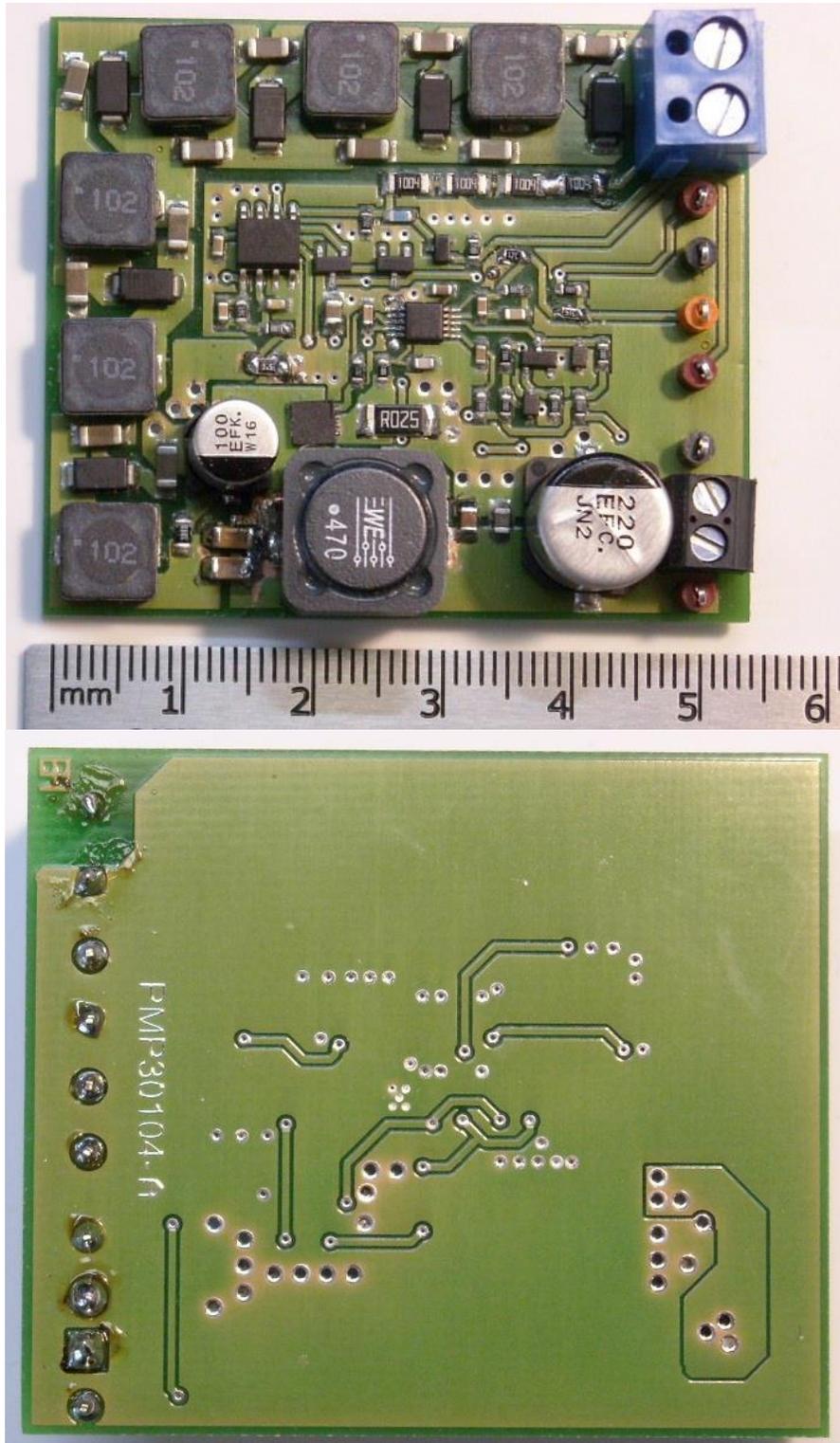


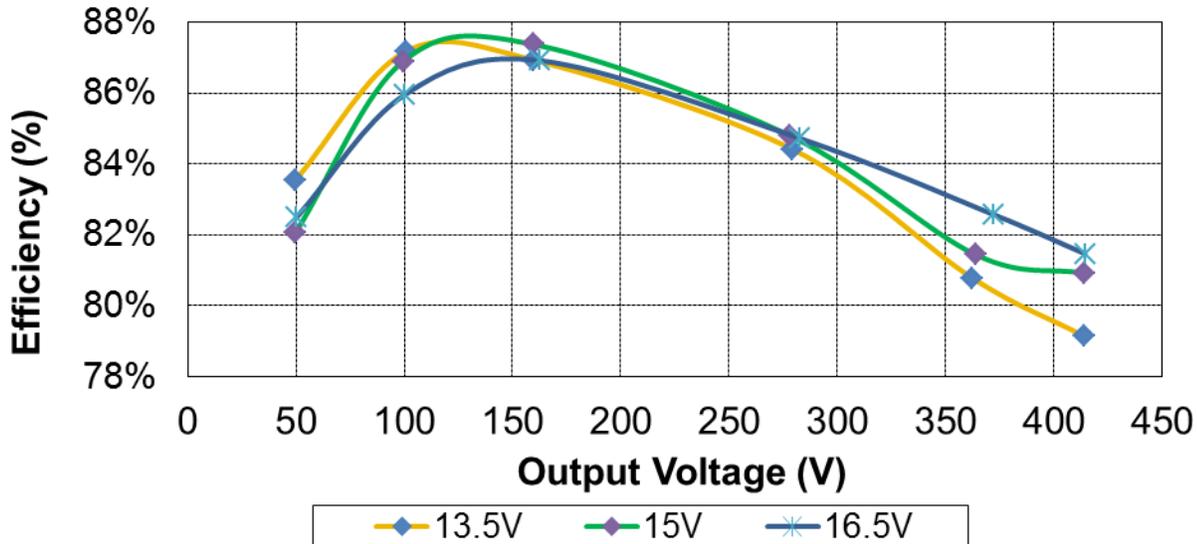
1 Photo of the prototype (54.61mm x 46.61mm, height 13mm).

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



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 \pm 10%.



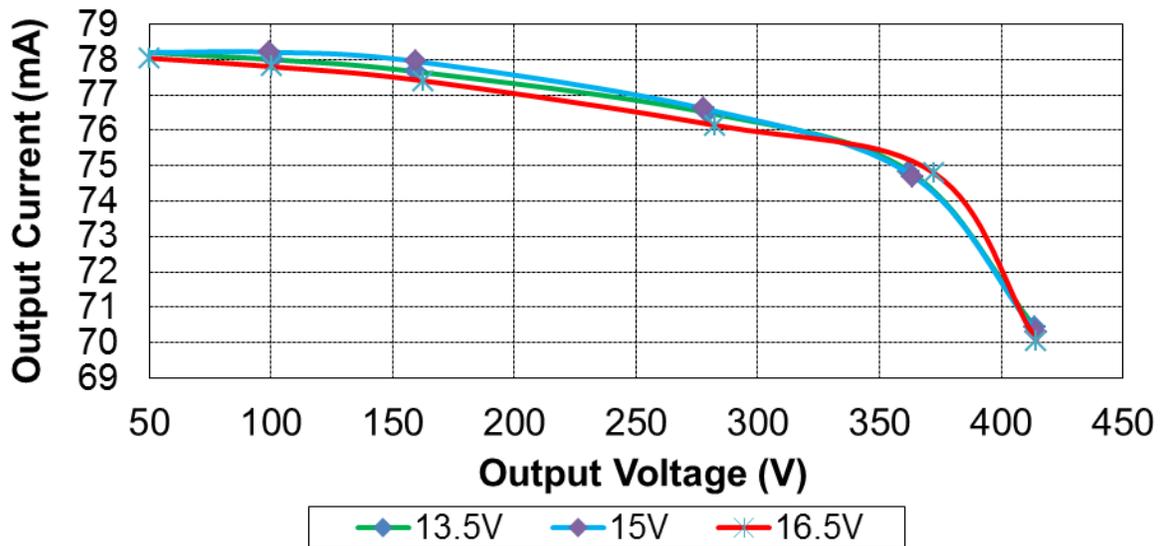
| Vin (V) | Iin(A) | Pin (W) | Vout (V) | Iout(mA) | Pout (W) | Efficiency (%) |
|---------|--------|---------|----------|----------|----------|----------------|
| 13.64 | 0.341 | 4.65 | 49.69 | 78.20 | 3.89 | 83.5% |
| 13.55 | 0.666 | 9.02 | 100.8 | 78.00 | 7.86 | 87.2% |
| 13.48 | 1.057 | 14.25 | 159.5 | 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

