

# ARTESYN LPS100-M SERIES

150 Watts (forced air)  
100 Watts (convection)



## PRODUCT DESCRIPTION

Advanced Energy's Artesyn LPS100-M series of open-frame AC-DC power supplies datasheet features ITE and medical safety approvals. The series offers a choice of six single output models, with voltages of 5 V, 12 V, 15 V, 24 V, 48 V or 54 V. Each model also provides an isolated 12 V fan output. The main output of the 54 V model features POE (Power over Ethernet) isolation. LPS100-M series power supplies have a typical full load power conversion efficiency of 88% and with a height of only 1.29 inches offer a power density in excess of 14 W/in<sup>3</sup>. The series is primarily designed for use in information technology equipment (ITE) and light industrial systems, as well as for equipment intended for non-patient contact and non-patient critical use in low power medical, dental and laboratory applications.

## SPECIAL FEATURES

- Medical and ITE safety approvals, 2X MOPP
- Active power factor correction
- 2" x 4" footprint
- Less than 1U high
- EN61000-3-2 compliant
- Remote sense
- Power fail
- Adjustable main output
- Built-in Class B EMI filter
- Overvoltage protection
- Overload protection
- Thermal overload protection
- Isolated 12 V fan output
- LPX100 enclosure kit available

- POE isolation on main output of LPS109-M

## SAFETY

- TUV 62368, 60601-1
- UL 62368, 60601-1
- cULus 62368, 60601-1
- CB Certificate and report
- CE Mark (LVD)
- CQC Mark
- UKCA Mark

## TYPICAL APPLICATIONS

- ITE
- Medical

## AT A GLANCE

### Total Power

80 to 150 Watts

### Input Voltage

90 to 264 Vac

### # of Outputs

Single



## MODEL NUMBERS

Standard	Output Voltage	Minimum Load	Maximum Load Convection Cooling ( $I_{O,maxCC}$ )	Maximum Load Forced Air 30CFM ( $I_{O,maxFA}$ )	Peak Load <sup>1</sup>
LPS102-M	5V	0A	16A	24A	30A
LPS103-M	12V	0A	8.3A	12.5A	14A
LPS104-M	15V	0A	6.7A	10A	11A
LPS105-M	24V	0A	4.2A	6.3A	7A
LPS108-M	48V	0A	2.1A	3.1A	3.5A
LPS109-M	54V	0A	1.85A	2.8A	3.1A

Note 1 - Peak current lasting <30 seconds with a maximum 10% duty cycle.

### Options

None

## ELECTRICAL SPECIFICATIONS

### Absolute Maximum Ratings

Stress in excess of those listed in the “Absolute Maximum Ratings” may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply’s reliability.

Table 1. Absolute Maximum Ratings							
Parameter	Model	Symbol	Min	Typ	Max	Unit	
Input Voltage	AC continuous operation	All models	$V_{IN,AC}$	90	-	264	Vac
	DC continuous operation	All models	$V_{IN,DC}$	120	-	300	Vdc
Maximum Output Power (Main + Fan) (convection continuous operation)	LPS102-M	$P_{O,maxCC}$	-	-	80	W	
	LPS103-M		-	-	100		
	LPS104-M		-	-	100		
	LPS105-M		-	-	100		
	LPS108-M		-	-	100		
	LPS109-M		-	-	100		
Maximum Output Power (Main + Fan) (forced air continuous operation - 30CFM)	LPS102-M	$P_{O,maxFA}$	-	-	120	W	
	LPS103-M		-	-	150		
	LPS104-M		-	-	150		
	LPS105-M		-	-	150		
	LPS108-M		-	-	150		
	LPS109-M		-	-	150		
Isolation Voltage	Input to output	All Models	-	-	4000	Vac	
	Input to safety ground	All Models	-	-	1500	Vac	
	Outputs to output ground	All Models	-	-	500	Vdc	
	Main output to fan output	All Models	-	-	100	Vdc	
Ambient Operating Temperature	All Models	$T_A$	0	-	+70 <sup>1</sup>	°C	
Cold Start-up Temperature	All Models	$T_{ST}$	-20	-	-	°C	
Storage Temperature	All Models	$T_{STG}$	-40	-	+85	°C	
Humidity (non-condensing)	Operating	All Models	10	-	90	%	
	Non-operating	All Models	10	-	95	%	
Altitude	Operating	All Models	-500	-	13,000 <sup>2</sup>	feet	
	Non-operating	All Models	-1,000	-	50,000	feet	

Note 1 - Derate each output at 2.5% per degree C from 50°C to 70°C.

Note 2 - Derate maximum operating temperature by 1°C per 1,000 feet above 13,000 feet.

## ELECTRICAL SPECIFICATIONS

### Input Specifications

Table 2. Input Specifications							
Parameter	Condition	Symbol	Min	Typ	Max	Unit	
Operating Input Voltage, AC	All	$V_{IN,AC}$	90	115/230	264	Vac	
Input AC Frequency	All	$f_{IN,AC}$	47	50/60	440	Hz	
Operating Input Voltage, DC	All	$V_{IN,DC}$	120	-	300	Vdc	
Maximum Steady State Input Current	$V_{IN,AC} = 90Vac$ $V_{IN,AC} = 170Vac$	$I_{IN,max}$	-	-	2.2 1.2	A	
No Load Input Current ( $V_O = ON, I_O = 0, I_{FAN} = 0$ )	$V_{IN,AC} = 90Vac$ $V_{IN,AC} = 264Vac$	$I_{IN,no-load}$	-	-	80 100	mA	
Harmonic Line Currents	All	THD	Per EN61000-3-2				
Power Factor	$I_O = 50\% \text{ to } 100\% I_{O,maxFA}$ $V_{IN,AC} = 115Vac$	PF	0.97	-	-		
Startup Surge Current (Inrush) @ 25 °C	$V_{IN,AC} = 230Vac$	$I_{IN,surge}$	-	-	50	$A_{PK}$	
Input Fuse	Internal, L and N 250Vac		-	-	2.5	A	
Input AC Low Line Start-up Voltage	$I_O = I_{O,maxFA}$	$V_{IN,AC-start}$	84	-	89	Vac	
Input AC Undervoltage Lockout Voltage	$I_O = I_{O,maxFA}$	$V_{IN,AC-stop}$	75	-	83	Vac	
Input DC Low Line Start-up Voltage	$I_O = I_{O,maxFA}$	$V_{IN,DC-start}$	110	-	119	Vac	
Input DC Undervoltage Lockout Voltage	$I_O = I_{O,maxFA}$	$V_{IN,DC-stop}$	100	-	106	Vac	
PFC Switching Frequency	All	$f_{SW,PFC}$	45	-	270	kHz	
Buck Switching Frequency	All	$f_{SW,Buck}$	70	-	88	kHz	
DCDC Switching Frequency	All	$f_{SW,DC-DC}$	117	-	143	kHz	
Efficiency ( $T_A = 25^\circ C$ , forced air cooling)	LPS102-M LPS103-M LPS104-M LPS105-M LPS108-M LPS109-M	$V_{IN,AC} = 230Vac$ $I_O = 75\% I_{O,maxFA}$ $I_{FAN} = 0$	$\eta$	-	84 90 90 90 91 91	- - - - - -	%
Hold Up Time	$V_{IN,AC} = 115Vac$ $P_O = P_{O,maxFA}$	$t_{Hold-Up}$	-	-	10	mSec	
Turn On Delay	$V_{IN,AC} = 90Vac$ $P_O = P_{O,maxFA}$	$t_{Turn-On}$	-	-	2.5	Sec	
Earth Leakage Current	$V_{IN,AC} = 264Vac$ $f_{IN,AC} = 50/60 \text{ Hz}$	$I_{IN,leakage}$	-	-	275	$\mu A$	
System Stability	Phase Margin Gain Margin	330 $\mu F/A$ Capacitive Load	45 10	- -	- -	$\emptyset$ dB	

