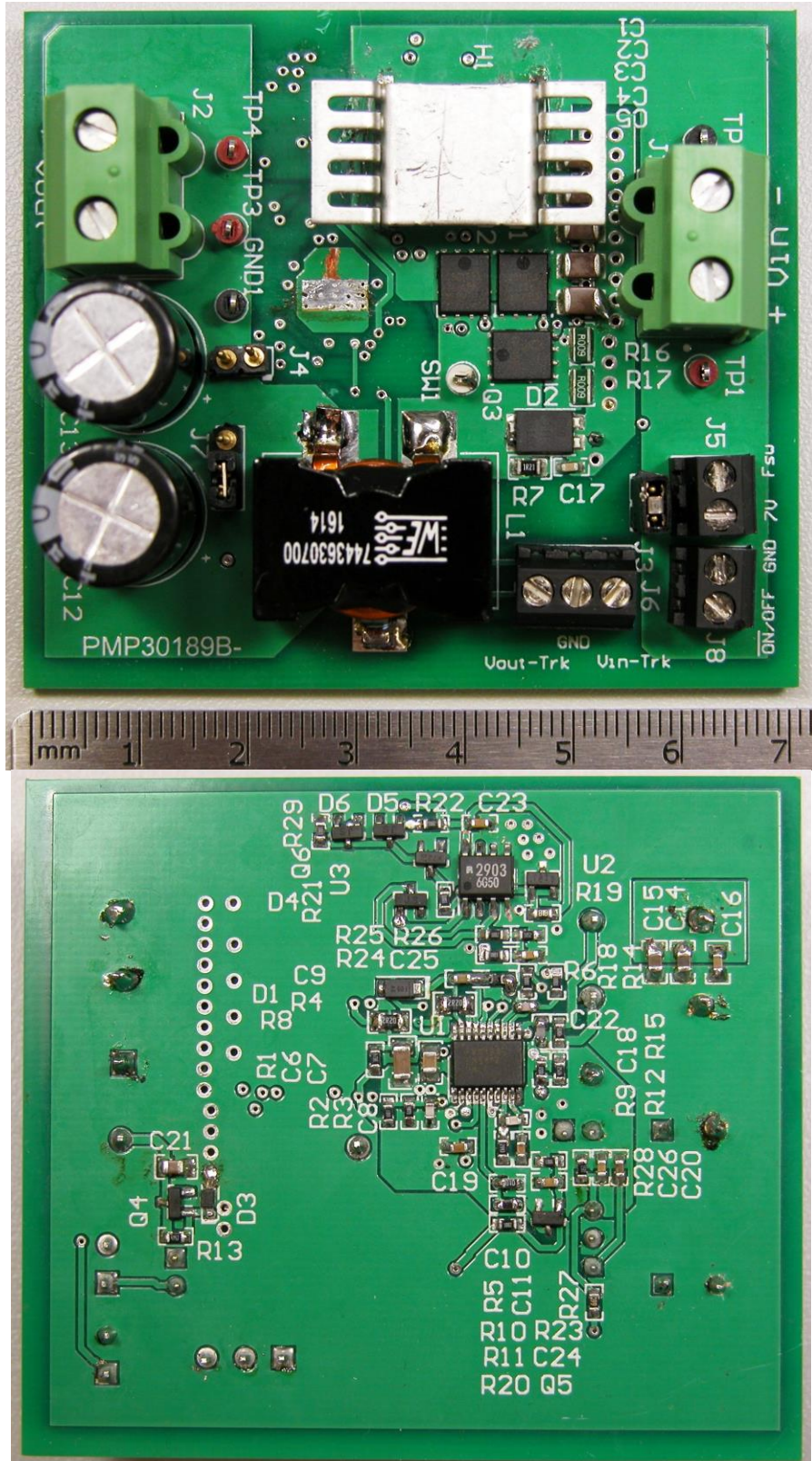


1. Photo of the prototype (71.12mm x 62.23mm).



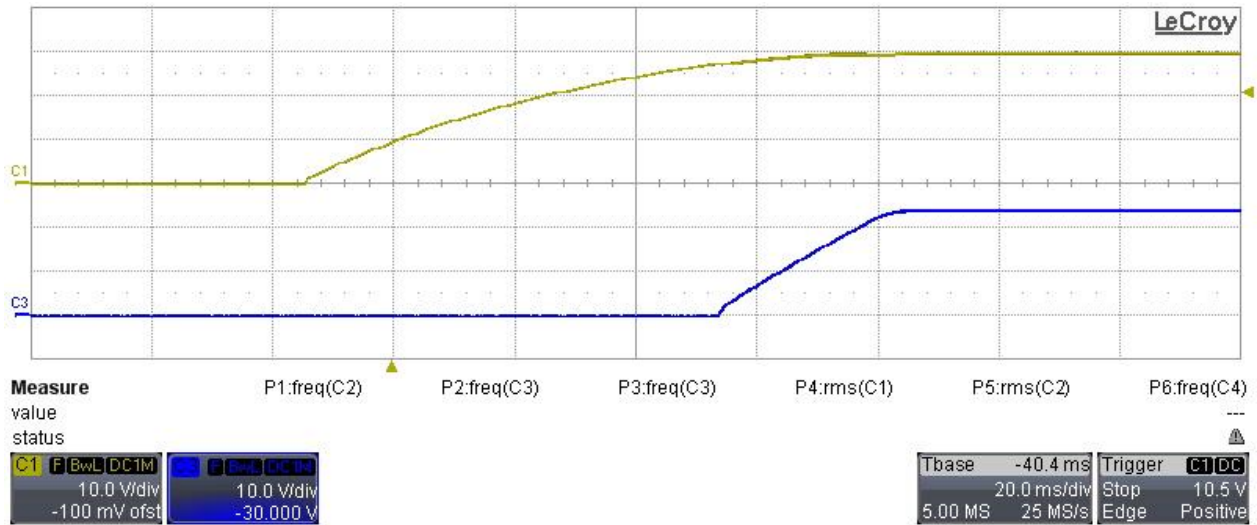
2. Startup

The input and output voltage behavior at full and no-load conditions is shown in the images below.

