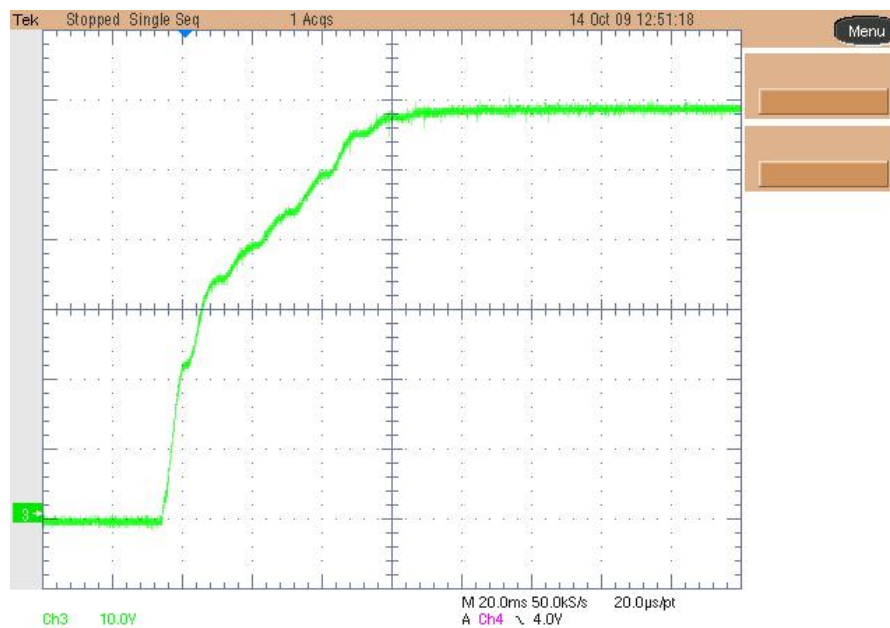


1 Startup

The output voltage at startup is shown in the images below. Input voltage is 230Vac. Channel 3 shows the output voltage (10V/div, 20ms/div).

No Load:

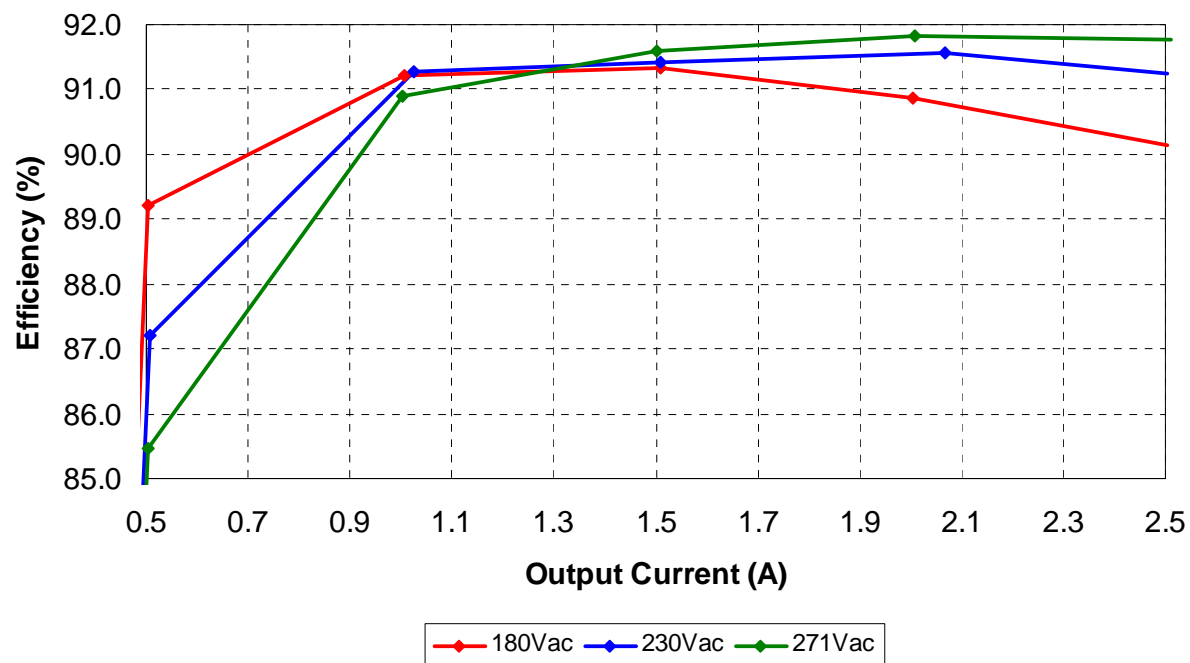


Full Load:



2 Efficiency

The efficiency data are shown in the tables and graph below.



