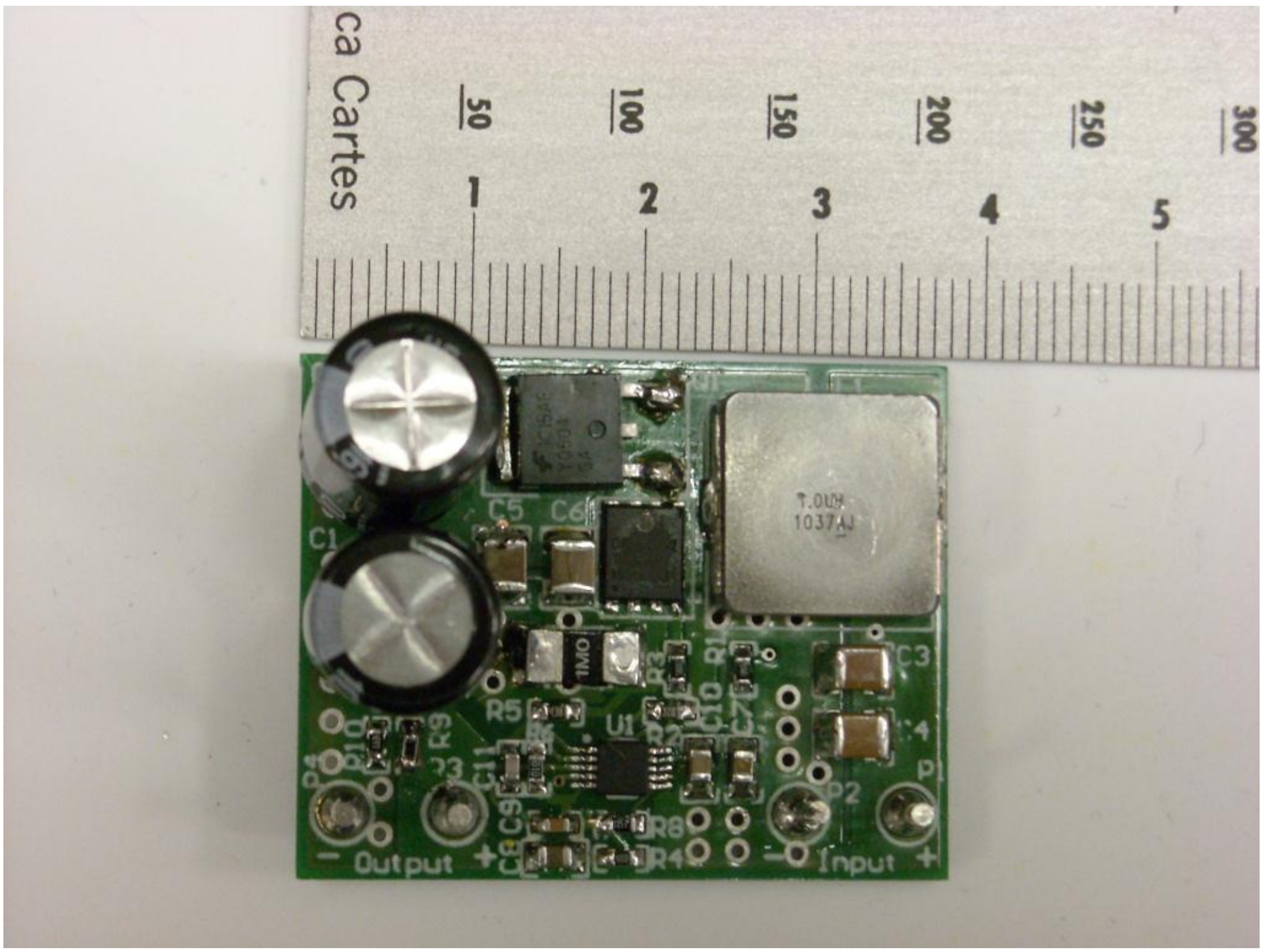
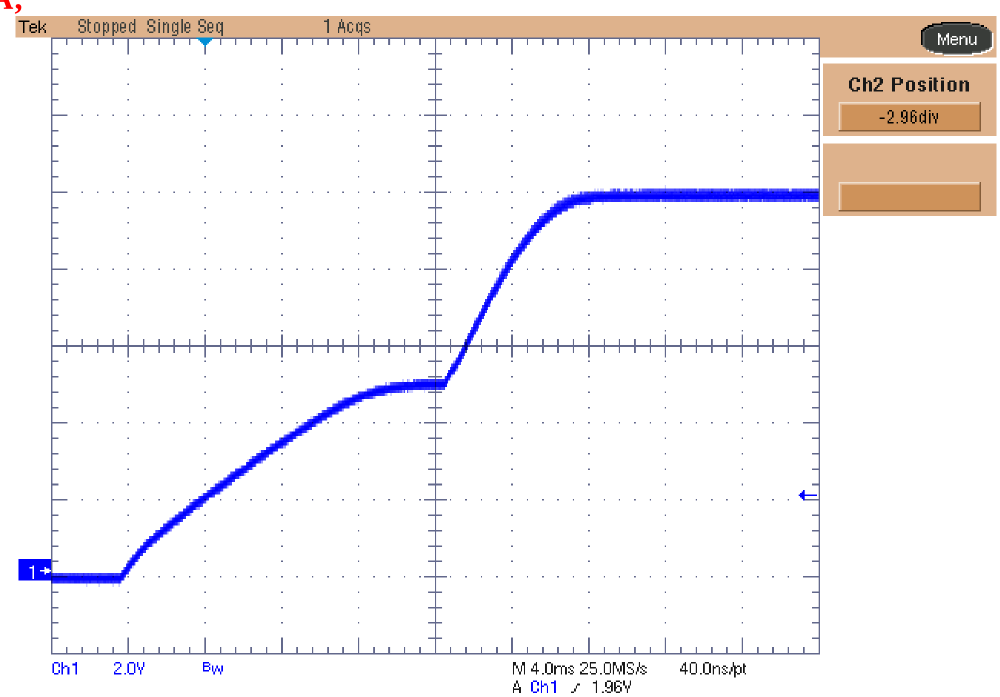
PICTURE OF THE BOARD:



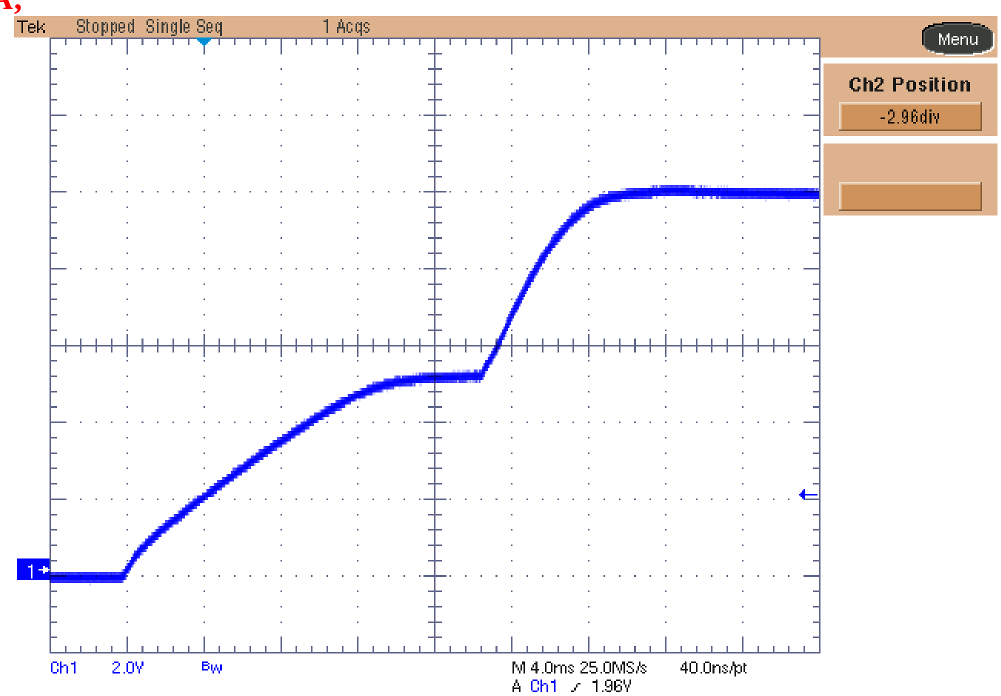
1. Startup

The output voltage behavior at startup is shown in the images below. The input voltage was set to 5.5V. The converter was loaded @ 1A for the upper picture and unloaded for the bottom one.
Ch.1: Output voltage (2V/div, 4ms/div, DC coupling, 20MHz BWL)