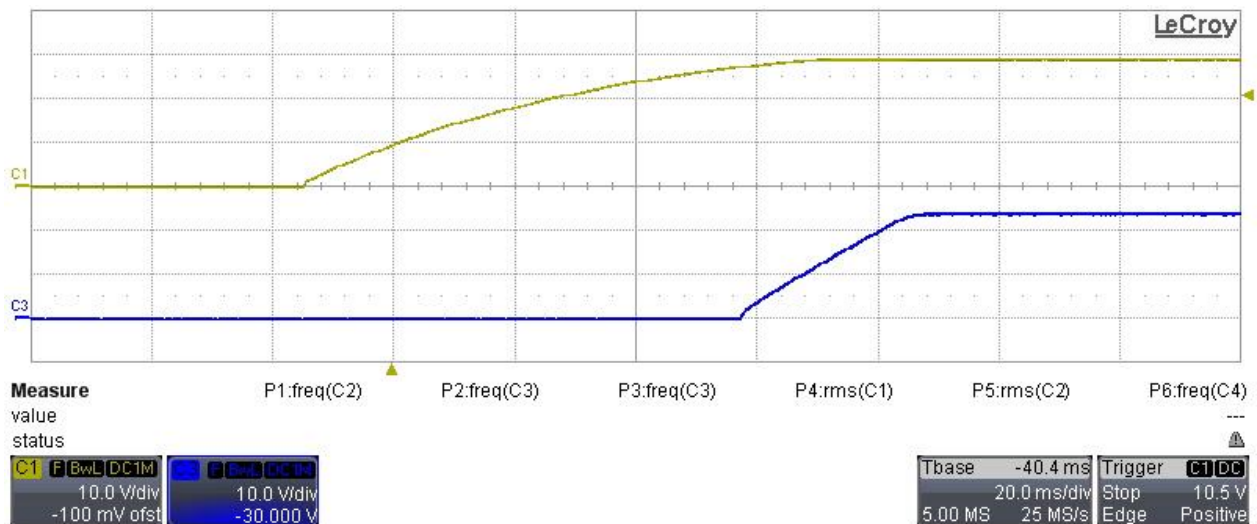
Ch.1: Input voltage (10V/div, 20ms/div, 20MHz BWL)

Ch.3: Output voltage (10V/div, 20MHz BWL)

Load = 11A (full load), $V_{in} = 29V$



Same condition as above but with zero load:



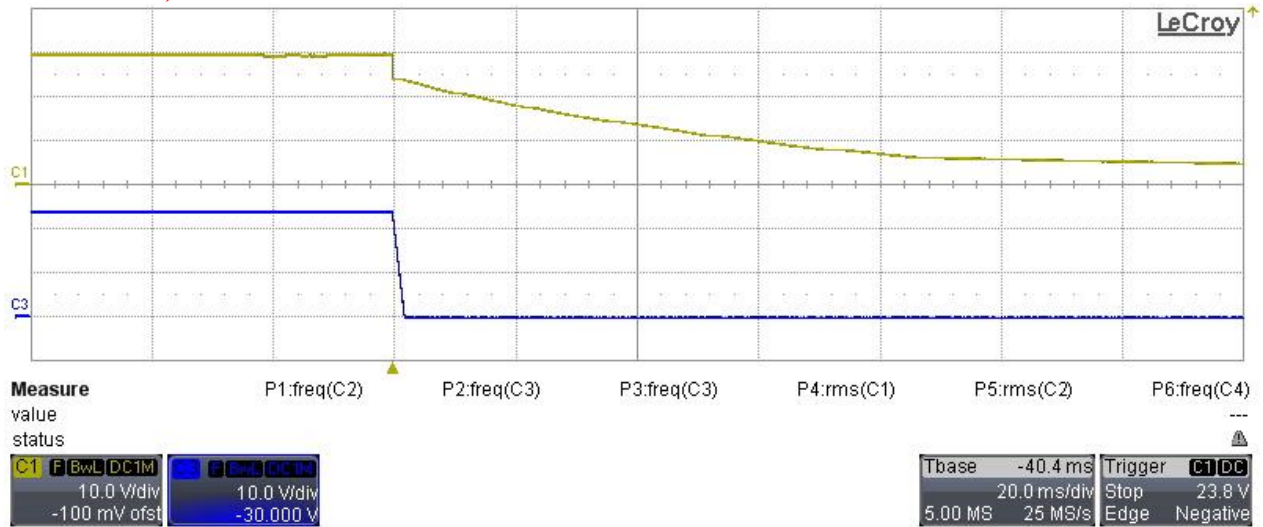
3. Shut down

The input and output voltage behavior during shut-down at full is shown below.

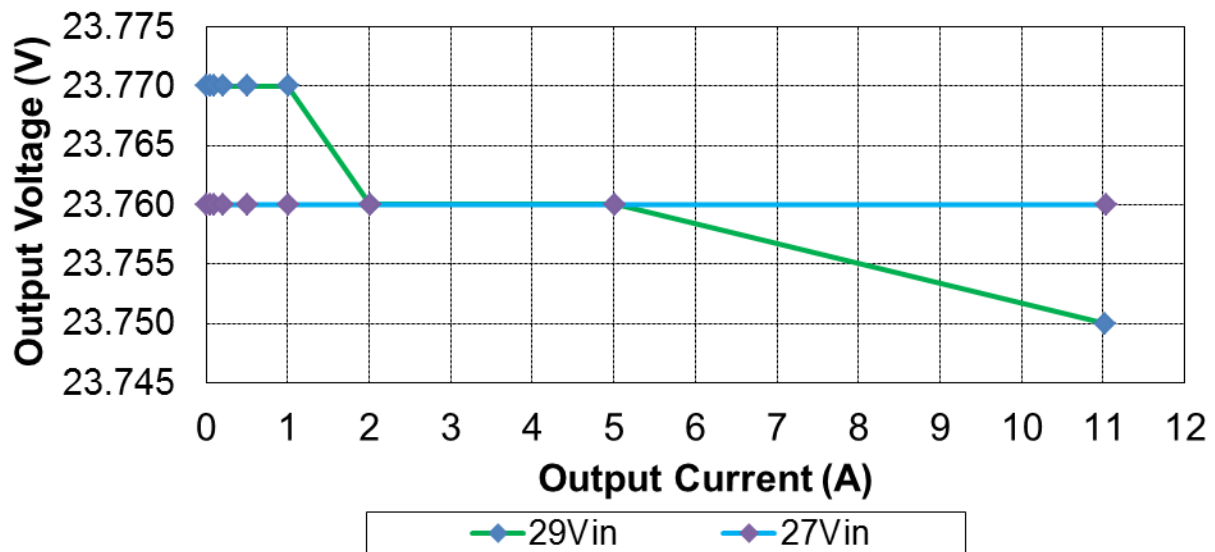
Ch.1: Input voltage (10V/div, 20ms/div, 20MHz BWL)

Ch.3: Output voltage (10V/div, 20MHz BWL)

