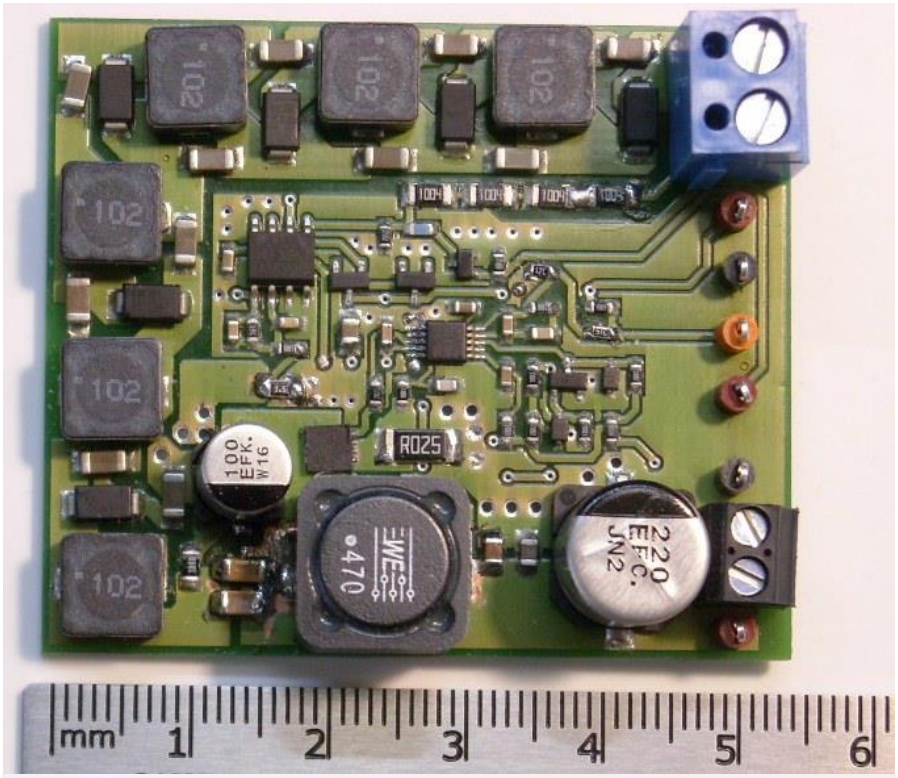
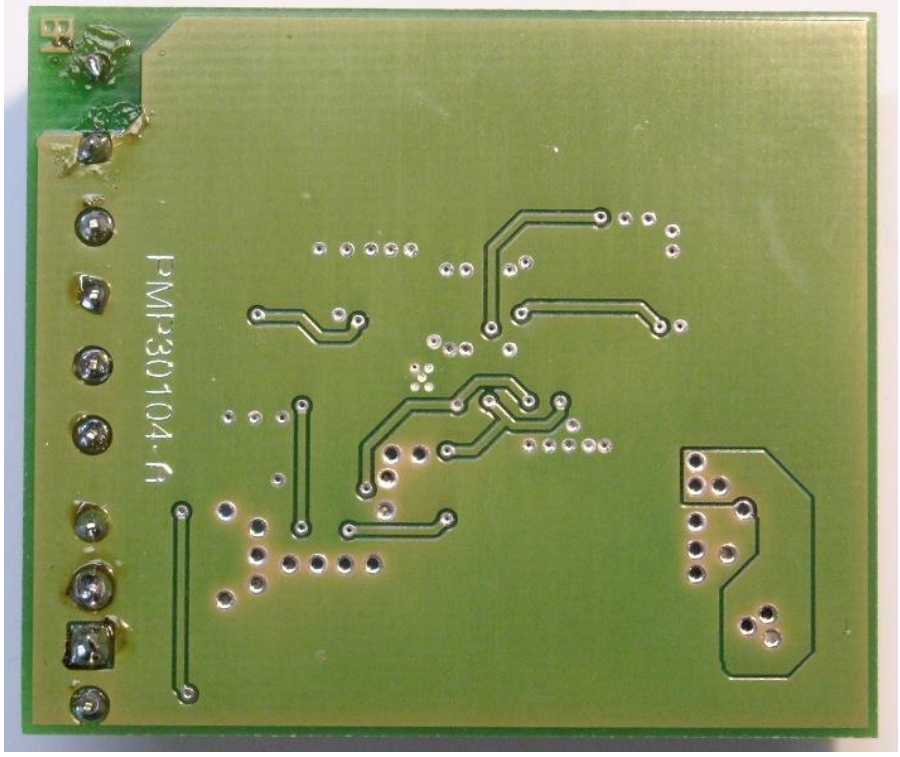
1 Photo of the prototype (54.61mm x 46.61mm, height 13mm).