Iout = 1A;

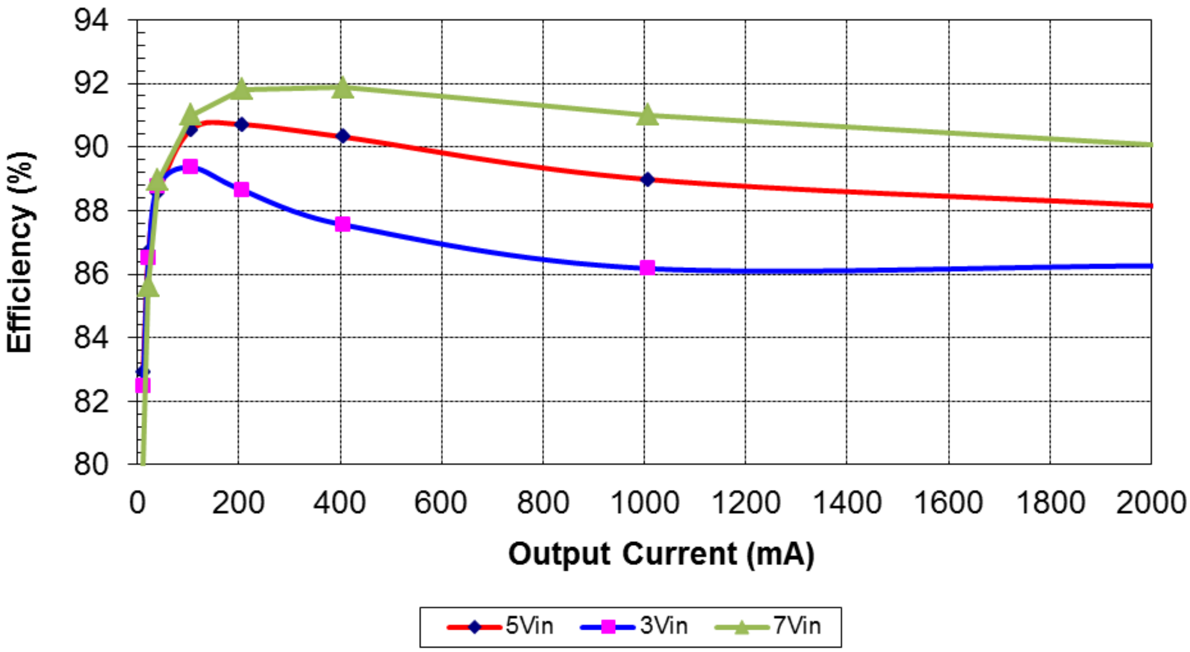


Iout = 0A;



1 Efficiency

The efficiency data are shown in the tables and graph below. A DC voltage source has been set to 3V, 5V and 7V and the load varied from 0 to 2A.