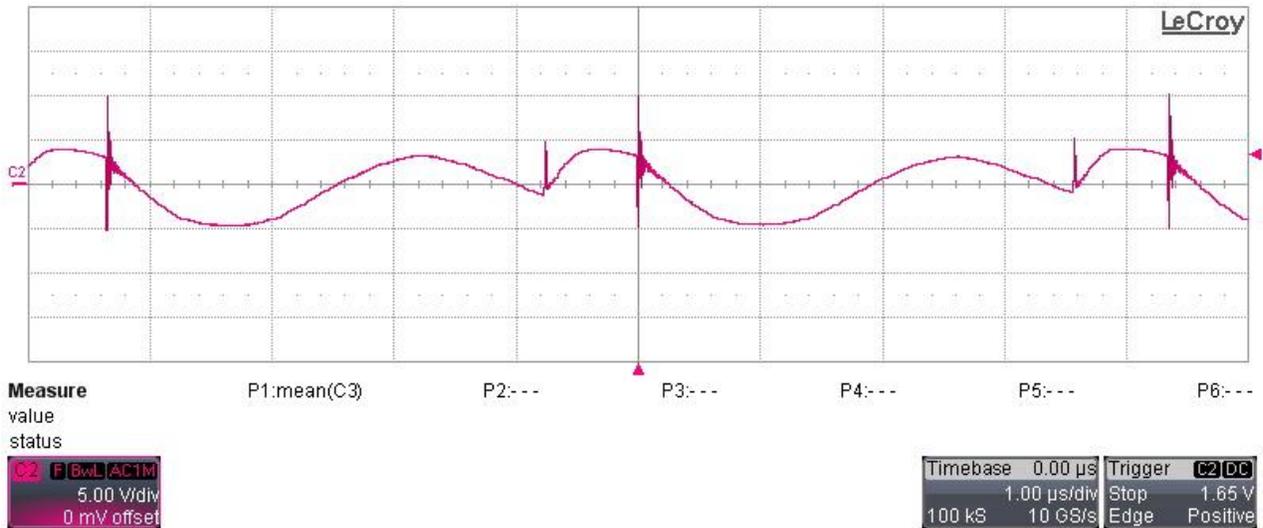
The output current variation versus output voltage, for different input voltages, is plotted below.



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.

