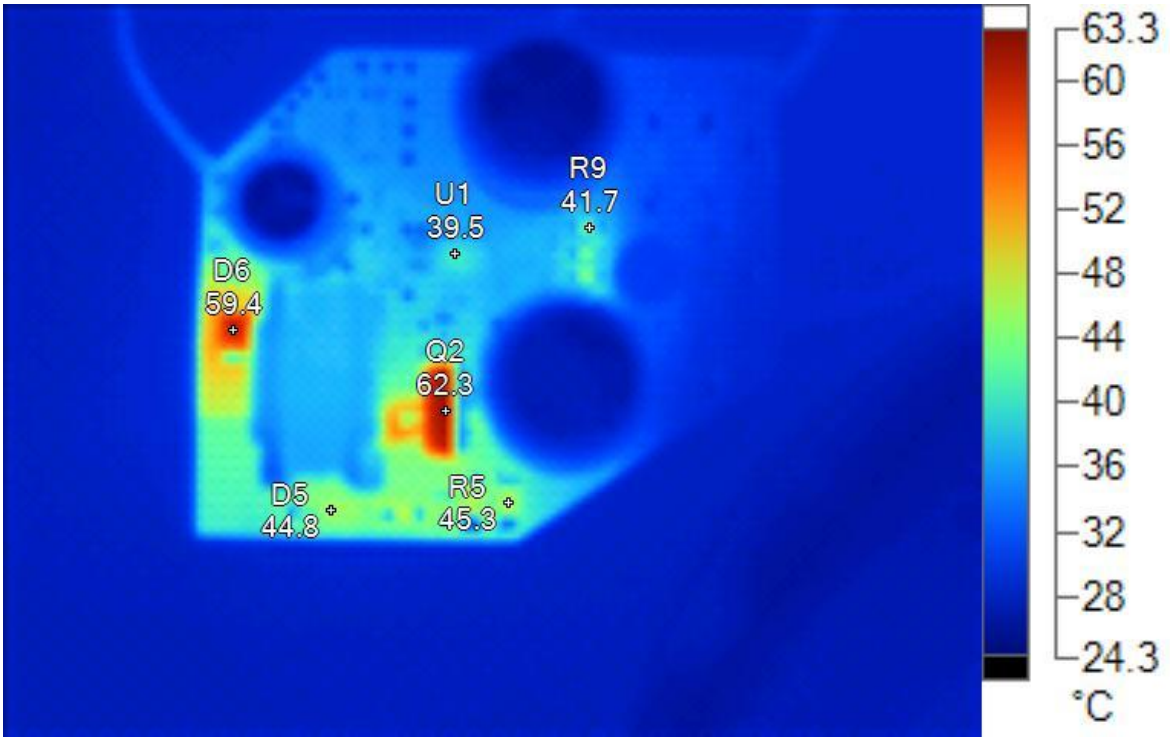
Ch2: 12V Output Voltage (200mV/div, 2msec/div, AC Coupling, 20MHz BWL)

Ch4: Output Current (500mA/div, DC Coupling, 20MHz BWL)



7 Thermal Analysis

The thermal analysis of the converter shows the temperatures for each component, in the graphs below. The converter has been placed horizontally on the bench without any forced convection. The input voltage was 1KVdc for the upper picture and 320Vdc for the bottom one. Both outputs were fully loaded and the ambient temperature 24C.



