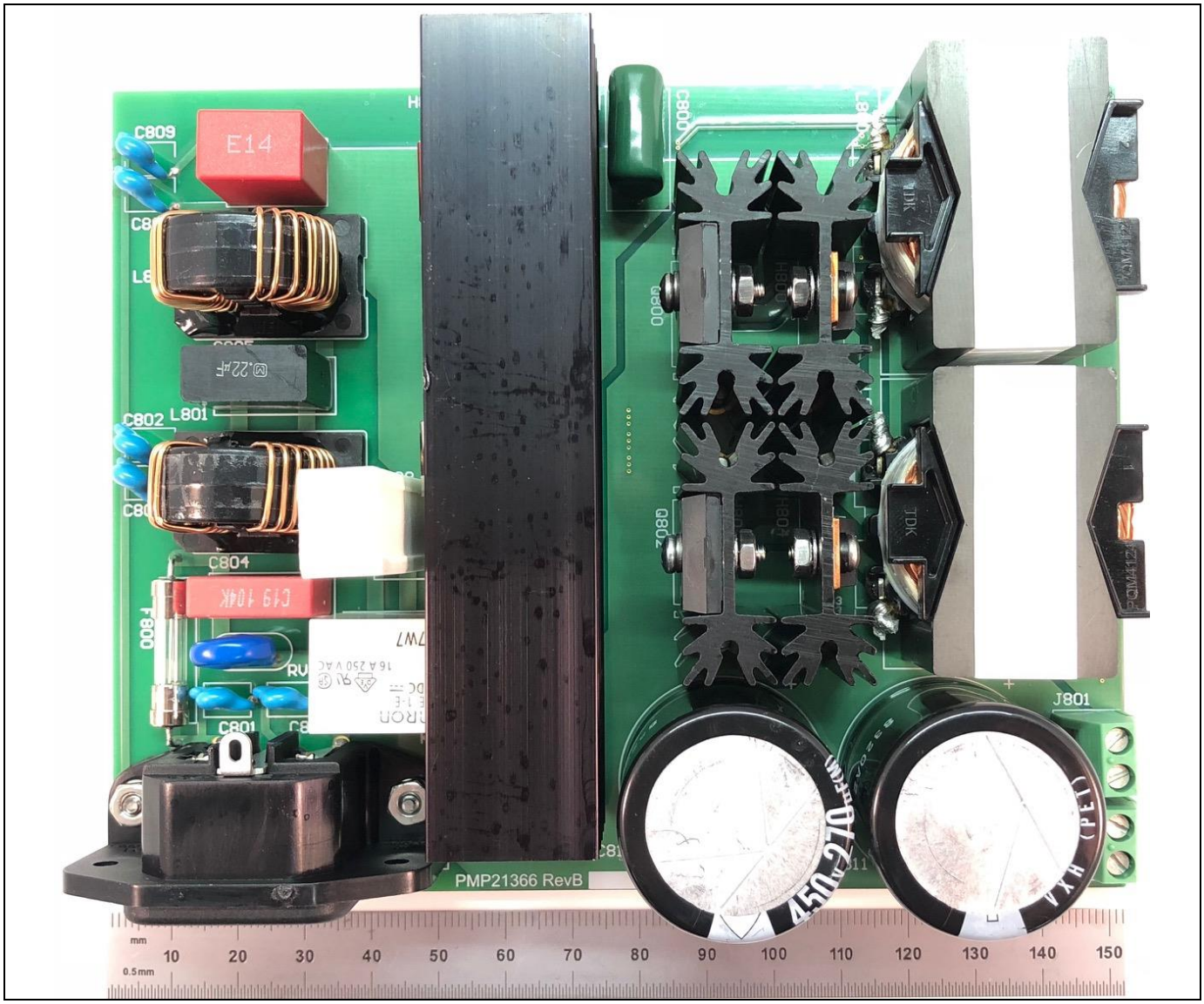
Test Report: PMP21366
700W Interleaving Transition-Mode PFC Reference Design

Description

The PMP21366 reference design uses UCC28064A natural interleaving transition-Mode PFC controller to provide a universal AC input to 380V/700W conversion. This design achieves 98% peak efficiency at 230VAC input and the light load efficiency maintained at a level close to full load efficiency because the burst mode operation provided by UCC28064A.



1 System Specification

1.1 Board Dimension:

4.7’ x 5.9” x 1.3”.

1.2 Input Characteristics

1.2.1 AC Input Voltage and Frequency Limitations:

Minimum	Nominal	Maximum	
90	100~240	265	VAC
47	50~60	63	Hz

1.2.2 AC Input Current:

- 7A Max. at 115VAC.
- 3.5A Max. at 230VAC.
- Current total harmonic distortion should be less than 20% from 50% to 100% load. 1.85A load current is defined as 100% load.

1.2.3 Power Factor:

Power factor should be greater than 0.9 at 100% load with either 115VAC/60Hz or 230VAC/50Hz input.

1.2.4 Inrush Current:

- Cold start: <50A at both 100VAC and 230VAC input and 25degC ambient temperature.
- Hot start: no component damage.

1.3 Output Characteristics

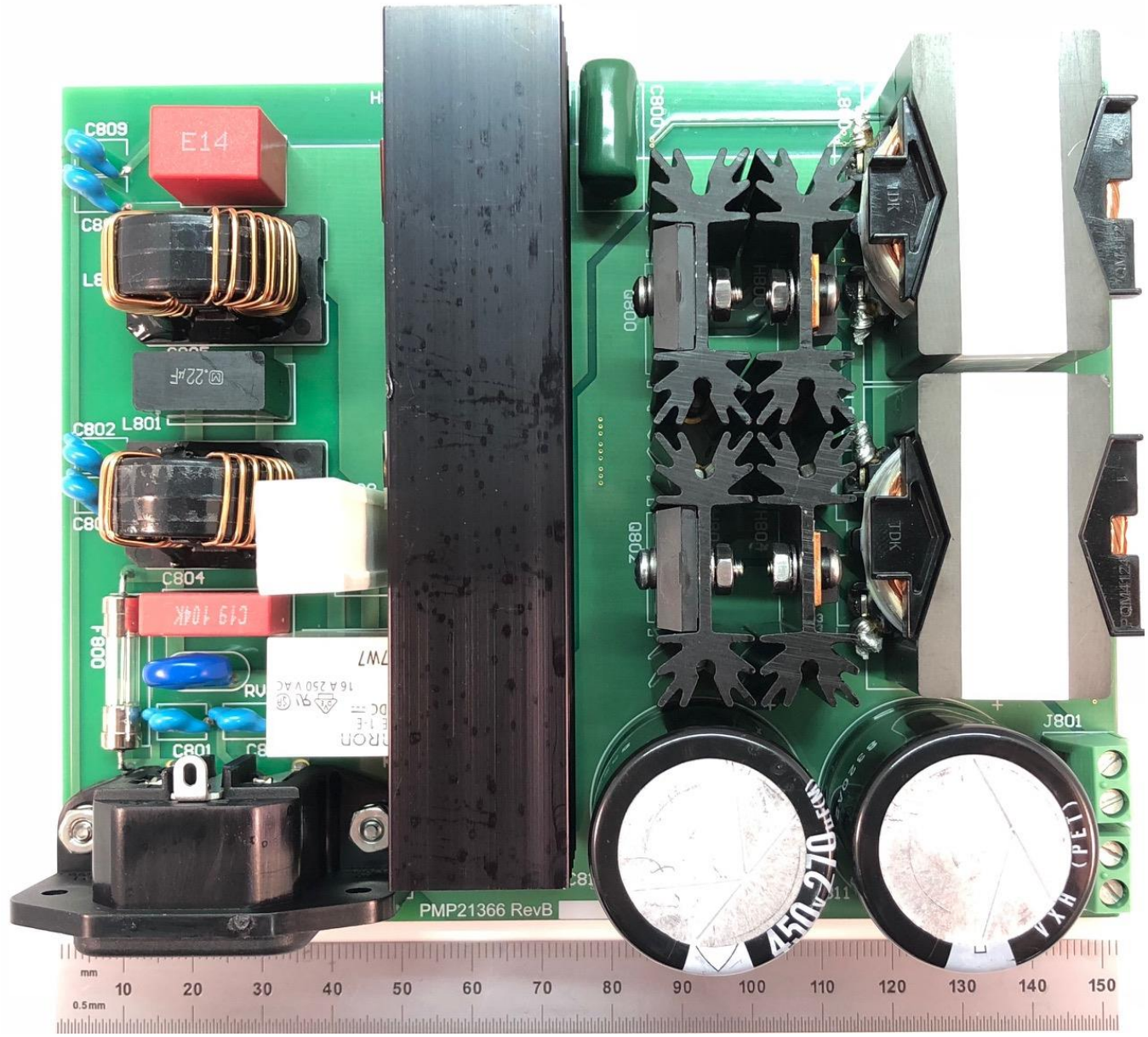
The power supply unit should be able to supply 700W output power continuously at 390V+/-5% output voltage.