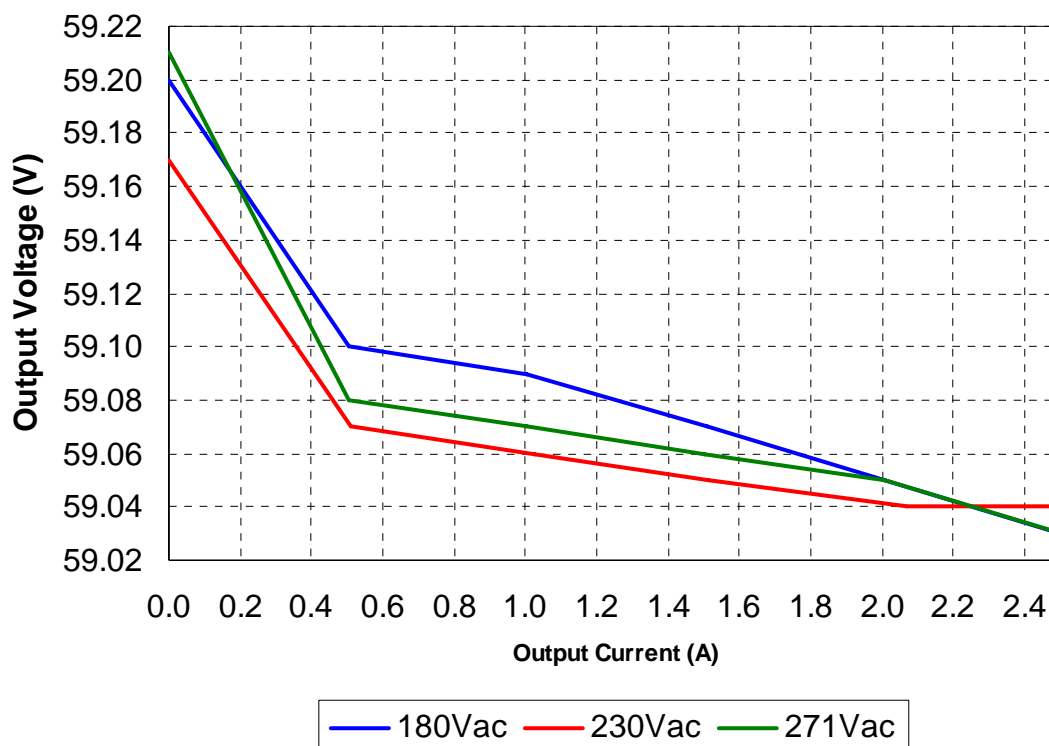
I _{out} (A)	V _{out} (V _{dc})	P _{out} (W)	V _{in} (Vac)	P _{in} (W)	P _{loss} (W)	Eff (%)	PF
0.0000	59.20	0.00	180	0.8	0.80	0.00	0
0.5041	59.10	29.79	180	33.4	3.61	89.20	0.94
1.0049	59.09	59.38	180	65.1	5.72	91.21	0.96
1.5090	59.07	89.14	180	97.6	8.46	91.33	0.95
2.0050	59.05	118.40	180	130.3	11.90	90.86	0.96
2.5040	59.03	147.81	180	164.0	16.19	90.13	0.955

I _{out} (A)	V _{out} (V _{dc})	P _{out} (W)	V _{in} (V _{ac})	P _{in} (W)	P _{loss} (W)	Eff (%)	PF
0.0000	59.17	0.00	230	0.9	0.90	0.00	0
0.5078	59.07	30.00	230	34.4	4.40	87.20	0.87
1.0263	59.06	60.61	230	66.4	5.79	91.29	0.93
1.5110	59.05	89.22	230	97.6	8.38	91.42	0.94
2.0660	59.04	121.98	230	133.2	11.22	91.57	0.945
2.5040	59.04	147.84	230	162.0	14.16	91.26	0.95