The Reference design PMP30104 Revision B has been built on PMP30104 Revision A PCB.

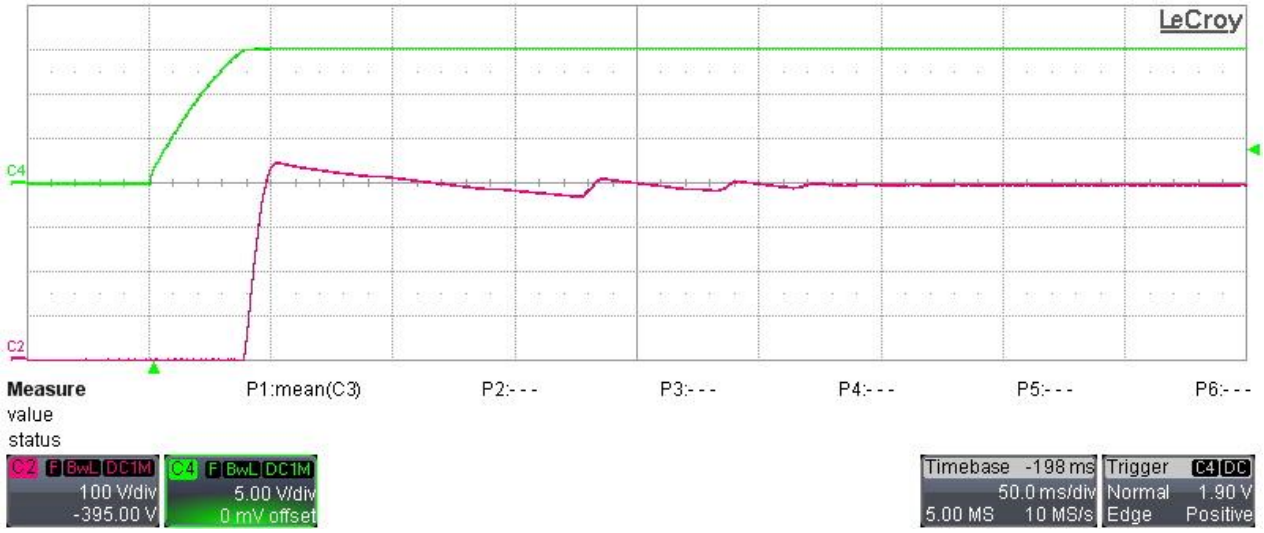




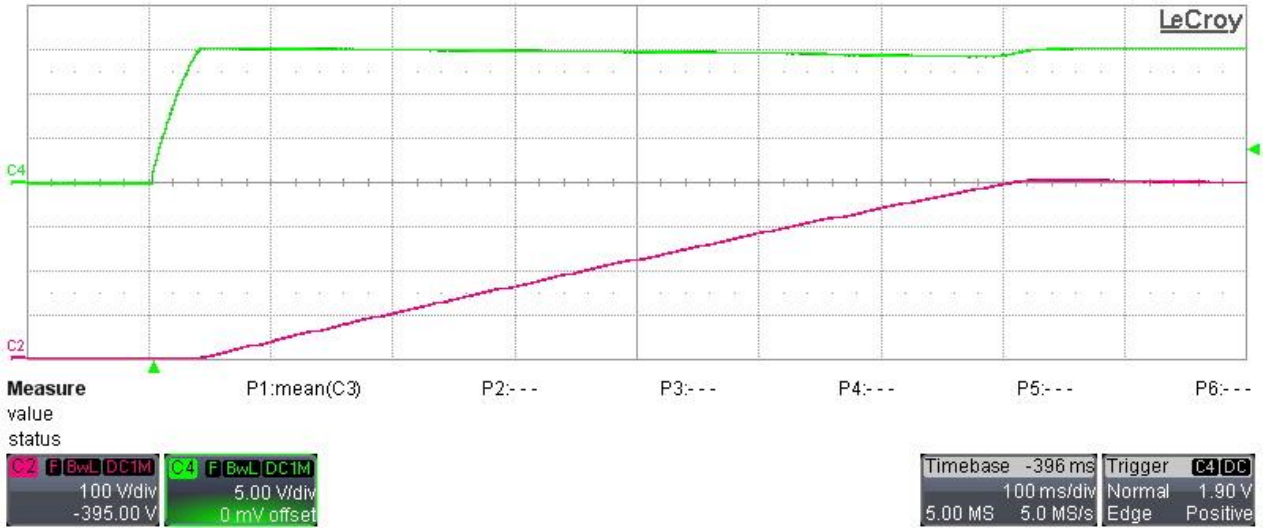
2 Startup

The input and output voltage behavior in different load conditions is shown in the images below.

Ch.2: Output voltage (100V/div, 50ms/div, 20MHz BWL)
Ch.4: Input voltage (5V/div, 20MHz BWL)
Vout set to 400V, output connector left open (no load, no capacitor), Vin = 15V.

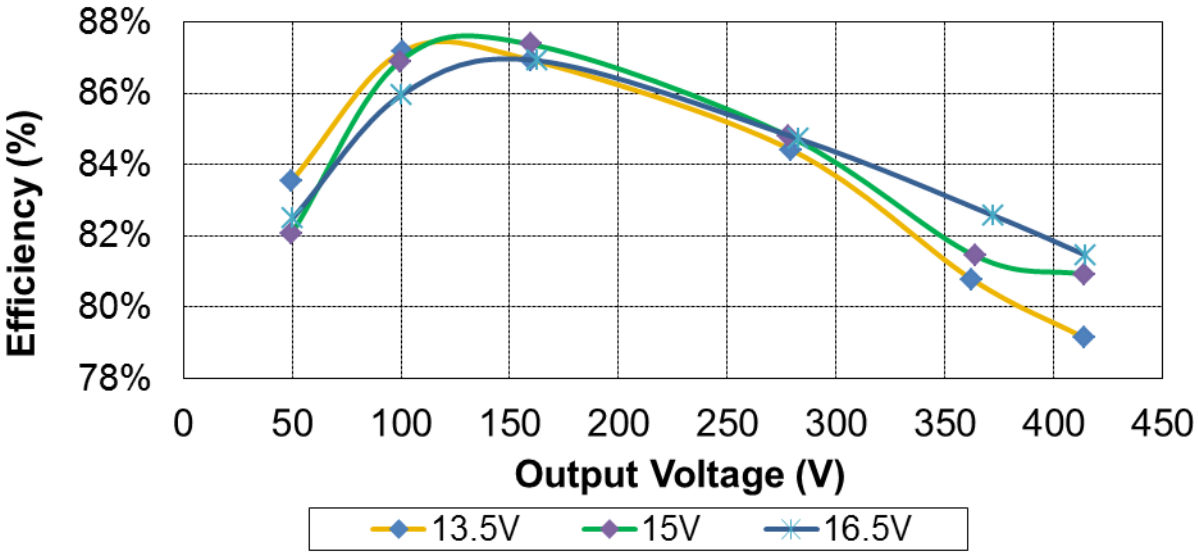


Ch.2: Output voltage (100V/div, 100ms/div, 20MHz BWL)
Ch.4: Input voltage (5V/div, 20MHz BWL)
Vout set to 400V, 130uF capacitor connected to Vout, output unloaded, Vin = 15V.



3 Efficiency

The efficiency data, versus input and output voltage are shown in the tables and graph below. The load (variable resistor) has been varied in order to get different Vout (since the converter is a constant current generator, set to deliver 420V (Q3 ON)). The input voltage has been set respectively to 15V ± 10%.