## ELECTRICAL SPECIFICATIONS

## Output Specifications

Table 3. Output Specifications							
Parameter		Condition	Symbol	Min	Typ	Max	Unit
Output Regulation	LPS102-M LPS103-M LPS104-M LPS105-M LPS108-M LPS109-M	Inclusive of set point, line, load temperature change, warm-up drift and cross regulation	$V_O$	4.90 11.76 14.70 23.52 47.04 52.92	5.00 12.00 15.00 24.00 48.00 54.00	5.10 12.24 15.30 24.48 48.96 55.08	V
	All models		$V_{FAN}$	10.2	12.0	13.8	
Output Adjust Range	LPS102-M LPS103-M LPS104-M LPS105-M LPS108-M LPS109-M	$V_{IN,AC} = 115V_{AC}$ $I_O = 50\%$ of $I_{O,maxFA}$ $I_{FAN} = 0$ Monitor $V_O$ at SK2	$V_O$	4.5 10.8 13.5 21.6 43.2 48.6	- - - - - -	5.5 13.2 16.5 26.4 52.8 59.4	V
Output Ripple	LPS102-M LPS103-M LPS104-M LPS105-M LPS108-M LPS109-M	Measure with a 0.1 $\mu$ F ceramic capacitor in parallel with a 10 $\mu$ F tantalum capacitor	$V_O$	- - - - - -	- - - - - -	50 120 150 240 480 540	mV <sub>PK-PK</sub>
	All models		$V_{FAN}$	-	-	240	
Convection Output Current Continuous	LPS102-M LPS103-M LPS104-M LPS105-M LPS108-M LPS109-M	Convection cooling	$I_{O,maxCC}$	0 0 0 0 0 0	- - - - - -	16 8.3 6.7 4.2 2.1 1.85	A
	All models		$I_{FAN,maxCC}$	0	-	0.5	
Maximum Convection Output Power Continuous	LPS102-M LPS103-M LPS104-M LPS105-M LPS108-M LPS109-M	Main output + fan output	$P_{O,maxCC}$	- - - - - -	- - - - - -	80 100 100 100 100 100	W
Force Air Output Current Continuous	LPS102-M LPS103-M LPS104-M LPS105-M LPS108-M LPS109-M	300 LFM forced air cooling	$I_{O,maxFA}$	0 0 0 0 0 0	- - - - - -	24 12.5 10 6.3 3.1 2.8	A
	All models		$I_{FAN,maxFA}$	0	-	1.0	
Maximum Force Air Output Power Continuous	LPS102-M LPS103-M LPS104-M LPS105-M LPS108-M LPS109-M	Main output + fan output, 30 CFM	$P_{O,maxFA}$	- - - - - -	- - - - - -	120 150 150 150 150 150	W
$V_O$ Capacitive Load		Startup		0	-	330	$\mu$ F/A

## ELECTRICAL SPECIFICATIONS

## Output Specifications

Table 3. Output Specifications Con't							
Parameter		Condition	Symbol	Min	Typ	Max	Unit
Output Peak Current	LPS102-M	Maximum duration <30 seconds, maximum duty cycle <10%	$I_{O,peak}$	-	-	30	A
	LPS103-M			-	-	14	
	LPS104-M			-	-	11	
	LPS105-M			-	-	7	
	LPS108-M			-	-	3.5	
	LPS109-M			-	-	3.1	
Output Adjust Range	LPS102-M	$V_{IN,AC} = 115V_{AC}$ $I_O = 50\%$ of $I_{O,maxFA}$ $I_{FAN} = 0$ Monitor $V_O$ at SK2	$V_O$	4.5	-	5.5	V
	LPS103-M			10.8	-	13.2	
	LPS104-M			13.5	-	16.5	
	LPS105-M			21.6	-	26.4	
	LPS108-M			43.2	-	52.8	
	LPS109-M			48.6	-	59.4	
$V_O$ Dynamic Response - Peak Deviation	LPS102-M	50% (50% to 100% of $I_{O,maxFA}$ ) load change Slew rate = 1A/ $\mu$ s Output capacitance = 100 $\mu$ F/A	$\pm\%V_O$	-	-	5	%
	LPS103-M			-	-	5	
	LPS104-M			-	-	5	
	LPS105-M			-	-	2	
	LPS108-M			-	-	2	
	LPS109-M			-	-	2	
$V_O$ Turn On Overshoot	LPS102-M	$I_O = 0, I_{FAN} = 0$	$V_O$	-	-	5.15	V
	LPS103-M			-	-	12.36	
	LPS104-M			-	-	15.45	
	LPS105-M			-	-	24.72	
	LPS108-M			-	-	49.44	
	LPS109-M			-	-	55.62	
$V_O$ Long Term Stability		Max change over 24 hours after thermal equilibrium (30 mins)	$\pm\%V_O$	-	-	1.0	%
$V_O$ Over Voltage Protection		Latch off (AC recycle to reset)	$\%V_O$	125	-	150	%
$V_O$ Over Current Protection		All	$\%I_O$	110	-	160	%
Over Temperature Protection		All		Auto Recovery			
Short Circuit Protection		All		Auto Recovery			

# ELECTRICAL SPECIFICATIONS

## LPS102-M Performance Curves

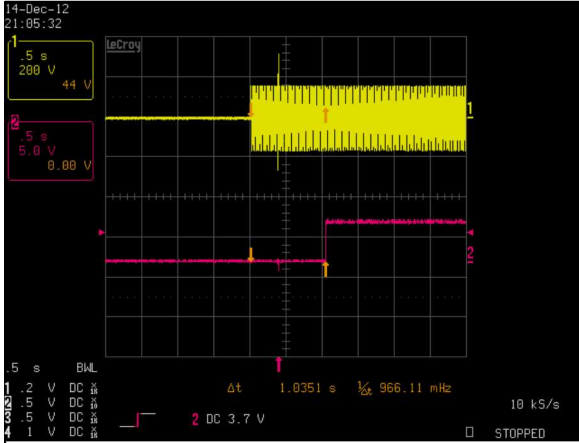


Figure 1: LPS102-M Turn-on delay  
 Vin = 115Vac Load: Io = 24A, I<sub>FAN</sub> = 0A  
 Ch 1: V<sub>IN</sub> Ch 2: Vo

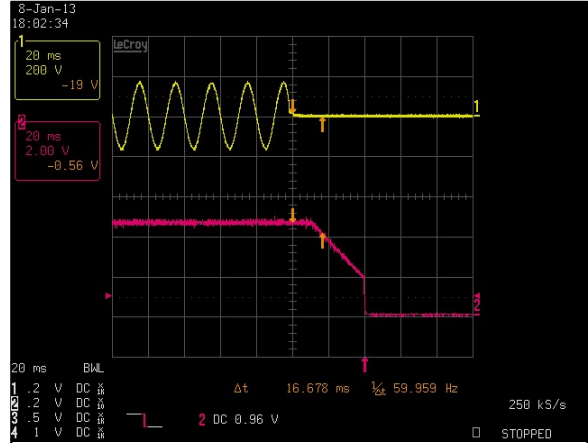


Figure 2: LPS102-M Hold-up Time (time to decay)  
 Vin = 115Vac Load: Io = 24A, I<sub>FAN</sub> = 0A  
 Ch 1: V<sub>IN</sub> Ch 2: Vo