I _{out} (A)	V _{out} (V _{dc})	P _{out} (W)	V _{in} (V _{ac})	P _{in} (W)	P _{loss} (W)	Eff (%)	PF
0.0000	59.21	0.00	271	1.0	1.00	0.00	0
0.5035	59.08	29.75	271	34.8	5.05	85.48	0.8
1.0034	59.07	59.27	271	65.2	5.93	90.91	0.89
1.5010	59.06	88.65	271	96.8	8.15	91.58	0.915
2.0090	59.05	118.63	271	129.2	10.57	91.82	0.93
2.5120	59.03	148.28	271	161.6	13.32	91.76	0.94

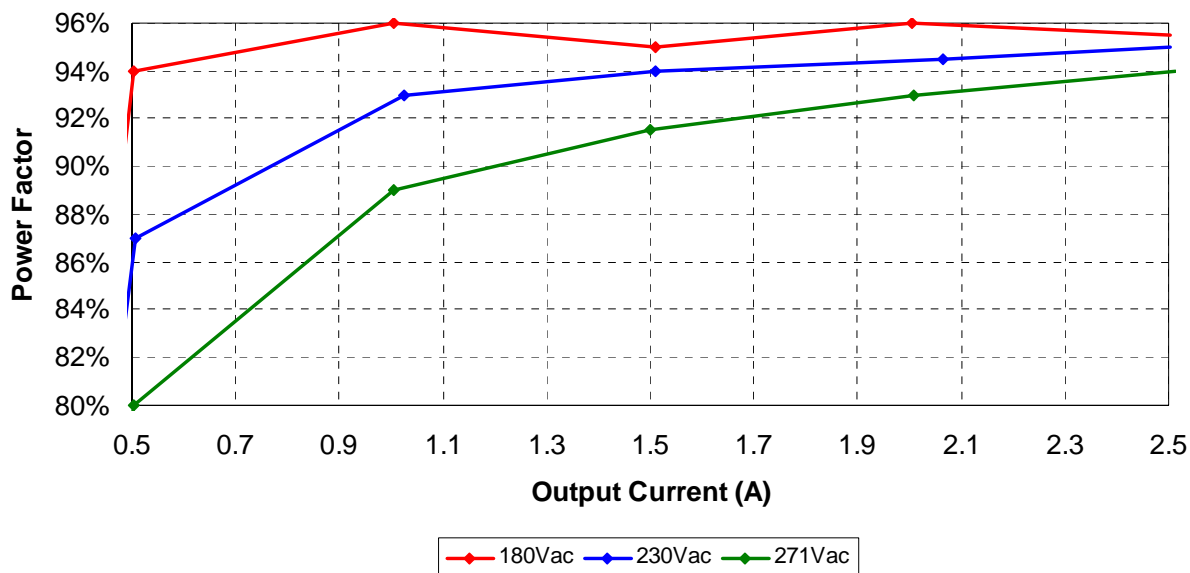
3 Output Voltage Regulation

The output voltage versus output current graph is plotted below.



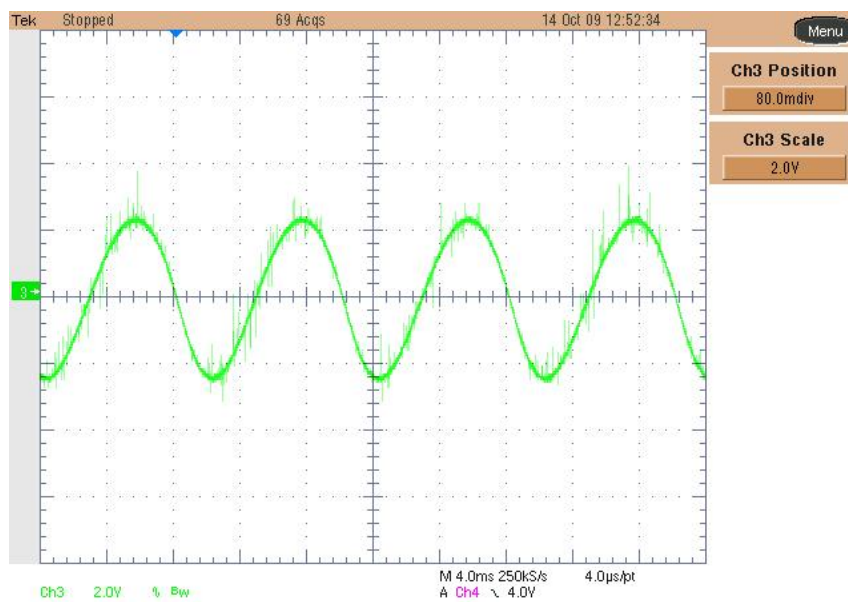
4 Power Factor

The Power Factor graph for the three input voltages is shown below:



5 Output Ripple Voltage

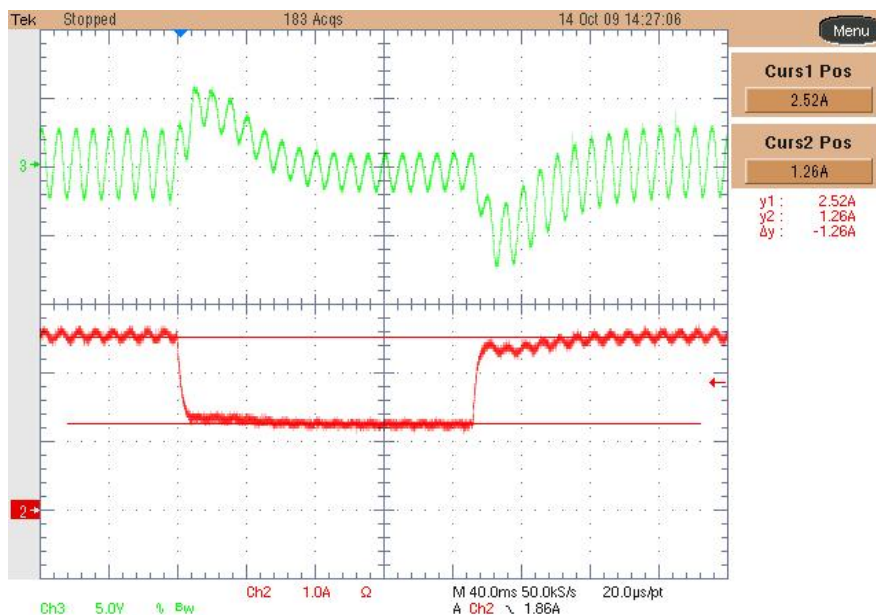
The output ripple voltage is shown in the plot below. The input was set to 230Vac and the load was set to 2.5A. Channel 3 shows the output ac voltage (2 V/div, 4ms/div).



6 Transient Response

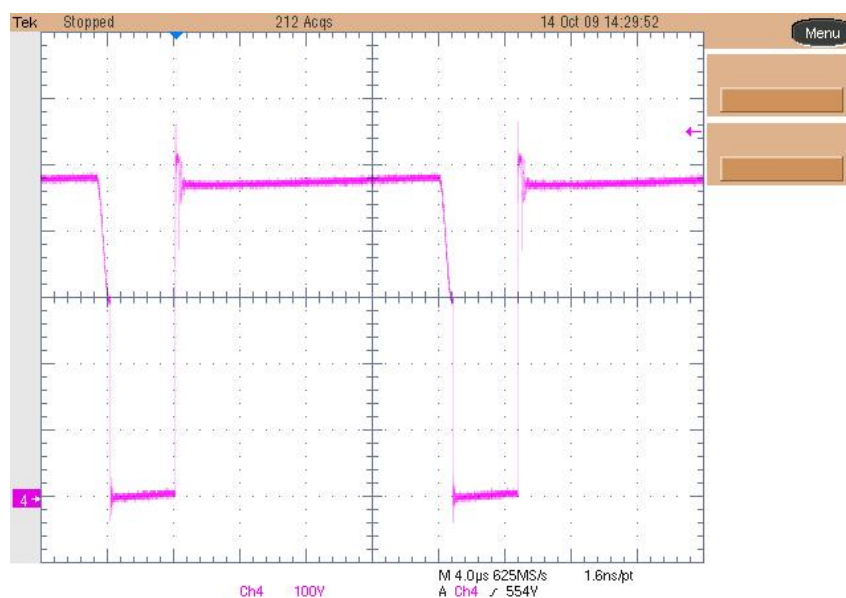
The output voltage transient response is shown in the plot below. The input was set to 230Vac and the load switched between 1.26A and 2.52A (74.34W to 148.68W).

Channel 3: output voltage (5 V/div, ac coupled, 40ms/div), Channel 2: output current (1A/div)



7 Switching Node Waveform

The image below shows the voltage on the drain of Q4, with a 271Vac input, and full load. Channel 4 shows the drain voltage (100V/div, 4µs/div).