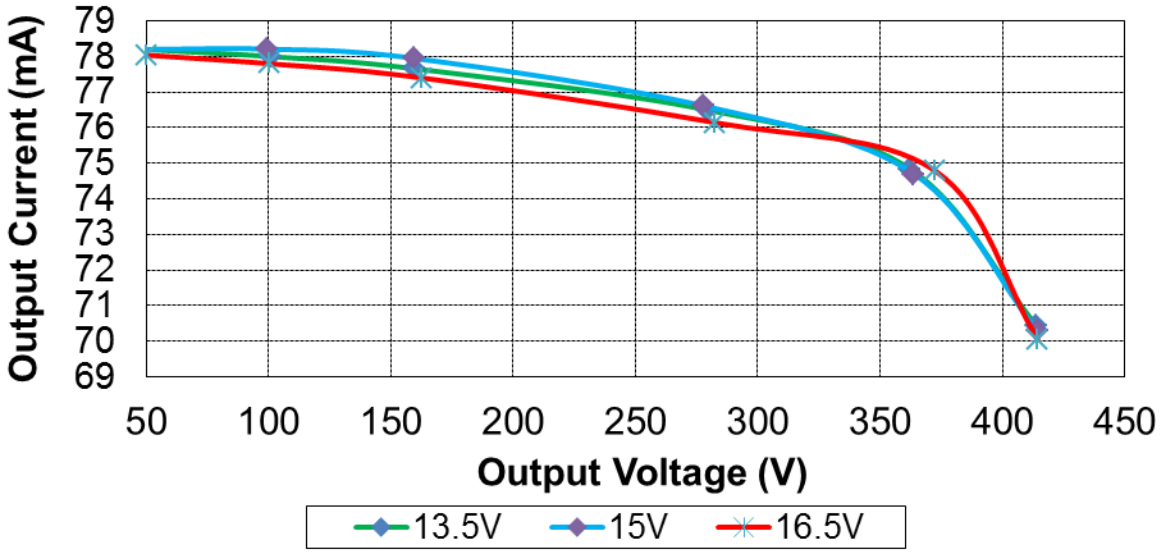
Vin (V)	Iin(A)	Pin (W)	Vout (V)	Iout(mA)	Pout (W)	Efficiency (%)
13.64	0.341	4.65	49.69	78.20	3.89	83.5%
13.55	0.666	9.02	100.8	78.00	7.86	87.2%
13.48	1.057	14.25	159.5	77.66	12.39	86.9%
13.55	1.868	25.31	279.3	76.50	21.37	84.4%
13.53	2.480	33.55	362.2	74.84	27.11	80.8%
13.65	2.698	36.83	413.9	70.42	29.15	79.1%
13.53	0.0188	0.254	418.8	0	0	0.0%

Vin (V)	Iin(A)	Pin (W)	Vout (V)	Iout(mA)	Pout (W)	Efficiency (%)
15.00	0.316	4.74	49.74	78.20	3.89	82.1%
14.95	0.600	8.97	99.6	78.21	7.79	86.9%
15.01	0.948	14.23	159.5	77.95	12.43	87.4%
15.03	1.671	25.12	278.0	76.61	21.30	84.8%
14.93	2.235	33.37	363.8	74.70	27.18	81.4%
14.92	2.411	35.97	414.1	70.29	29.11	80.9%
15.57	0.0191	0.297	420.2	0	0	0.0%

Vin (V)	Iin(A)	Pin (W)	Vout (V)	Iout(mA)	Pout (W)	Efficiency (%)
16.75	0.283	4.74	50.10	78.04	3.91	82.5%
16.55	0.548	9.07	100.2	77.80	7.80	86.0%
16.67	0.869	14.48	162.6	77.40	12.59	86.9%
16.53	1.537	25.41	282.7	76.14	21.52	84.7%
16.59	2.033	33.73	372.3	74.80	27.85	82.6%
16.51	2.158	35.63	414.4	70.04	29.02	81.5%
16.50	0.0179	0.295	420.4	0	0	0.0%