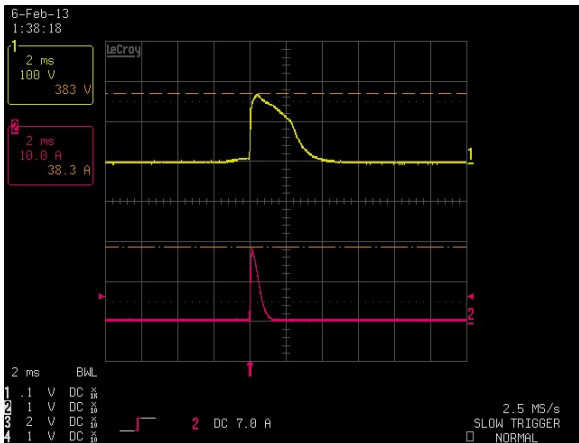


Figure 3: LPS102-M Inrush Current  
 Vin = 230Vac Load: Io = 0A, I<sub>FAN</sub> = 0A, Turn on at 90 deg  
 Ch 1: V<sub>IN</sub> Ch 2: I<sub>IN</sub>

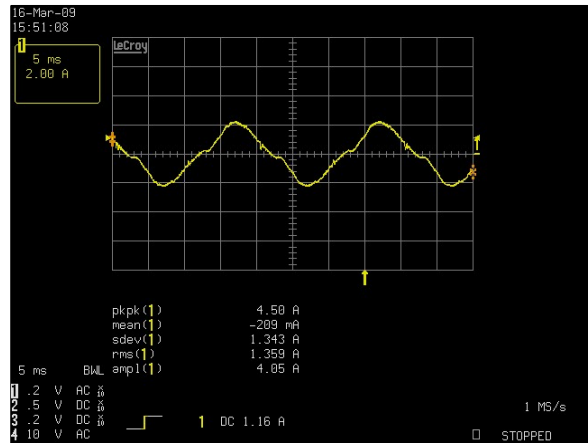


Figure 4: LPS102-M Input Current Waveform  
 Vin = 115Vac Load: Io = 24A, I<sub>FAN</sub> = 0A  
 Ch 1: I<sub>IN</sub>

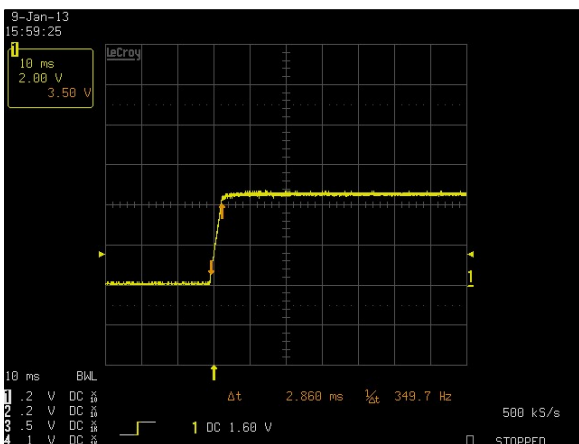


Figure 5: LPS102-M Output Voltage Startup Characteristic  
 Vin = 90Vac Load: Io = 24A, I<sub>FAN</sub> = 0A  
 Ch 1: Vo Output Capacitance = 330μF/A

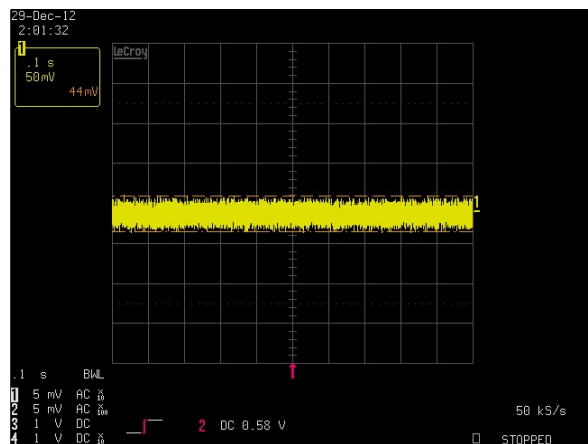


Figure 6: LPS102-M Ripple and Noise Measurement  
 Vin = 115Vac Load: Io = 24A, I<sub>FAN</sub> = 0A  
 Ch 1: Vo

# ELECTRICAL SPECIFICATIONS

## LPS102-M Performance Curves

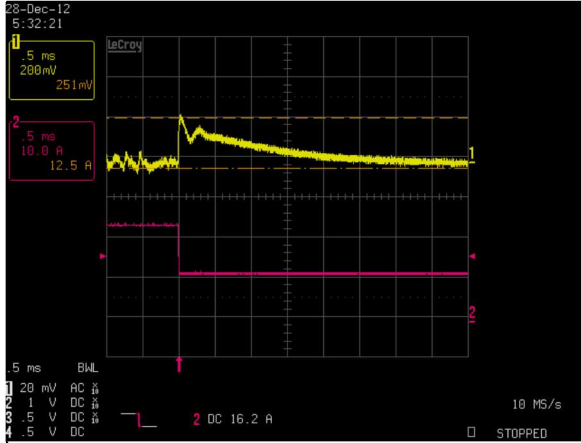


Figure 7: LPS102-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 100% to 50%, 1A/μs slew rate  
 Ch 1: Vo Ch 2: Io

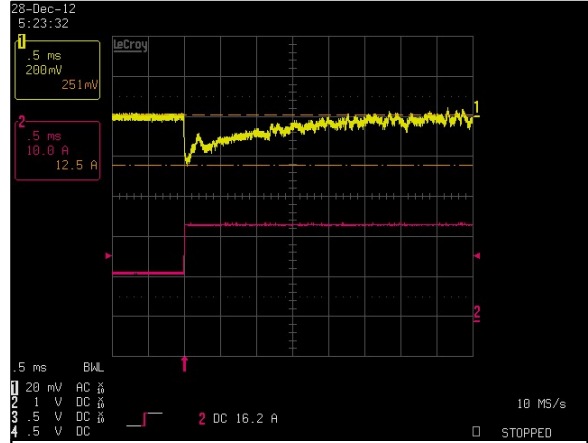


Figure 8: LPS102-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 50% to 100%, 1A/μs slew rate  
 Ch 1: Vo Ch 2: Io

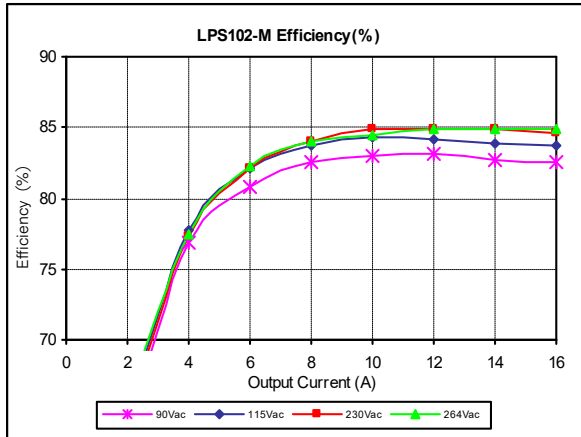


Figure 9: LPS102-M Efficiency Curves @ 25 degC  
 Convection Cooling  
 Vin = 90 to 264Vac Load: Io = 0 to 16A, I<sub>FAN</sub> = 0A

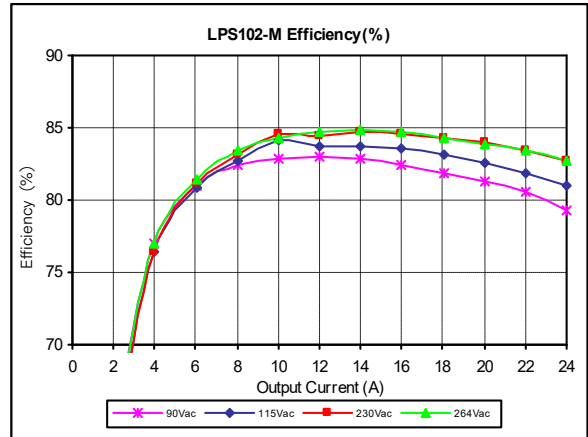


Figure 10: LPS102-M Efficiency Curves @ 25 degC  
 30 CFM Forced Air  
 Vin = 90 to 264Vac Load: Io = 0 to 24A, I<sub>FAN</sub> = 0A