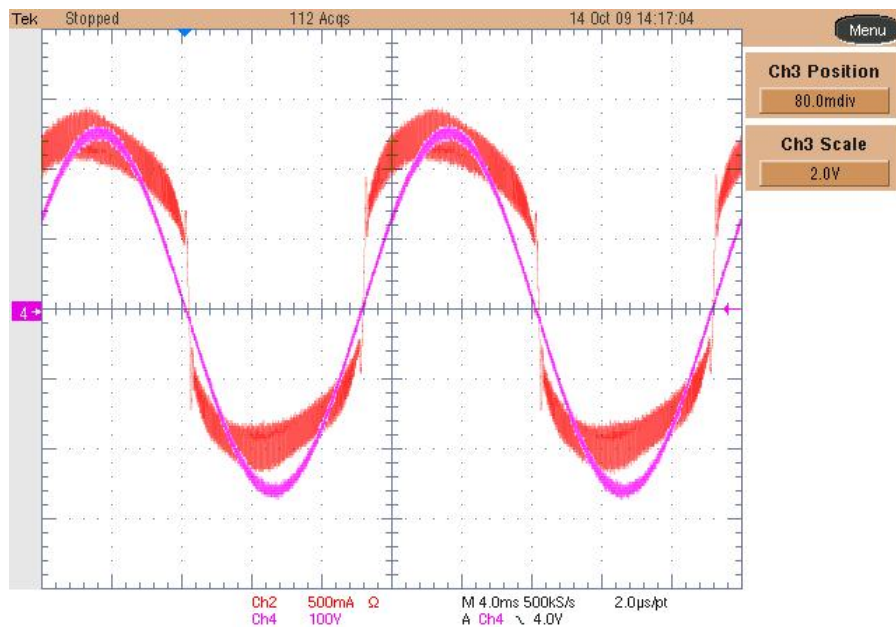


8 Input Voltage and Current Waveforms

The images below show the input voltage and current while the source was set to the three different input voltages and the converter was fully loaded.

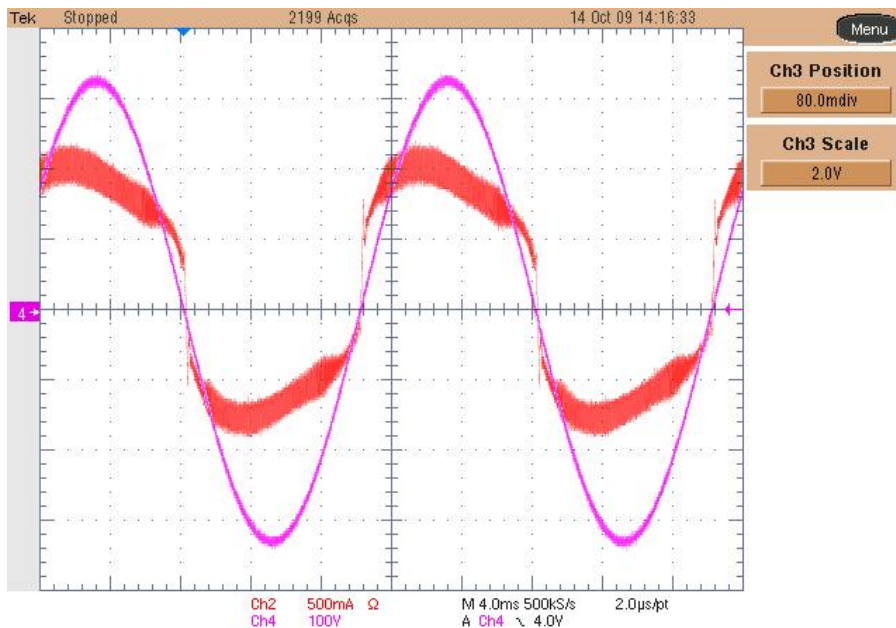
$V_{in} = 180V_{ac}$

Channel 4: input voltage (100V/div, 4ms/div); Channel 2: input current (500mA/div)