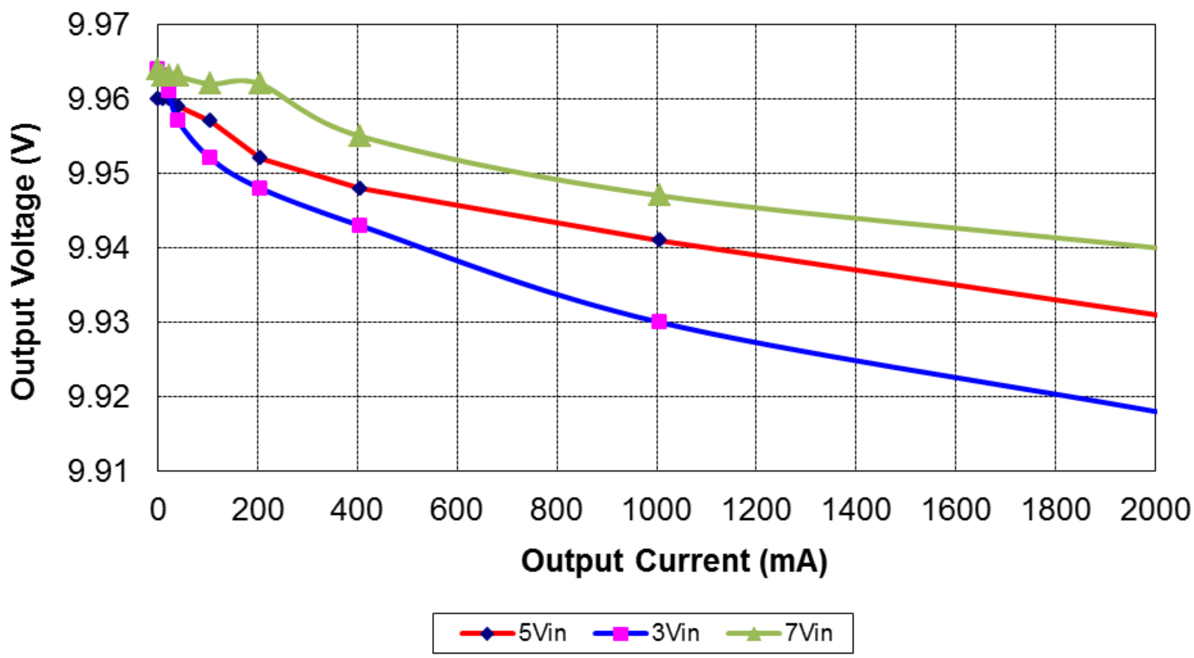
Iout (mA)	Vout (V)	Pout (W)	Iin (mA)	Vin (Vdc)	Pin (W)	Ploss (W)	Eff (%)
0	9.960	0	2.8	5.003	0.014	0.0140	0.00
11.2	9.960	0.112	26.9	5.000	0.135	0.0229	82.94
22.0	9.960	0.219	50.4	5.015	0.253	0.0336	86.69
40.9	9.959	0.407	91.8	5.010	0.460	0.0526	88.56
105.7	9.957	1.052	231.4	5.023	1.162	0.1099	90.55
205.5	9.952	2.045	447.6	5.037	2.255	0.2094	90.71
405.3	9.948	4.032	889.1	5.021	4.464	0.4322	90.32
1007.4	9.941	10.015	2251	5.000	11.255	1.2404	88.98
2007	9.931	19.932	4514	5.009	22.611	2.6791	88.15

Iout (mA)	Vout (V)	Pout (W)	Iin (mA)	Vin (Vdc)	Pin (W)	Ploss (W)	Eff (%)
0	9.964	0	3.2	3.007	0.010	0.0096	0.00
11.2	9.963	0.112	45.1	3.000	0.135	0.0237	82.47
22.0	9.961	0.219	84.2	3.008	0.253	0.0341	86.52
41.0	9.957	0.408	153.3	3.000	0.460	0.0517	88.77
105.7	9.952	1.052	391.1	3.010	1.177	0.1253	89.36
205.6	9.948	2.045	763.7	3.021	2.307	0.2618	88.65
405.4	9.943	4.031	1529	3.011	4.604	0.5729	87.56
1007.4	9.930	10.003	3854	3.012	11.608	1.6048	86.18
2005	9.918	19.886	7603	3.032	23.052	3.1667	86.26

Iout (mA)	Vout (V)	Pout (W)	Iin (mA)	Vin (Vdc)	Pin (W)	Ploss (W)	Eff (%)
0	9.964	0	2.8	7.017	0.020	0.0196	0.00
11.2	9.963	0.112	19.9	7.016	0.140	0.0280	79.92
22.0	9.963	0.219	36.5	7.014	0.256	0.0368	85.62
41.0	9.963	0.408	65.5	7.011	0.459	0.0507	88.95
105.7	9.962	1.053	165.3	7.000	1.157	0.1041	91.00
205.6	9.962	2.048	318.5	7.004	2.231	0.1826	91.82
405.4	9.955	4.036	627.5	7.000	4.393	0.3567	91.88
1007.4	9.947	10.021	1570	7.014	11.012	0.9914	91.00
2004	9.940	19.920	3159	7.002	22.119	2.1996	90.06