2 Testing and Results

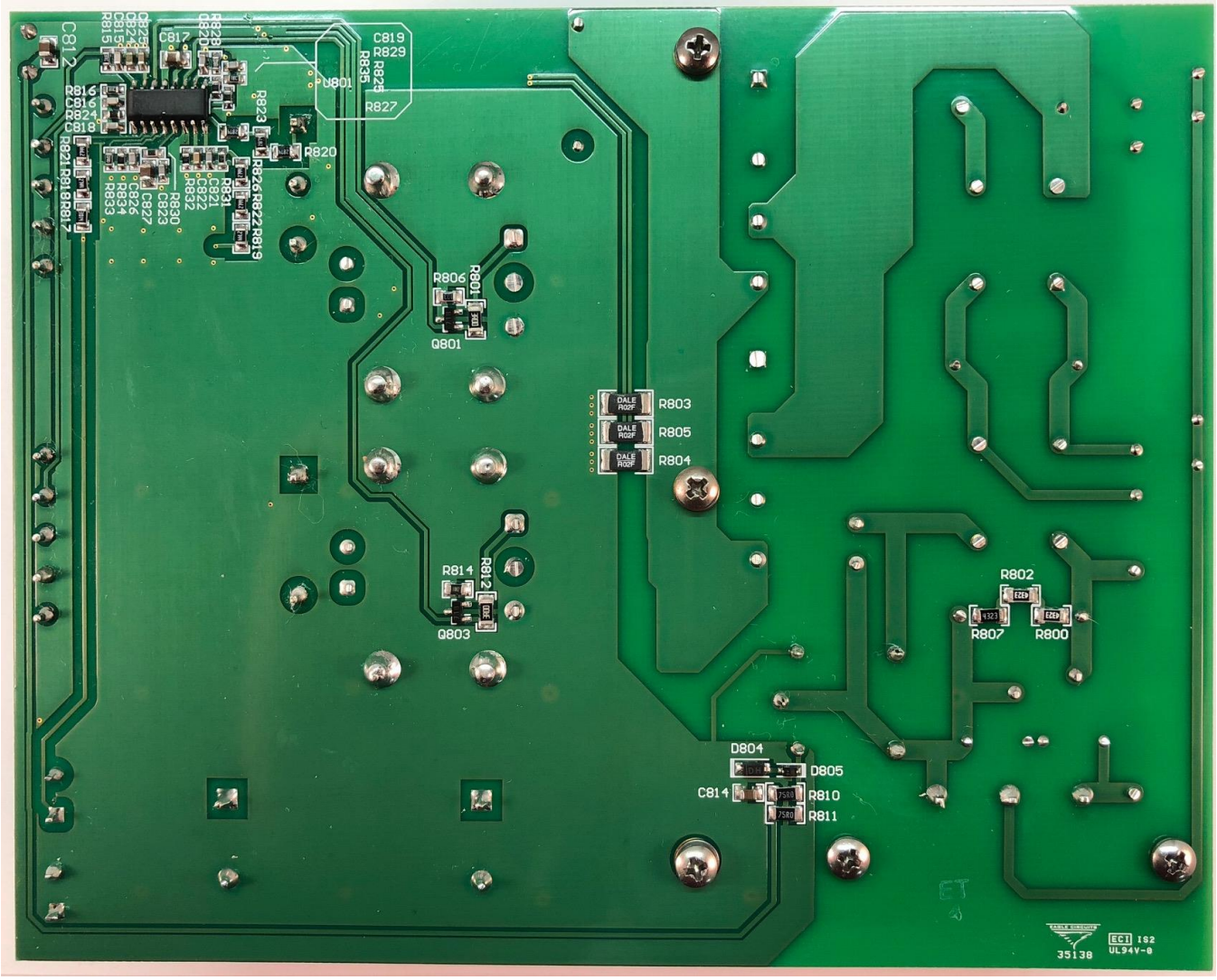
2.1 Board Photos

The photographs below show the top and bottom view of the PMP21366Rev B board.

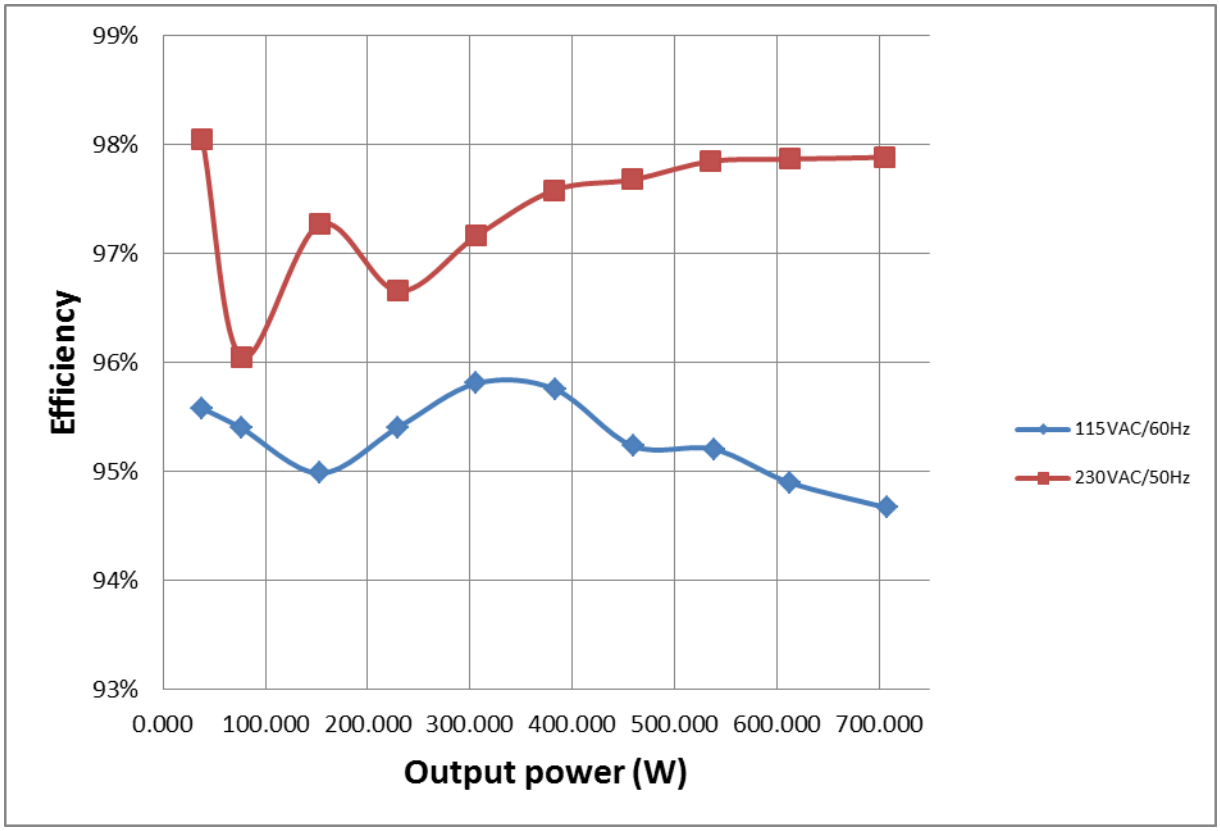
2.1.1 Top Side



2.1.2 Bottom Side



2.2 Efficiency Data



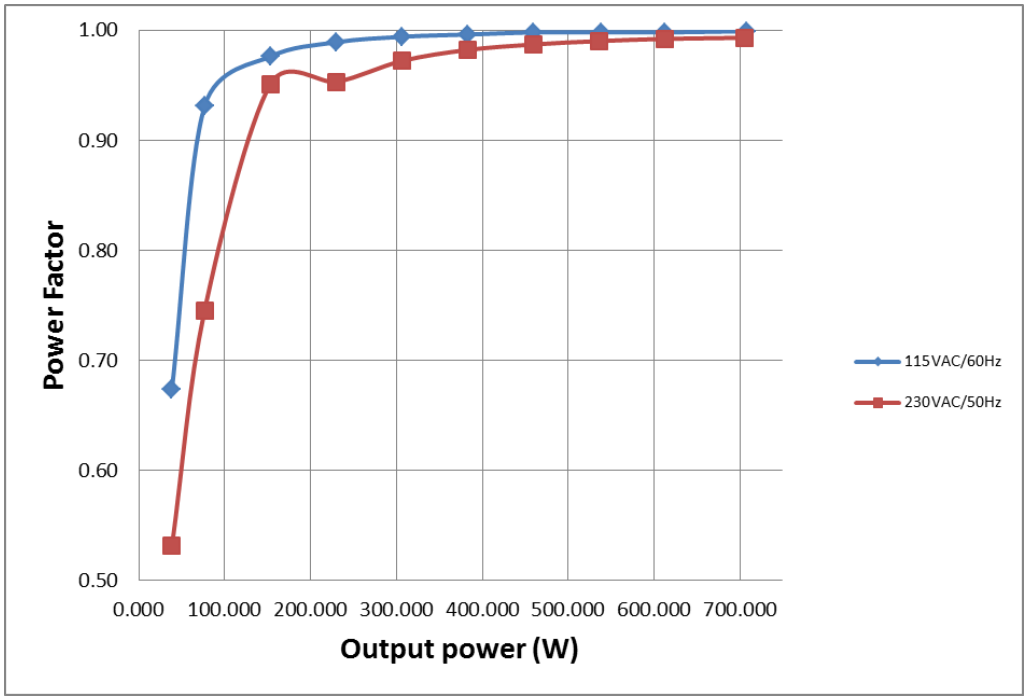
2.2.1 115V_{AC}/60Hz Efficiency Measurement

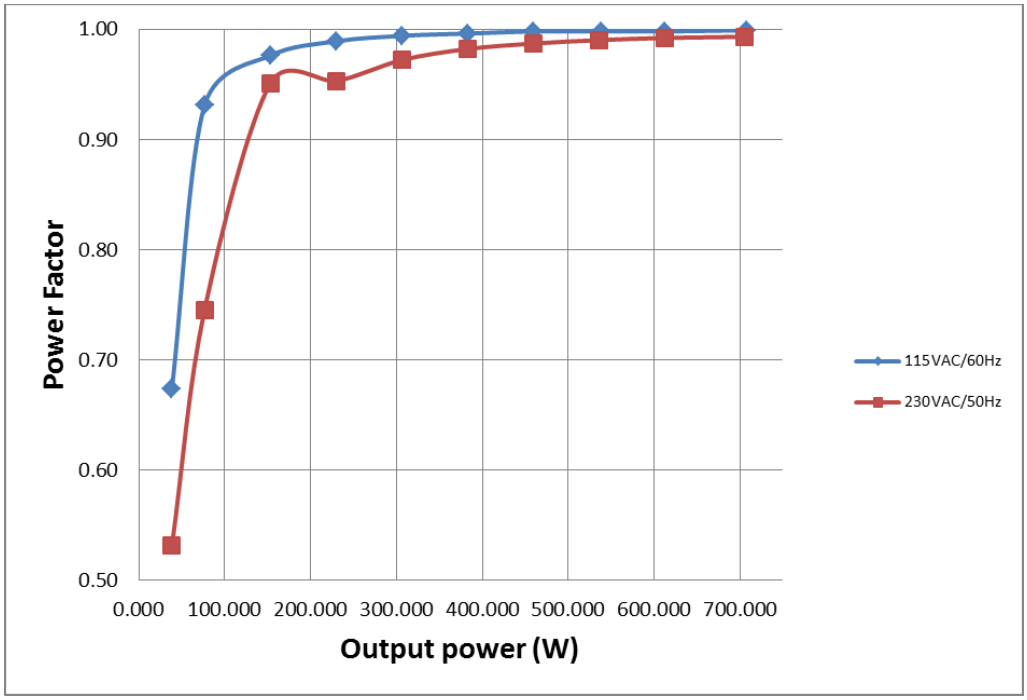
115VAC/60Hz								
Vin,rms(V)	Iin,rms(A)	Pin(W)	P.F.	THD	Vout(V)	Iout(A)	Pout(W)	Eff. (%)
114.99	6.510	747.70	0.999	2.9%	382.8	1.849	707.797	94.66%
114.99	5.626	645.60	0.998	3.5%	382.9	1.600	612.640	94.89%
114.94	4.932	565.50	0.998	3.8%	382.9	1.406	538.357	95.20%
115.04	4.206	482.50	0.998	4.6%	382.9	1.200	459.480	95.23%
115.03	3.491	400.00	0.996	5.7%	383	1.000	383.000	95.75%
115.04	2.798	319.90	0.994	7.4%	383.1	0.800	306.480	95.80%
115.05	2.118	241.00	0.989	10.1%	383.2	0.600	229.920	95.40%
114.97	1.438	161.38	0.976	15.7%	383.2	0.400	153.280	94.98%
114.97	0.751	80.32	0.931	14.2%	383.1	0.200	76.620	95.39%
115.08	0.518	40.22	0.673	15.2%	384.4	0.100	38.440	95.57%

2.2.2 230VAC/50Hz Efficiency Measurement

230VAC/50Hz								
Vin,rms(V)	Iin,rms(A)	Pin(W)	P.F.	THD	Vout(V)	Iout(A)	Pout(W)	Eff. (%)
230.0	3.155	720.60	0.993	5.5%	382.7	1.843	705.316	97.88%
229.9	2.744	625.70	0.992	6.6%	382.7	1.600	612.320	97.86%
230.0	2.406	547.60	0.990	7.4%	382.7	1.400	535.780	97.84%
230.0	2.072	470.30	0.987	8.5%	382.8	1.200	459.360	97.67%
230.0	1.737	392.30	0.982	10.6%	382.8	1.000	382.800	97.58%
230.0	1.409	315.20	0.972	12.5%	382.8	0.800	306.240	97.16%
230.0	1.085	237.70	0.953	17.4%	382.9	0.600	229.740	96.65%
230.0	0.720	157.55	0.951	11.8%	383.1	0.400	153.240	97.26%
230.0	0.464	79.56	0.745	66.0%	384	0.199	76.416	96.05%
230.0	0.321	39.25	0.531	71.8%	384.8	0.100	38.480	98.04%

2.3 Power Factor and Total Harmonic Distortion

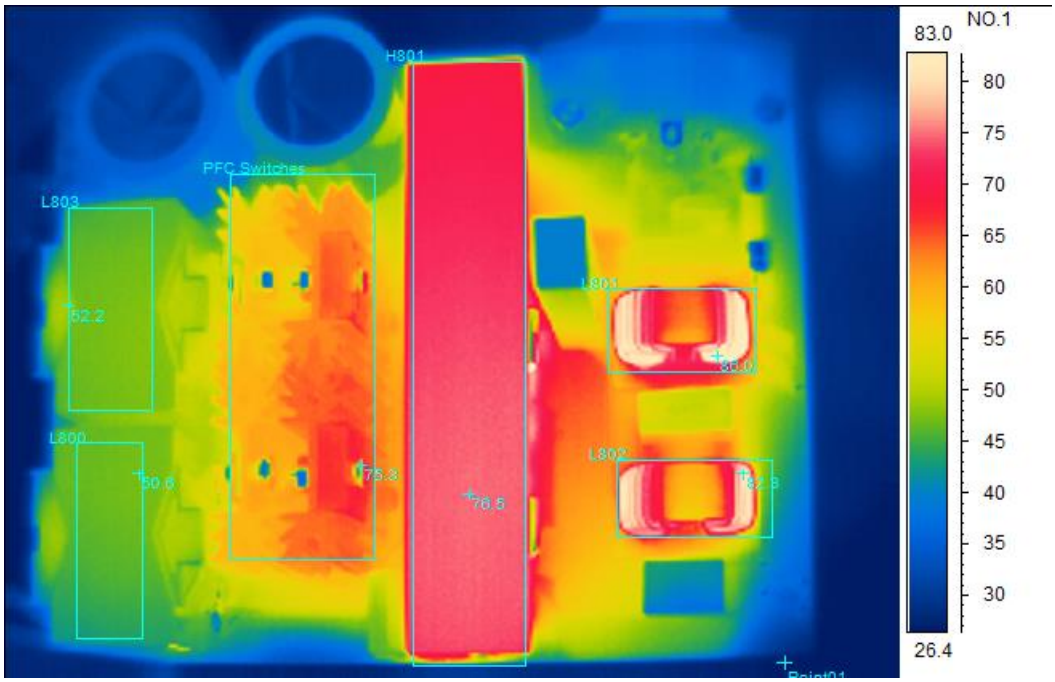




2.4 Thermal Images

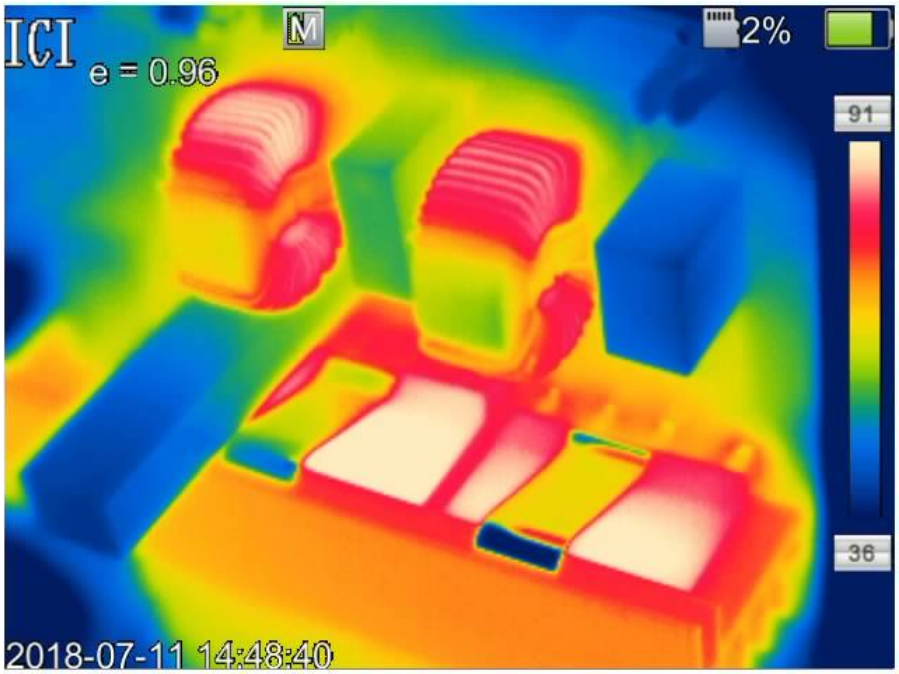
The thermal images below show a top view and bottom view of the board. The board is placed vertically during the test. The ambient temperature was 25ºC with no air flow. The output was loaded with 385V/1.85A.

2.4.1 115V_{AC}/60Hz, Top Side

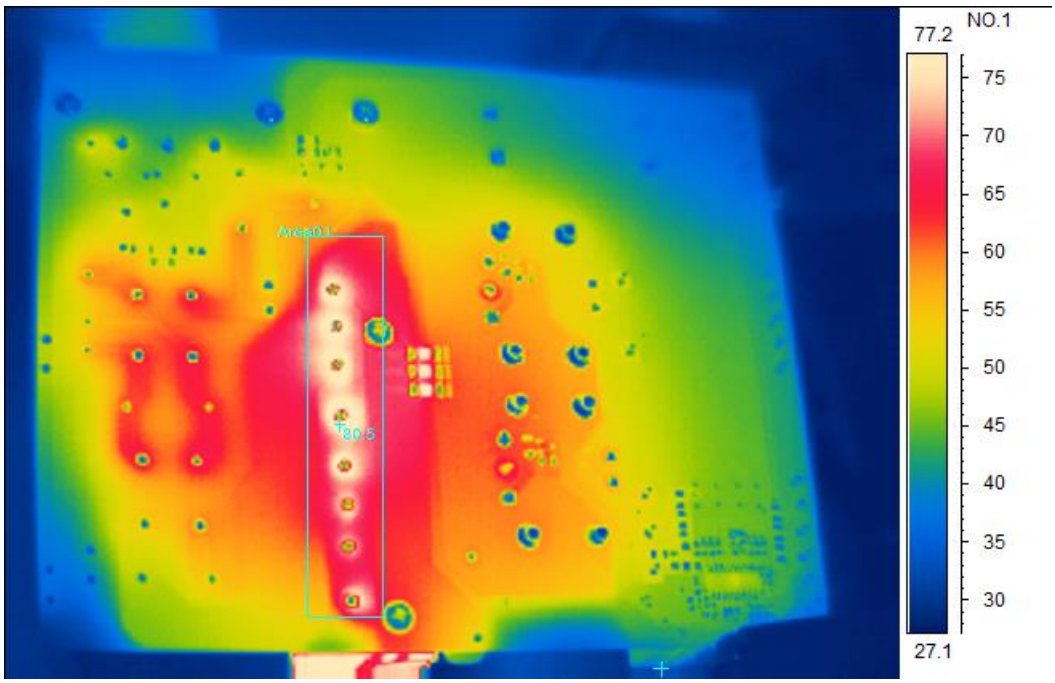


Spot analysis	Value
Point01Temperat	26.9°C
Area analysis	**Value**
H801Max	76.5°C
PFC	75.3°C
L803Max	52.2°C
L800Max	50.6°C
L802Max	82.3°C
L801 Max	86.0°C

2.4.2 115V_{AC}/60Hz, Bridge Diodes

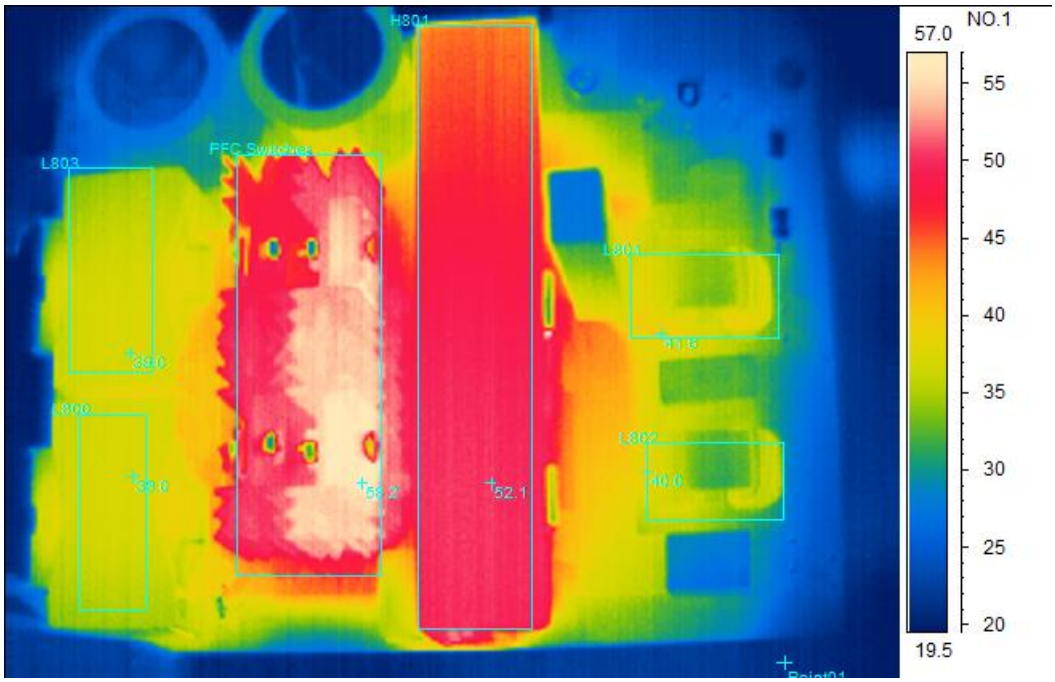


2.4.3 115V_{AC}/60Hz, Bottom Side



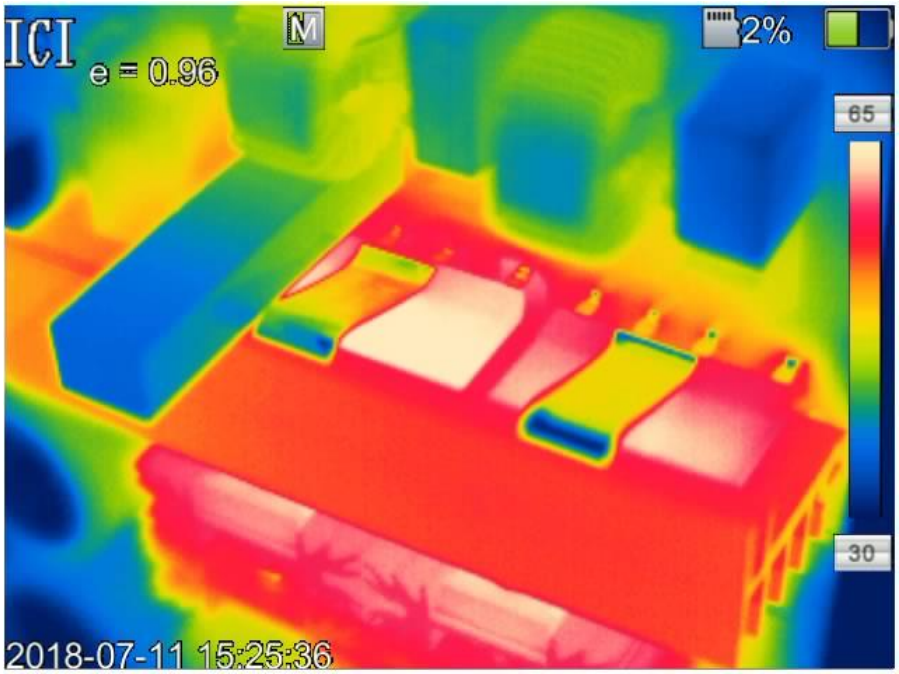
Spot analysis	Value
Point01Temperat	33.0°C
Area analysis	**Value**
Area01Max	80.5°C

2.4.4 230V_{AC}/50Hz, Top Side

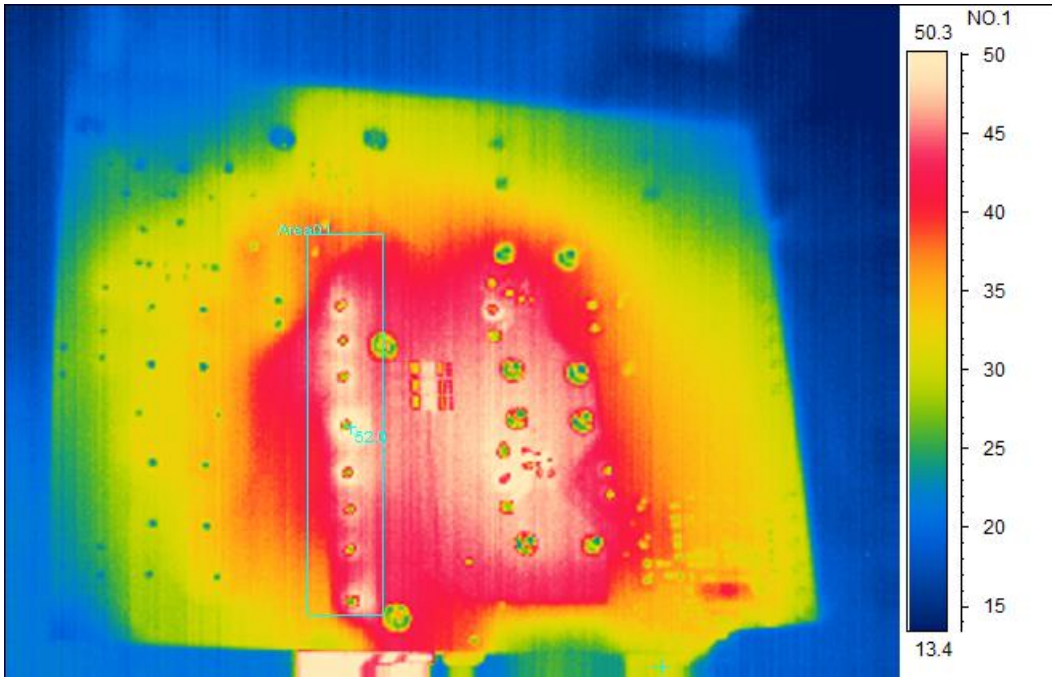


Spot analysis	Value
Point01Temperat	21.5°C
Area analysis	**Value**
H801Max	52.1°C
PFC	58.2°C
L803Max	39.0°C
L800Max	39.0°C
L802Max	40.0°C
L801 Max	41.6°C

2.4.5 230V_{AC}/50Hz, Bridge Diodes



2.4.6 230V_{AC}/50Hz, Bottom Side

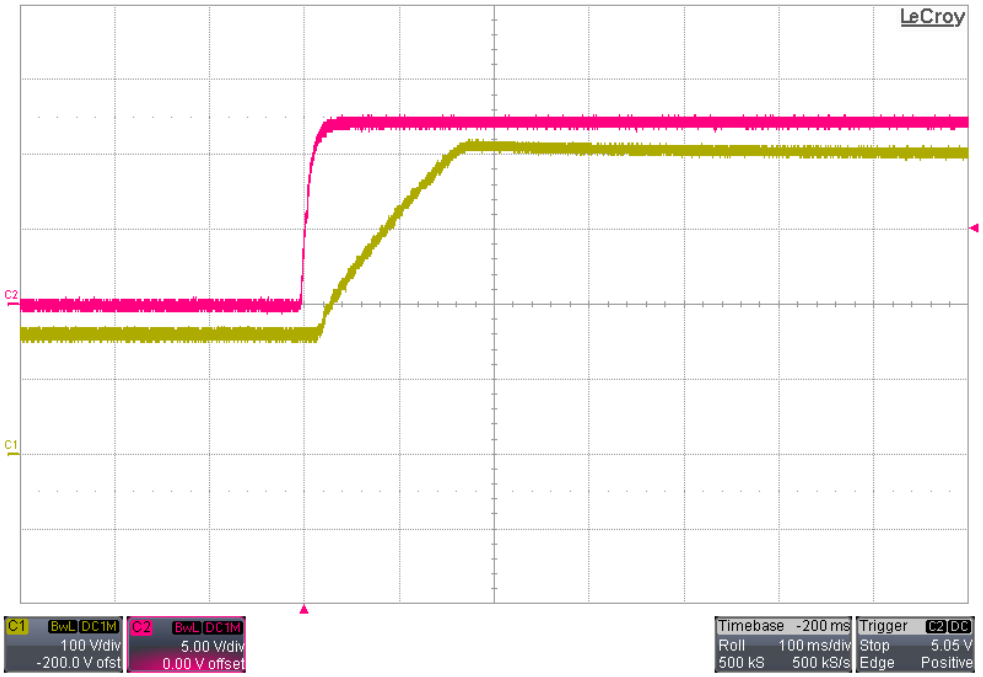


Spot analysis	Value
Point01Temperat	31.6°C
Area analysis	**Value**
Area01Max	52.0°C

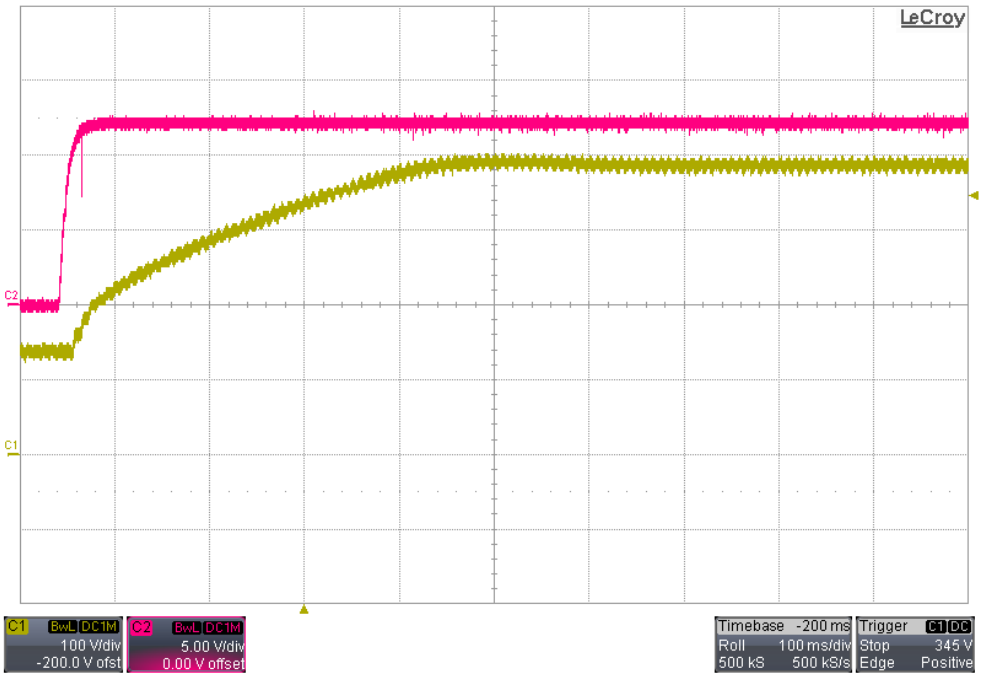
2.5 Startup

The voltages at startup are shown in the images below, where Channel 3 is VBulk to GND, and Channel 4 is External 13V.

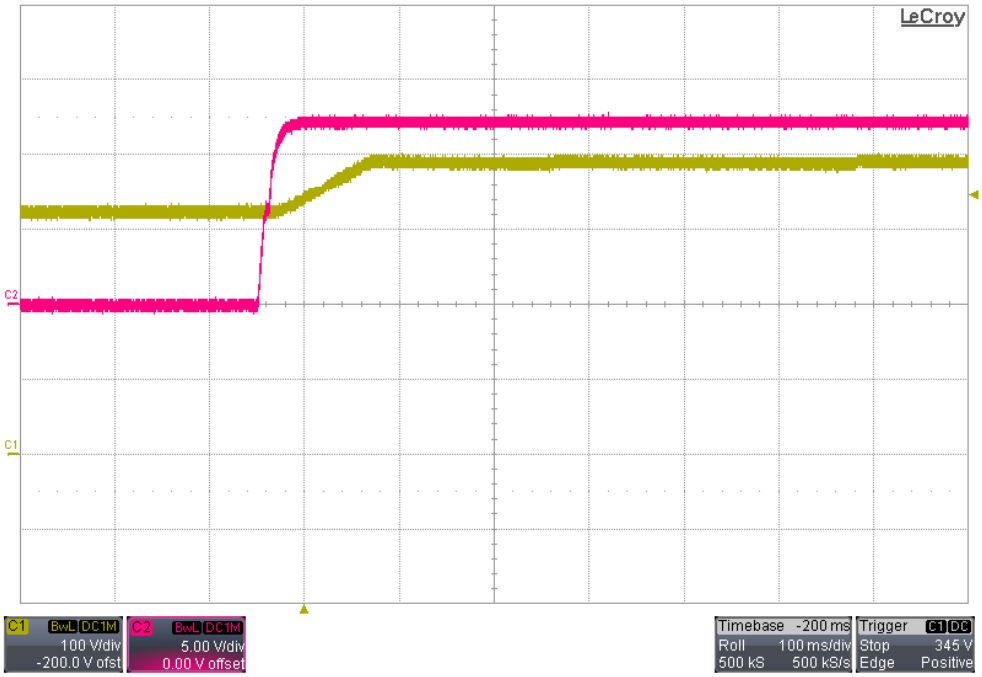
2.5.1 115V_{AC}/60Hz – No Load



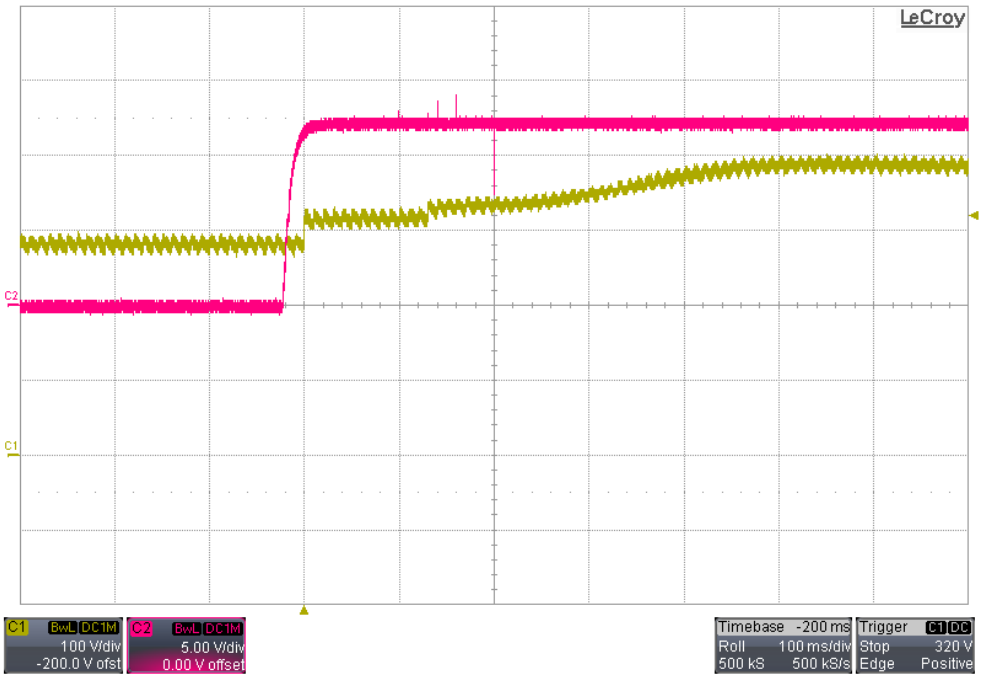
2.5.2 115V_{AC}/60Hz – 383V/333Ω Load



2.5.3 230V_{AC}/50Hz – No Load



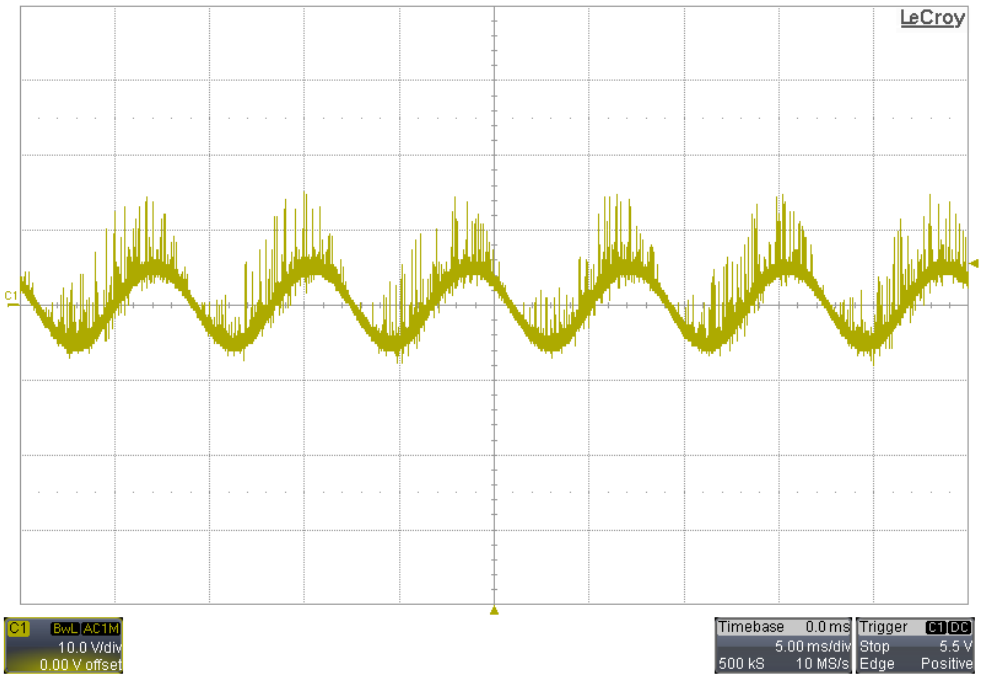
2.5.4 230V_{AC}/50Hz – 383V/333Ω Load



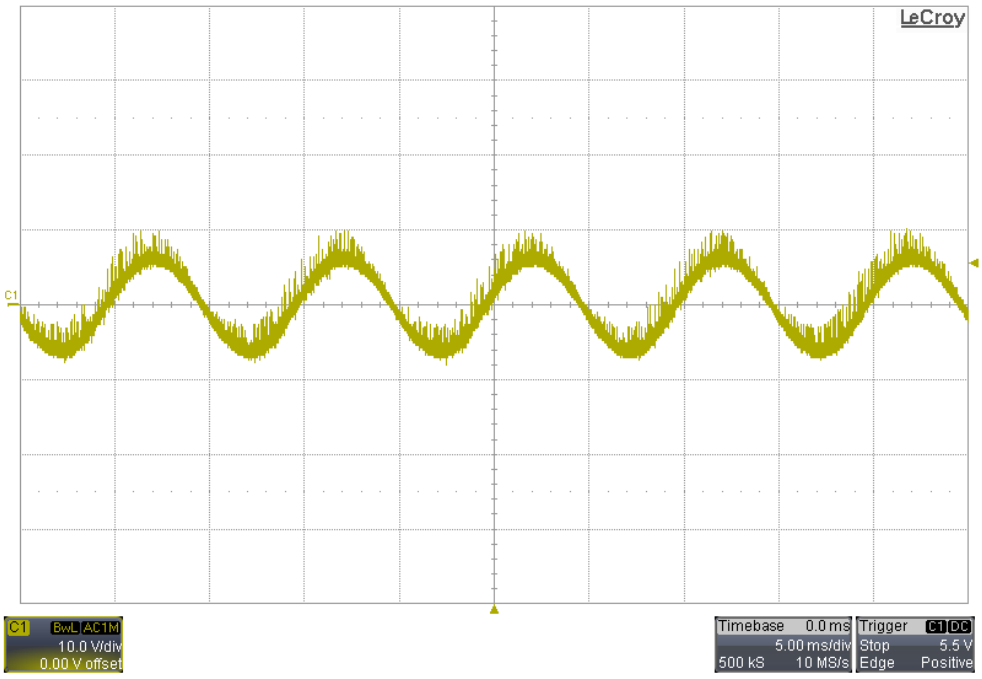
2.6 Ripple Voltages

Ripple voltages are shown in the images below, where Channel 1 is the output voltage in AC level.