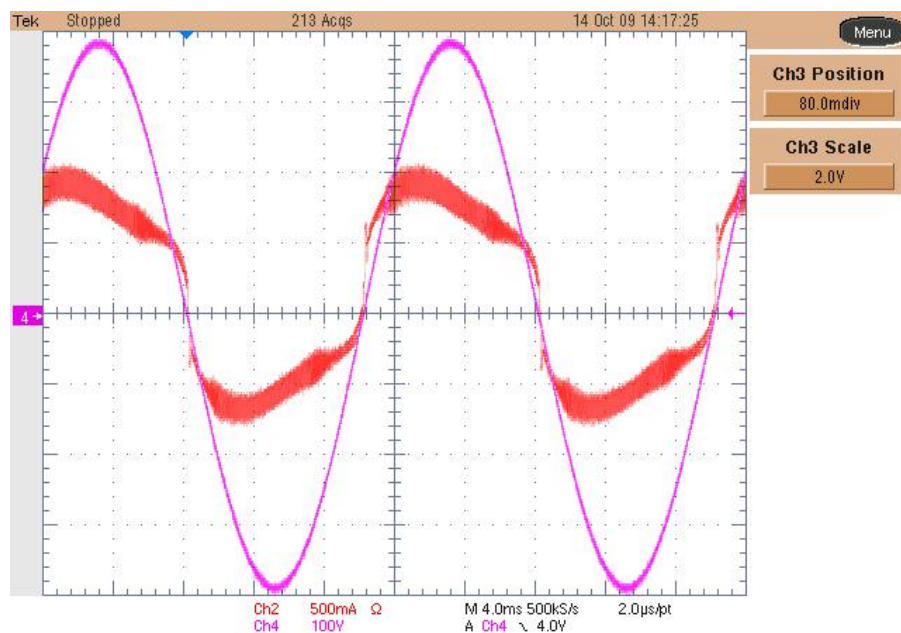
$V_{in} = 230V_{ac}$

Channel 4: input voltage (100V/div, 4ms/div); Channel 2: input current (500mA/div)



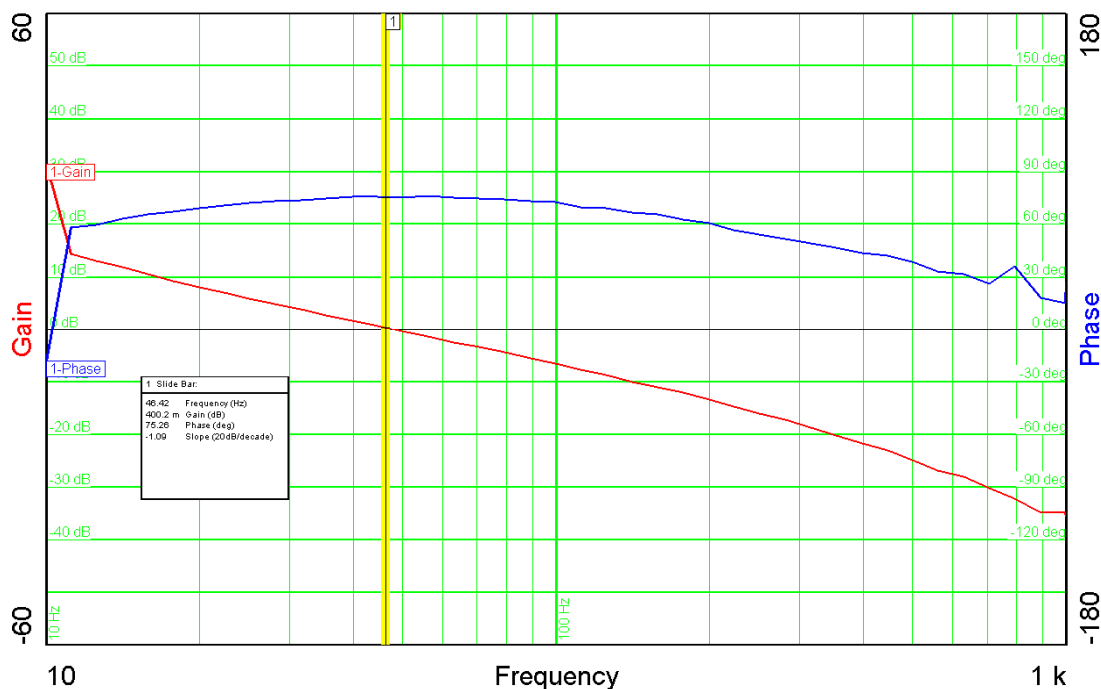
$V_{in} = 271V_{ac}$

Channel 4: input voltage (100V/div, 4ms/div); Channel 2: input current (500mA/div)