4 Output Current

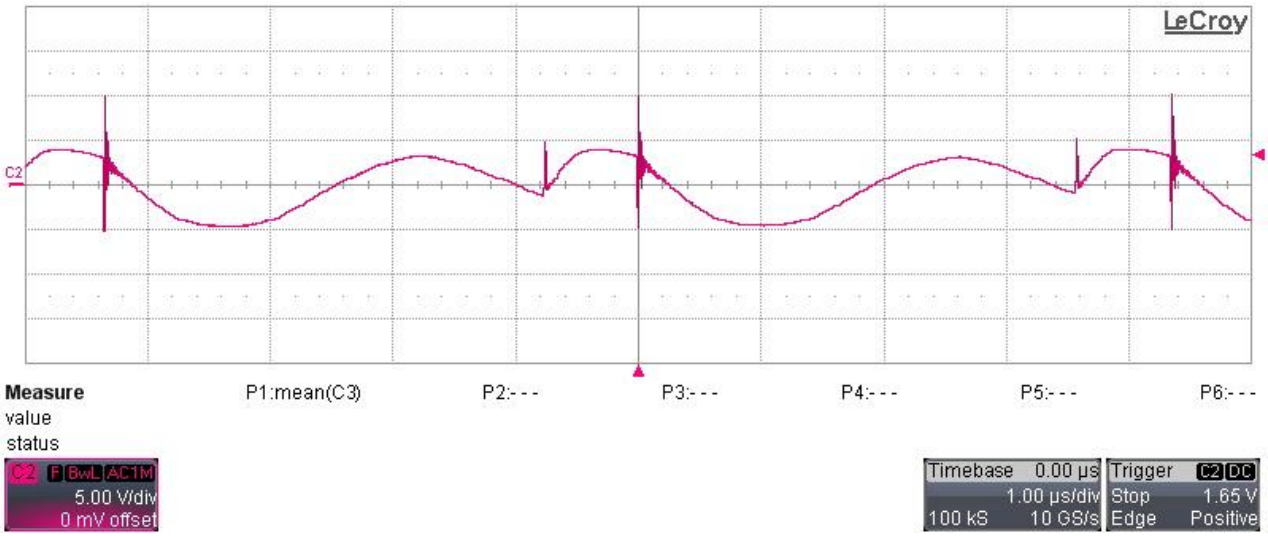
The output current variation versus output voltage, for different input voltages, is plotted below.



5 Output Ripple Voltage

The output ripple voltage has been measured by supplying the converter at 15V while running in constant current limit and set to deliver 420V.

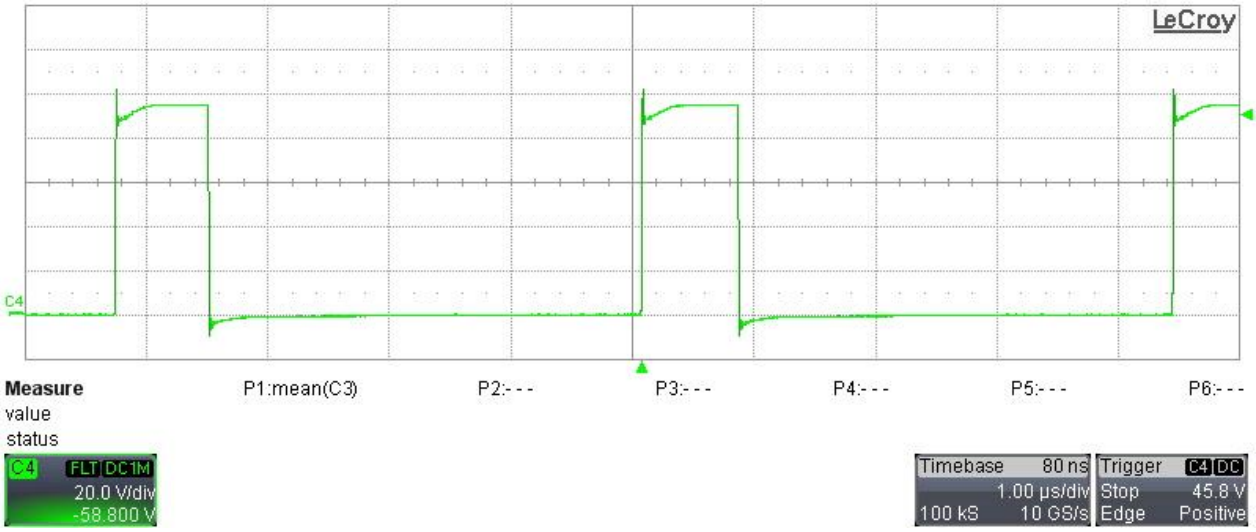
Ch.2: Output ripple voltage (5V/div, AC coupling, 1usec/div, 20MHz BWL)