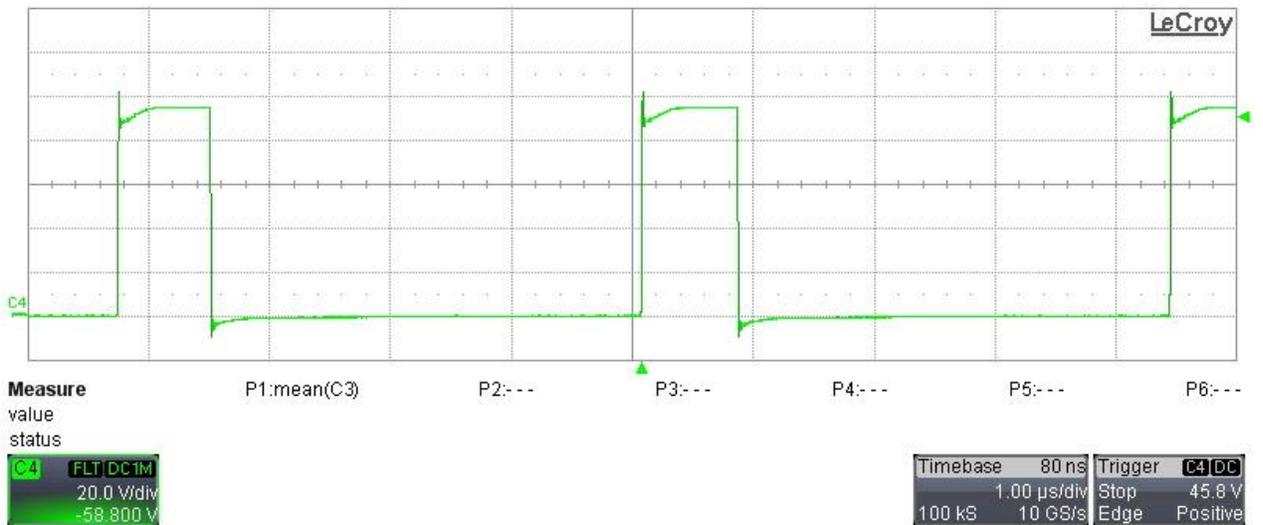
Ch.2: Output ripple voltage (5V/div, AC coupling, 1usec/div, 20MHz BWL)



6 Switch node

The image below shows the drain of Q2 taken at $V_{in} = 16.5V$ and $V_{out} = 420V$, while delivering 78mA.

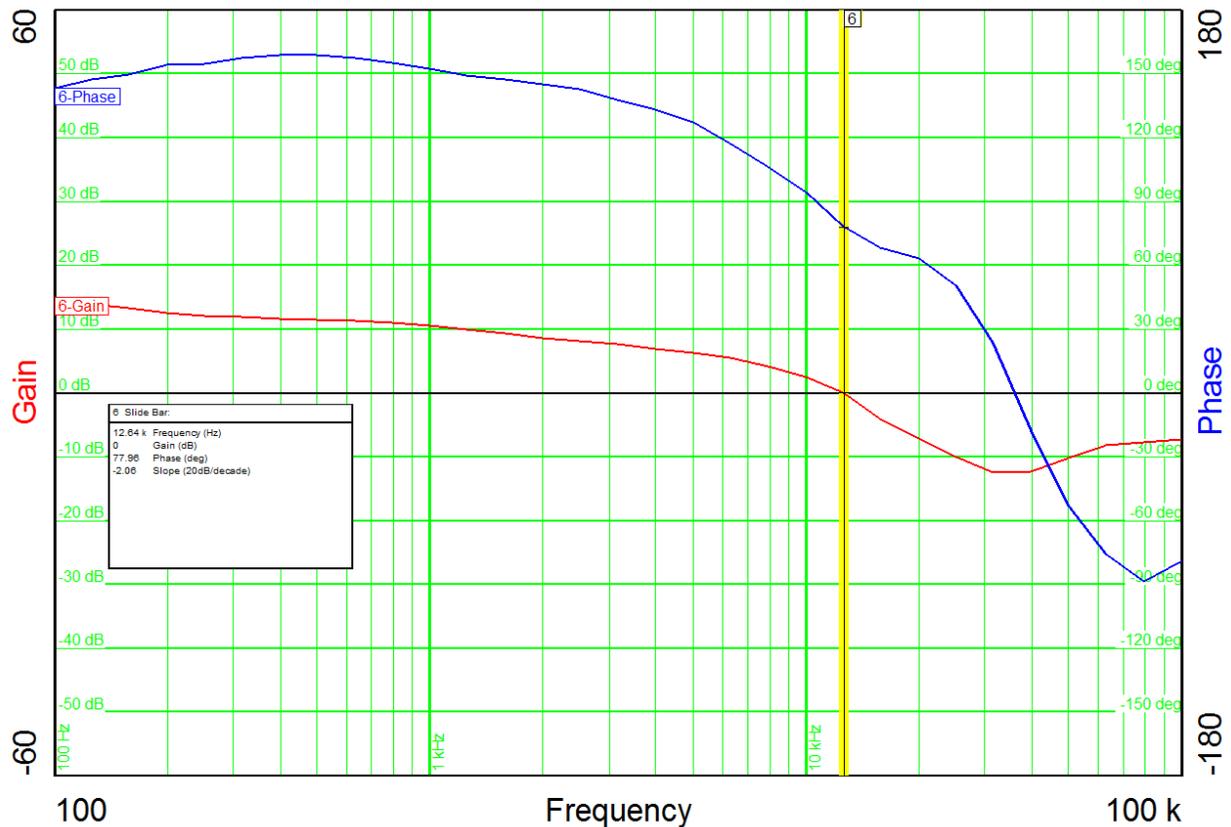
Ch.4: Q2-Drain voltage (20V/div, 1us/div, no BWL)