2 Output Voltage Regulation

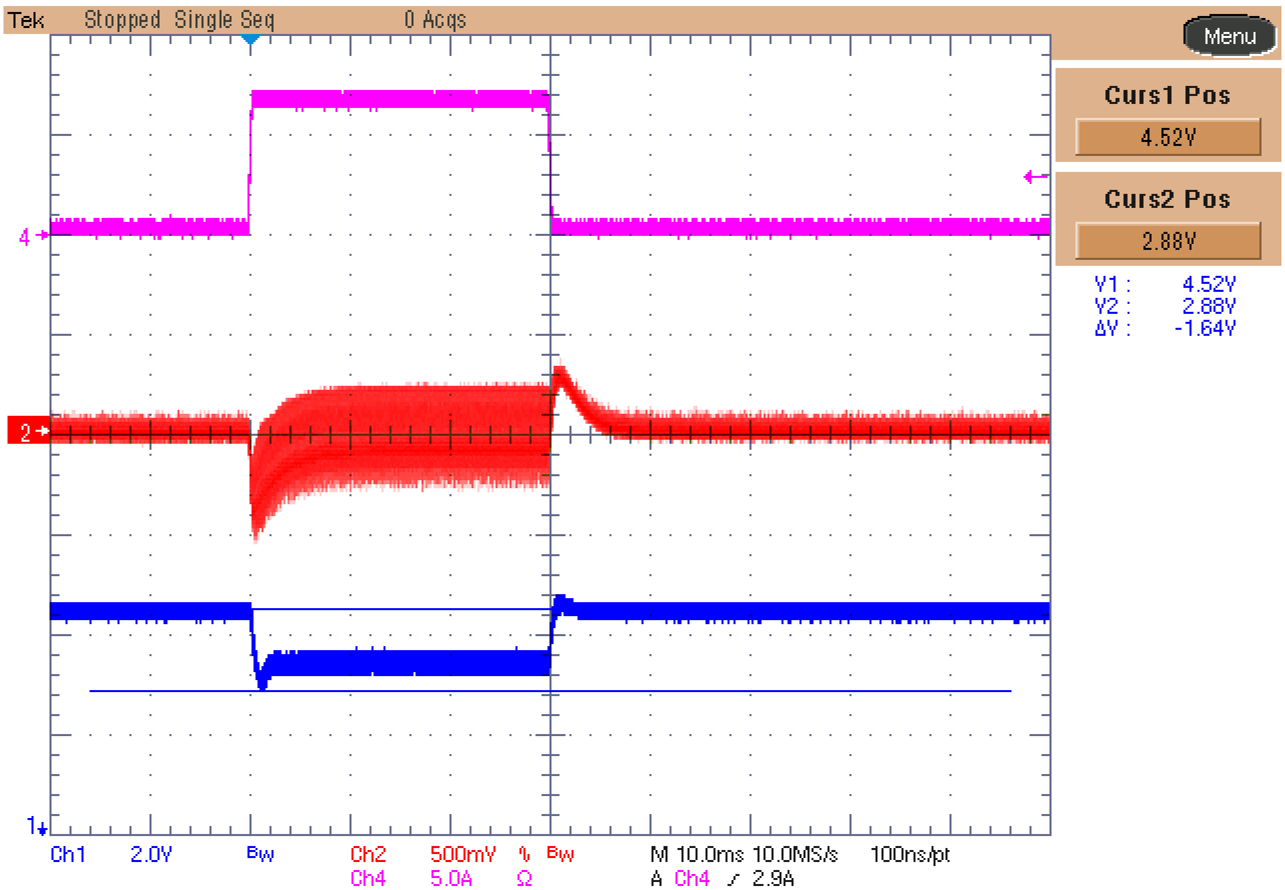
The output voltage variation as function of load and input voltage is shown below:



3 Transient Response

The image below shows the transient response on the output voltage when the load has been switched between 0.5A and 7A. The input voltage was 4.5V. The Vin trace shows that, due to non-zero impedance of cabling, the input voltage is as low as 2.88V. It is also possible to measure the peak-peak ripple voltage on the output terminals during the 7A load, which is 500mVpk-pk.