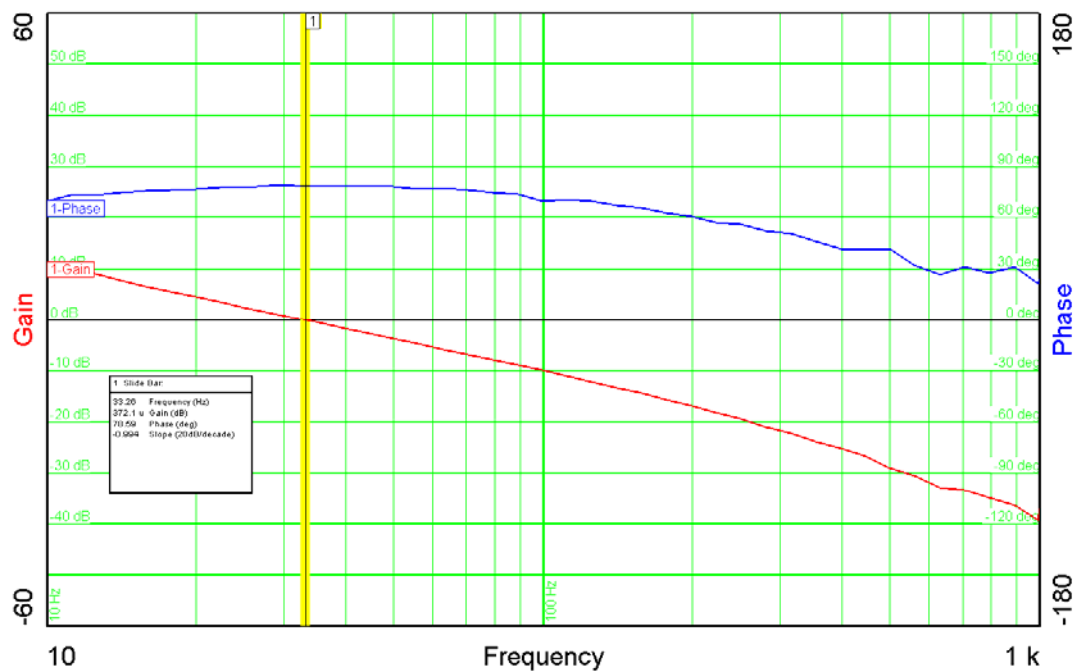
9 Loop Response

The image below shows the loop response of the converter measured with a 300Vdc input and 0.5A load. Phase margin is 75.26 deg. and crossover frequency is 46.42 Hz.

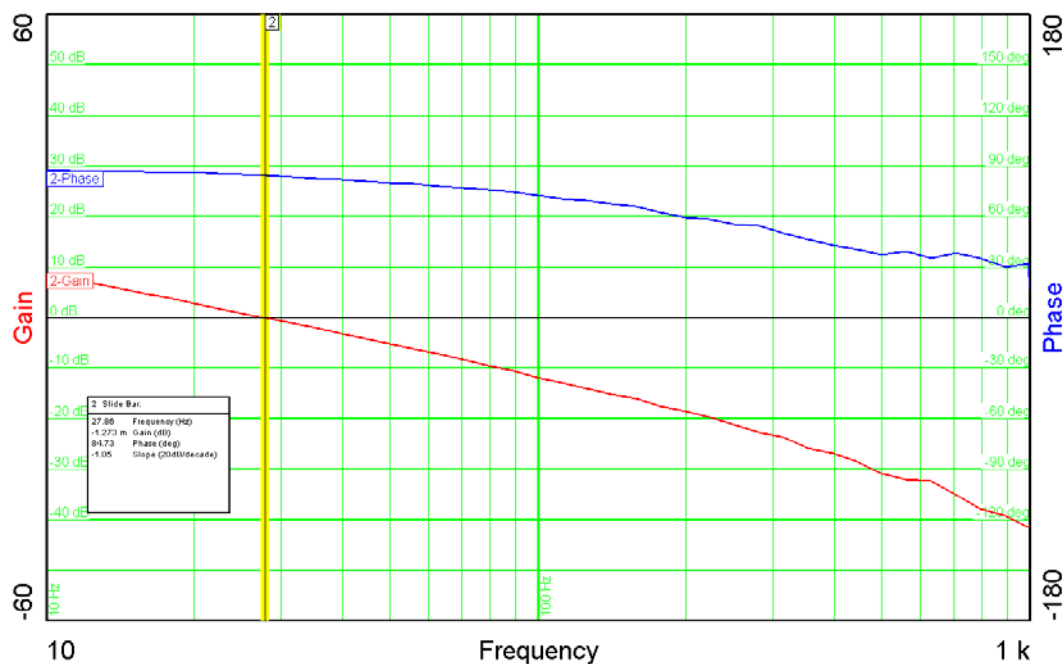


The loop response of the converter was measured again with the same input voltage but at half load and full load.