7 Feedback Loop Analysis

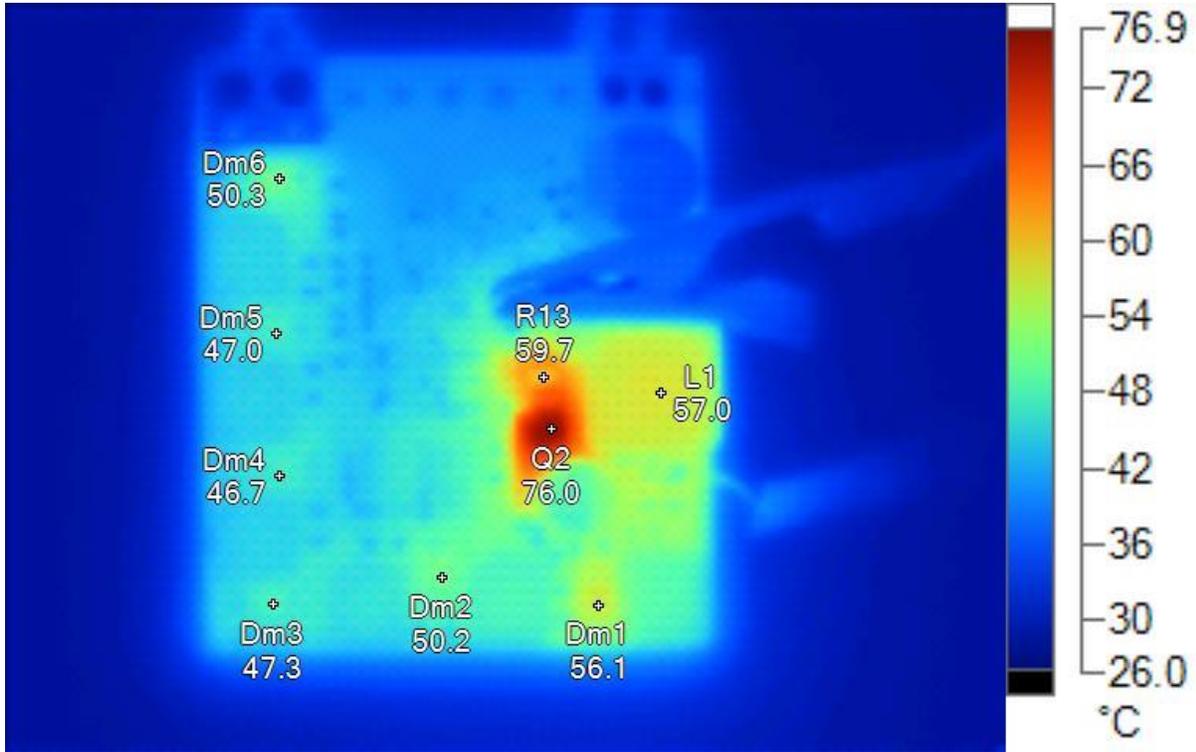
The image below shows the open loop gain and phase margin of the constant current loop. The board has been supplied at $V_{in} = 15V$ and the load was a resistor + an electrolytic capacitor (130uF). The resistor has been varied to obtain 350V on output terminals. Here are the results:

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.



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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