Load = 11A, Vin = 29V



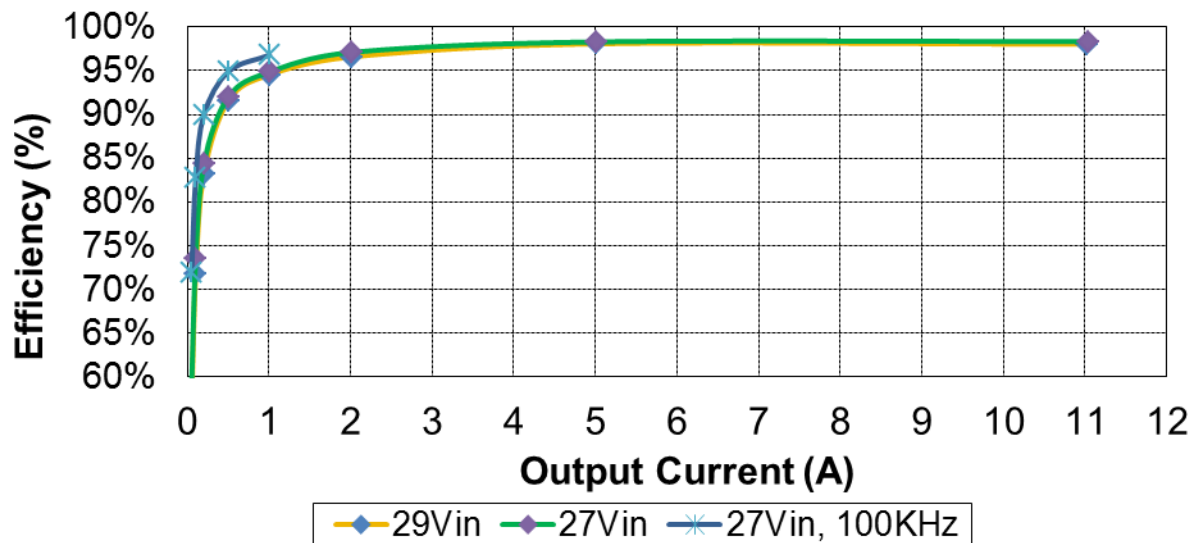
4. Output voltage regulation



5. Efficiency

The efficiency data, versus input and output voltage are shown in the tables and graphs below. The load (constant-current electronic load) has been varied from 0 to 11A. The input voltage has been set to 27V and 29V. Switching frequency setup:

- 100KHz: pin 1-2 of J5 left open
- 250KHz pin 1-2 of J5 shorted

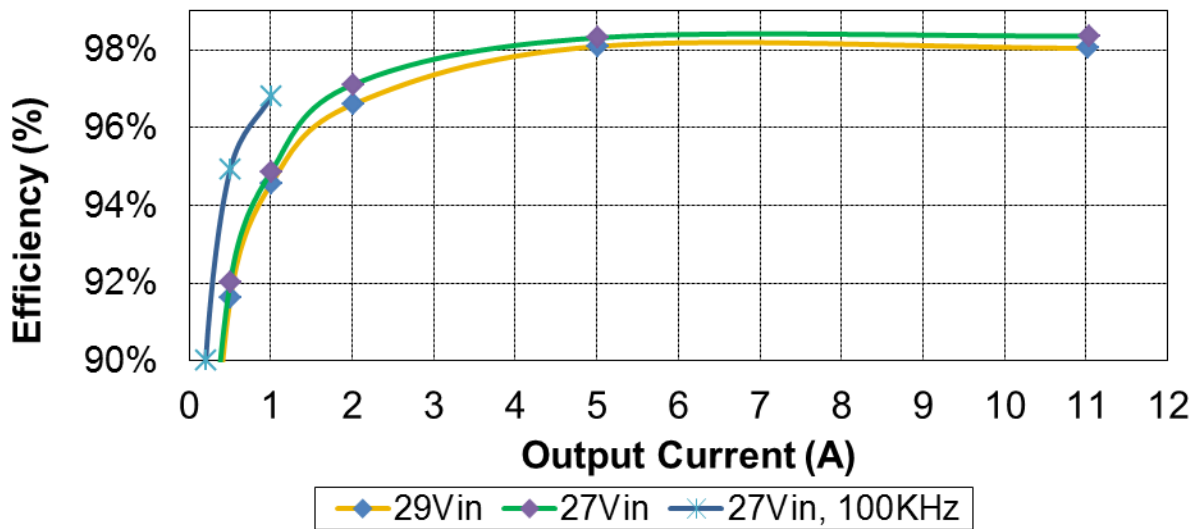


29Vin, Fsw = 250 KHz						
Vin (V)	Iin(mA)	Pin (W)	Vout (V)	Iout(A)	Pout (W)	Efficiency (%)
29.01	32.1	0.9312	23.77	0	0	0%
29.02	76.0	2.206	23.77	0.0531	1.262	57.2%
29.01	117.0	3.394	23.77	0.1025	2.436	71.8%
29.00	198.9	5.77	23.77	0.2020	4.80	83.2%
29.00	450.5	13.06	23.77	0.5035	11.97	91.6%
29.02	871.6	25.29	23.77	1.0062	23.92	94.6%
29.01	1704	49.43	23.76	2.0098	47.75	96.6%
29.00	4192	121.57	23.76	5.0190	119.25	98.1%
29.00	9206	266.97	23.75	11.021	261.75	98.0%

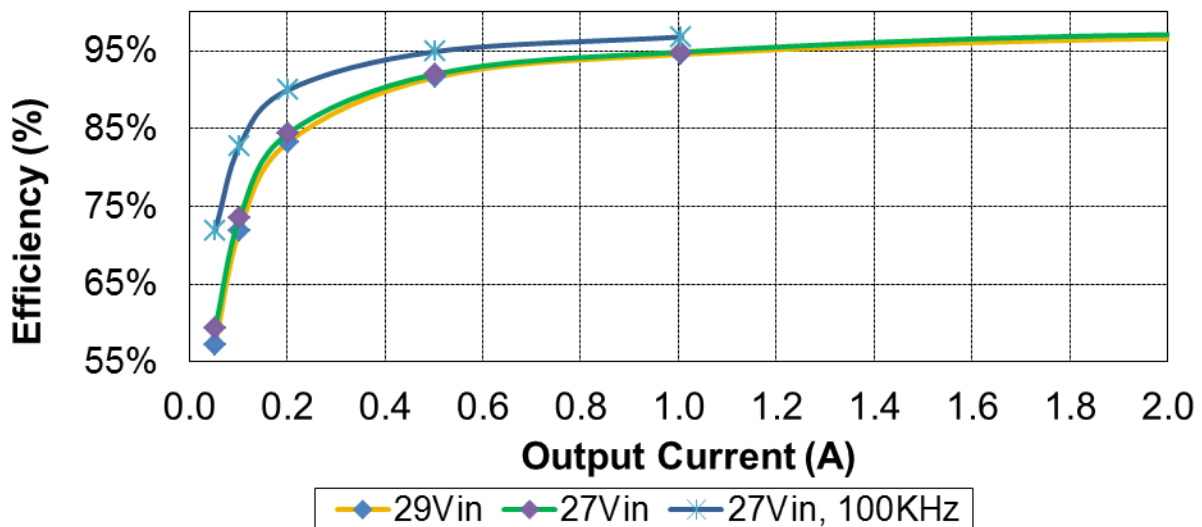
27Vin, Fsw = 250 KHz						
Vin (V)	Iin(mA)	Pin (W)	Vout (V)	Iout(A)	Pout (W)	Efficiency (%)
27.04	32.1	0.8680	23.76	0	0	0%
27.04	78.9	2.133	23.76	0.0532	1.264	59.2%
27.03	122.9	3.322	23.76	0.1027	2.440	73.5%
27.02	210.6	5.69	23.76	0.2021	4.80	84.4%
27.01	481.3	13.00	23.76	0.5035	11.96	92.0%
27.04	931.8	25.20	23.76	1.0060	23.90	94.9%
27.04	1820	49.21	23.76	2.0115	47.79	97.1%
27.02	4490	121.32	23.76	5.0200	119.28	98.3%
27.03	9861	266.54	23.76	11.034	262.17	98.4%