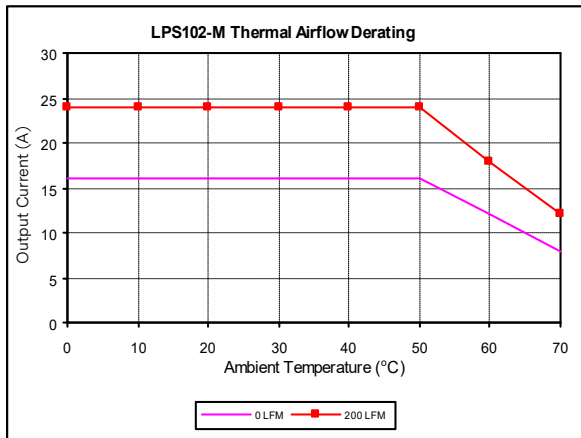


Figure 11: LPS102-M Derating Curves  
 Vin = 115Vac Load: Io = 0 to 24A, I<sub>FAN</sub> = 0A



# ELECTRICAL SPECIFICATIONS

## LPS103-M Performance Curves

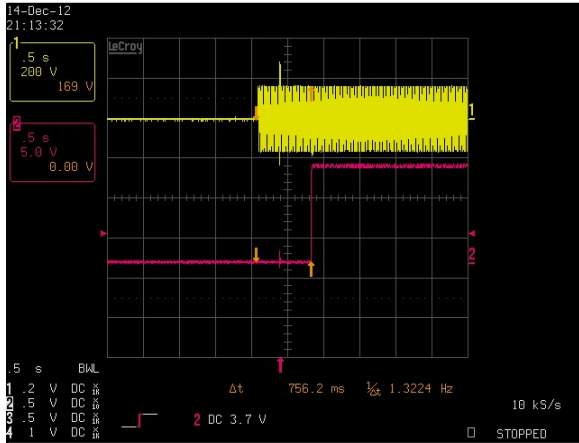


Figure 12: LPS103-M Turn-on delay  
 Vin = 115Vac Load: Io = 12.5A, I<sub>FAN</sub> = 0A  
 Ch 1: V<sub>IN</sub> Ch 2: V<sub>O</sub>

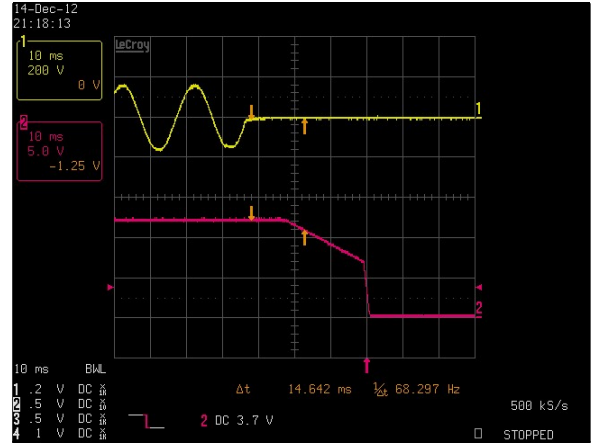


Figure 13: LPS103-M Hold-up Time (time to decay)  
 Vin = 115Vac Load: Io = 12.5A, I<sub>FAN</sub> = 0A  
 Ch 1: V<sub>IN</sub> Ch 2: V<sub>O</sub>

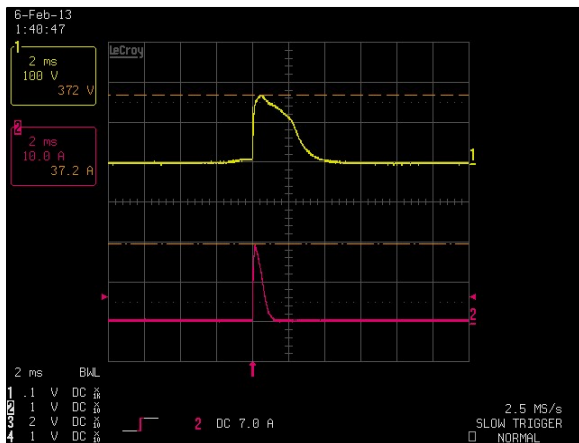


Figure 14: LPS103-M Inrush Current  
 Vin = 230Vac Load: Io = 0A, I<sub>FAN</sub> = 0A, Turn on at 90 deg  
 Ch 1: V<sub>IN</sub> Ch 2: I<sub>IN</sub>

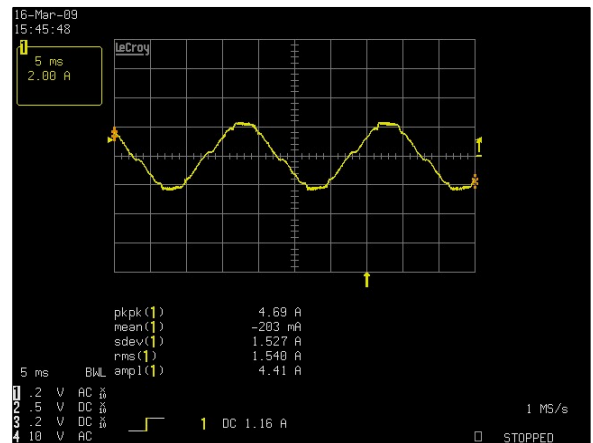


Figure 15: LPS103-M Input Current Waveform  
 Vin = 115Vac Load: Io = 12.5A, I<sub>FAN</sub> = 0A  
 Ch 1: I<sub>IN</sub>

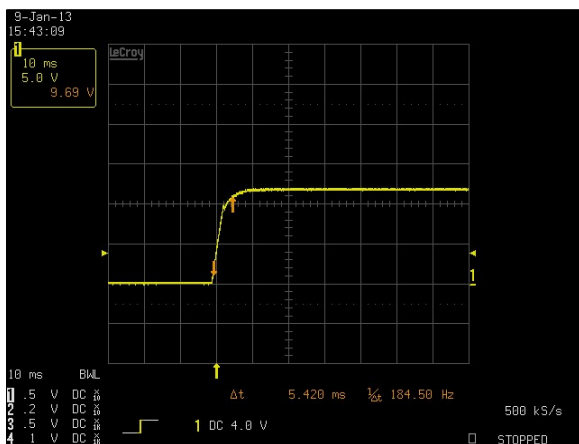


Figure 16: LPS103-M Output Voltage Startup Characteristic  
 Vin = 90Vac Load: Io = 12.5A, I<sub>FAN</sub> = 0A  
 Ch 1: V<sub>O</sub> Output Capacitance = 330μF/A

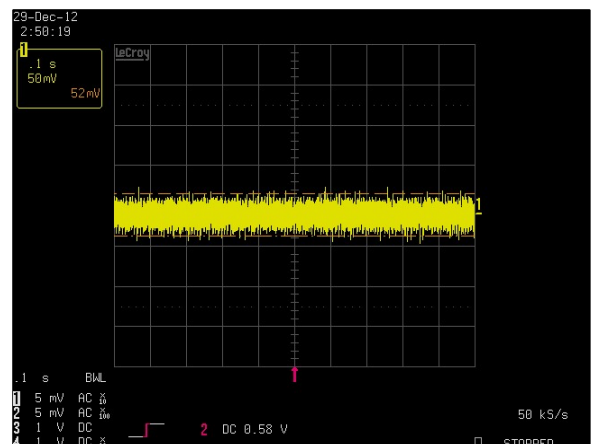


Figure 17: LPS103-M Ripple and Noise Measurement  
 Vin = 115Vac Load: Io = 12.5A, I<sub>FAN</sub> = 0A  
 Ch 1: V<sub>O</sub>

