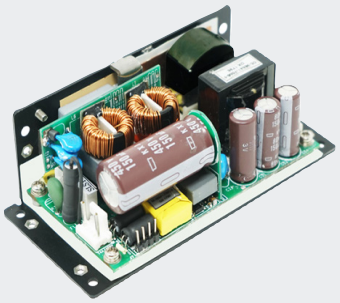
APPLICATION NOTE

SL POWER LU225 SERIES

225 Watts Single Output
LED & Industry Grade



LED

Industrial

Advanced Energy's SL Power LU225 Family of internal LED power supplies is a superior performance 150-225 Watts (depending on cooling mode), ~ 2” x 4” platform AC to DC power supply designed to ensure easy integration into LED lighting applications. This power supply is most suited for low noise applications where conduction cooling is preferred. It has a universal AC input range of 90 to 305 VAC. Highly efficient, the LU225 product family has ultra-low no load power consumption of 0.5W for high efficiency power applications. All models are CE marked to low voltage directive and approved to safety standard EN60950-1 2nd edition and UL8750.This family of products come in a compact size and has industry leading grams per watt weight to power ratio. 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 LU225 families’ AC mains emissions comply with FCC class B & EN55015 (EN55032) Class B 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.

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PROPER USE

The LU225 power supplies have high power conversion efficiency and can be attached to a heat sink or cold plate, however they do rely on 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 proper thermal performance of the power supply.

- Use mounting holes provided on the either on the side (model ending K) or bottom (model ending KL) of the power supply to mount a stable surface.
- The supply should be mounted to a conductive surface for proper EMI/EMC performance.
- The supply can be mounted directly to a heat sink.
- Proper bonding to the end-product main protective earthing termination is required.
- For Class I input applications, the chassis must be bonded to protective earth in the end product. Using the earth terminal for the end product protective earthing is not recommended and a separate dedicated bonding conductor and suitable termination should be used to connect the chassis to the end product protective earth.
- Ensure mounting holes are isolated from ground for Class II input applications.
- Use a proper mating connectors for connection to the input, output and signal connectors of the power supply.
- Do not exceed the power rating of the product.

CONNECTOR INFORMATION

Connector	Pin Assignment		Mating Connector
J1 (Input connector)	PIN 1	AC Line	MATING CONNECTOR Tyco/AMP 640250-3 Terminals: 3-640252-1
	PIN 2	Empty	
	PIN 3	AC Neutral	
J3 (Output connector)	PIN 1	-Vout	MATING CONNECTOR AMP 640250-6 Terminals: 3-640252-1
	PIN 2	-Vout	
	PIN 3	-Vout	
	PIN 4	+Vout	
	PIN 5	+Vout	
	PIN 6	+Vout	

ORDERING INFORMATION

Model Number[1]	Output Voltage	Output Current (w/200LFM air)	Output Current (Conduction)	Output Current (Convection)	Ripple & Noise	Total Regulation	OVP Threshold
LU225S12K	12 V	17.5 A	13.3 A	11.67A	1%	±2%	14.1±1.0 Vdc
LU225S24K	24 V	9.38 A	7.50 A	6.25A	1%	±2%	27.6±1.0 Vdc
LU225S36K	36 V	6.25 A	5.00 A	4.16A	1%	±2%	39.8±1.0 Vdc
LU225S48K	48 V	4.69 A	3.75 A	3.125A	1%	±2%	55.2±2.0 Vdc
LU225S56K	56 V	4.00 A	3.2 A	2.68A	1%	±2%	64.3±2.0 Vdc

Notes:
1. Replace K in the model number with KL for top mount Version. Example: LU225S56KL.

PERFORMANCE DATA

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

Efficiency

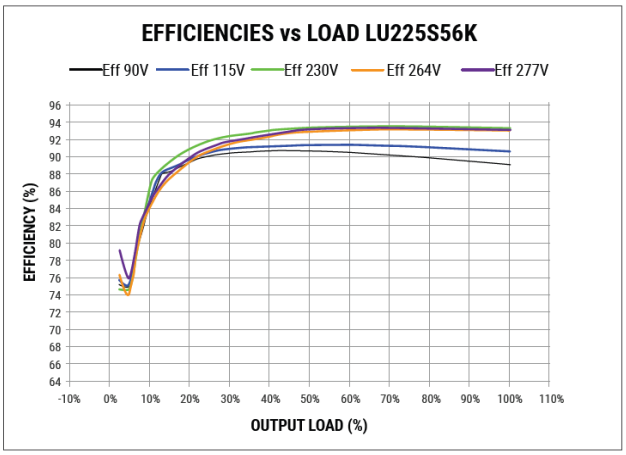

Fig. 1: EFFICIENCIES vs LOAD LU225S56K

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 long product life. SL Power Electronics uses only high quality electrolytic capacitors in its LU225 model family resulting in an expected cap life of 100,000 hours at 50°C @225 Watts with 200LFM/50,000 hours at 50°C at 180 Watts conduction. Calculations and measurements are performed to verify capacitor ripple current, voltage and thermal stress and life time estimations. Contact SL Power for information on other use profiles. Maximum power wattage provided for various condition is given below in the table.

Ambient Temperature	Cooling Method	Max Wattage
50°C	Forced Air, 200 LFM	225
60°C	Forced Air, 200 LFM	190
70°C	Forced Air, 200 LFM	160
50°C with Max. Temperature of heat-sink to be held under TBD°C	Conduction	180
60°C with Max. Temperature of heat-sink to be held under TBD°C	Conduction	165
50°C	Conduction	140

PERFORMANCE DATA

AC INRUSH CURRENT

The AC input inrush current (cold start power on) is limited to less 15A. 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.

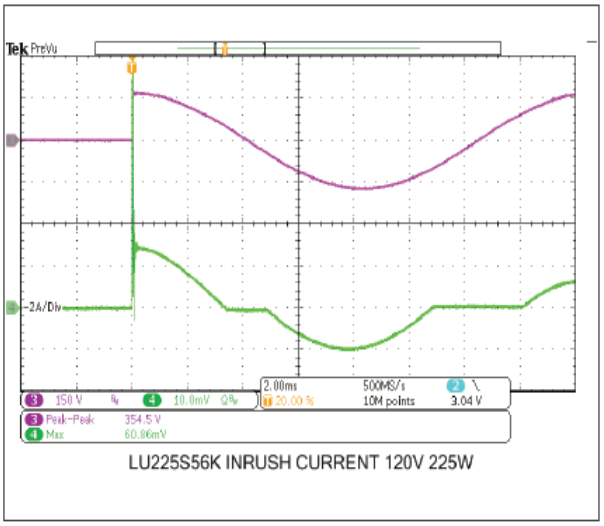

Fig. 2: INRUSH CURRENT AT 120VAC 56V 4A – CH4: 2A Div.

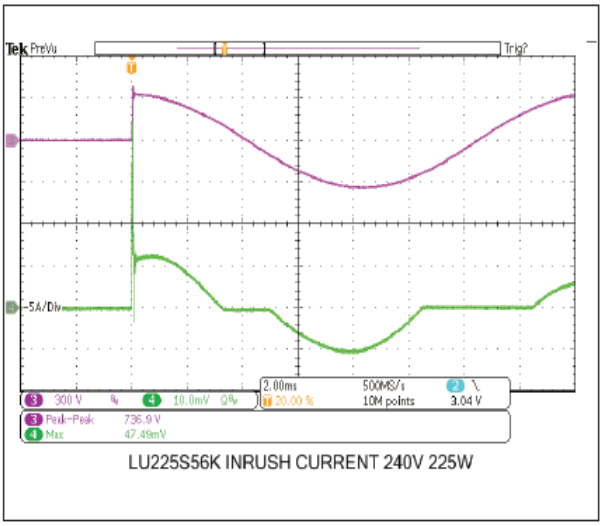

Fig. 3: INRUSH CURRENT AT 240VAC 56V 4A – CH4: 5A Div.

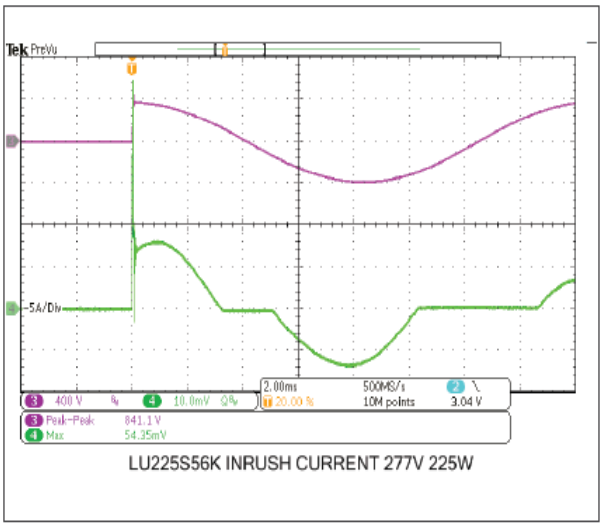

Fig. 4: INRUSH CURRENT AT 277VAC 56V 4A – CH4: 5A Div.

PERFORMANCE DATA

TURN-ON DELAY TIME

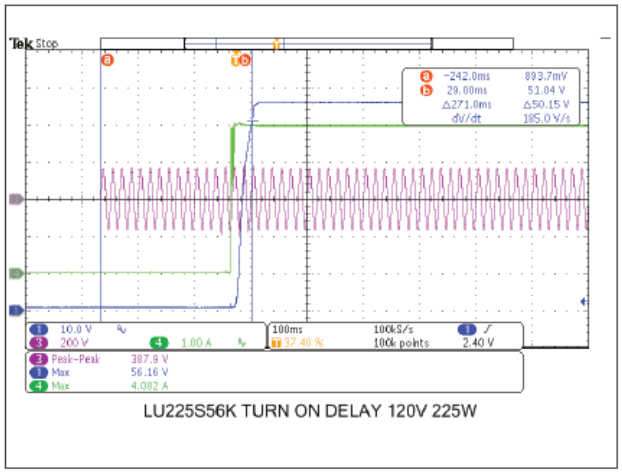

Fig. 5: TURN-ON DELAY AT 120VAC 56V 4A – CH4: 1A Div.

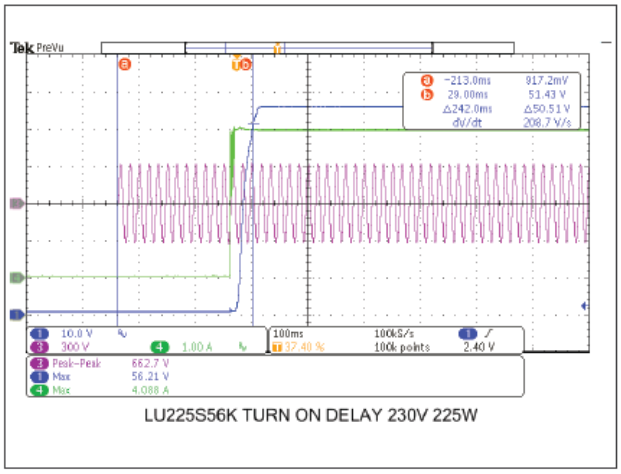

Fig. 6: TURN-ON DELAY AT 230VAC 56V 4A – CH4: 1A Div.

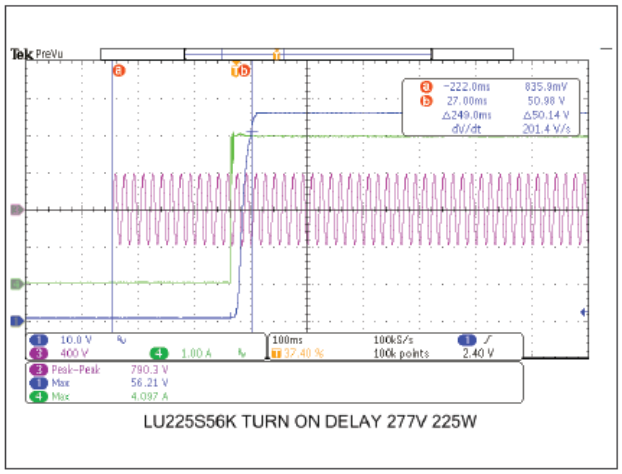

Fig. 7: TURN-ON DELAY AT 277VAC 56V 4A – CH4: 1A Div.

PERFORMANCE DATA

OUTPUT TURN-ON RISE TIME

Constant current load

No load

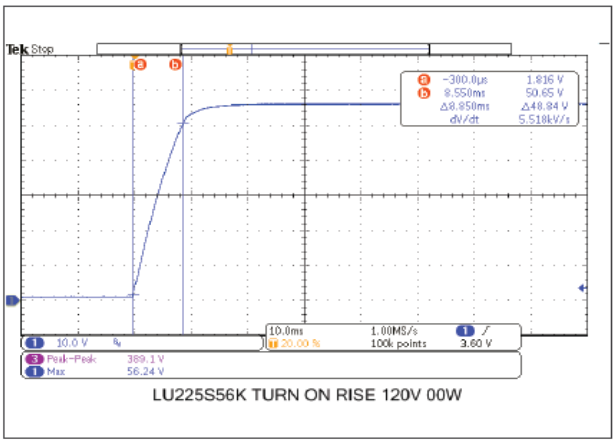

Fig. 8: TURN-ON RISE TIME AT 120VAC 56V 0A

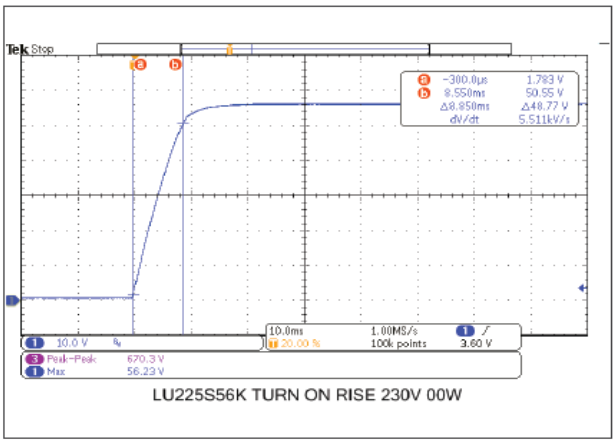

Fig. 9: TURN-ON RISE TIME AT 230VAC 56V 0A

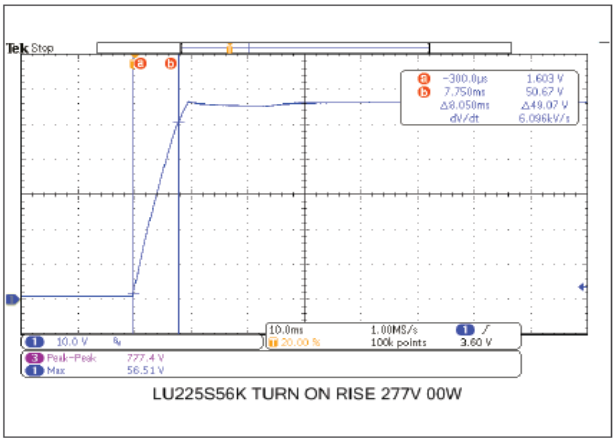

Fig. 10: TURN-ON RISE TIME AT 277VAC 56V 0A

PERFORMANCE DATA

OUTPUT TURN-ON RISE TIME

IMax load

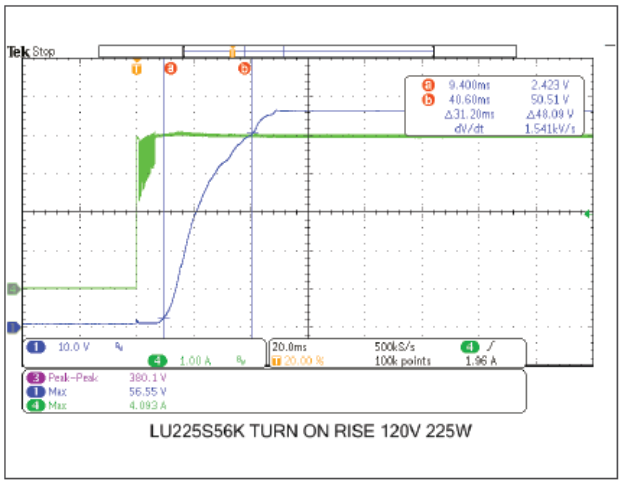

Fig. 11: TURN-ON RISE TIME AT 120VAC 56V 4A – CH4: 1A Div.

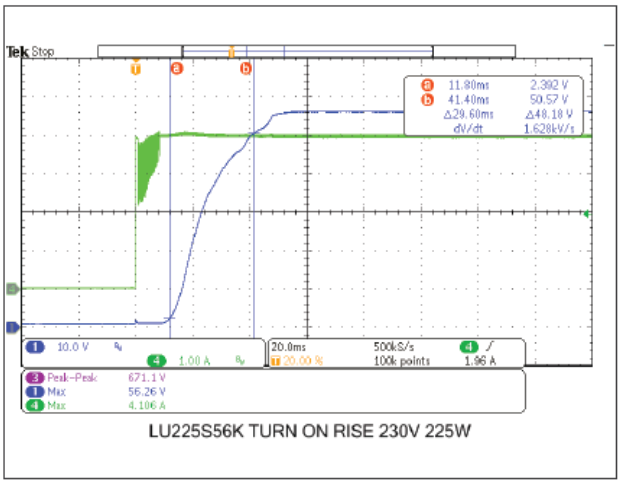

Fig. 12: TURN-ON RISE TIME AT 230VAC 56V 4A – CH4: 1A Div.

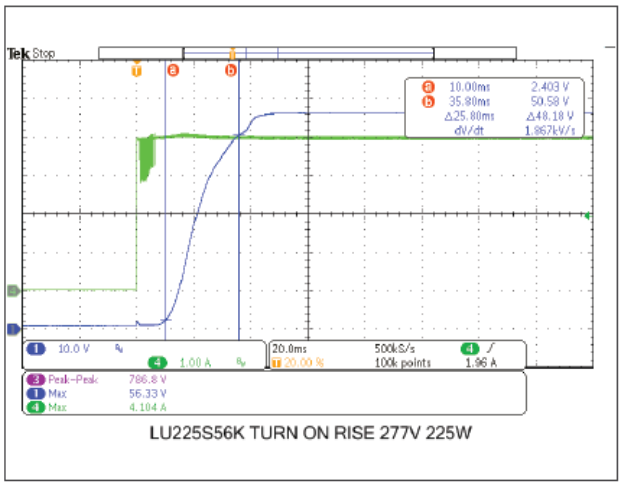

Fig. 13: TURN-ON RISE TIME AT 277VAC 56V 4A – CH4: 1A Div.

PERFORMANCE DATA

OUTPUT HOLD-UP TIME

Time to Vout drops to 90% rated

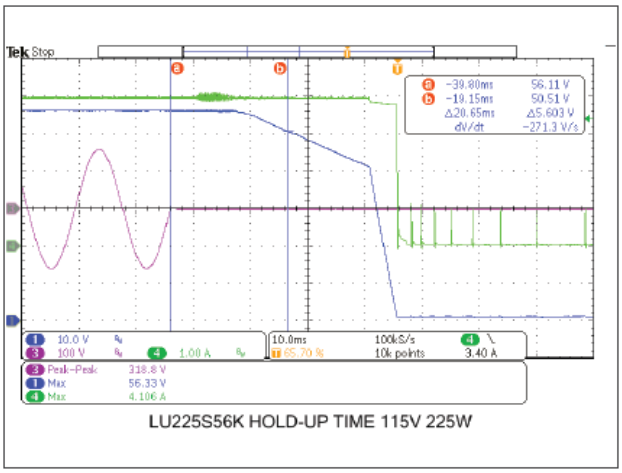

Fig. 14: HOLD-UP TIME AT 115VAC 56V 4A – CH4: 1A Div.

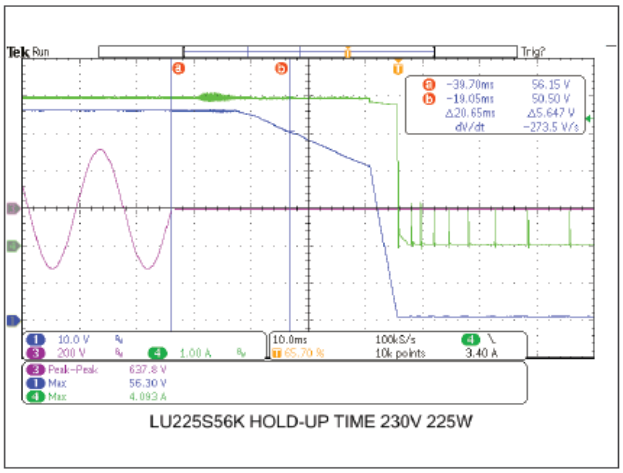

Fig. 15: HOLD-UP TIME AT 230VAC 56V 4A – CH4: 1A Div.

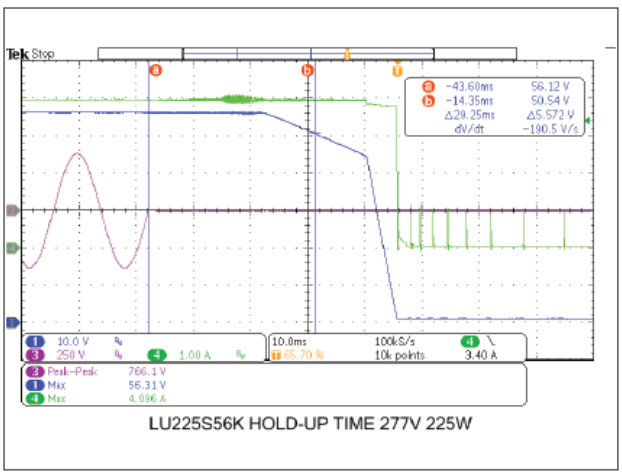

Fig. 16: HOLD-UP TIME AT 277VAC 56V 4A – CH4: 1A Div.

PERFORMANCE DATA

OVERLOAD PROTECTION

Hiccup mode

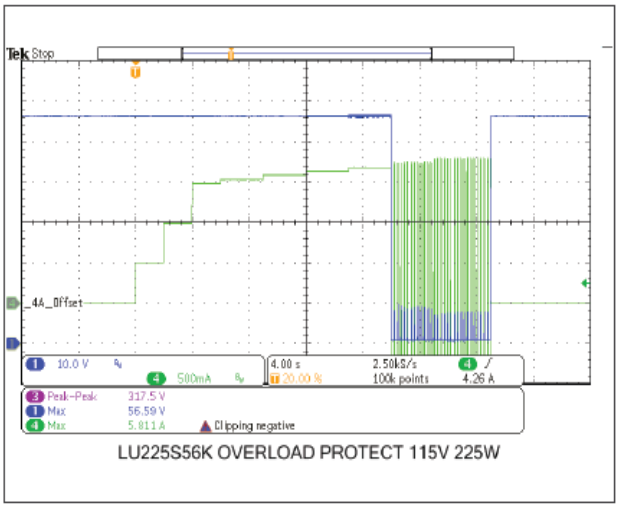

Fig. 17: OVERLOAD AT 115VAC 56V 4A – CH4: 0.5A Div.

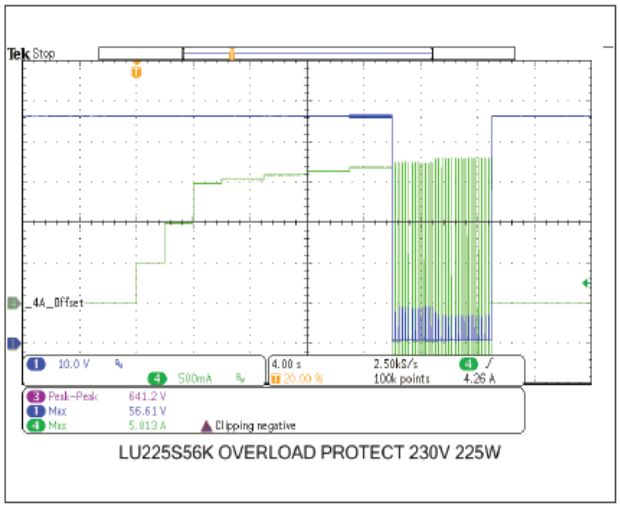

Fig. 18: OVERLOAD AT 230VAC 56V 4A – CH4: 0.5A Div.

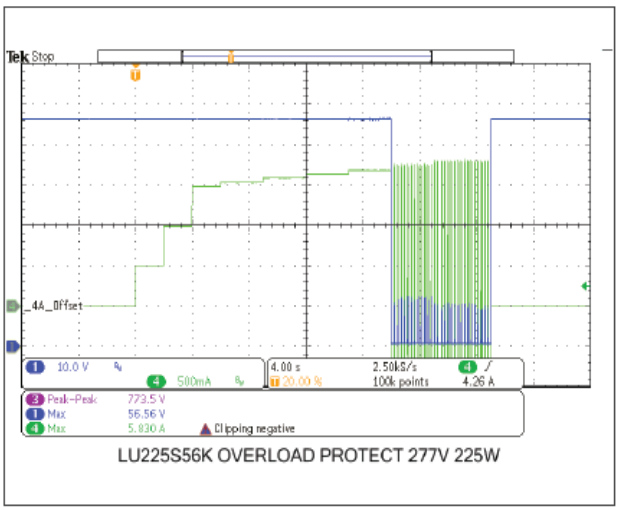

Fig. 19: OVERLOAD AT 277VAC 56V 4A – CH4: 0.5A Div.

PERFORMANCE DATA

SHORT-CIRCUIT PROTECTION

Initial event/ Initial short circuit response

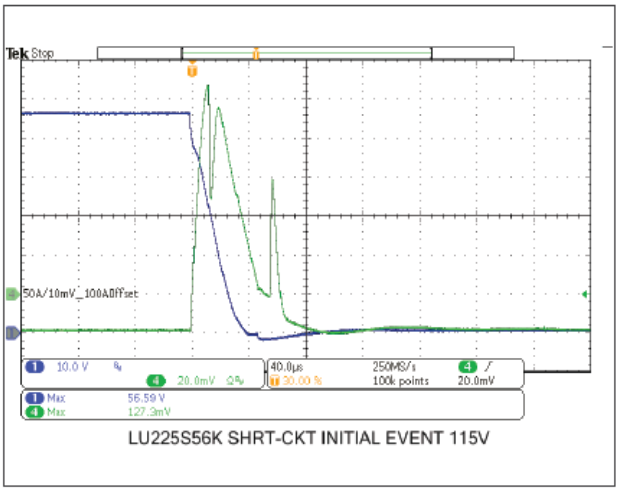

Fig. 20: SHORT-CIRCUIT AT 115VAC 56V 4A – CH4: 50A Div.

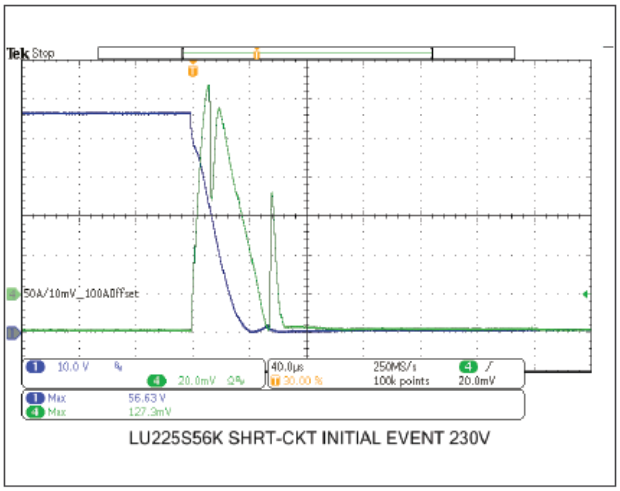

Fig. 21: SHORT-CIRCUIT AT 230VAC 56V 4A – CH4: 50A Div.

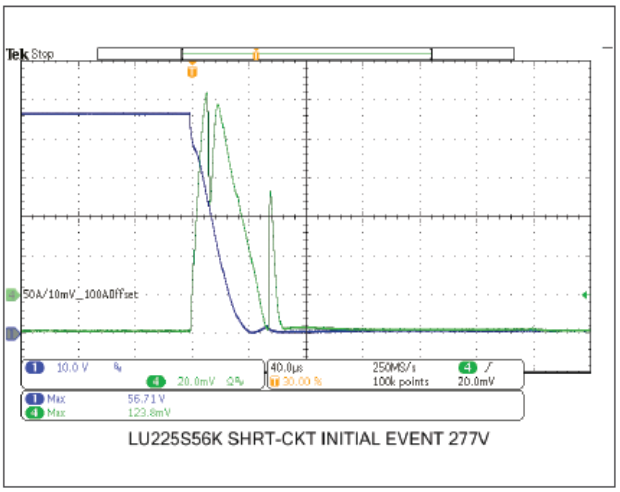

Fig. 22: SHORT-CIRCUIT AT 277VAC 56V 4A – CH4: 50A Div.

PERFORMANCE DATA

SHORT-CIRCUIT PROTECTION

Initial event/ Initial short circuit responseRecovery

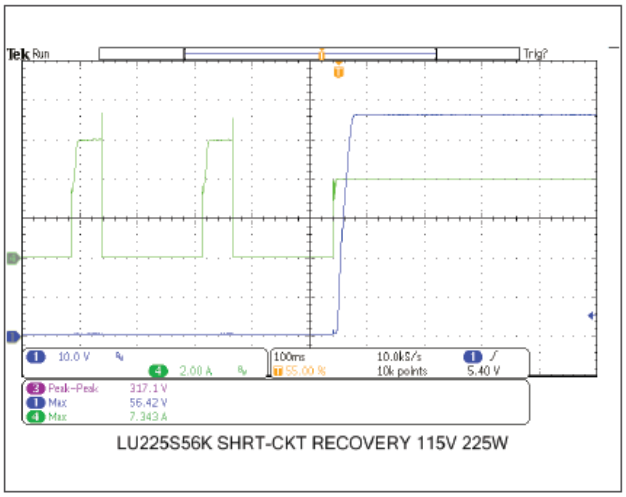

Fig. 23: SHORT-CIRCUIT AT 115VAC 56V 4A – CH4: 2A Div.

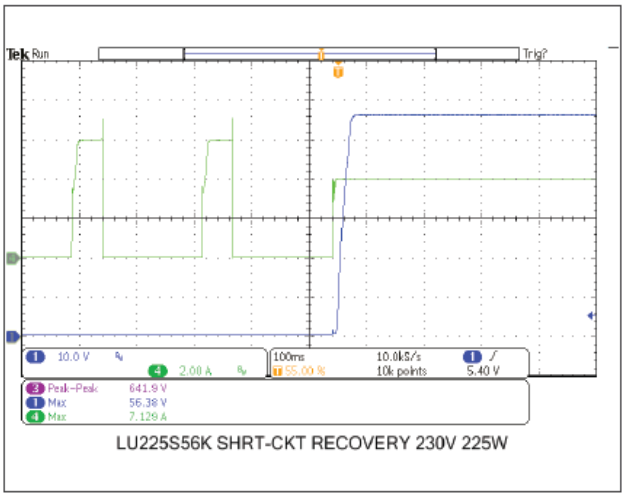

Fig. 24: SHORT-CIRCUIT AT 230VAC 56V 4A – CH4: 2A Div.

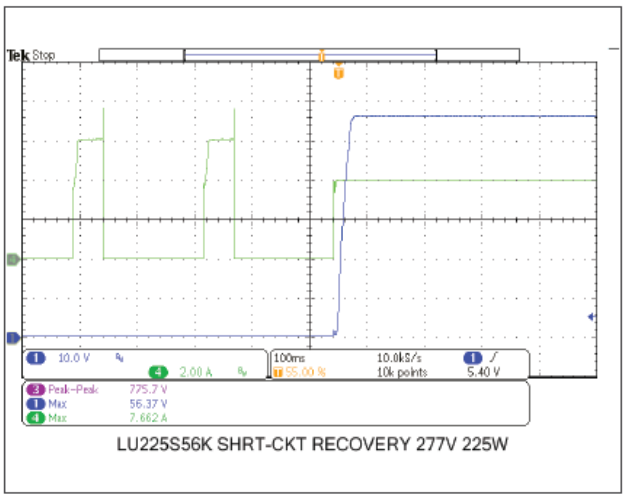

Fig. 25: SHORT-CIRCUIT AT 277VAC 56V 4A – CH4: 3A Div

PERFORMANCE DATA

COMMON MODE NOISE

Common Mode Noise is 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 supply 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 Current Noise measured with the output return connected to Earth Ground

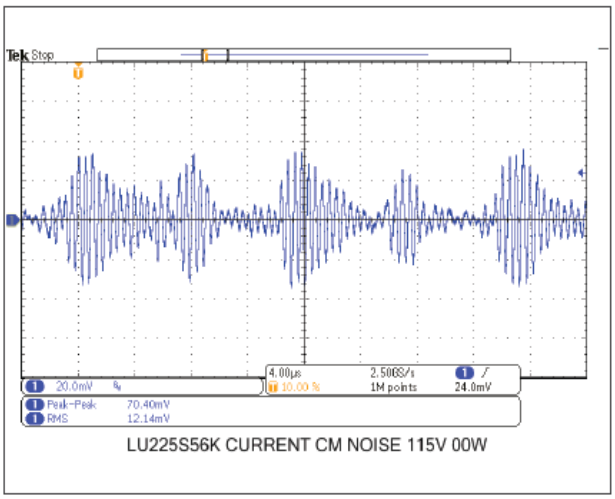

Fig. 26: CM NOISE CURRENT AT 115VAC 56V 0A, – CH1 1mA/1mV

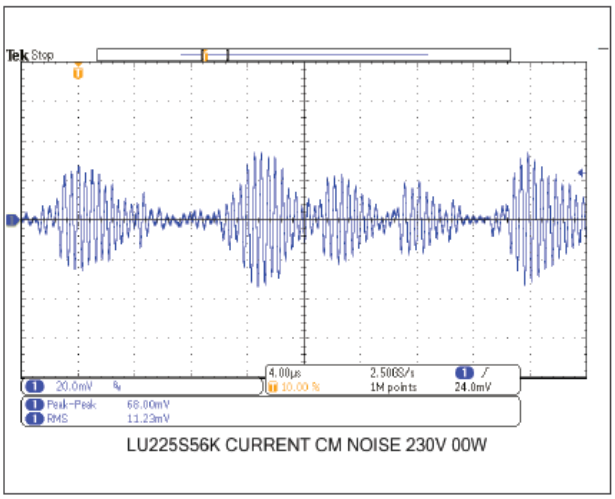

Fig. 27: CM NOISE CURRENT AT 230VAC 56V 0A, – CH1 1mA/1mV

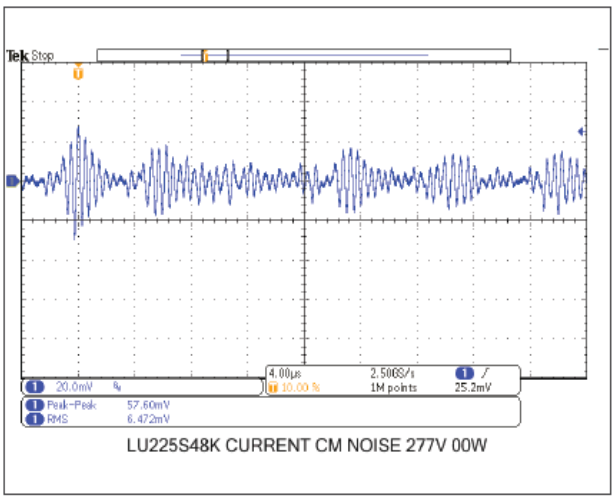

Fig. 28: CM NOISE CURRENT AT 277VAC 56V 0A, – CH1 1mA/1mV

PERFORMANCE DATA

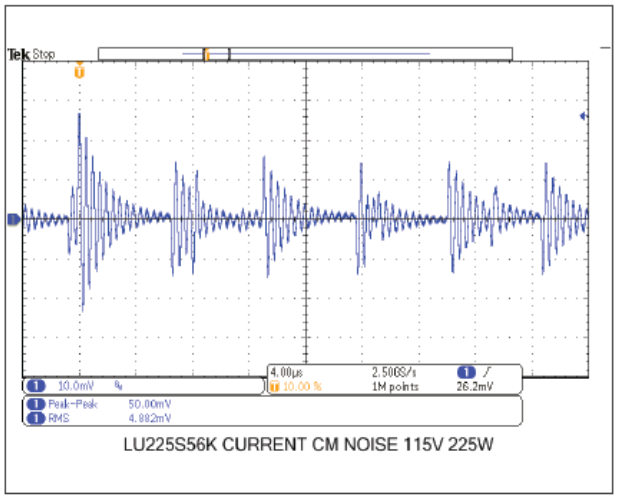

Fig. 29: CM NOISE VOLTAGE AT 115VAC 56V 4A, – CH1 1mA/1mV

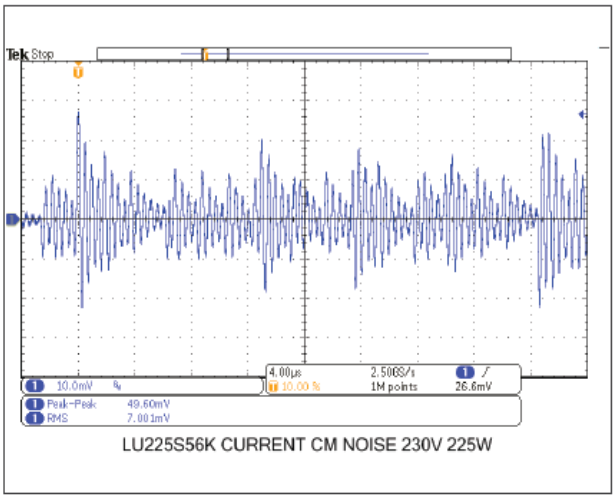

Fig. 30: CM NOISE VOLTAGE AT 230VAC 56V 4A, – CH1 1mA/1mV

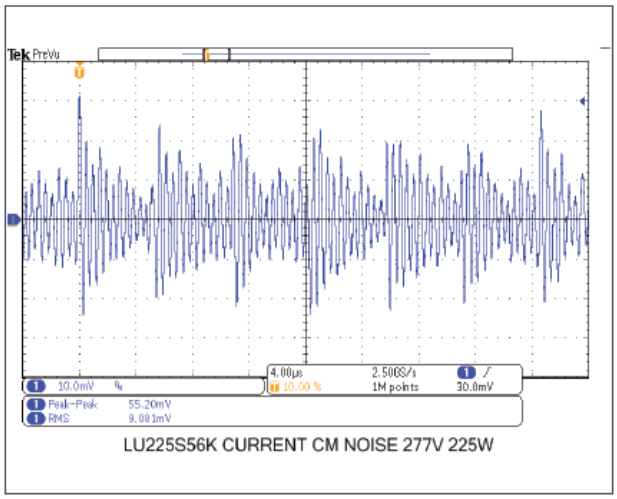

Fig. 31: CM NOISE VOLTAGE AT 277VAC 56V 4A, – CH1 1mA/1mV

PERFORMANCE DATA

CONDUCTED EMISSION

EMI Plots were collected at 10% and 100% loads, 120VAC/60Hz and 240VAC 50Hz. The Curves are Blue Max Peak Trace, Green Quasi Peak Trace and Yellow CISPR Average Trace. Detailed EMI reports are available upon request. Plots below shows that LU225S24 series passed EN55032 Class B limits shown in red.

Conducted Emission: (EN55032 Reference Limits)

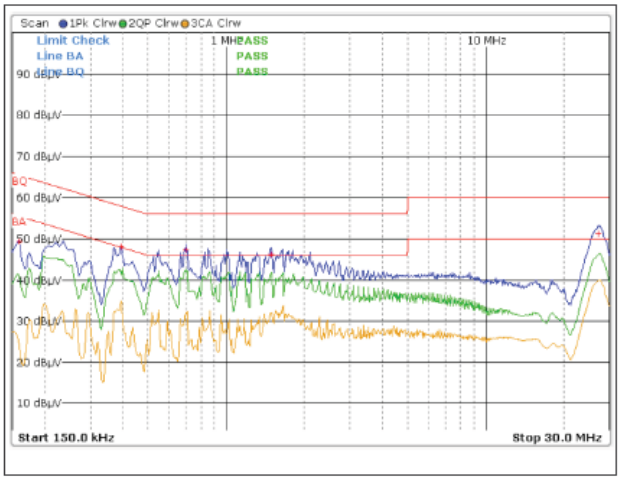

Fig. 32: CE Quasi Peak & Average 100% Load 120V/60Hz 56V 0.4A

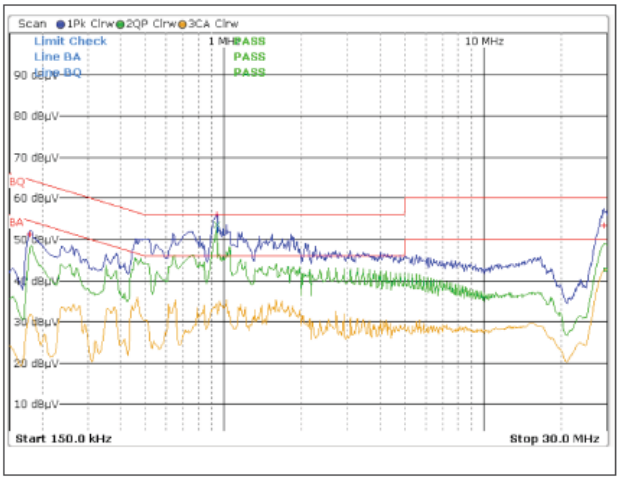

Fig. 33: CE Quasi Peak & Average 100% Load 277V/60Hz 56V 4A

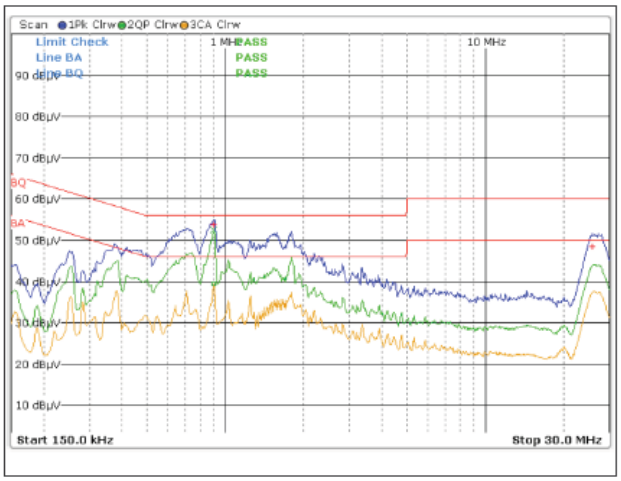

Fig. 34: CE Quasi Peak & Average 10% Load 120V/60Hz 56V 0.4A

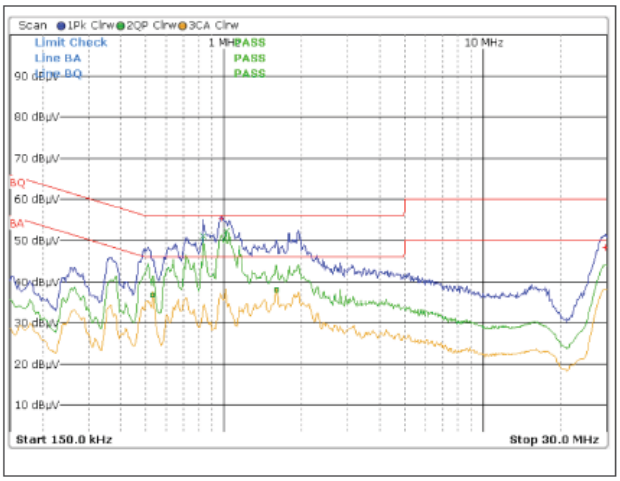

Fig. 35: CE Quasi Peak & Average 10% Load 277V/60Hz 56V 4A

Blue Max Peak Trace, Green Quasi Peak Trace and Yellow CISPR Average Trace

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

PRECISION | POWER | PERFORMANCE | TRUST

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