6 Switch node

The image below shows the drain of Q2 taken at Vin = 16.5V and Vout = 420V, while delivering 78mA.

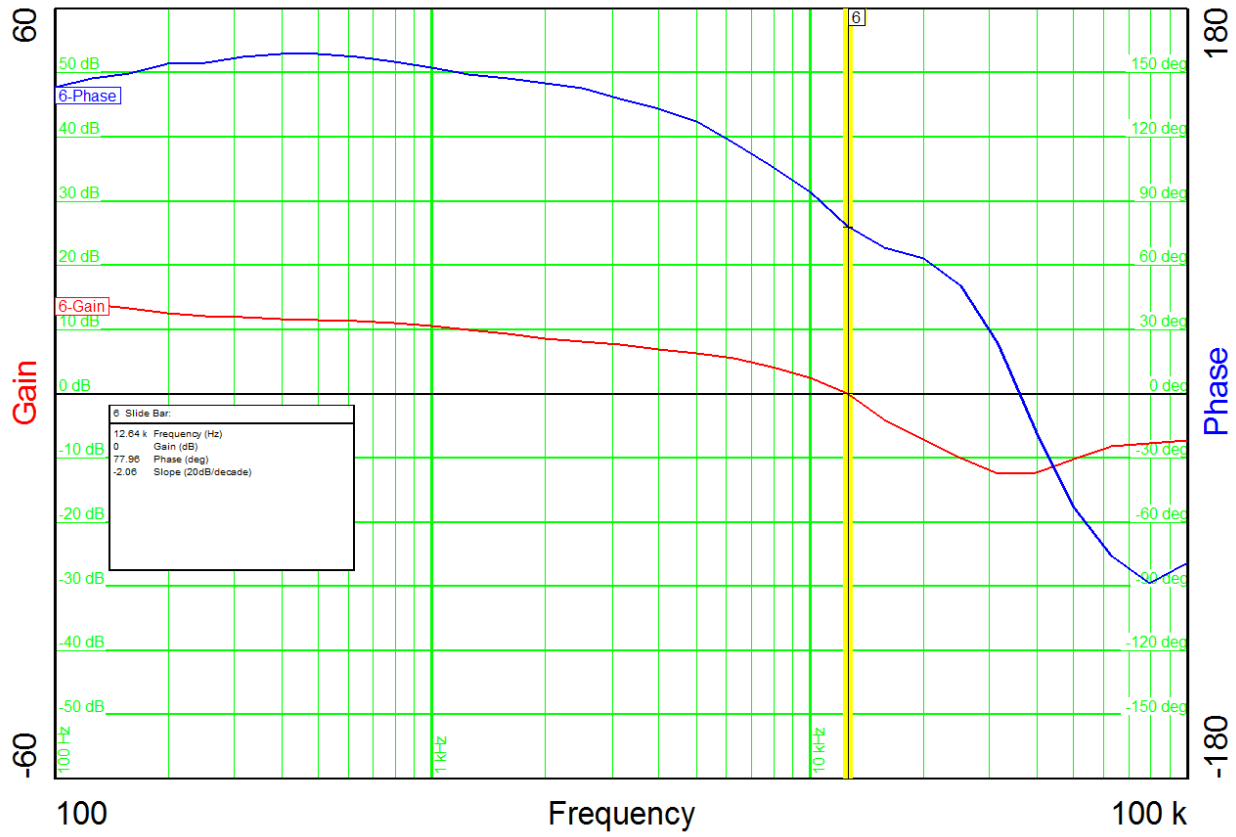
Ch.4: Q2-Drain voltage (20V/div, 1us/div, no BWL)



7 Feedback Loop Analysis

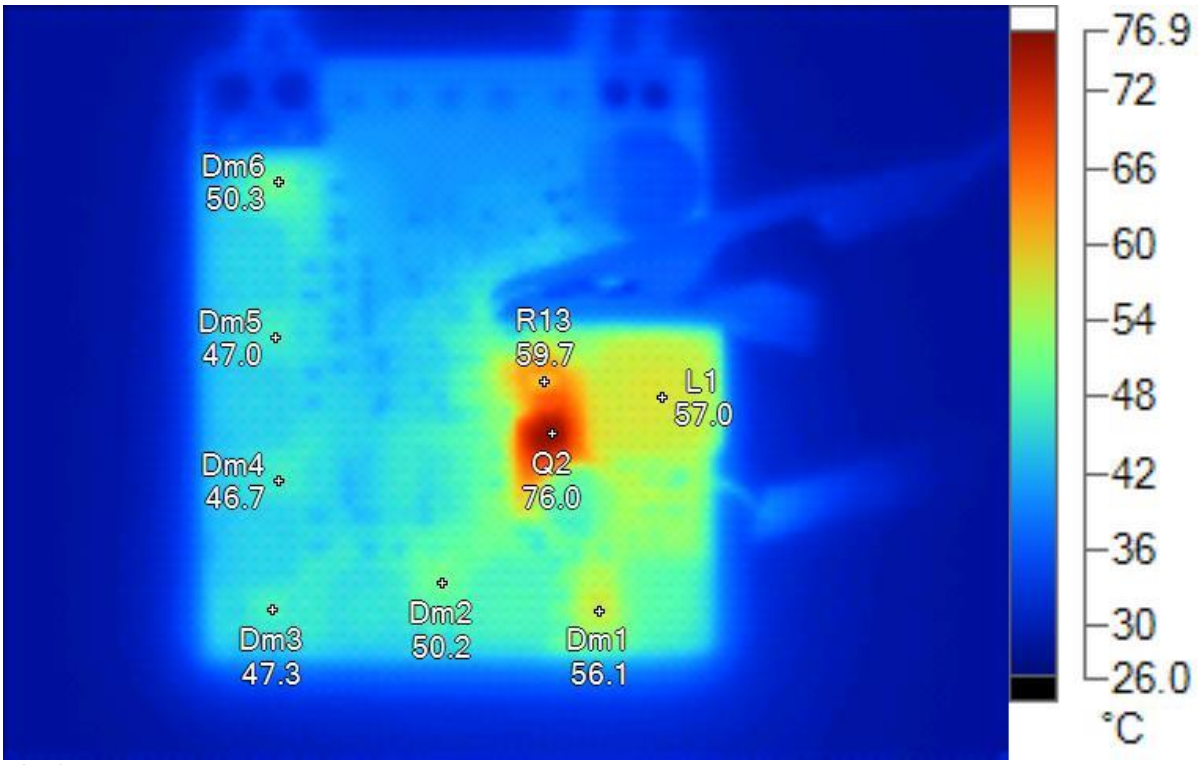
The image below shows the open loop gain and phase margin of the constant current loop. The board has been supplied at Vin = 15V and the load was a resistor + an electrolytic capacitor (130uF). The resistor has been varied to obtain 350V on output terminals. Here are the results:

Crossover frequency: 12.64 KHz
Phase margin: 77.96 deg.
Gain margin: 12.45 dB



8 Thermal Analysis

During the thermal analysis, the converter has been placed horizontally on the bench in still air conditions, while supplied 13.5V (worst case) and delivering 390V @ 80mA for two minutes.



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Main Image Markers

Name	Temperature	Emissivity	Background
Q2	76.0°C	0.95	23.0°C
Dm1	56.1°C	0.95	23.0°C
L1	57.0°C	0.95	23.0°C
Dm6	50.3°C	0.95	23.0°C
Dm5	47.0°C	0.95	23.0°C
Dm4	46.7°C	0.95	23.0°C
Dm3	47.3°C	0.95	23.0°C
Dm2	50.2°C	0.95	23.0°C
R13	59.7°C	0.95	23.0°C

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