# ELECTRICAL SPECIFICATIONS

## LPS103-M Performance Curves

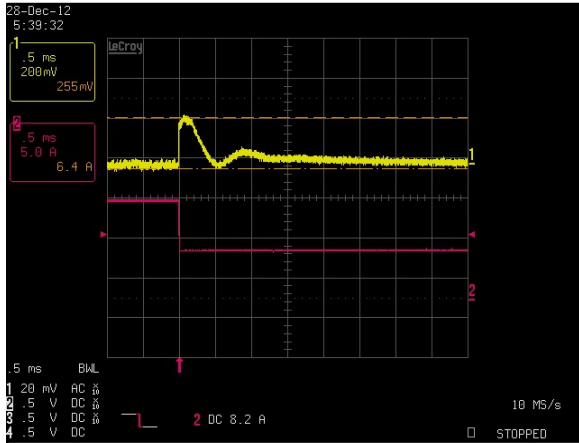


Figure 18: LPS103-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 100% to 50%, 1A/ $\mu$ s slew rate  
 Ch 1: Vo Ch 2: Io

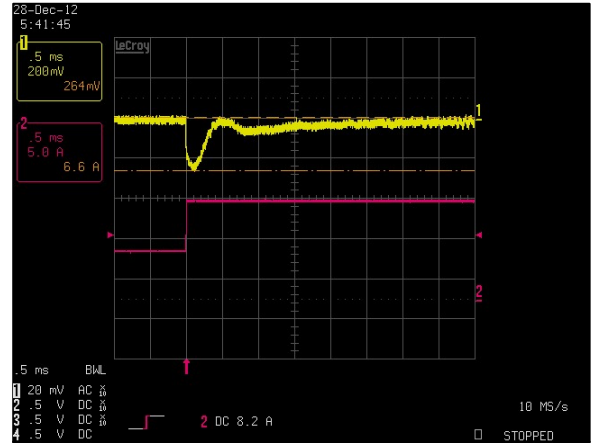


Figure 19: LPS103-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 50% to 100%, 1A/ $\mu$ s slew rate  
 Ch 1: Vo Ch 2: Io

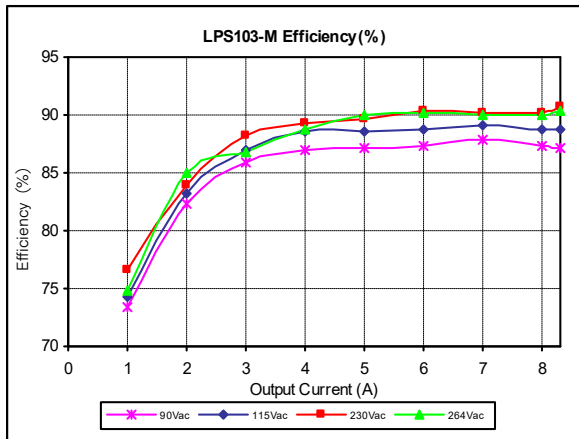


Figure 20: LPS103-M Efficiency Curves @ 25 degC  
 Convection Cooling  
 Vin = 90 to 264Vac Load: Io = 0 to 8.3A, IFAN = 0A

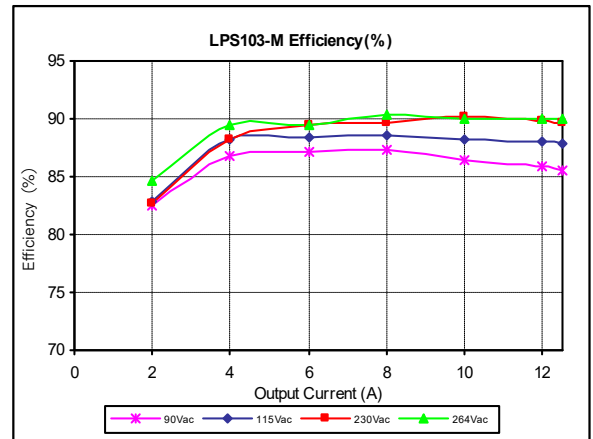


Figure 21: LPS103-M Efficiency Curves @ 25 degC  
 30 CFM Forced Air  
 Vin = 90 to 264Vac Load: Io = 0 to 12.5A, IFAN = 0A

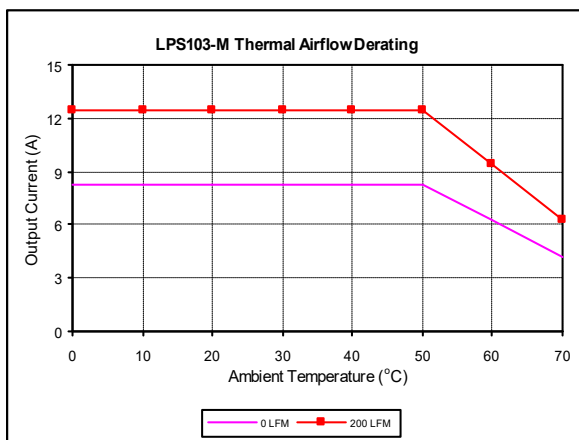


Figure 22: LPS103-M Derating Curves  
 Vin = 115Vac Load: Io = 0 to 12.5A, IFAN = 0A

# ELECTRICAL SPECIFICATIONS

## LPS104-M Performance Curves

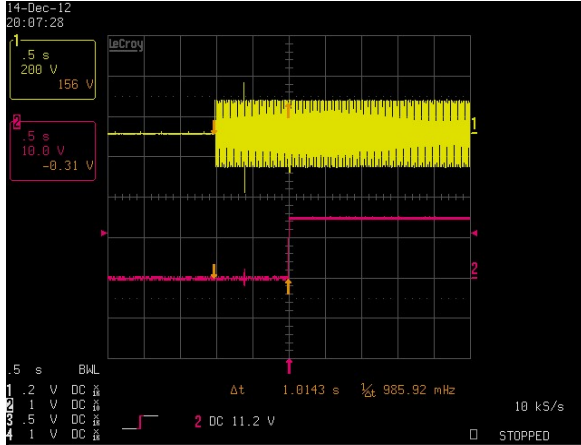


Figure 23: LPS104-M Turn-on delay  
 Vin = 115Vac Load: Io = 10A, IFAN = 0A  
 Ch 1: VIN Ch 2: Vo

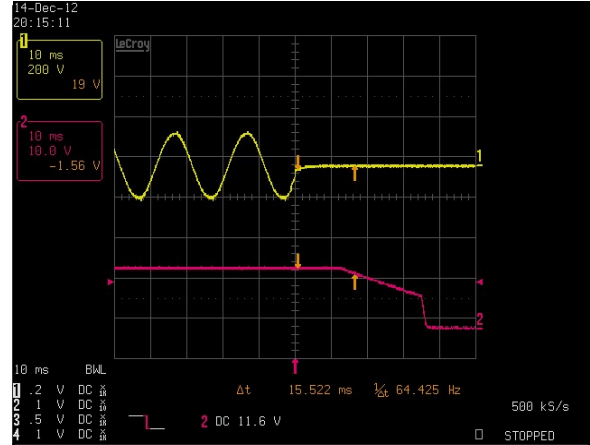


Figure 24: LPS104-M Hold-up Time (time to decay)  
 Vin = 115Vac Load: Io = 10A, IFAN = 0A  
 Ch 1: VIN Ch 2: Vo