27Vin, Fsw = 100 KHz						
Vin (V)	Iin(mA)	Pin (W)	Vout (V)	Iout(A)	Pout (W)	Efficiency (%)
27.01	18.3	0.4943	23.76	0	0	0%
27.00	65.5	1.769	23.76	0.0535	1.271	71.9%
27.00	109.4	2.954	23.76	0.1029	2.445	82.8%
27.00	197.9	5.34	23.76	0.2024	4.81	90.0%
27.02	466.7	12.61	23.76	0.5038	11.97	94.9%
27.01	914.6	24.70	23.76	1.0065	23.91	96.8%

More details about efficiency:



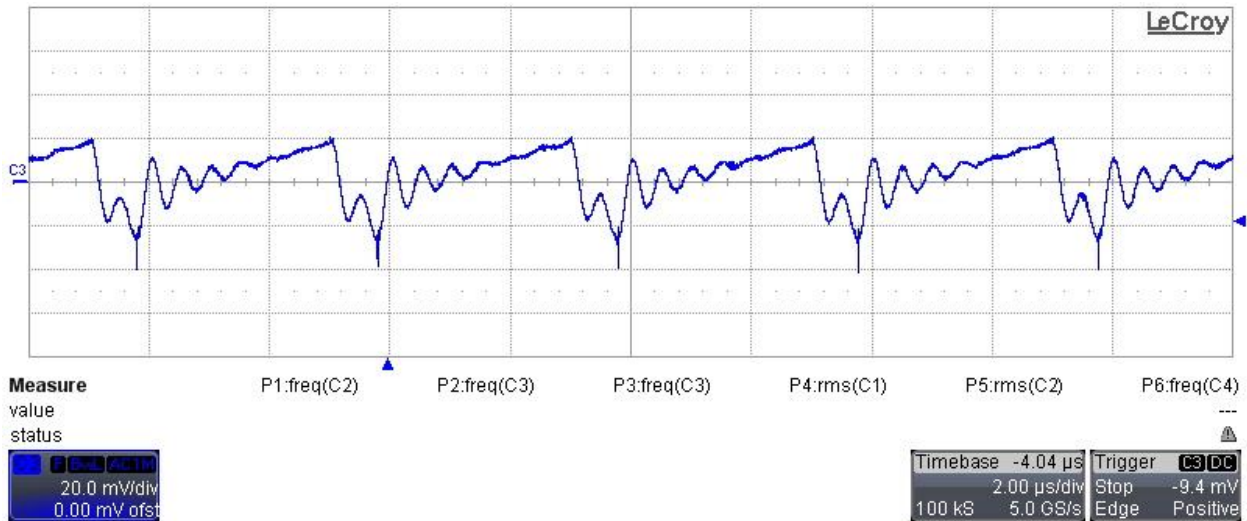
Light load details:



6. Output Ripple Voltage

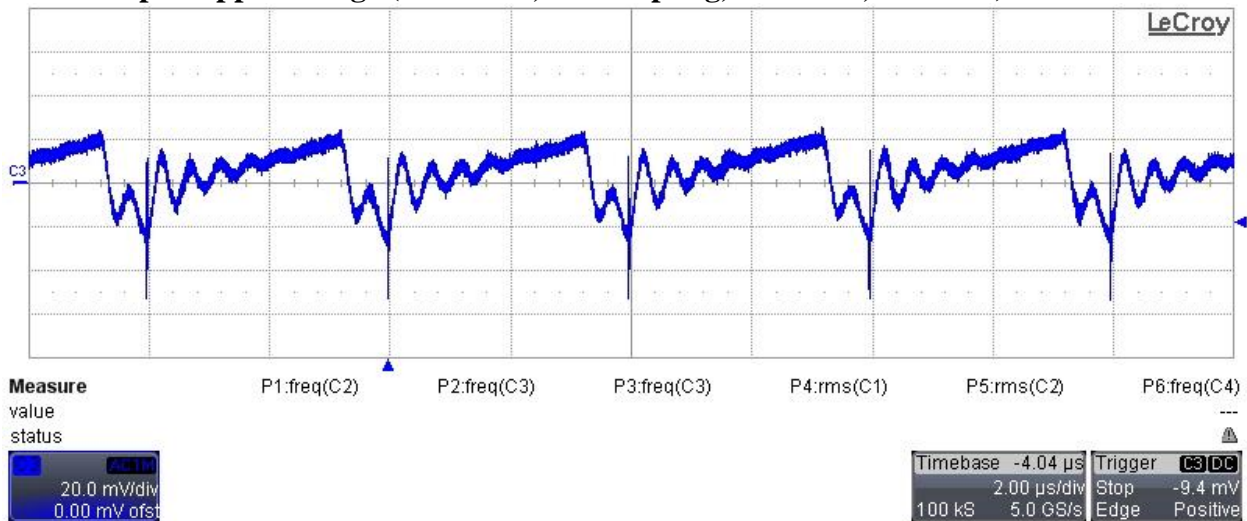
The output ripple voltage has been measured by supplying the converter at 29V while running at full load.

Ch.3: Output ripple voltage (20mV/div, AC coupling, 2usec/div, 20MHz BWL)



The following shows the measurement taken at the same conditions but without any bandwidth limit.

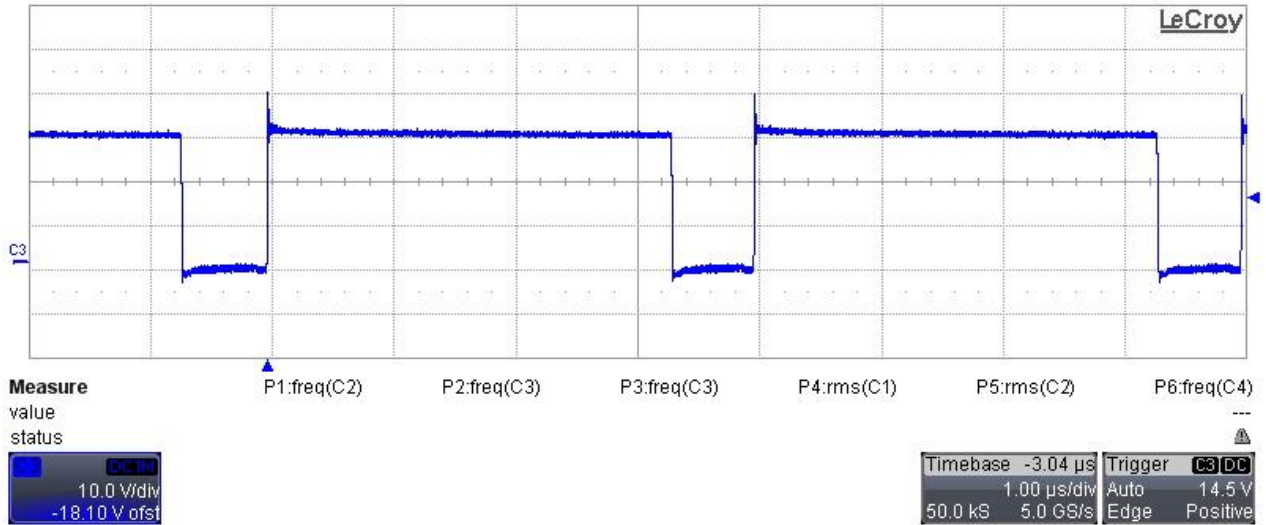
Ch.3: Output ripple voltage (20mV/div, AC coupling, 2usec/div, no BWL)



7. Switch Node

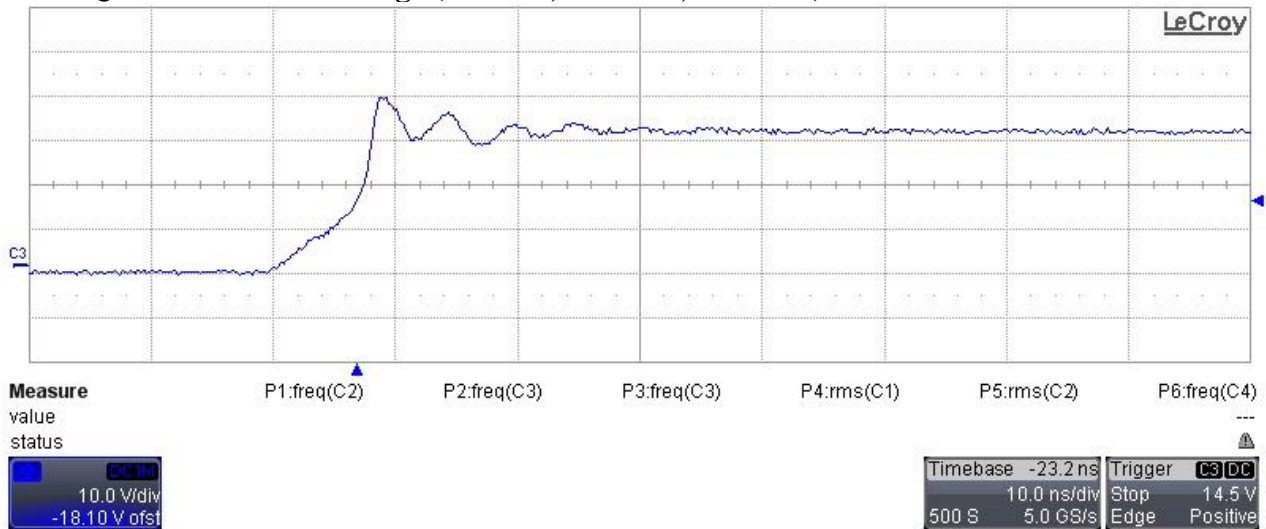
The images below show the drain of Q3 taken at $V_{in} = 29V$ and full load.

Ch.3: Q3 Drain-Source voltage (10V/div, 1us/div, no BWL)



Same waveform but at smaller time base.

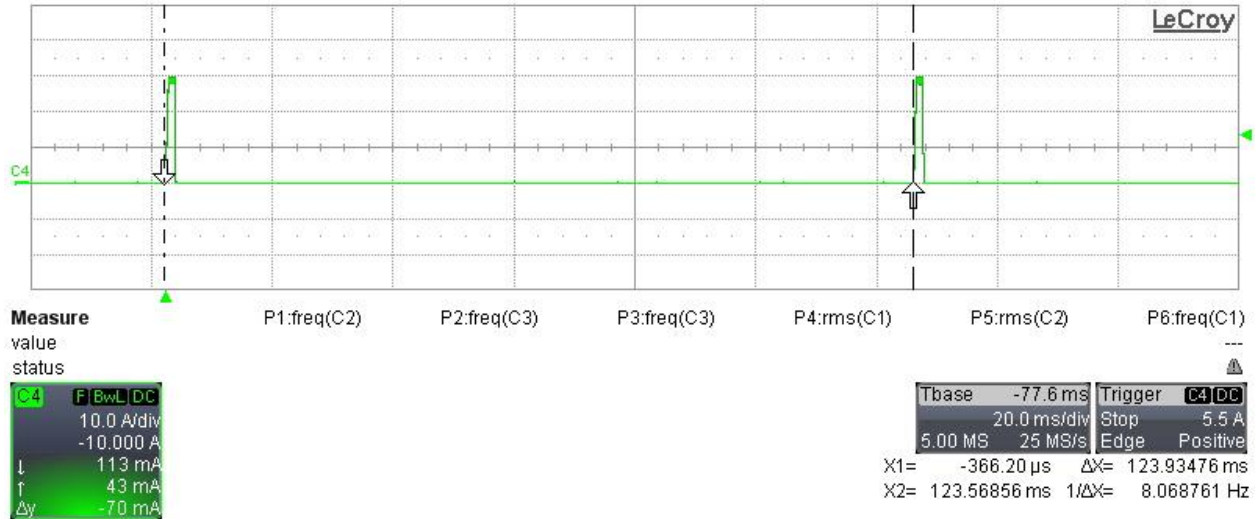
Ch.3: Q3 Drain-Source voltage (10V/div, 10ns/div, no BWL)



8. Behavior in short circuit

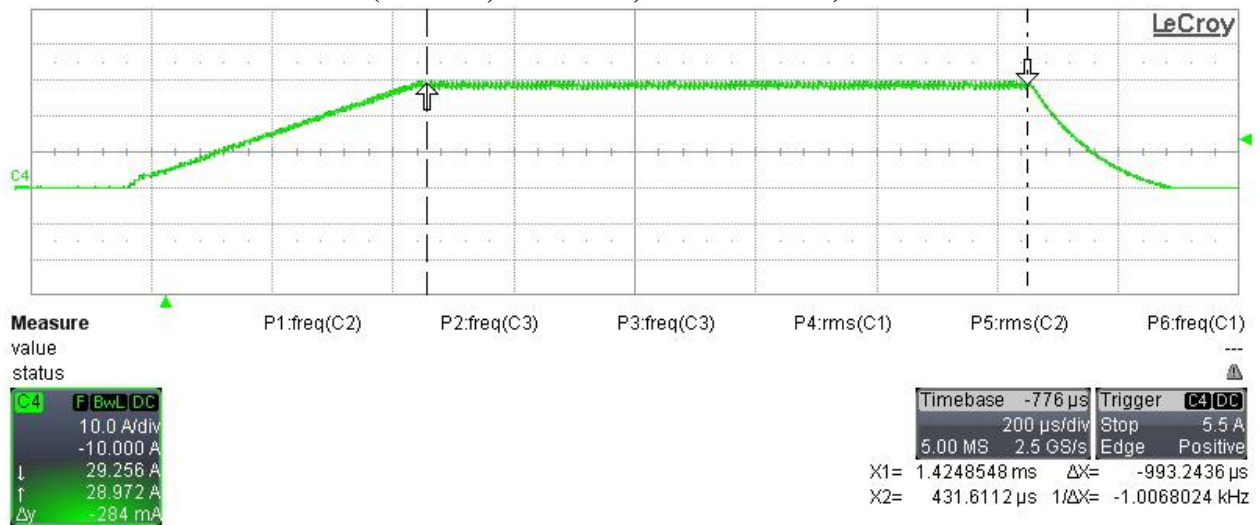
The images below show the behavior of inductor current during short circuit condition at $V_{in} = 29V$.

Ch.4: L1 inductor current (10A/div, 20ms/div, 20MHz BWL)



Same measurement but with smaller time base:

Ch.4: L1 inductor current (10A/div, 200us/div, 20MHz BWL)

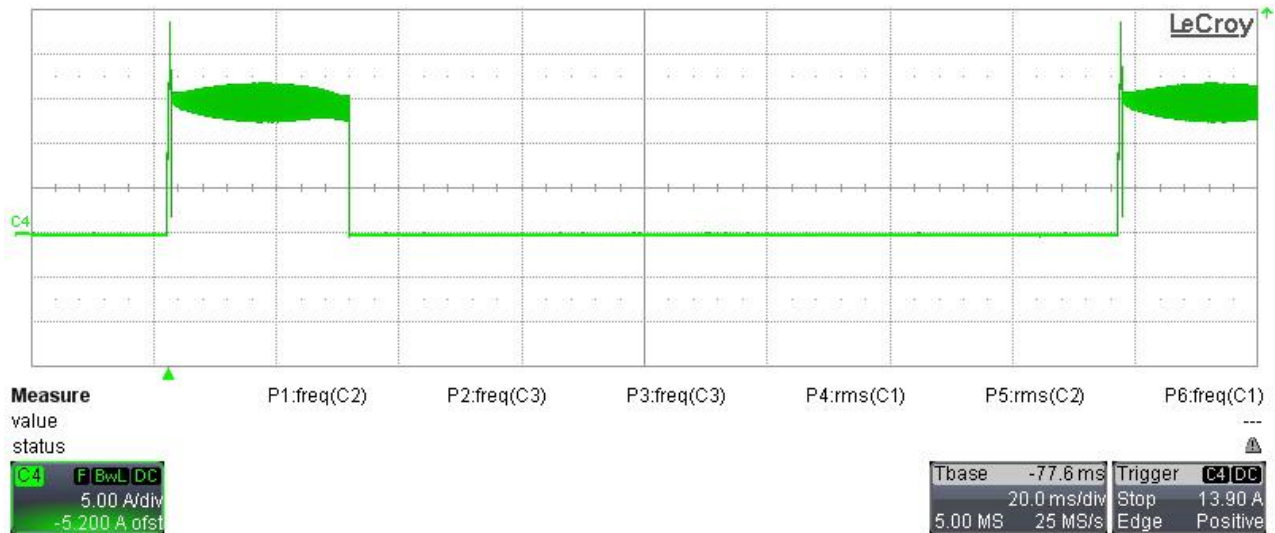


9. Current limit protection

The images below show the behavior of the converter during current limit protection (without latch). Vin has been set to 29V and the current increased until switch-off.

Ch.4: L1 inductor current (5A/div, 20ms/div, 20MHz BWL)

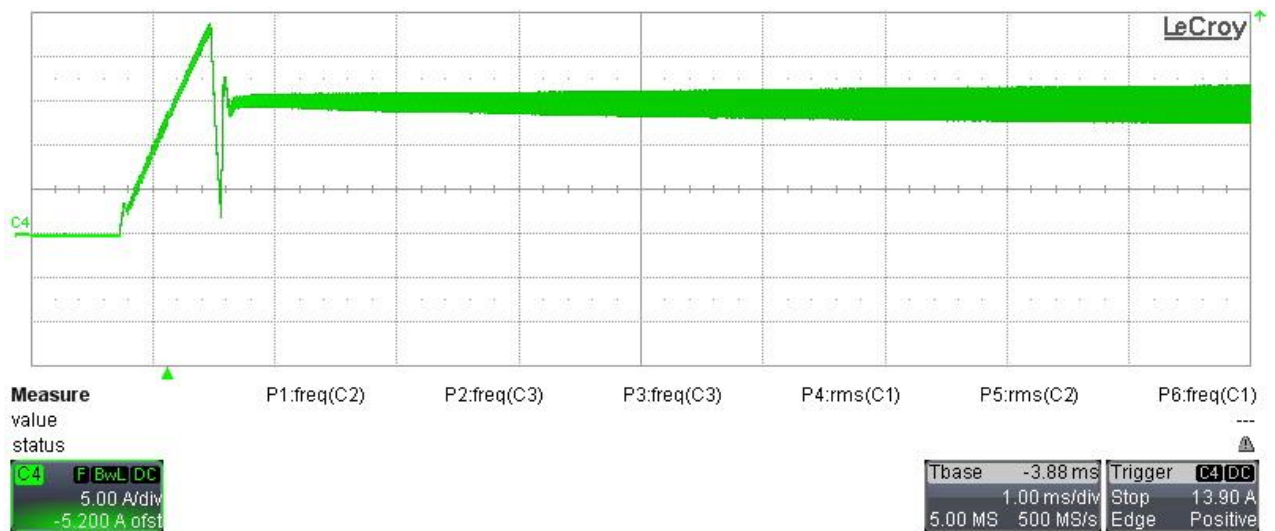
Load = 14.1A



Same measurement as above, but with smaller time base:

Ch.4: L1 inductor current (5A/div, 1ms/div, 20MHz BWL)

Load = 14.1A



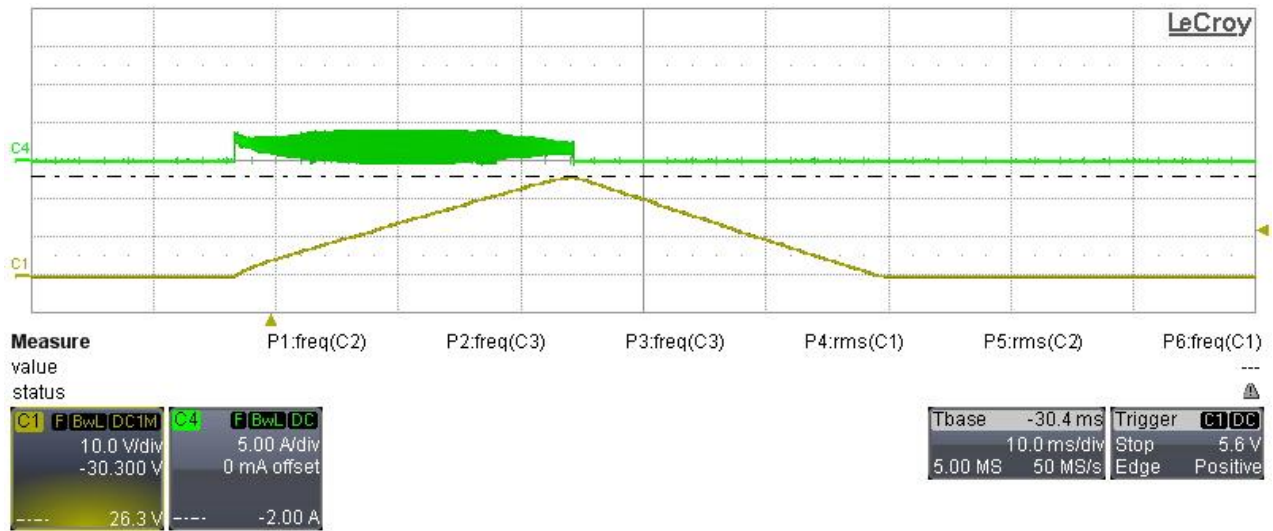
10. Behavior during over voltage protection

The images below show the behavior of the converter during over-voltage protection (with latch), performed by decreasing R9 to a value equivalent to $V_{out} = 30V$. V_{in} has been set to 29V and the load set to 1A for the first screenshot and to 10A for the second one.

Ch.1: Output voltage (10V/div, 10ms/div, 20MHz BWL)

Ch.4: L1 inductor current (5A/div, 20MHz BWL)

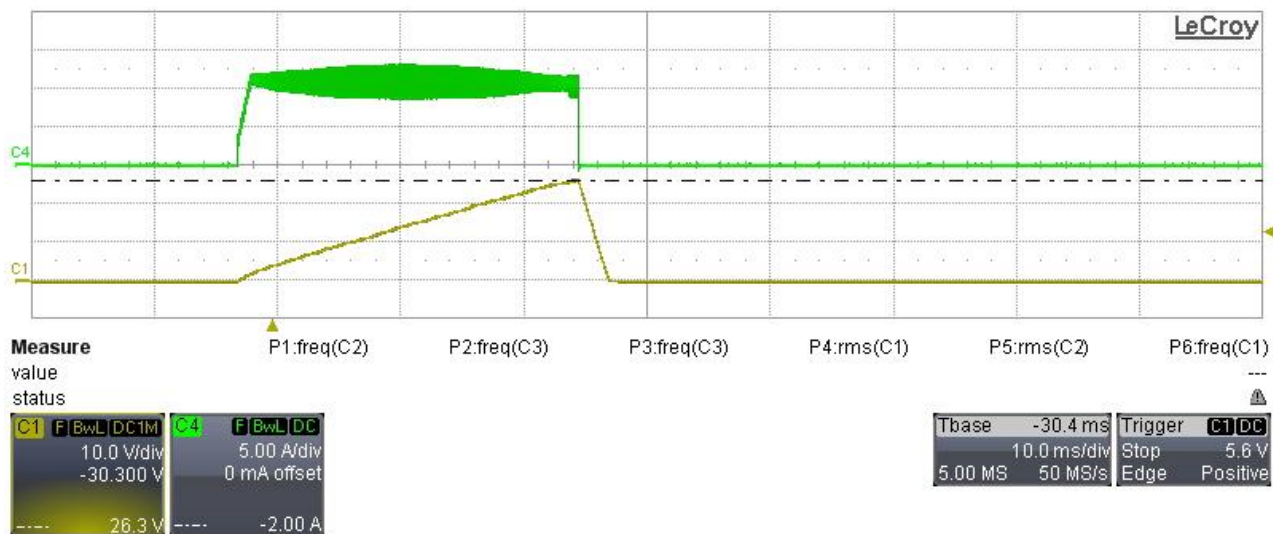
Load = 1A



Ch.1: Output voltage (10V/div, 10ms/div, 20MHz BWL)

Ch.4: L1 inductor current (5A/div, 20MHz BWL)

Load = 10A

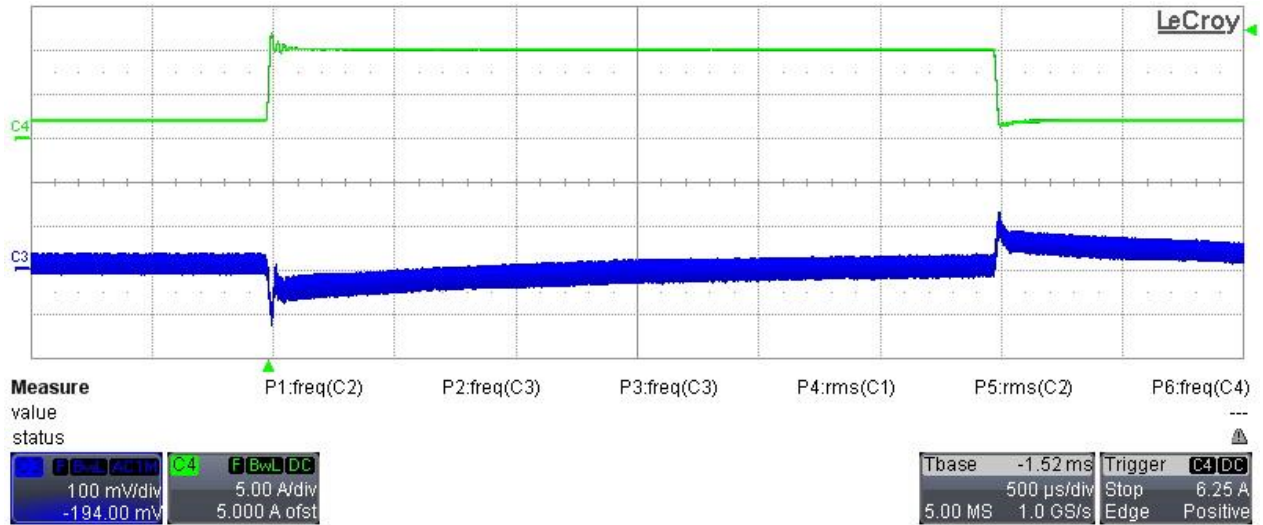


11. Load transient response

The converter has been loaded by switching the output current between 2A and 10A while supplied at 29V. The image below shows the output voltage deviation from nominal value.