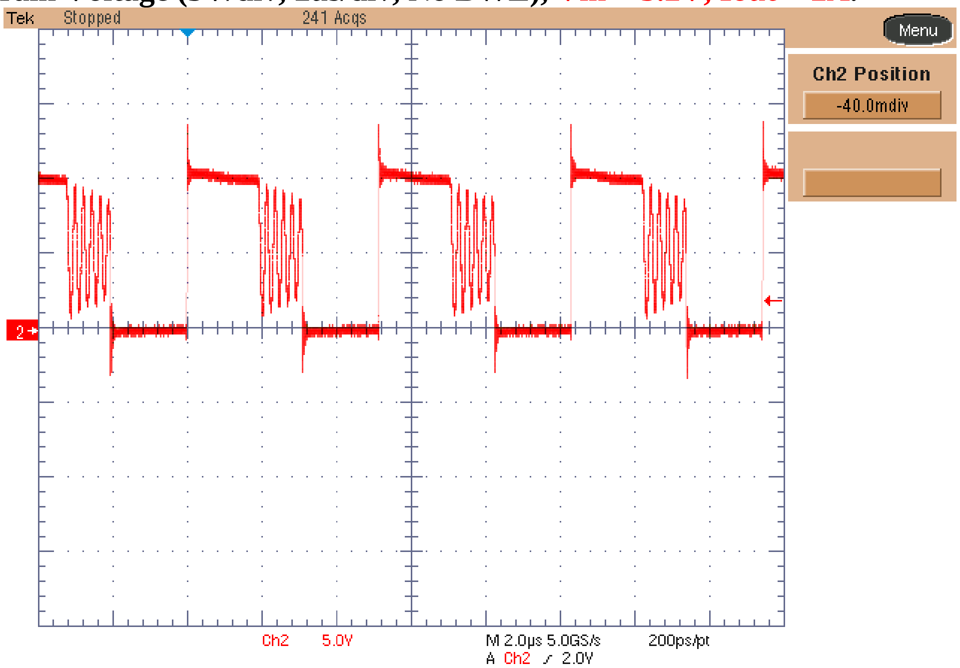
Ch1: Input Voltage (2V/div, 10ms/div, DC coupled, 20MHz BWL)
Ch2: Output Voltage (500mV/div, AC coupled, 20MHz BWL)
Ch4: Output Current (5A/div, DC coupled, no BWL)