Half Load: Phase margin 78.59 deg., crossover frequency 33.26 Hz.



Full Load: Phase margin 84.73 deg., crossover frequency 27.86 Hz.



10 Thermal Analysis

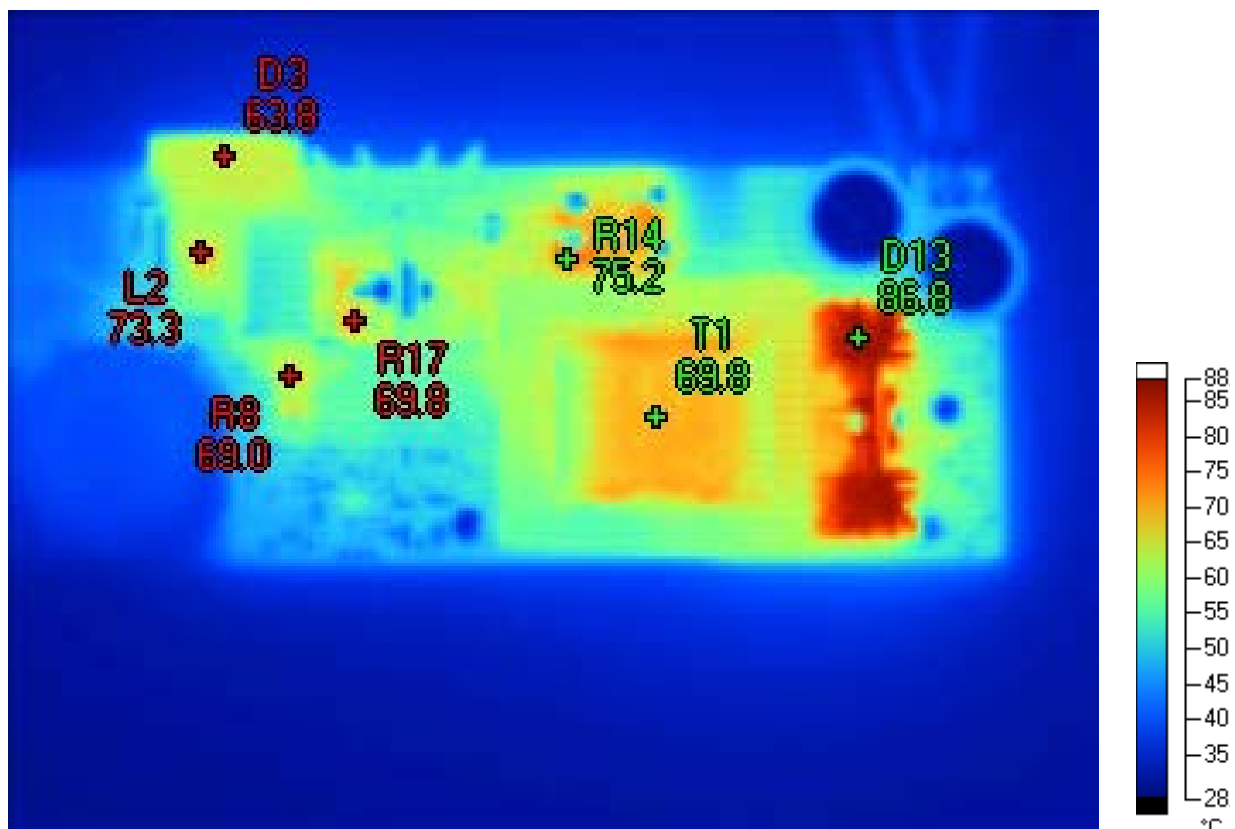


Image Info

Emissivity	0.95
Background	23.0 °C
Average Temperature	43.1 °C
Camera Model	Ti40FT
Image Range	29.5 °C to 87.2 °C
Image Time	10/14/2009 1:53:16 PM
Manufacturer	Fluke
Camera Serial Number	Ti40FT-070263

Markers

Label	Temperature	Emissivity	Background
D13	86.8 °C	0.95	23.0 °C
T1	69.8 °C	0.95	23.0 °C
D3	63.8 °C	0.95	23.0 °C
L2	73.3 °C	0.95	23.0 °C
R8	69.0 °C	0.95	23.0 °C
R17	69.8 °C	0.95	23.0 °C
R14	75.2 °C	0.95	23.0 °C

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for 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, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps