



LE500 Family

LED 500W Power Supplies



OVERVIEW

The SL Power Electronics LE500 Family of IP67 power supplies is a superior performance 500 Watt AC to DC power supply designed to ensure easy integration into LED driver applications. It has a universal AC input range of 90 to 305 VAC. Highly efficient, the LE500 product family has droop current share for redundant/paralleling for higher power applications. All models are CE marked to low voltage directive and approved to safety standard EN60950 2nd edition and UL8750. This family of products come in a compact size and has industry leading grams per watt weight to power ratio. The LE500 family is IP67 rated for the most rugged environment. In addition, this model family has enhanced Electro-Magnetic Compatibility (EMC) features offering heavy industrial ESD, AC mains surge and RF immunity resulting in a more robust and reliable product. The LE500 families' AC mains emissions comply with FCC class B & EN55015 standards. Output emissions for differential ripple and common mode voltage and current have been reduced to minimize system level EMI and system circuit interference.

For long-term reliability, this model family has been designed using high-quality components to provide long life, thoroughly tested and approved by regulatory agencies. See the product datasheet for more details.

This application note provides guidance for proper use, system design consideration, and key performance data. Additional performance data is available upon request.

PROPER USE

The LE500 power supplies have high power conversion efficiency however they do rely on conduction and convection cooling in the surrounding environment (air) to prevent overheating or excessive component temperatures. Therefore, there needs to be adequate access to ambient air to ensure the proper thermal performance of the power supply.

- Switch off the main AC power before connecting the power supply.
- Use mounting holes provided on either side of the power supply to mount on a stable surface.
- Use proper mating connectors for connection to the input and output connectors of the power supply.
- Do not exceed the power rating of the product.
- Adequate space must be left around the supply for air movement and to an appropriate thermally conductive surface.
- No need to use any thermal grease or sil-pad type material, bolt directly to clean, flat and smooth plate.



MECHANICAL MOUNTING

Refer to the specification sheet mechanical drawing.

MODELS

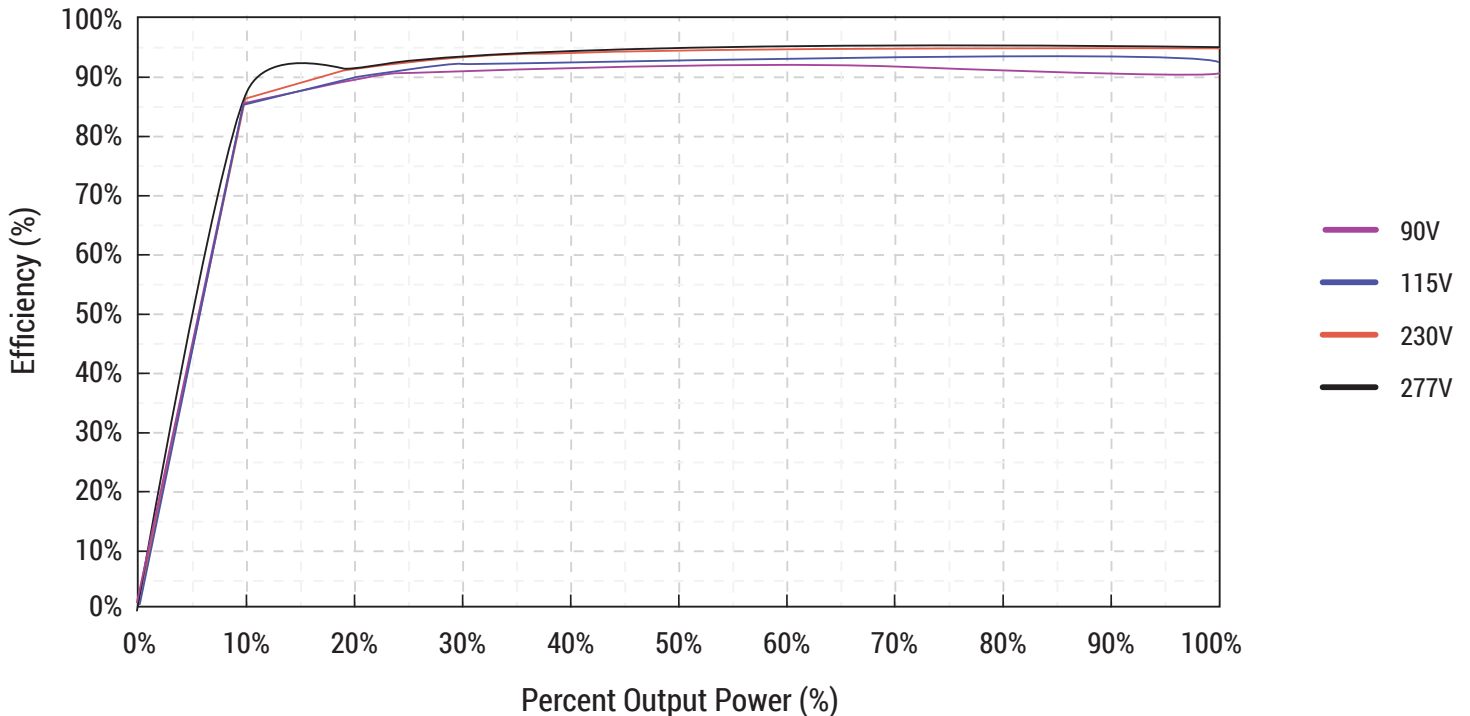
Model Number	Output Volts	Output Current	Total Noise & Ripple	Total Regulation	OVP Threshold
LE500S12X	12V	33.3A	1%	±2%	13.8 ± 1.0V
LE500S24X	24V	20.8A	1%	±2%	27.6 ± 1.0V
LE500S48X	48V	10.4A	1%	±2%	55.5 ± 2.0V

PERFORMANCE DATA

The following data is provided to aid in proper selection and system design. Additional performance data is available upon request.

EFFICIENCY

Efficiency vs Output Power - LE500S48





RELIABILITY AND ROBUSTNESS

Electrolytic capacitors are one of the main life-limiting components used in the power supply. Selecting high-quality capacitors with long life ratings are essential to achieving a long product life. SL Power Electronics uses only high-quality electrolytic capacitors in its LE500 model family resulting in an expected cap life of greater than 11 years in 50°C ambient continuous use, at 24 hours/day, 365 days/year. Calculations and measurements are performed to verify capacitor ripple current, voltage and thermal stress and lifetime estimations. Contact SL Power for information on other user profiles. Power supply has 50,000 hours of life at 80% load convection cooled at 115VAC (*see note below). And it also has 50,000 hours life at conduction cooled with the base temperature not exceeding 90°C at 100% load and 115VAC input.

*** Note:** Temperature profile used for convection cooled life calculation. This is the weighted temperature average used to calculate the capacitor life and is also shown in data sheet

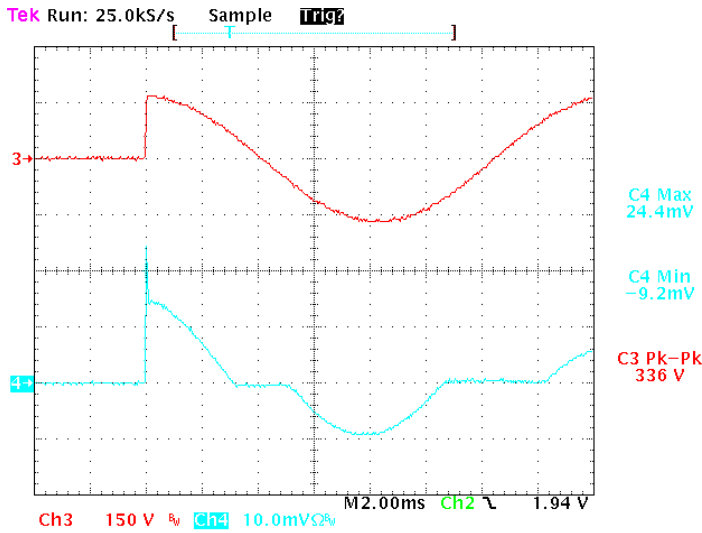
Ambient (outside of supply)	Hours per day, 365 days per year
65°C	6 hours
57.5°C	12 hours
50°C	6 hours



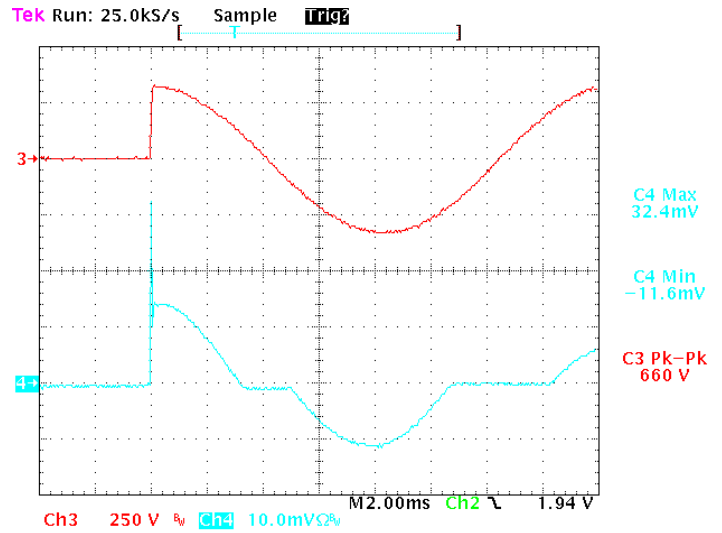
AC INRUSH CURRENT: 24V AND 48V

The AC input inrush current (cold start power on) is limited to less than 20A. This less than 20A inrush current is four times lower than other manufacturers at the same power level. This allows one circuit breaker to be connected to four power supply cutting the installation cost by 75% and saving space.

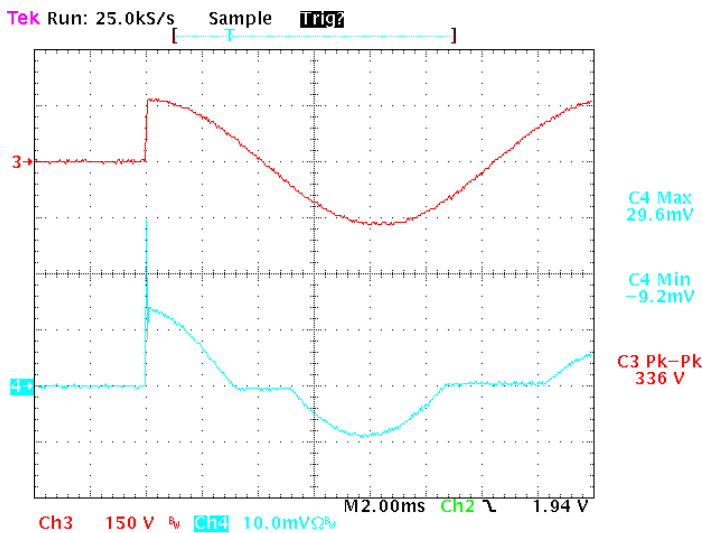
INRUSH CURRENT AT 115VAC 24V 20.8A CH4: 5A Div.



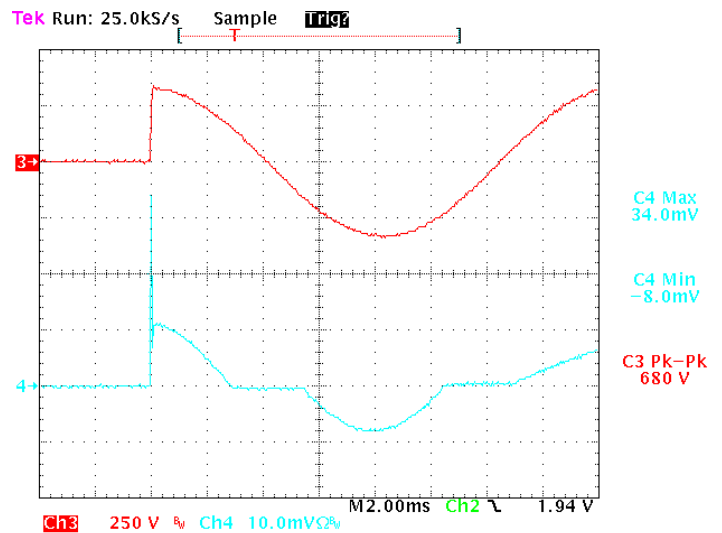
INRUSH CURRENT AT 230VAC 24V 20.8A CH4: 5A Div.



INRUSH CURRENT AT 115VAC 48V 10.4A CH4: 5A Div.



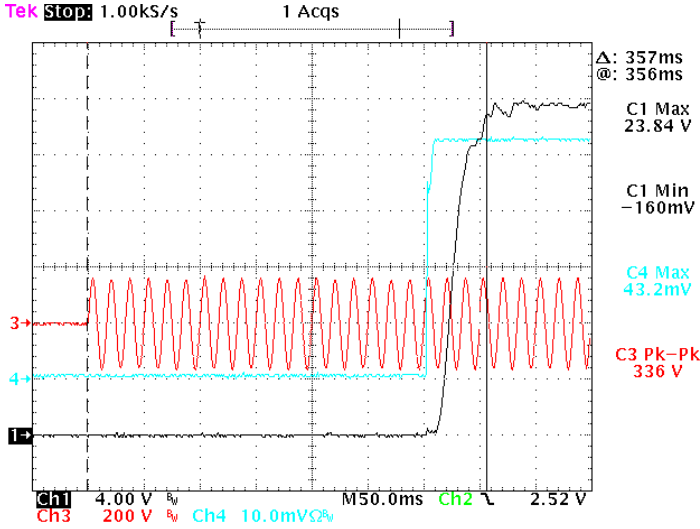
INRUSH CURRENT AT 230VAC 48V 10.4A CH4: 5A Div.



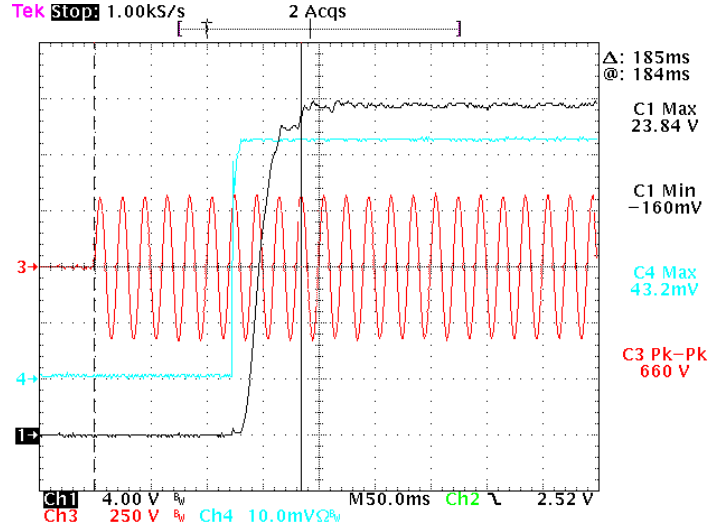


TURN-ON DELAY TIME: 24V AND 48V

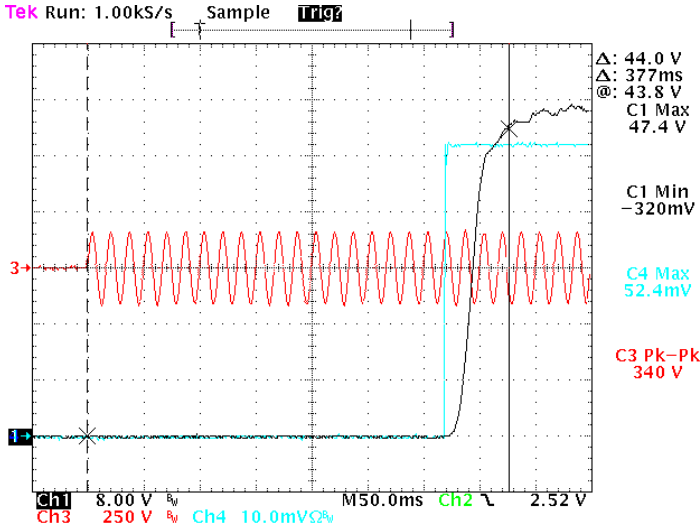
TURN-ON DELAY AT 115VAC 24V 20.8A CH4: 5A Div.



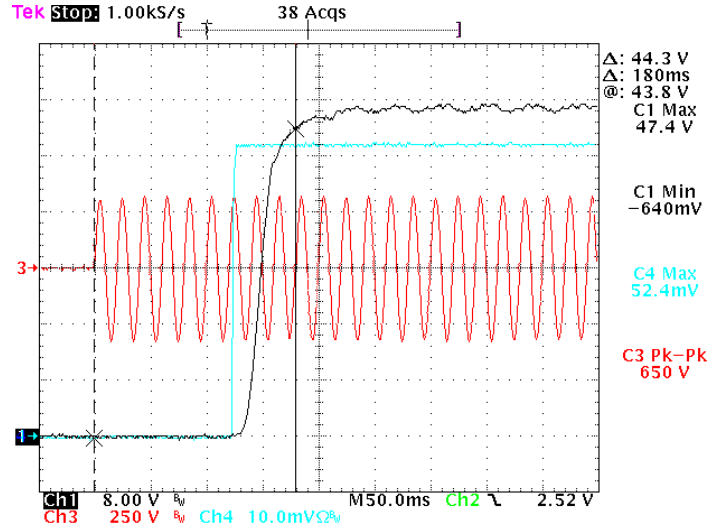
TURN-ON DELAY AT 230VAC 24V 20.8A CH4: 5A Div.



TURN-ON DELAY AT 115VAC 48V 10.4A CH4: 2A Div.



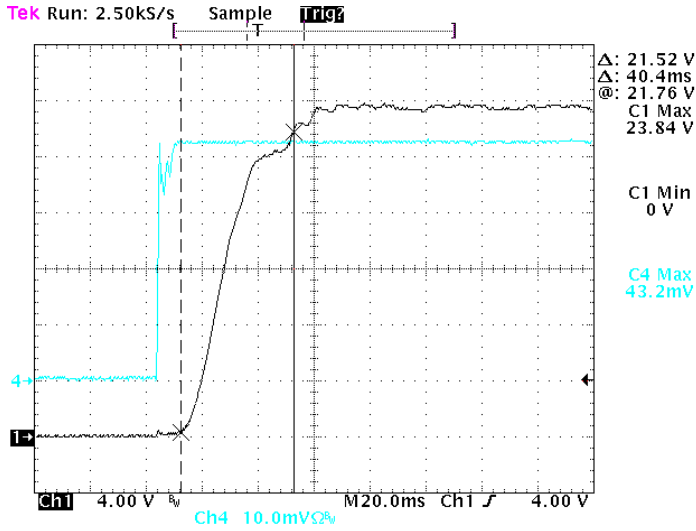
TURN-ON DELAY AT 230VAC 48V 10.4A CH4: 2A Div.



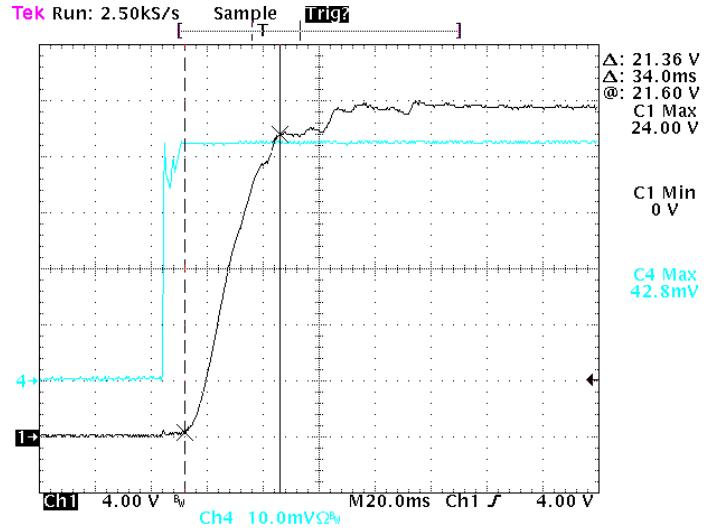


OUTPUT TURN-ON RISE TIME: 24V (constant current load)

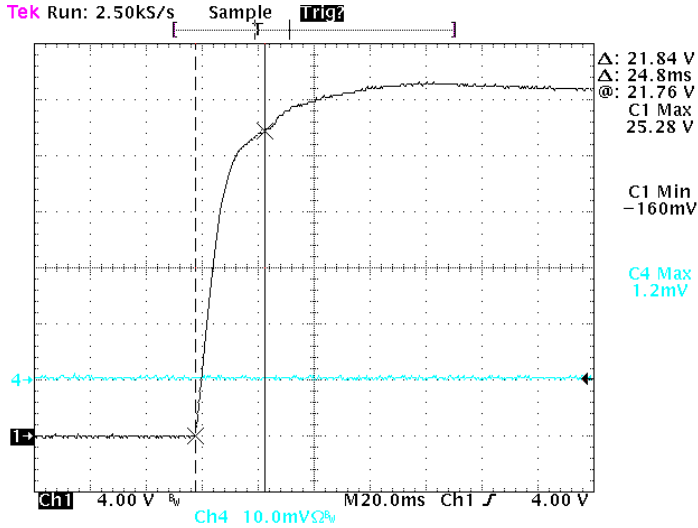
TURN-ON RISE TIME AT 115VAC 24V 20.8A CH4: 5A Div.



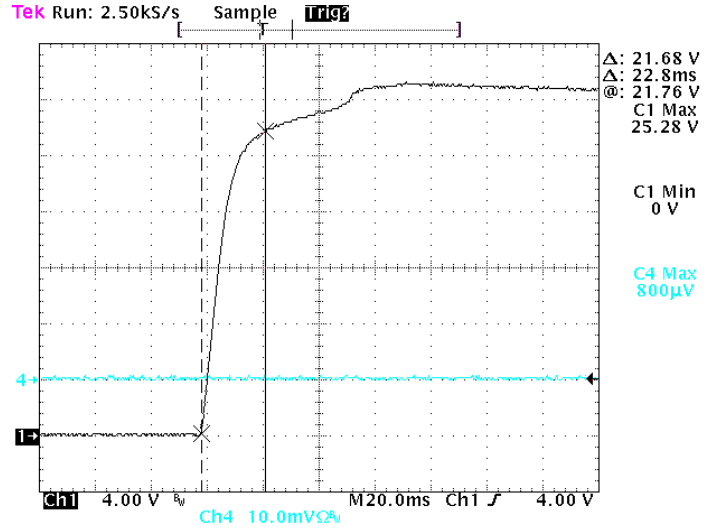
TURN-ON RISE TIME AT 230VAC 24V 20.8A CH4: 5A Div.



TURN-ON RISE TIME AT 115VAC 24V 0.0A CH4: 5A Div.



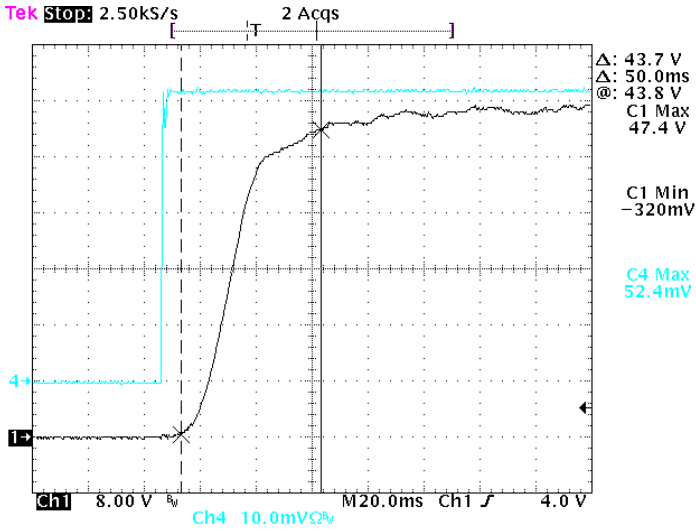
TURN-ON RISE TIME AT 230VAC 24V 0.0A CH4: 5A Div.



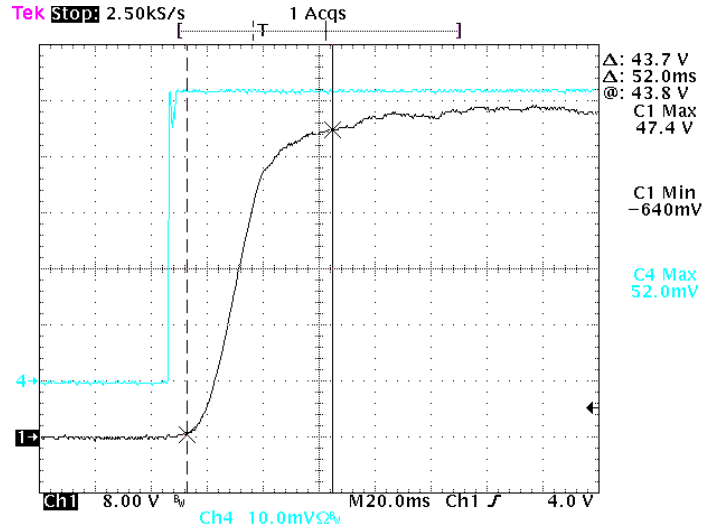


OUTPUT TURN-ON RISE TIME: 48V (constant current load)

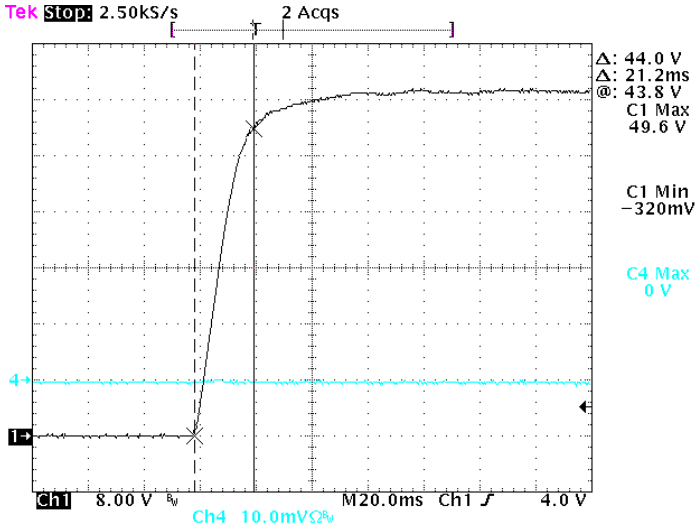
TURN-ON RISE TIME AT 115VAC 48V 10.4A CH4: 2A Div.



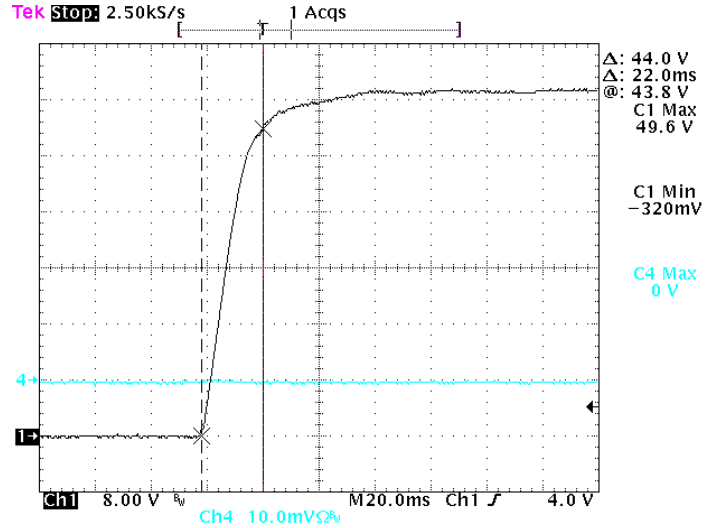
TURN-ON RISE TIME AT 230VAC 48V 10.4A CH4: 2A Div.



TURN-ON RISE TIME AT 115VAC 48V 0.0A CH4: 2A Div.



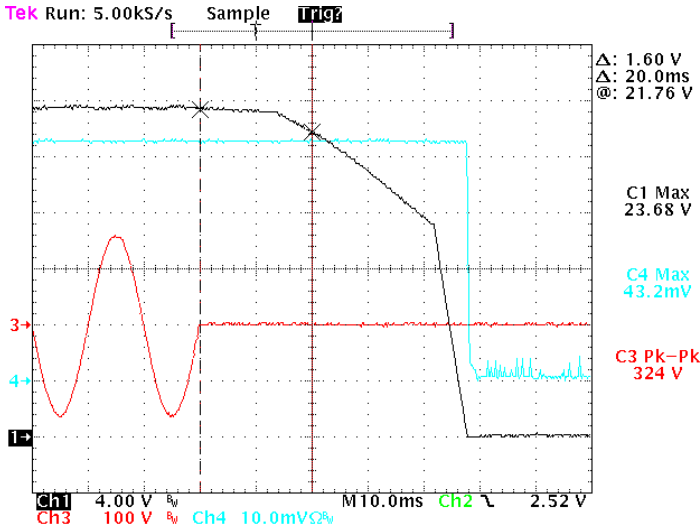
TURN-ON RISE TIME AT 230VAC 48V 0.0A CH4: 2A Div.



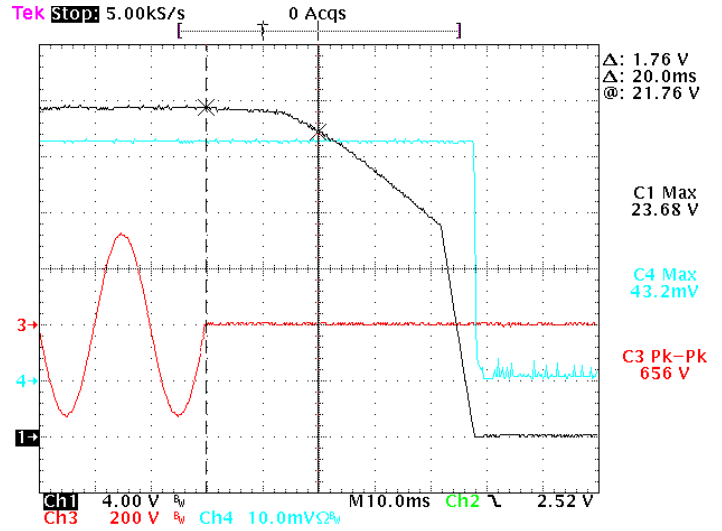


OUTPUT HOLD-UP TIME: 24V and 48V (time to Vout drops to 90% rated)

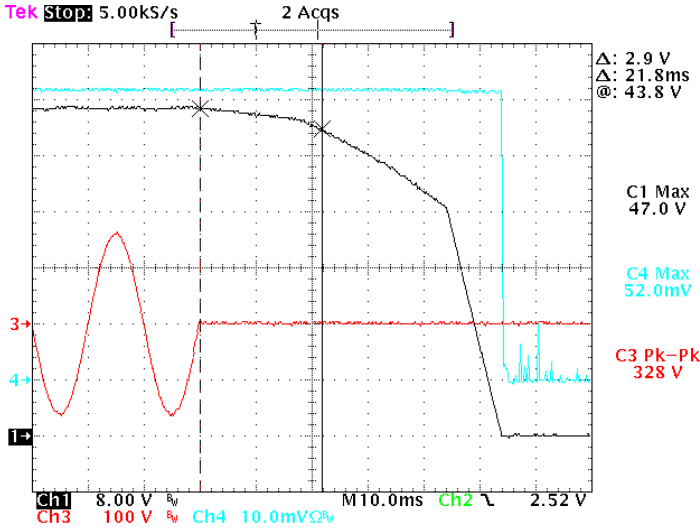
HOLD-UP TIME AT 115VAC 24V 20.8A CH4: 5A Div.



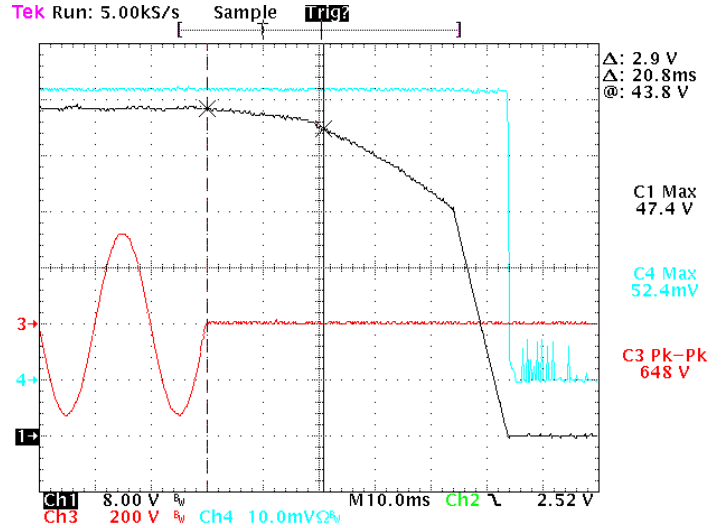
HOLD-UP TIME AT 230VAC 24V 20.8A CH4: 5A Div.



HOLD-UP TIME AT 115VAC 48V 10.4A CH4: 2A Div.



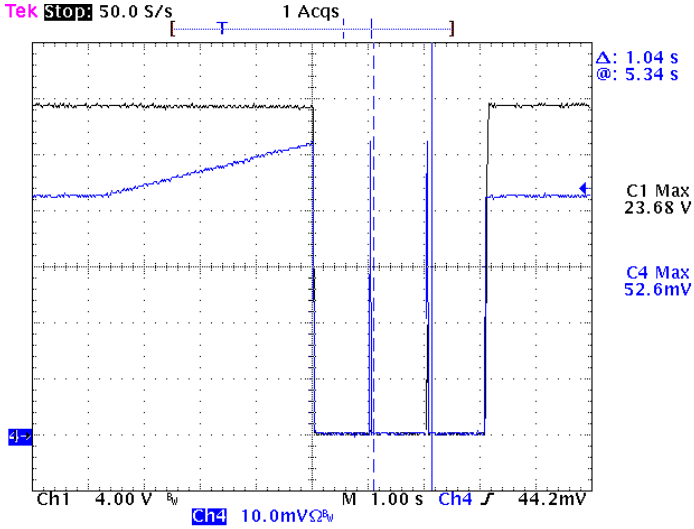
HOLD-UP TIME AT 230VAC 48V 10.4A CH4: 2A Div.



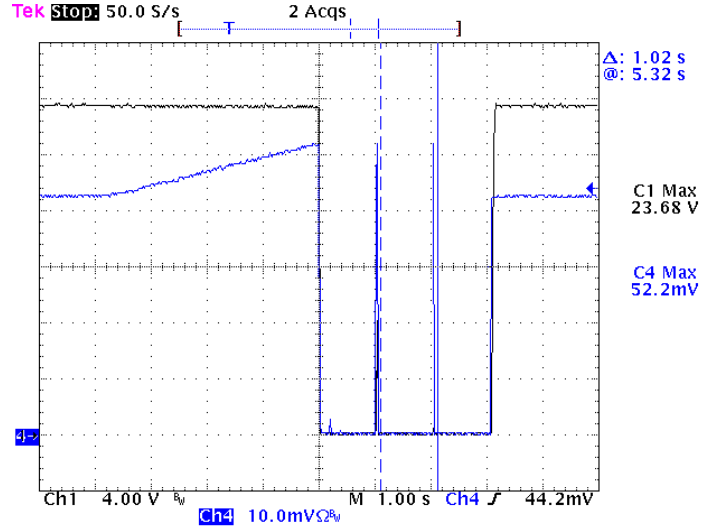


OVERLOAD PROTECTION: 24V (Hiccup Mode)

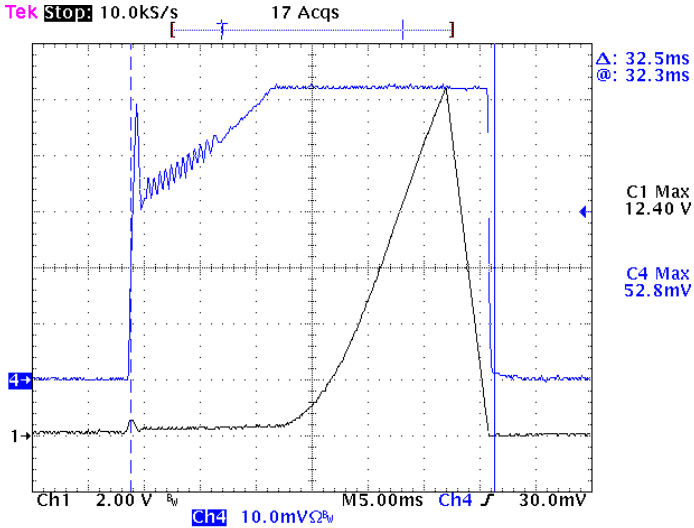
LE500S24 OVERLOAD AT 115VAC 24V 26A CH4: 5A Div.



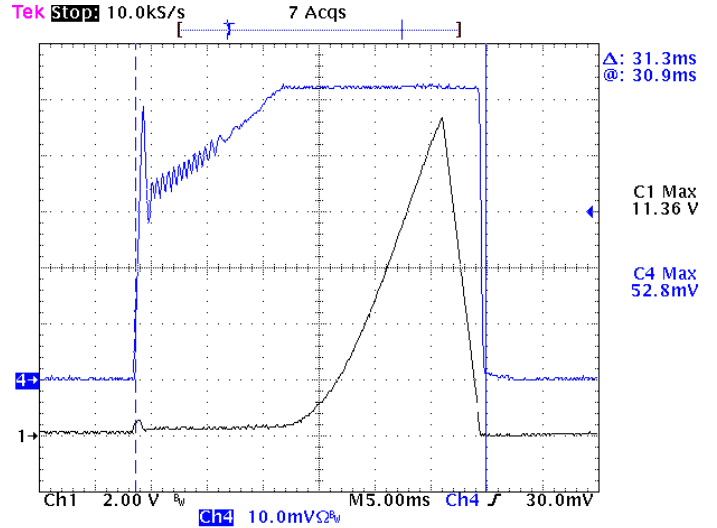
LE500S24 OVERLOAD AT 230VAC 24V 26A CH4: 5A Div.



LE500S24 OVERLOAD HICC-UP DUTY AT 115VAC 24V 26A CH4: 5A Div.



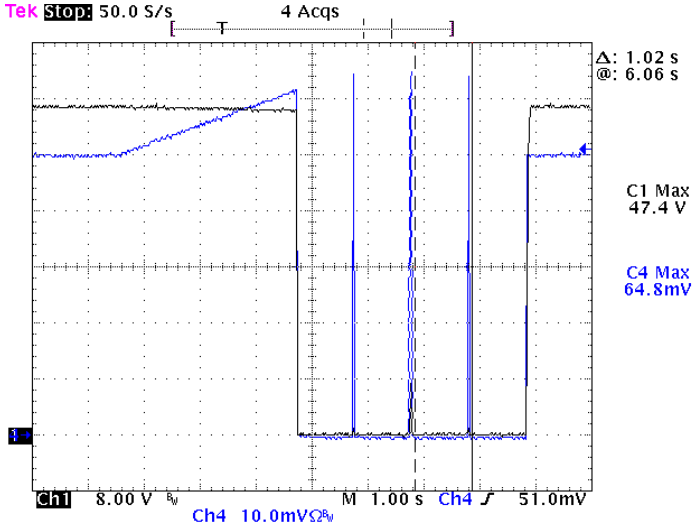
LE500S24 OVERLOAD HICC-UP DUTY AT 230VAC 24V 26A CH4: 5A Div.



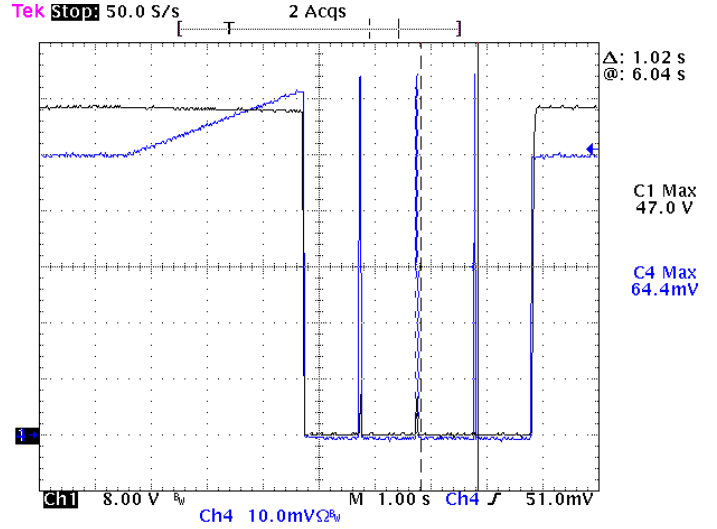


OVERLOAD PROTECTION: 48V (Hiccup Mode)

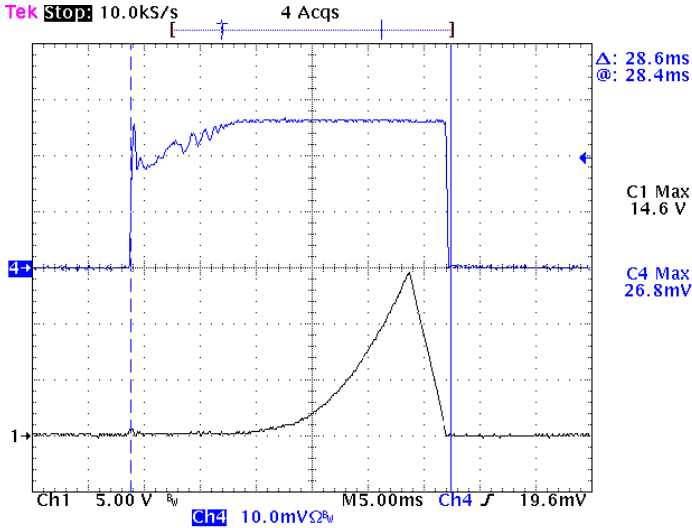
LE500S48 OVERLOAD AT 115VAC 48V 12.5A CH4: 2A Div.



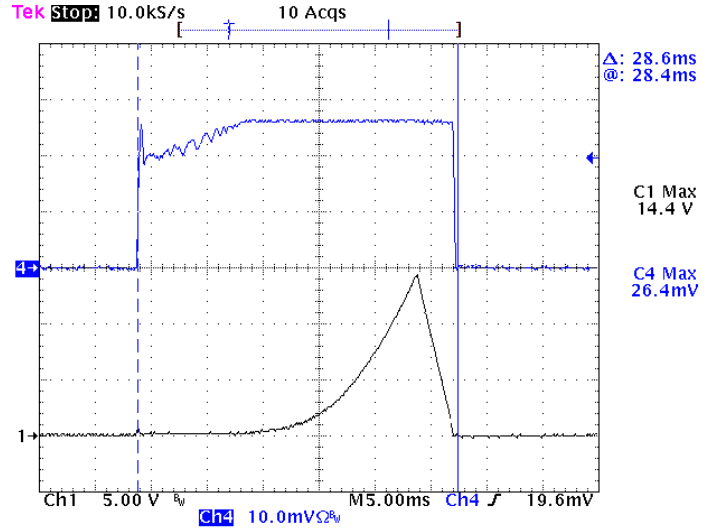
LE500S48 OVERLOAD AT 230VAC 48V 12.5A CH4: 2A Div.



LE500S48 OVERLOAD HICC-UP DUTY AT 115VAC 48V 12.5A CH4: 5A Div.



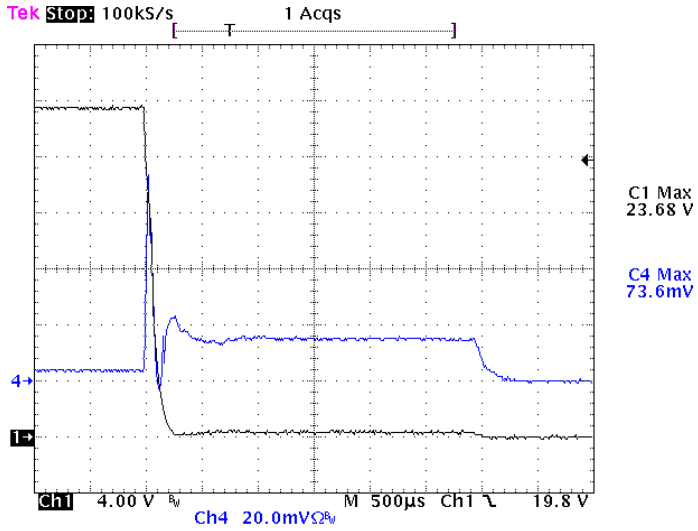
LE500S48 OVERLOAD HICC-UP DUTY AT 230VAC 48V 12.5A CH4: 5A Div.



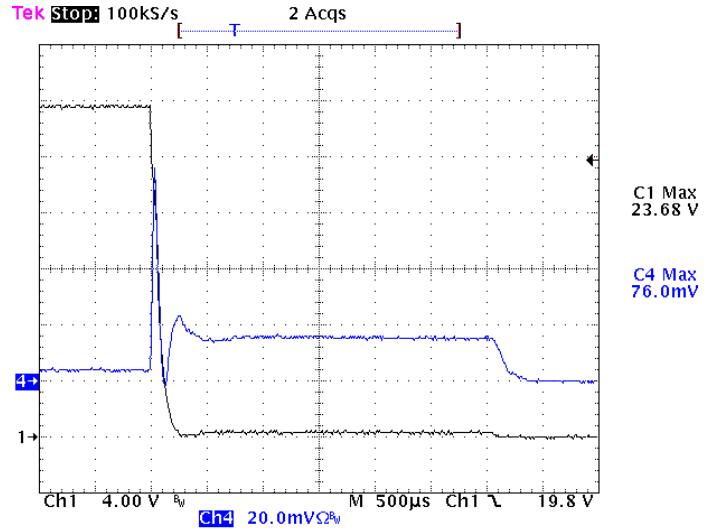


SHORT-CIRCUIT PROTECTION: 24V

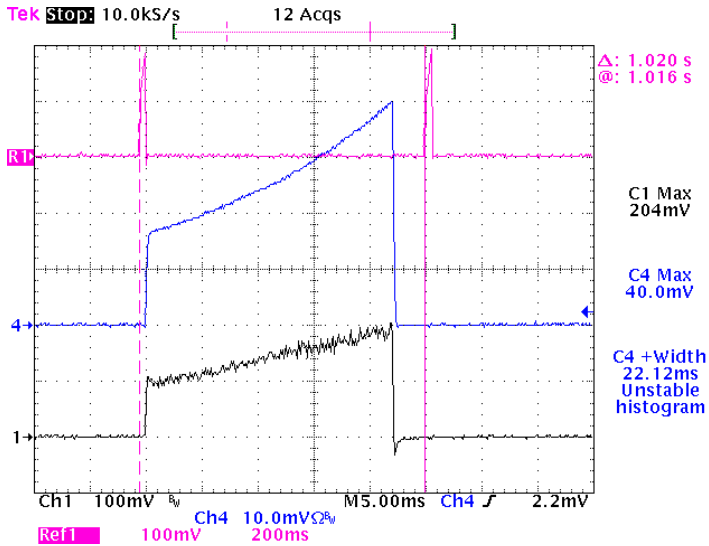
LE500S24 SHORT-CIRCUIT AT 115VAC 24V 20.8A CH4: 100A Div.



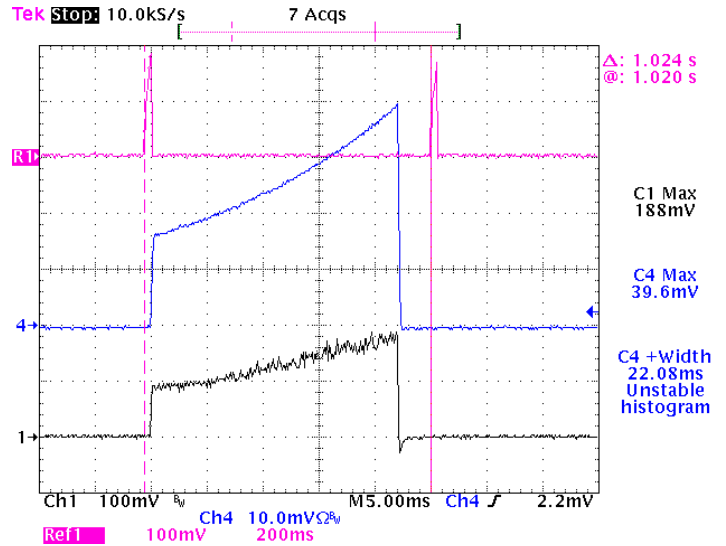
LE500S24 SHORT-CIRCUIT AT 230VAC 24V 20.8A CH4: 100A Div.



LE500S24 SHORT-CIRCUIT HICC-UP DUTY AT 115VAC 24V 20.8A CH4: 10A Div., Ref1: Hiccup Cycle



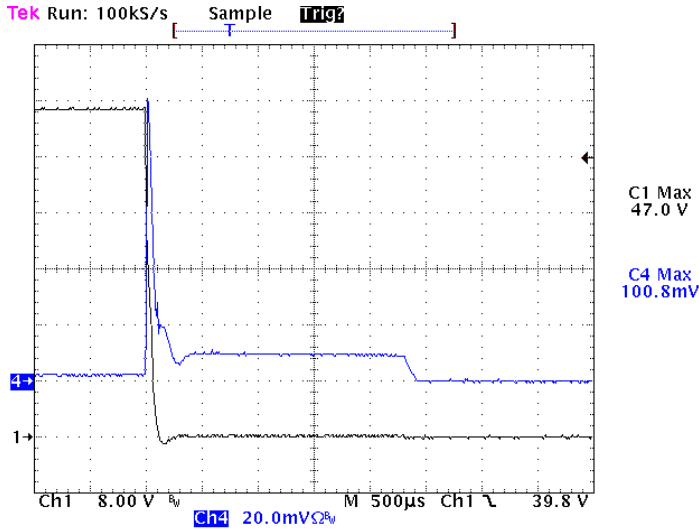
LE500S24 SHORT-CIRCUIT HICC-UP DUTY AT 230VAC 24V 20.8A CH4: 10A Div., Ref1: Hiccup Cycle



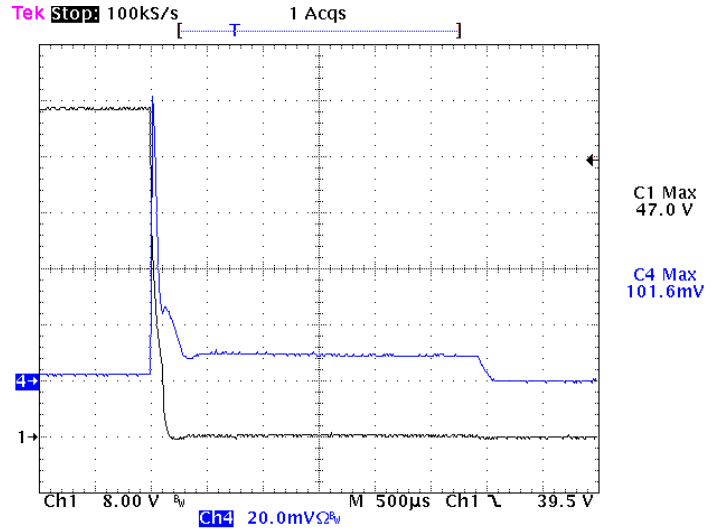


SHORT-CIRCUIT PROTECTION: 48V

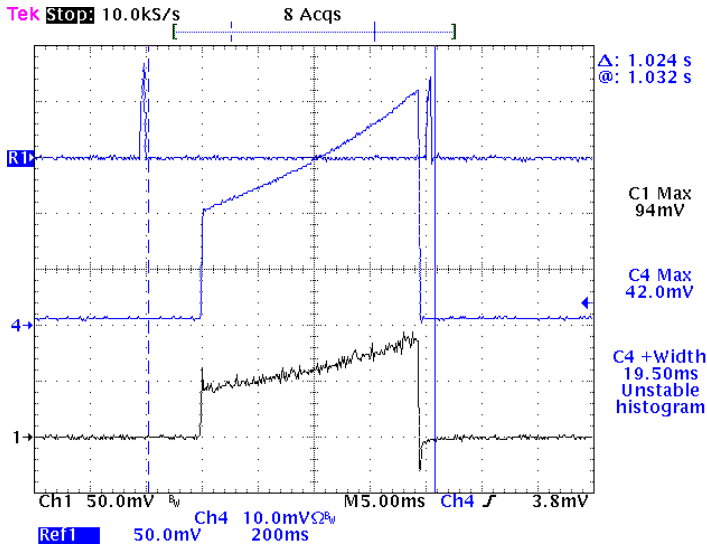
LE500S48 SHORT-CIRCUIT AT 115VAC 48V 10.4A CH4: 100A Div.



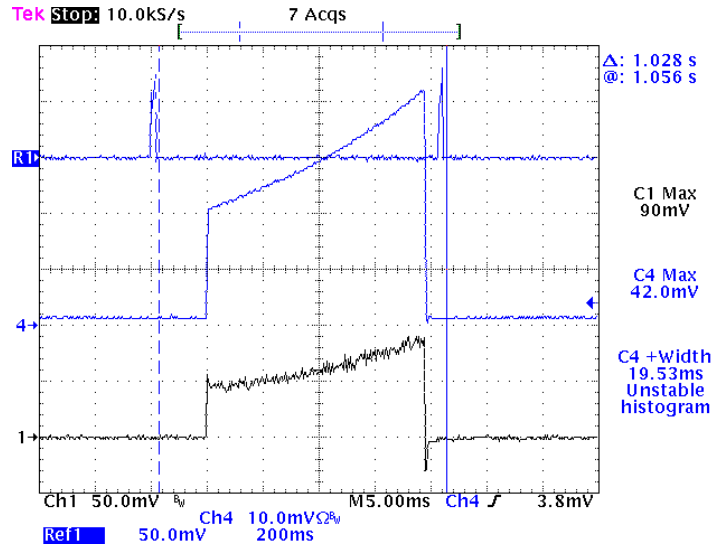
LE500S48 SHORT-CIRCUIT AT 230VAC 48V 10.4A CH4: 100A Div.



LE500S48 SHORT-CIRCUIT HICC-UP DUTY AT 115VAC 48V 10.4A CH4: 5A Div, Ref1: Hiccup Cycle



LE500S48 SHORT-CIRCUIT HICC-UP DUTY AT 230VAC 48V 10.4A CH4: 5A Div, Ref1: Hiccup Cycle



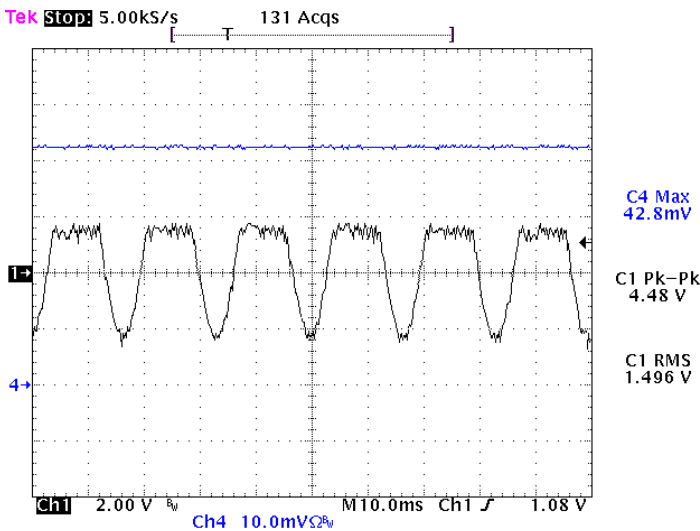


COMMON MODE NOISE

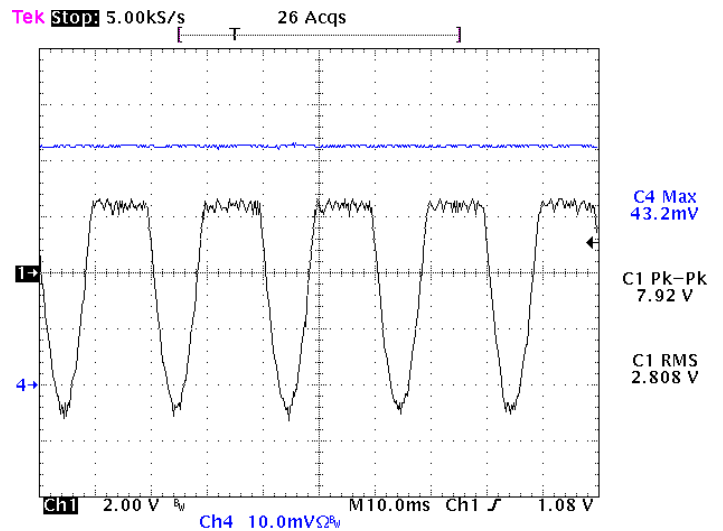
Common mode noise is an electrical signal that appears between either output and earth ground or chassis ground. This comes about due to parasitic capacitance and inductive coupling in the power supplies that couples electrical energy from the primary to the secondary or from the secondary to earth ground. Although the coupling is minimized by design and construction, it cannot easily be eliminated.

COMMON MODE NOISE: 24V

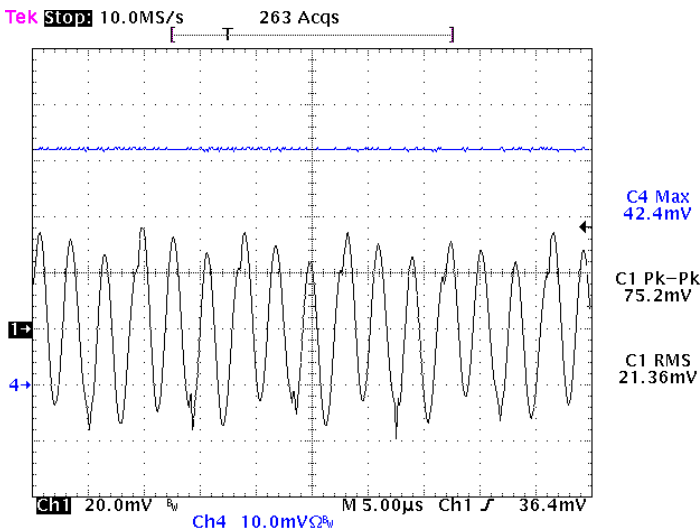
LE500S24 CM NOISE VOLTAGE AT 115VAC 24V 20.8A
CH1: 1mA Div., CH4: 5A Div.



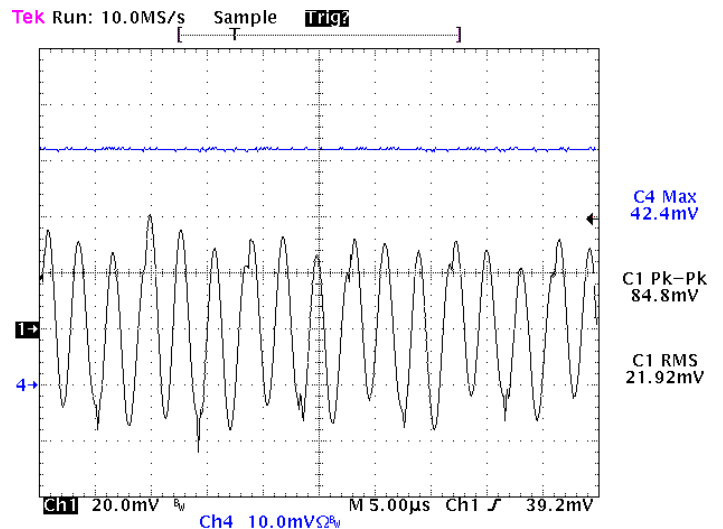
LE500S24 CM NOISE VOLTAGE AT 230VAC 24V 20.8A
CH1: 1mA Div., CH4: 5A Div.



LE500S24 CM NOISE CURRENT AT 115VAC 24V 20.8A
CH1: 1mA/1mV, CH4: 5A Div.



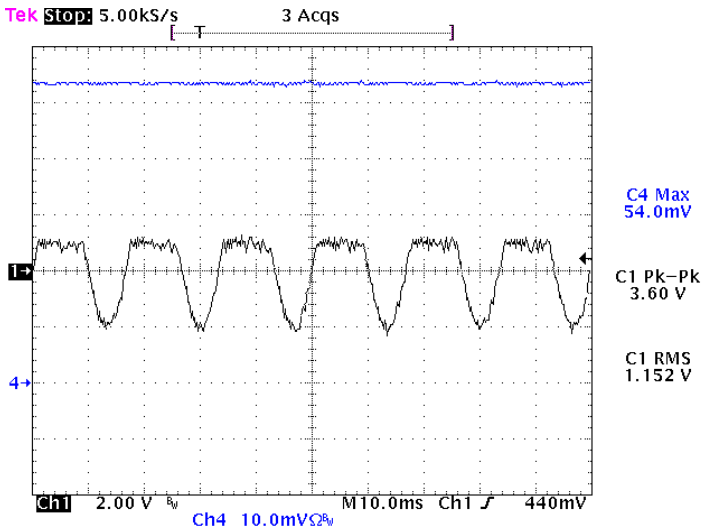
LE500S24 CM NOISE CURRENT AT 230VAC 24V 20.8A
CH1: 1mA/1mV, CH4: 5A Div.



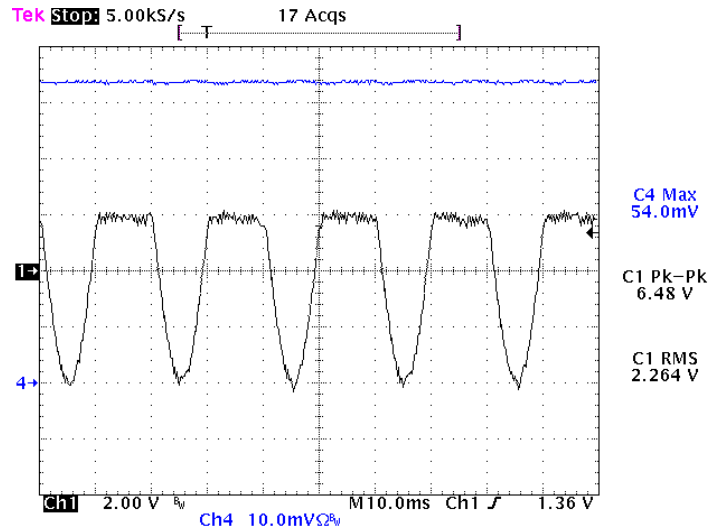


COMMON MODE NOISE: 48V

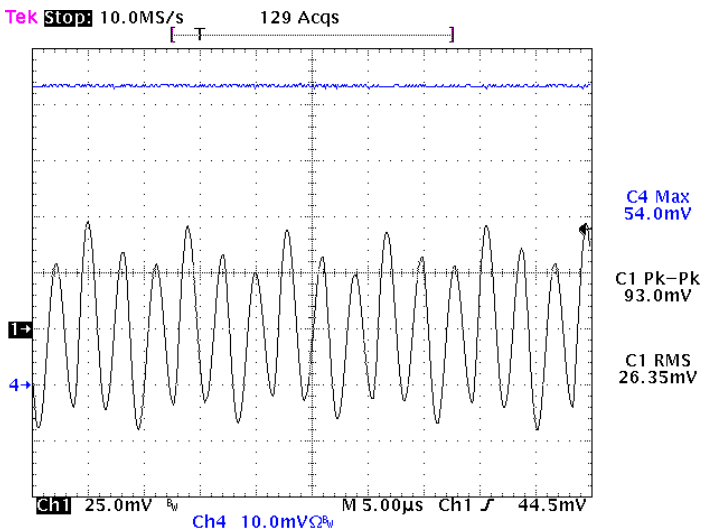
LE500S48 CM NOISE VOLTAGE AT 115VAC 48V 10.4A CH1: 1mA/1mV, CH4: 2A Div.



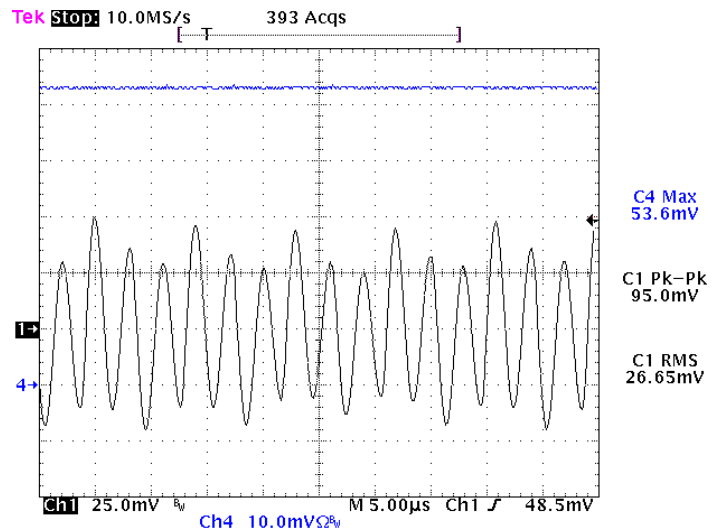
LE500S48 CM NOISE VOLTAGE AT 230VAC 48V 10.4A CH1: 1mA/1mV, CH4: 2A Div.



LE500S48 CM NOISE CURRENT AT 115VAC 48V 10.4A CH1: 1mA Div., CH4: 2A Div.



LE500S48 CM NOISE CURRENT AT 230VAC 48V 10.4A CH1: 1mA Div., CH4: 2A Div.

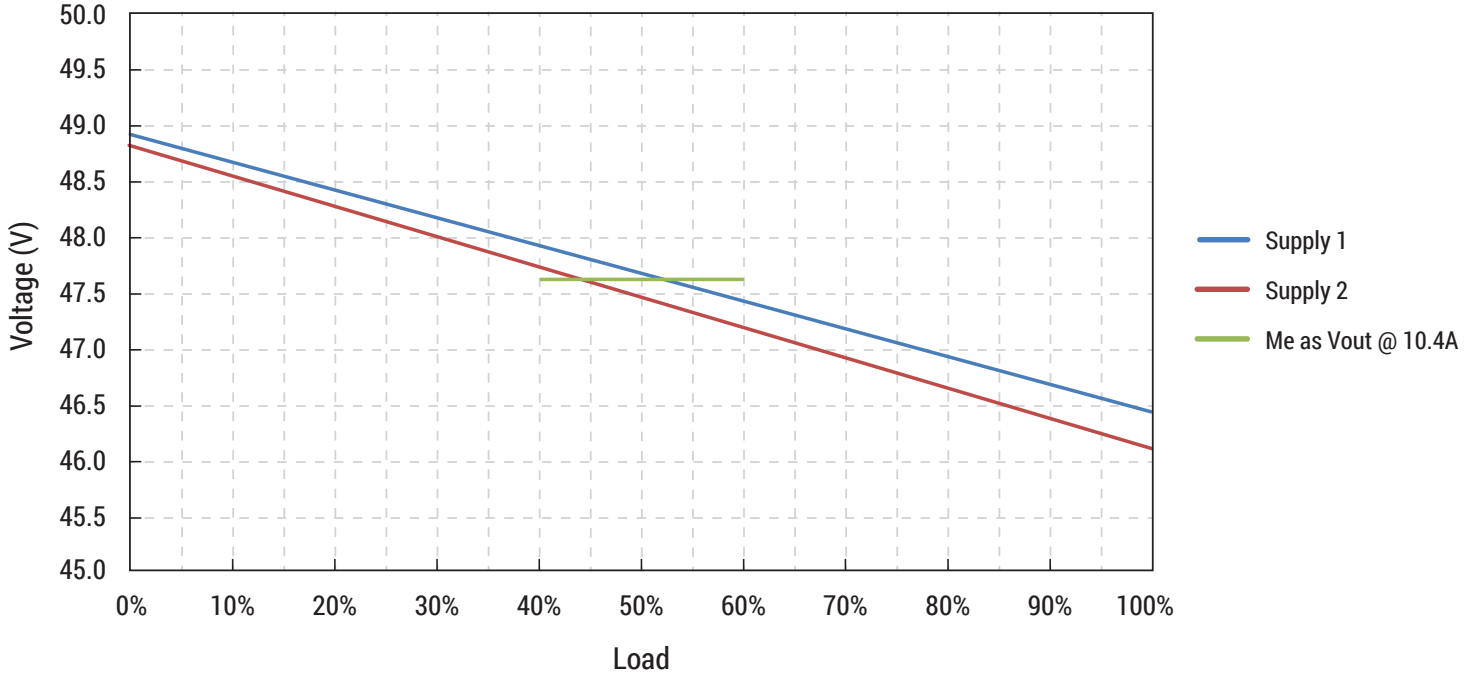




DROOP SHARING

LE500 series has droop sharing capability for easy scalability for high power application. Using a single SKU will reduce the total cost of ownership. The graph shows two power supplies with different voltage slopes and setpoint due to component tolerances being used to share current.

Voltage vs Load



When two power supplies were connected in parallel to share 10.4 A of current, measured voltage was 47.6V and measured current on supply 1 was 5.56A and supply 2 was 4.81A.

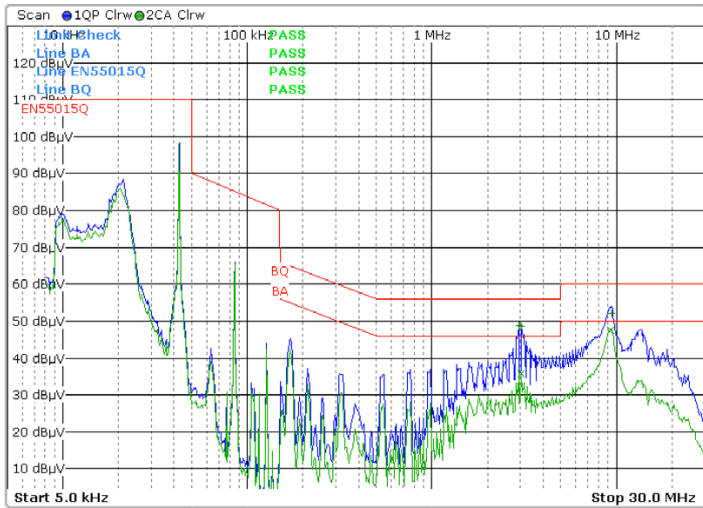


CONDUCTED EMISSION

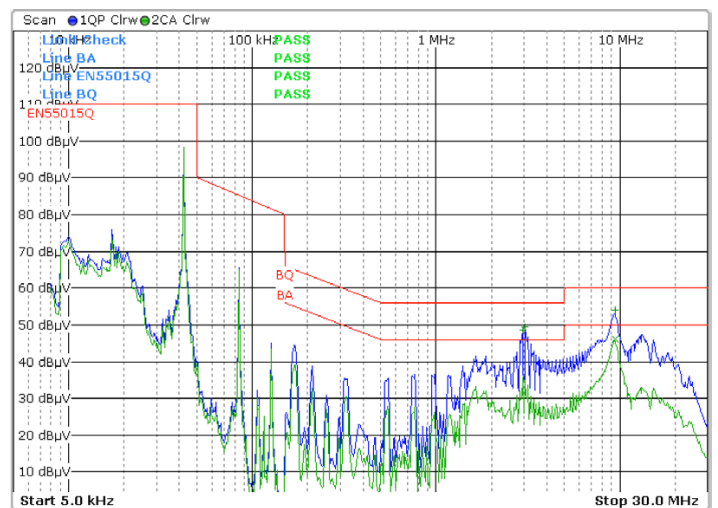
EMI Plots were collected at 10% and 100% loads, 120VAC/60Hz and 240VAC/50 Hz. The Curves are Quasi-peak (QP) and average measurements. The QP and average value point data are not shown in these plots but detailed EMI reports are available upon request. Plots below shows that LE500 series passed EN55015 Class B limits shown in red.

CONDUCTED EMISSION: 24V

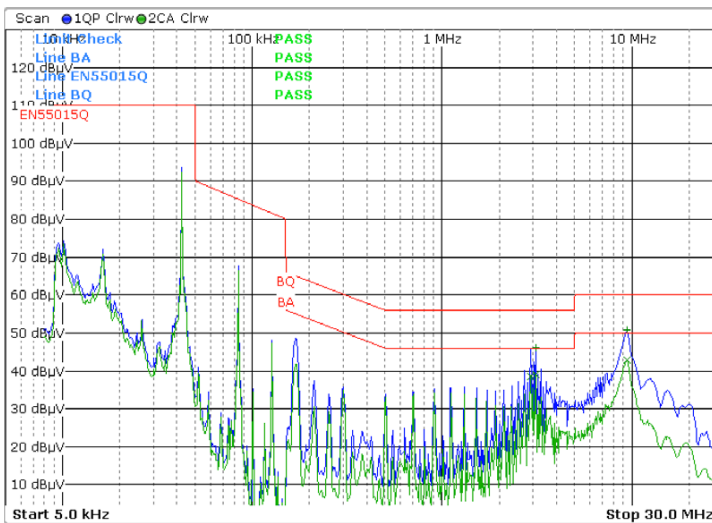
CE Quasi Peak & Average 100% Load 120V/60Hz 24V 20.8A



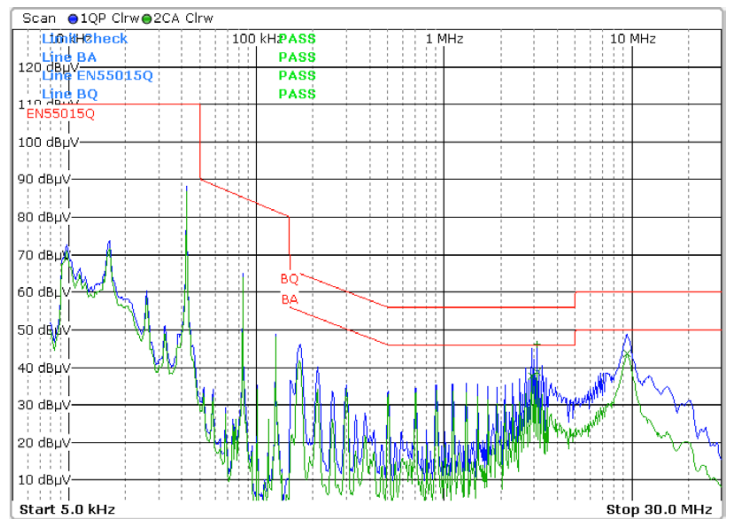
CE Quasi Peak & Average 100% Load 240V/60Hz 24V 20.8A



CE Quasi Peak & Average 10% Load 120V/60Hz 24V 2.1A



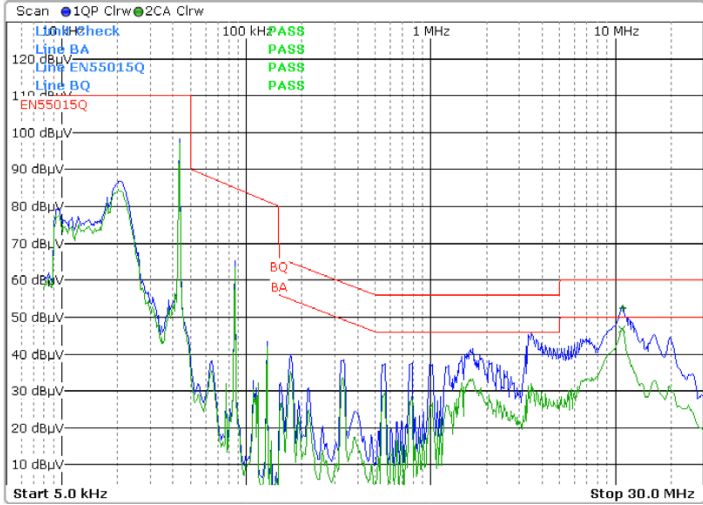
CE Quasi Peak & Average 10% Load 240V/60Hz 24V 2.1A



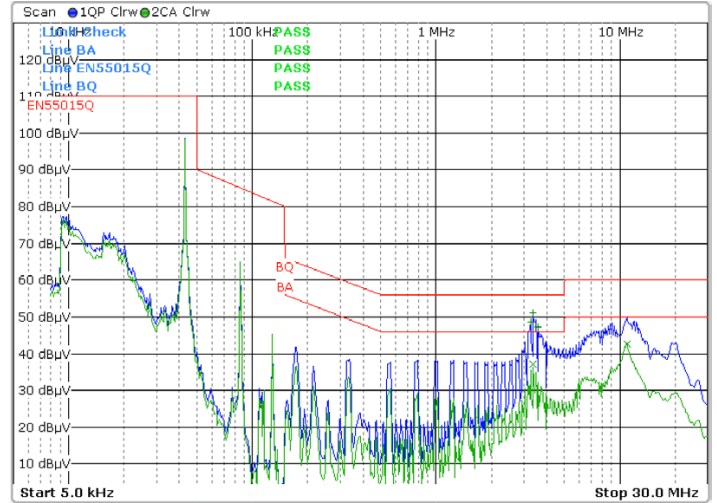


CONDUCTED EMISSION: 48V

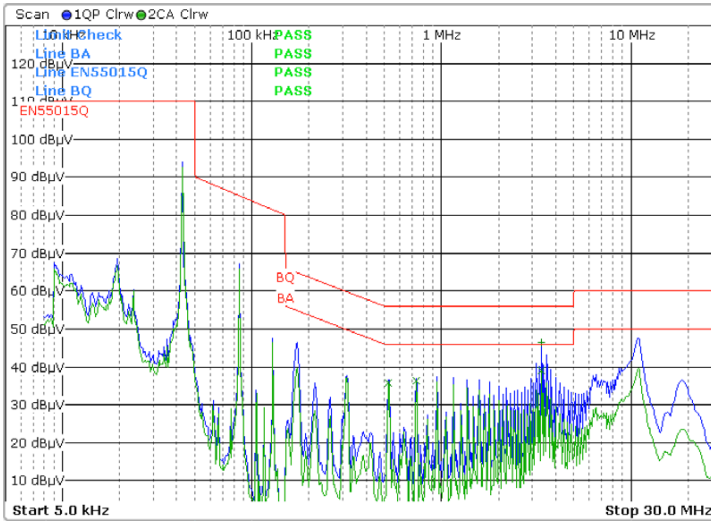
CE Quasi Peak & Average 100% Load 120V/60Hz 48V 10.4A



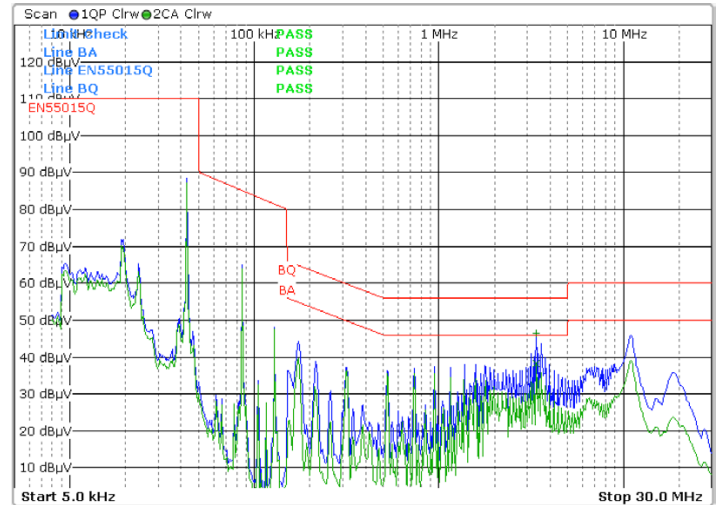
CE Quasi Peak & Average 100% Load 240V/60Hz 48V 10.4A



CE Quasi Peak & Average 10% Load 120V/60Hz 48V 1A



CE Quasi Peak & Average 10% Load 240V/60Hz 48V 1A





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