2.6.1 115V_{AC}/60Hz – 385V/1.85A



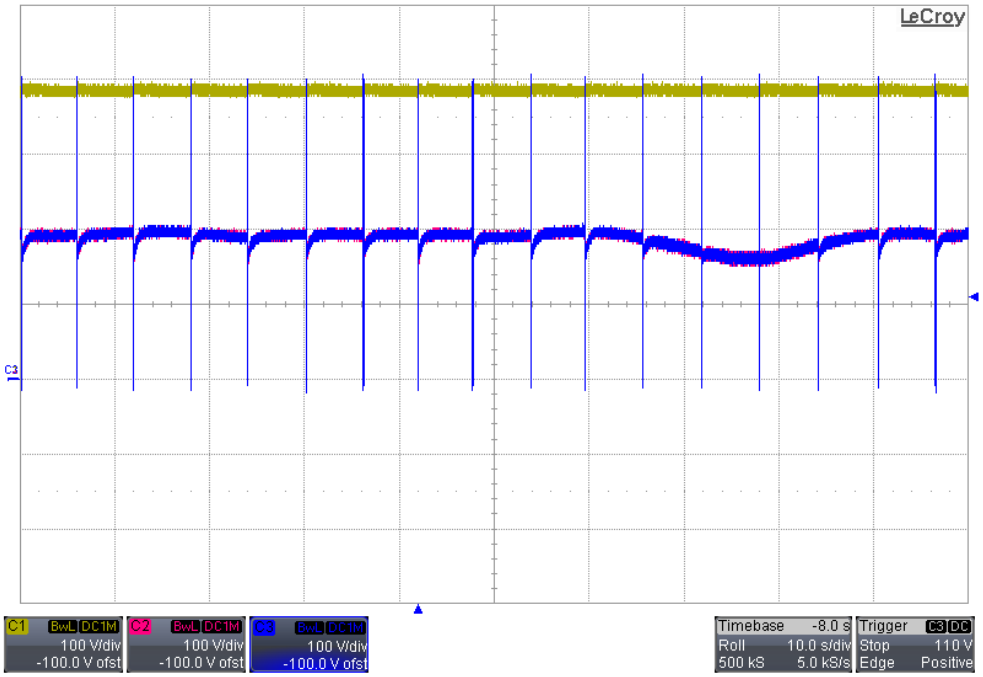
2.6.2 230V_{AC}/50Hz – 385V/1.85A



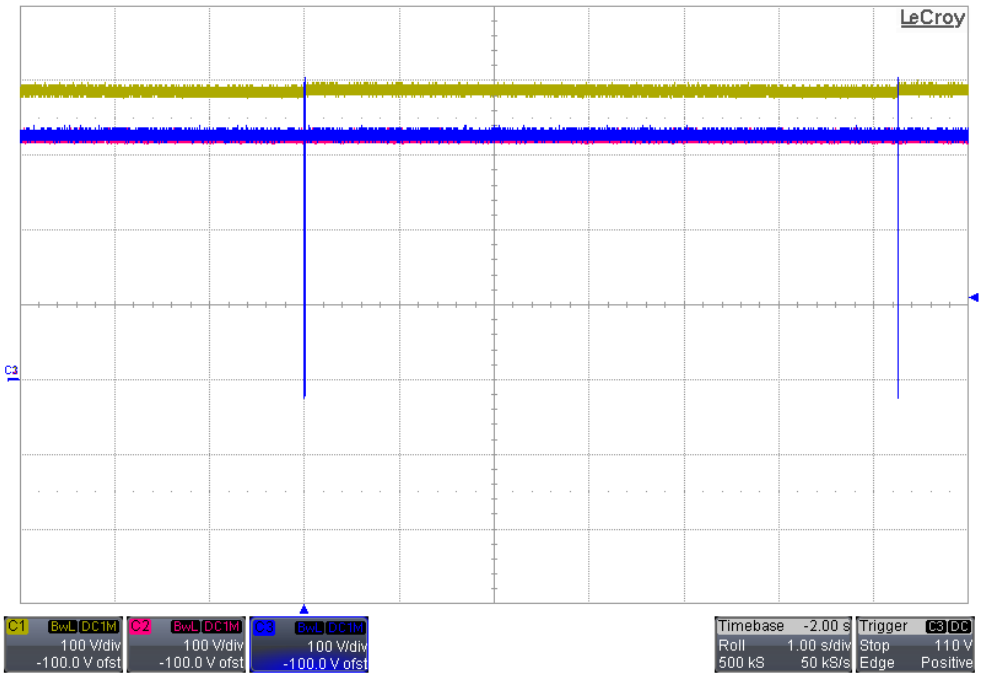
2.7 Burst Mode Operations

Burst mode operations are shown in the images below, where Channel 1 is the output voltage, Channel 2 is Q802 V_{DS} voltage, Channel 3 is Q800 V_{DS}.

2.7.1 115V_{AC}/60Hz – No Load



2.7.2 230V_{AC}/50Hz – No Load



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