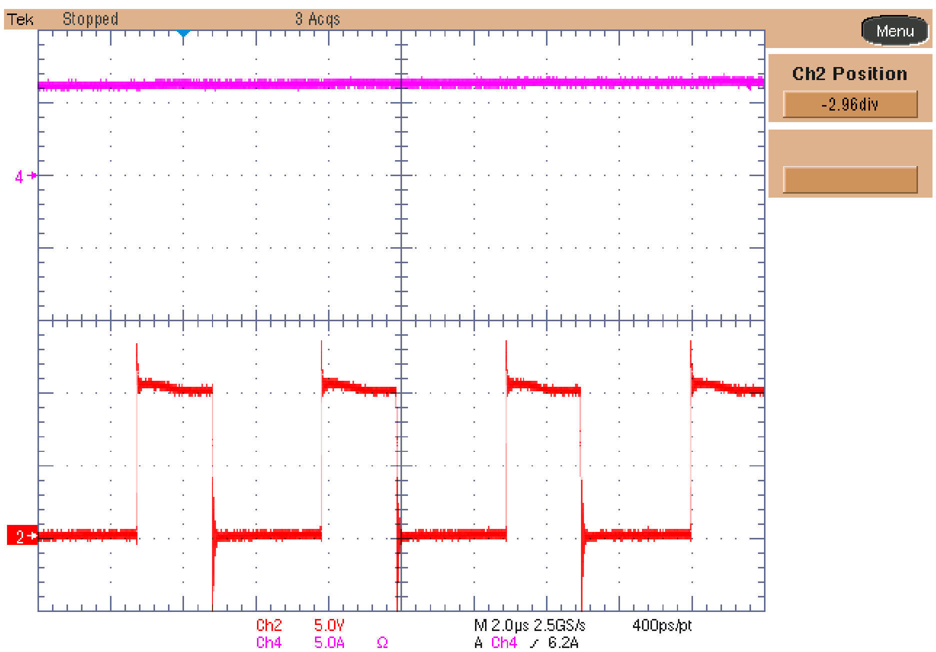
4 Switching Node Waveform

The images below show the peak voltage on drain of Q1 with 5.2Vin, 2A load and 3.5Vin, 7A load.

Ch2: Q1 drain Voltage (5V/div, 2us/div, No BWL), Vin = 5.2V, Iout = 2A.



Ch2: Q1 drain Voltage (5V/div, 2us/div, No BWL), Vin = 3.5V, Iout = 7A.
Ch4: Output Current (5A/div, No BWL).



5 Thermal Analysis

The thermal analysis of the converter shows the temperatures for each component, in the graph below. The converter has been placed horizontally on the bench without any forced convection. The input voltage was 4.5V, the load switched between 500mA and 7A (30msec ON, 630msec OFF); the ambient temperature 23C.

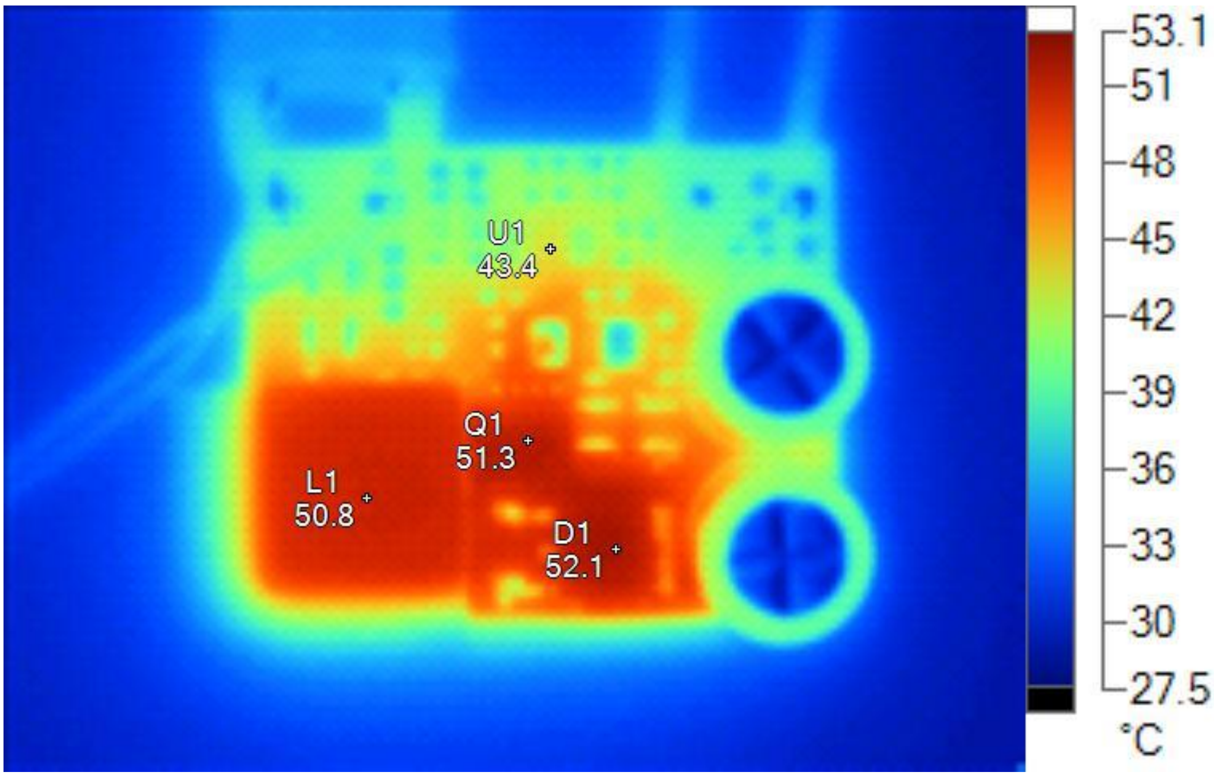


Image Info

Background temperature	20.0°C
Average Temperature	36.2°C
Image Range	28.5°C to 52.1°C
Camera Model	Ti40FT
Camera Manufacturer	Fluke
Image Time	10/29/2013 1:04:40 PM