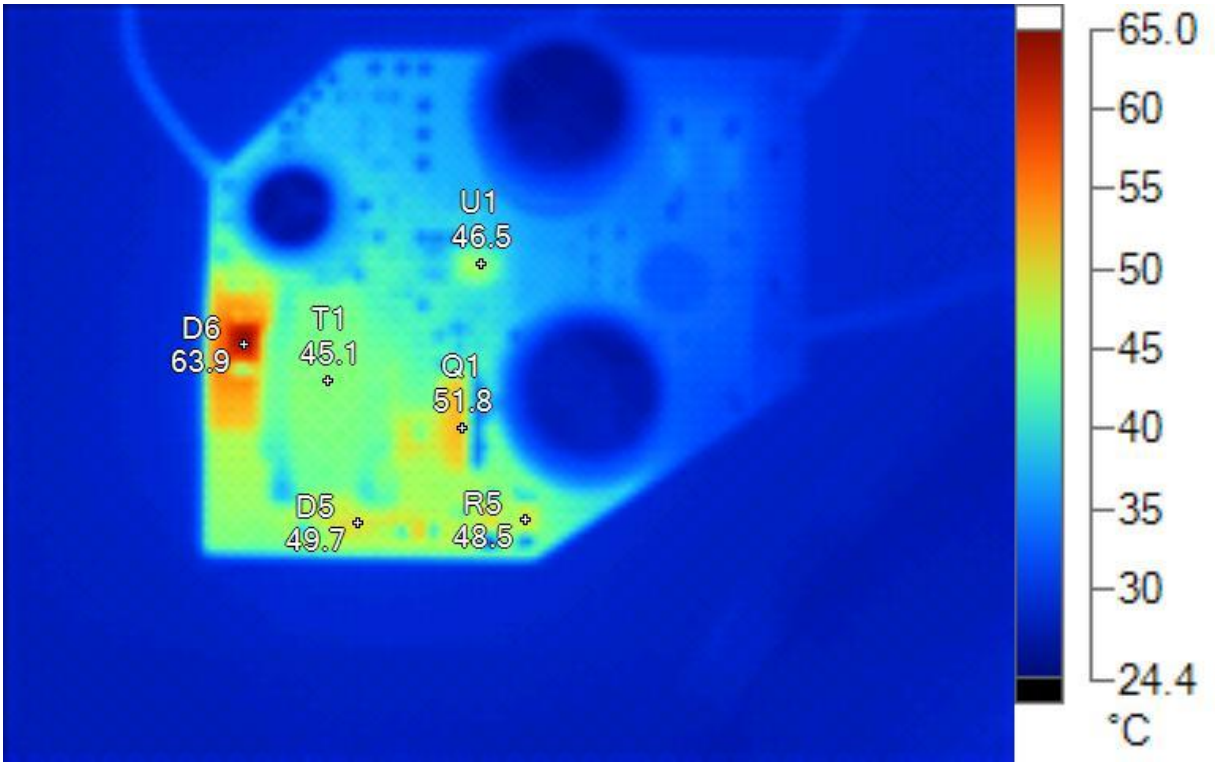
Vin = 1KVdc, Full load

Image Info

Background temperature	24.0°C
Average Temperature	29.9°C
Image Range	25.3°C to 62.3°C
Camera Model	Ti40FT
Camera Manufacturer	Fluke
Image Time	12/6/2013 6:22:50 PM

Main Image Markers

Name	Temperature
D6	59.4°C
Q2	62.3°C
D5	44.8°C
R5	45.3°C
U1	39.5°C
R9	41.7°C



Vin = 320Vdc, Full load

Image Info

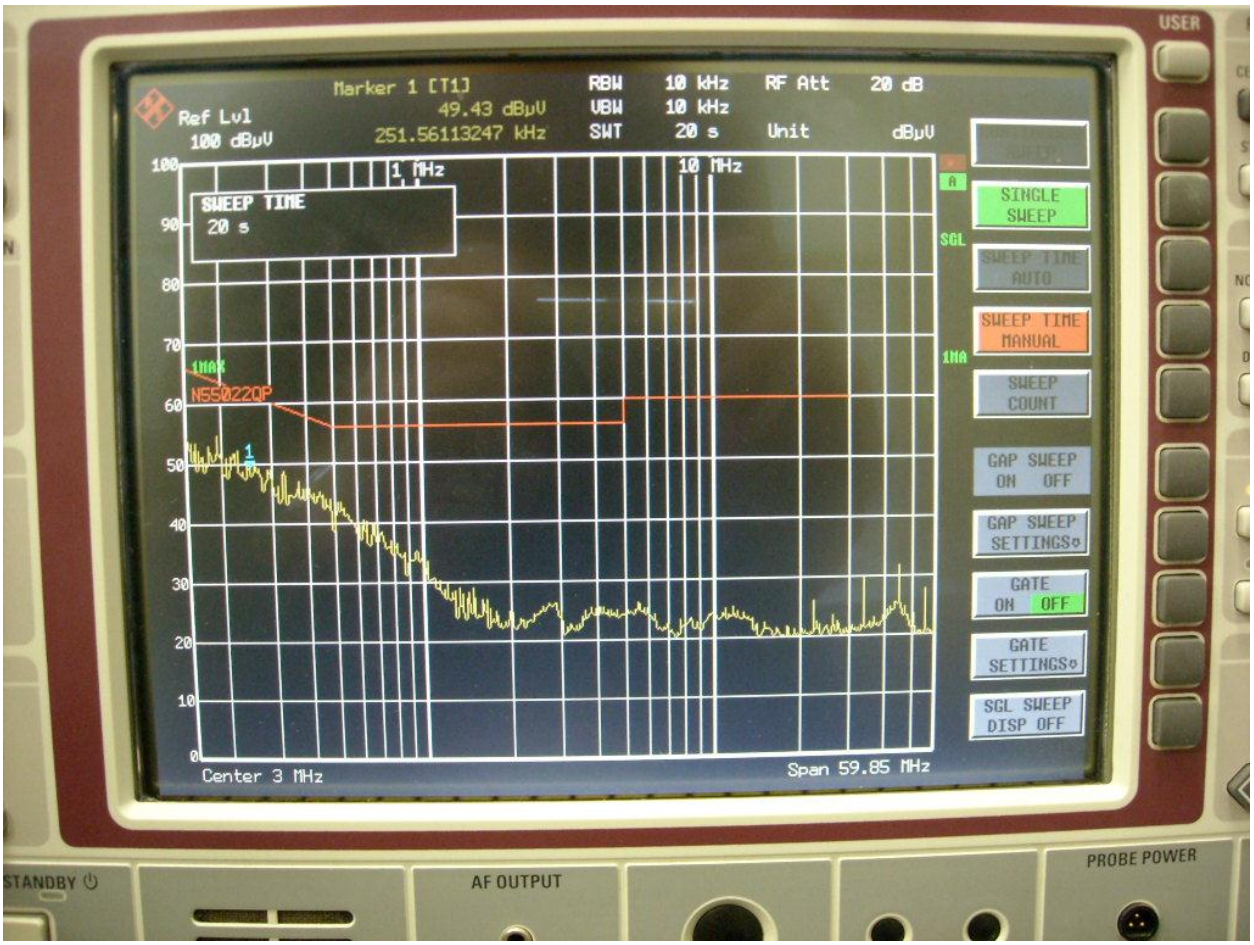
Background temperature	24.0°C
Average Temperature	31.2°C
Image Range	25.4°C to 64.0°C
Camera Model	Ti40FT
Camera Manufacturer	Fluke
Image Time	12/6/2013 6:26:09 PM

Main Image Markers

Name	Temperature
D6	63.9°C
Q1	51.8°C
D5	49.7°C
R5	48.5°C
U1	46.5°C
T1	45.1°C

8 EMI measurement

The screenshot below shows the EMI measurement (quasi-peak) of the converter connected to an isolation transformer and a Hameg HM6050-2 LISN. The supply voltage was 230Vac.
The converter has been loaded with a 12 Ohm power resistor. Both converter and resistor have been placed 20cm over the ground plane. The output ground terminal has been connected to LISN earth.



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