Ch.3: Output voltage (100mV/div, 500us/div, AC coupling, 20MHz BWL)

Ch.4: Output current (5A/div, 20MHz BWL)



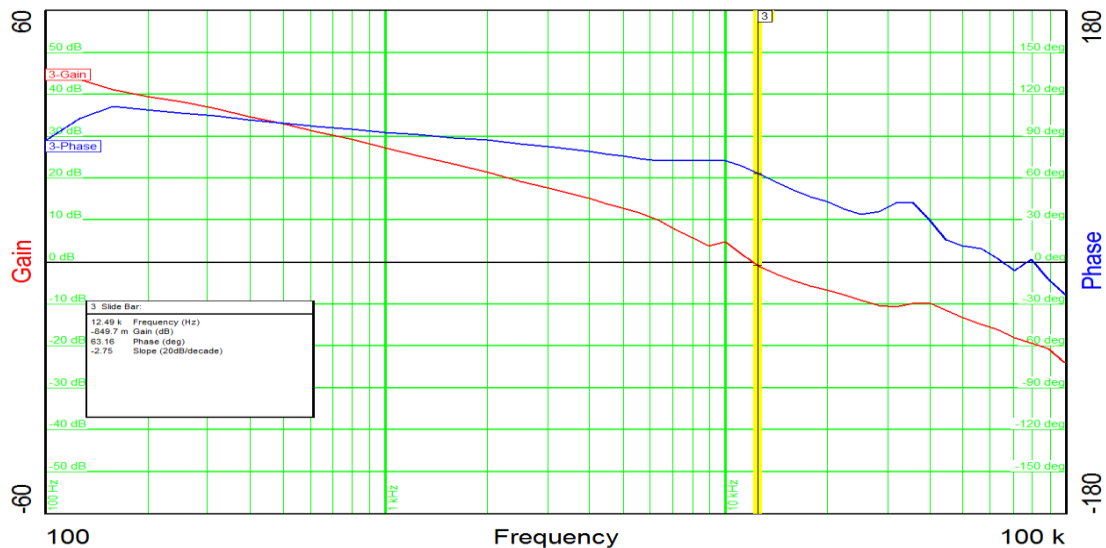
12. Feedback Loop Analysis

The image below shows the open loop gain and phase bode plot of the converter. The board has been supplied at $V_{in} = 29V$ and the load was a constant-current electronic load, set to 11A.

Crossover frequency: 12.49 KHz

Phase margin: 63.16 deg.

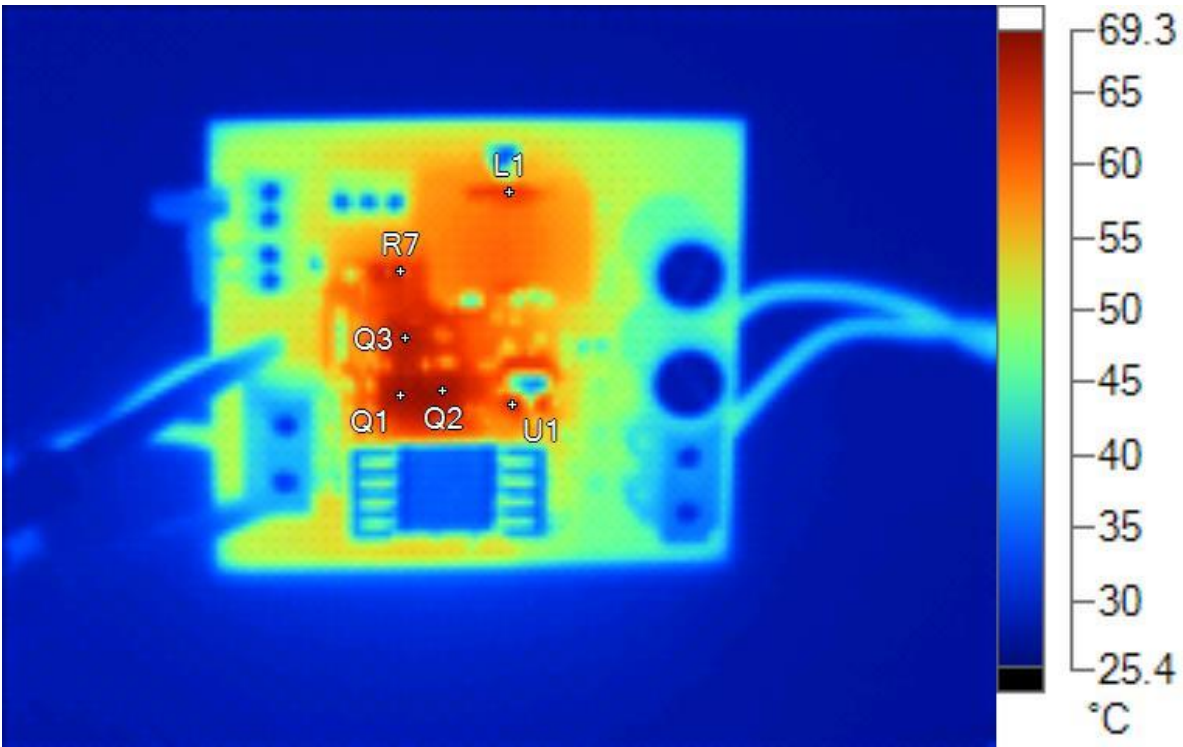
Gain margin: 16.44 dB



13. Thermal Analysis

During the thermal analysis, the converter has been placed vertical on the bench in still air conditions, while supplied at 29V and fully loaded.

The thermal image has been taken after 30 minutes @ $T_a = 25\text{C}$.



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Main Image Markers

Name	Temperature	Emissivity	Background
Q1	68.1°C	0.95	25.0°C
Q2	68.1°C	0.95	25.0°C
Q3	66.3°C	0.95	25.0°C
R7	63.8°C	0.95	25.0°C
L1	62.9°C	0.95	25.0°C
U1	64.8°C	0.95	25.0°C

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