Main Image Markers

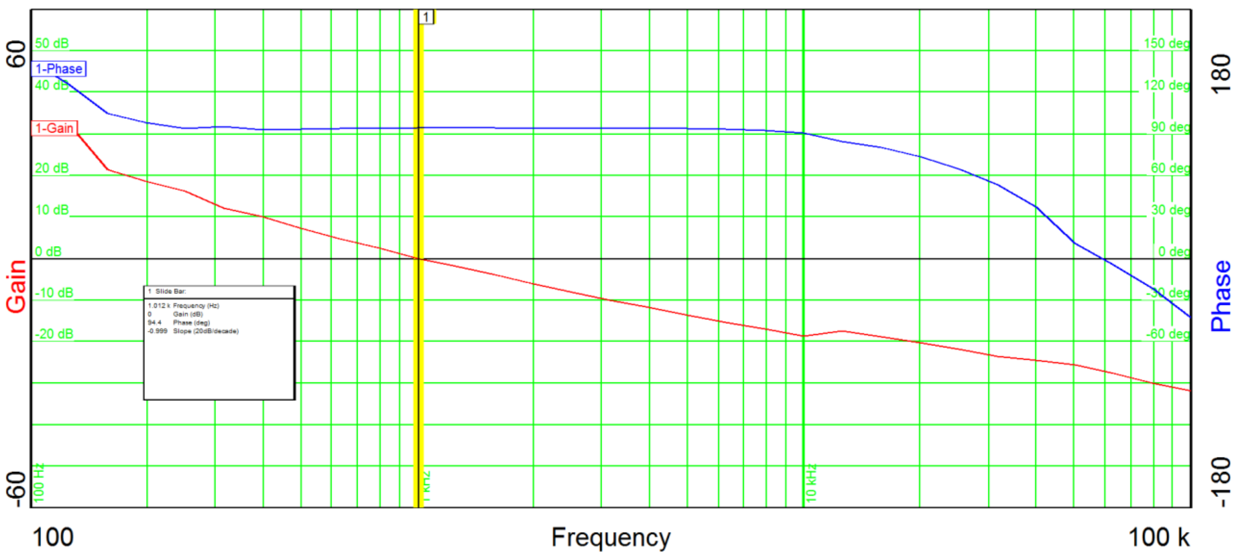
Name	Temperature
L1	50.8°C
D1	52.1°C
Q1	51.3°C
U1	43.4°C

6 Loop Analysis

The loop analysis on the converter shows results regarding phase margin and gain margin, as well as crossover frequency. The converter has been supplied @ 3.5Vin, and 2A load.

The measurement showed these results:

1) Phase margin = 94.4 deg.
2) Gain margin = 27.14 dB
3) Crossover frequency = 1 KHz



Even though the phase margin is very high and stays constant until 10KHz…20KHz, we have to consider that at this 2A load the converter runs in DCM mode, therefore showing a lower bandwidth and high phase margin. The real application will be a transient load of 7A for 30msec, which happens only for this short time. It is not possible to measure the loop at 7A load, because of a heavy overheating. At this high current the converter runs in CCM (see switch node waveform) and therefore we have to take into account the right half plane zero (RHPZ) which will destroy the phase margin very quickly if we choose a high bandwidth.

EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMER

For Feasibility Evaluation Only, in Laboratory/Development Environments. The EVM is not a complete product. It is intended solely for use for preliminary feasibility evaluation in laboratory / development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical / mechanical components, systems and subsystems. It should not be used as all or part of a production unit.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
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.

Certain Instructions. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output ranges are maintained at nominal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be indentified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of this agreement. This obligation shall apply whether Claims arise under the law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate TI components for possible use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.