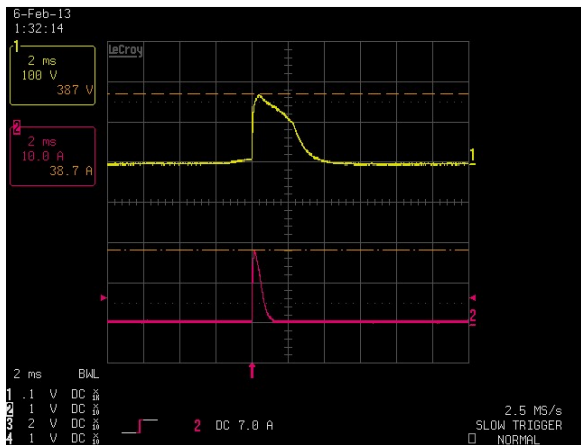


Figure 25: LPS104-M Inrush Current  
 Vin = 230Vac Load: Io = 0A, IFAN = 0A, Turn on at 90 deg  
 Ch 1: VIN Ch 2: IIN

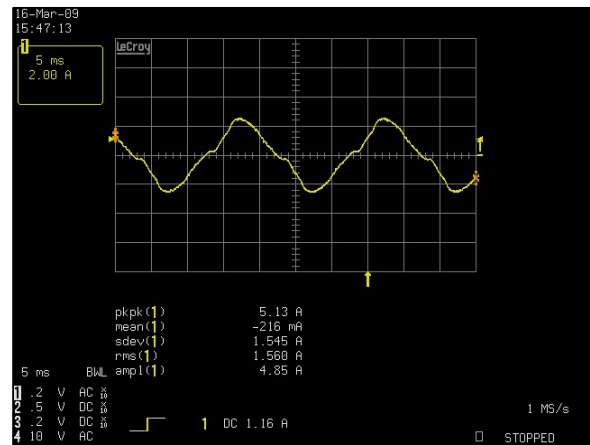


Figure 26: LPS104-M Input Current Waveform  
 Vin = 115Vac Load: Io = 10A, IFAN = 0A  
 Ch 1: IIN

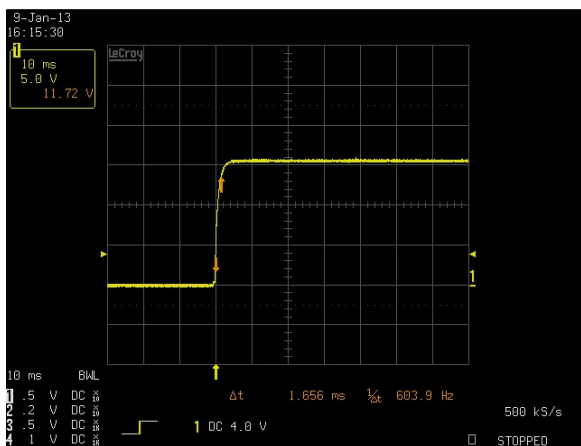


Figure 27: LPS104-M Output Voltage Startup Characteristic  
 Vin = 90Vac Load: Io = 10A, IFAN = 0A  
 Ch 1: Vo Output Capacitance = 330µF/A

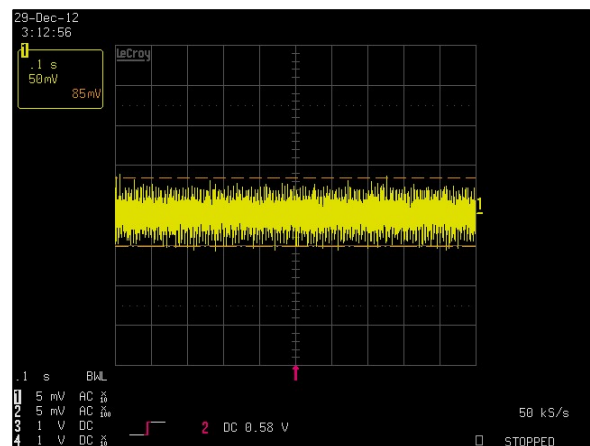


Figure 28: LPS104-M Ripple and Noise Measurement  
 Vin = 115Vac Load: Io = 10A, IFAN = 0A  
 Ch 1: Vo

# ELECTRICAL SPECIFICATIONS

## LPS104-M Performance Curves

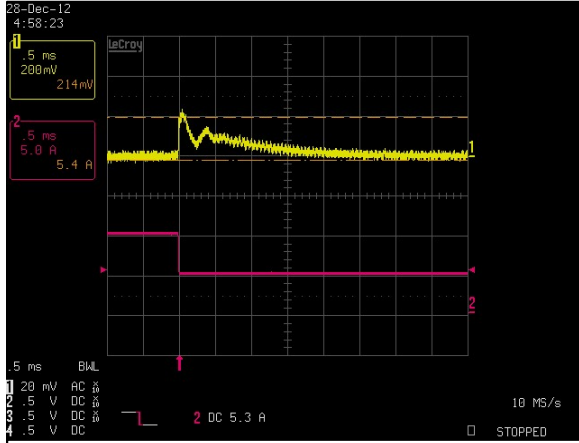


Figure 29: LPS104-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 100% to 50%, 1A/μs slew rate  
 Ch 1: Vo Ch 2: Io

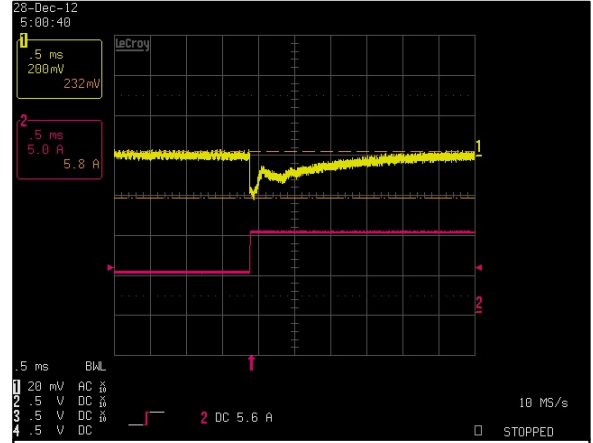


Figure 30: LPS104-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 50% to 100%, 1A/μs slew rate  
 Ch 1: Vo Ch 2: Io

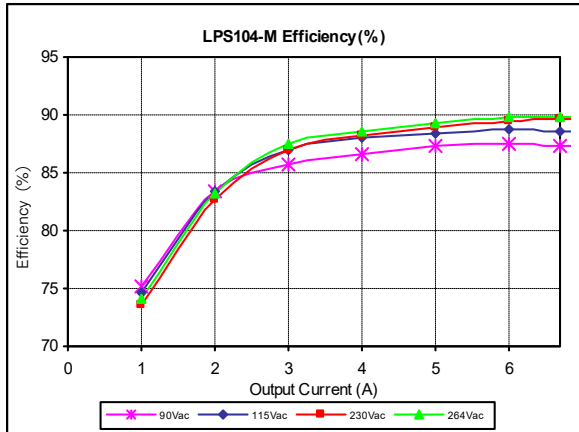


Figure 31: LPS104-M Efficiency Curves @ 25 degC  
 Convection Cooling  
 Vin = 90 to 264Vac Load: Io = 0 to 6.7A, I<sub>FAN</sub> = 0A

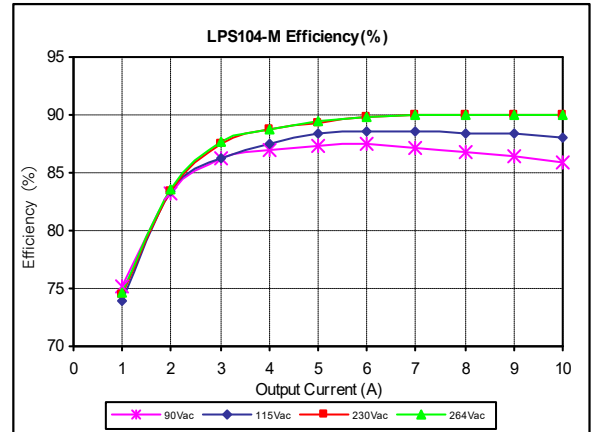


Figure 32: LPS104-M Efficiency Curves @ 25 degC  
 30 CFM Forced Air  
 Vin = 90 to 264Vac Load: Io = 0 to 10A, I<sub>FAN</sub> = 0A

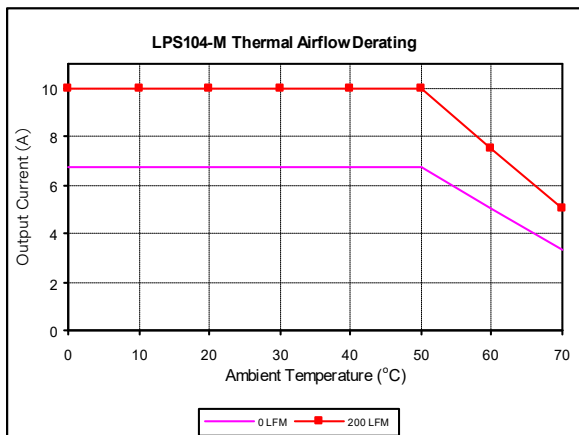


Figure 33: LPS104-M Derating Curves  
 Vin = 115Vac Load: Io = 0 to 10A, I<sub>FAN</sub> = 0A

# ELECTRICAL SPECIFICATIONS

## LPS105-M Performance Curves

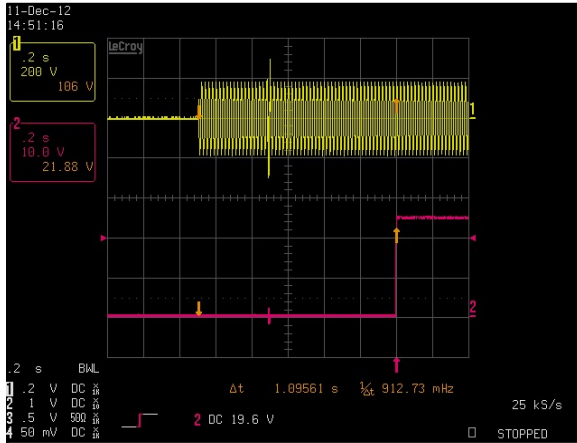


Figure 34: LPS105-M Turn-on delay  
 Vin = 115Vac Load: Io = 6.3A, I<sub>FAN</sub> = 0A  
 Ch 1: V<sub>IN</sub> Ch 2: Vo

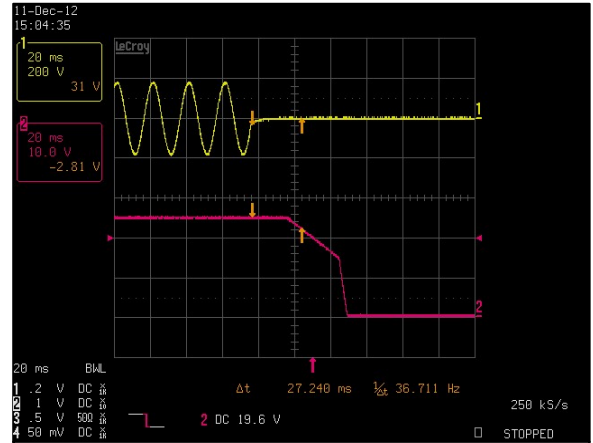


Figure 35: LPS105-M Hold-up Time (time to decay)  
 Vin = 115Vac Load: Io = 6.3A, I<sub>FAN</sub> = 0A  
 Ch 1: V<sub>IN</sub> Ch 2: Vo

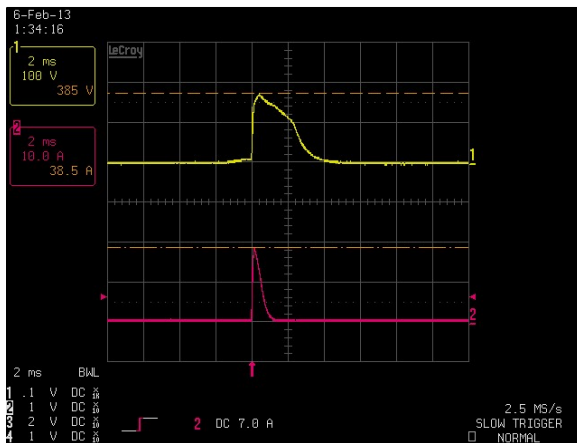


Figure 36: LPS105-M Inrush Current  
 Vin = 230Vac Load: Io = 0A, I<sub>FAN</sub> = 0A, Turn on at 90 deg  
 Ch 1: V<sub>IN</sub> Ch 2: I<sub>IN</sub>

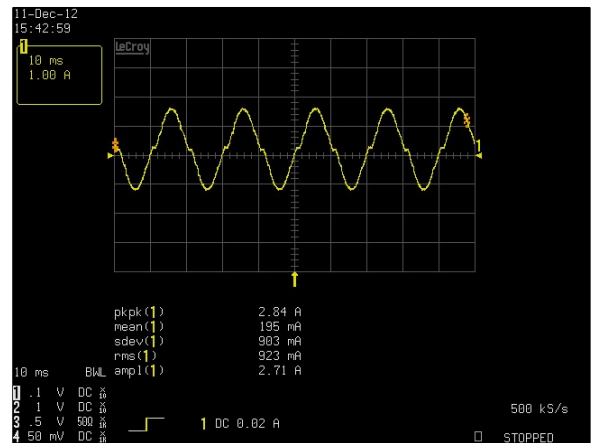


Figure 37: LPS105-M Input Current Waveform  
 Vin = 115Vac Load: Io = 10A, I<sub>FAN</sub> = 0A  
 Ch 1: I<sub>IN</sub>

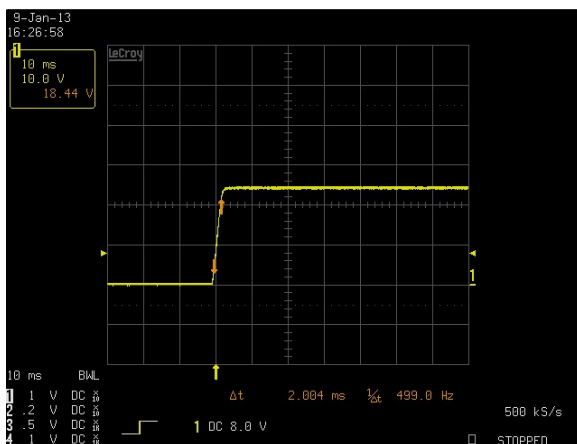


Figure 38: LPS105-M Output Voltage Startup Characteristic  
 Vin = 90Vac Load: Io = 6.3A, I<sub>FAN</sub> = 0A  
 Ch 1: Vo Output Capacitance = 330μF/A

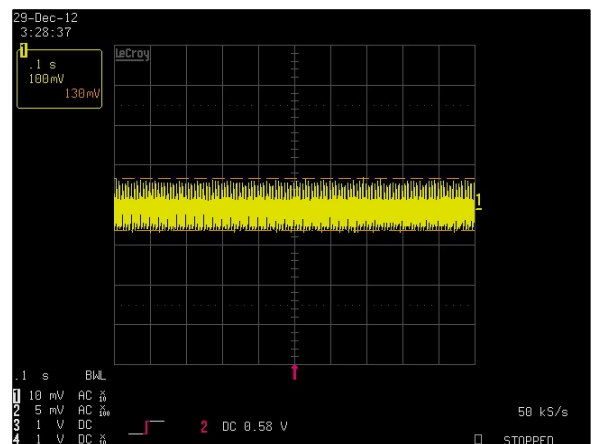


Figure 39: LPS105-M Ripple and Noise Measurement  
 Vin = 115Vac Load: Io = 6.3A, I<sub>FAN</sub> = 0A  
 Ch 1: Vo

# ELECTRICAL SPECIFICATIONS

## LPS105-M Performance Curves

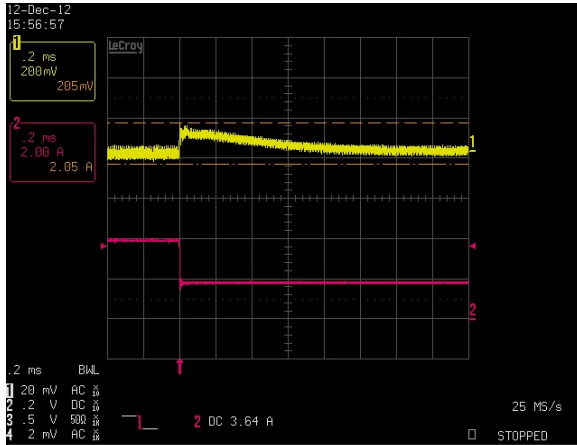


Figure 40: LPS105-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 100% to 50%, 1A/ $\mu$ s slew rate  
 Ch 1: Vo Ch 2: Io

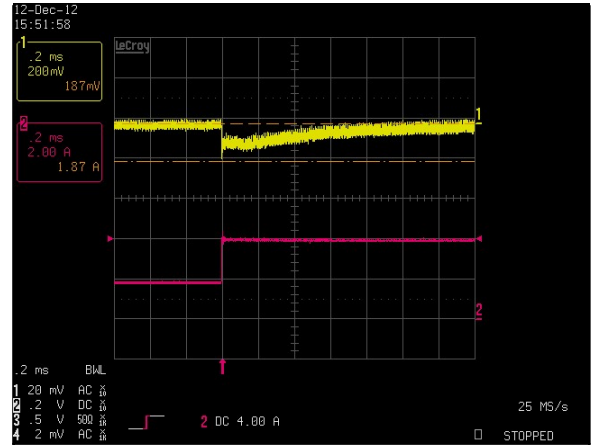


Figure 41: LPS105-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 50% to 100%, 1A/ $\mu$ s slew rate  
 Ch 1: Vo Ch 2: Io

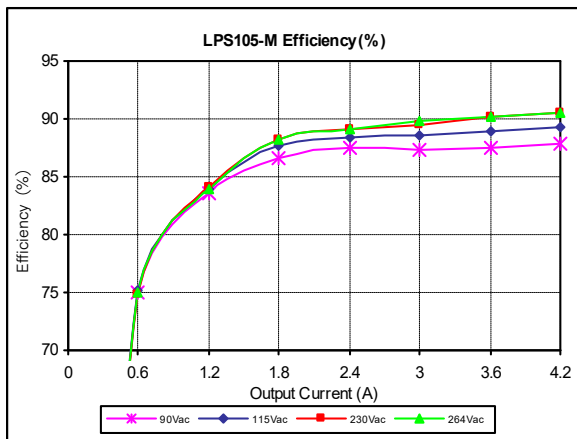


Figure 42: LPS105-M Efficiency Curves @ 25 degC  
 Convection Cooling  
 Vin = 90 to 264Vac Load: Io = 0 to 4.2A, I<sub>FAN</sub> = 0A

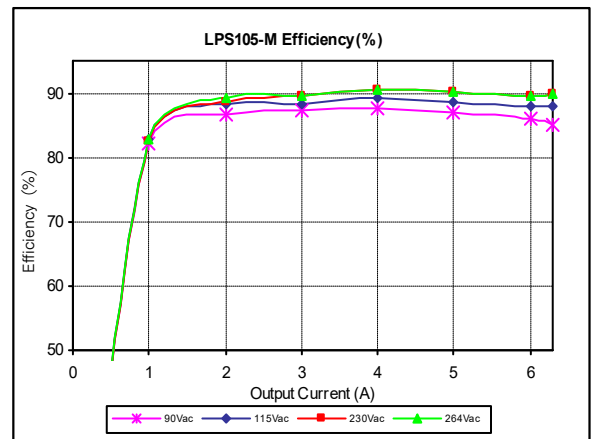


Figure 43: LPS105-M Efficiency Curves @ 25 degC  
 30 CFM Forced Air  
 Vin = 90 to 264Vac Load: Io = 0 to 6.3A, I<sub>FAN</sub> = 0A

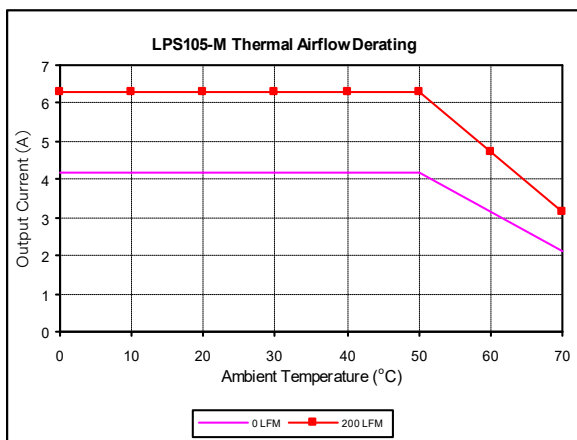


Figure 44: LPS105-M Derating Curves  
 Vin = 115Vac Load: Io = 0 to 6.3A, I<sub>FAN</sub> = 0A

# ELECTRICAL SPECIFICATIONS

## LPS108-M Performance Curves

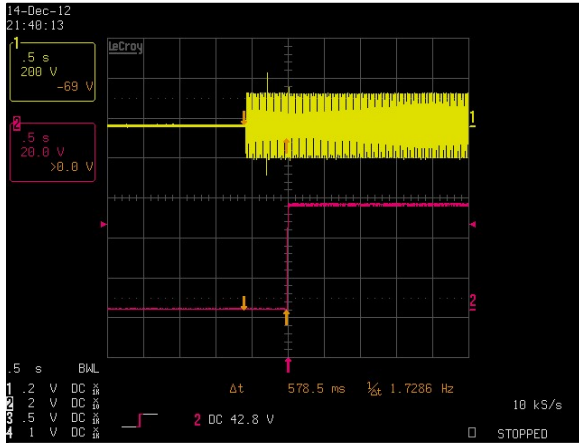


Figure 45: LPS108-M Turn-on delay  
 Vin = 115Vac Load: Io = 3.1A, IFAN = 0A  
 Ch 1: VIN Ch 2: Vo

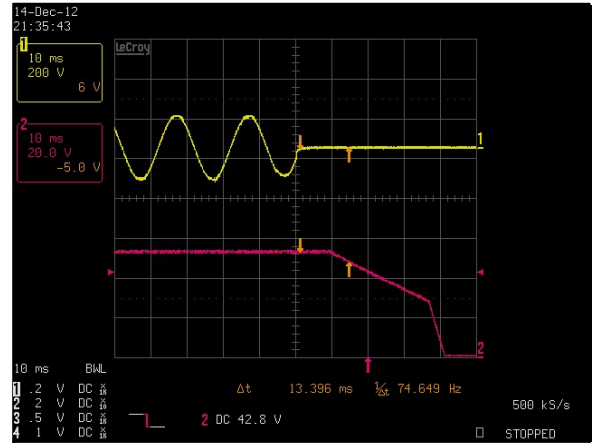


Figure 46: LPS108-M Hold-up Time (time to decay)  
 Vin = 115Vac Load: Io = 3.1A, IFAN = 0A  
 Ch 1: VIN Ch 2: Vo

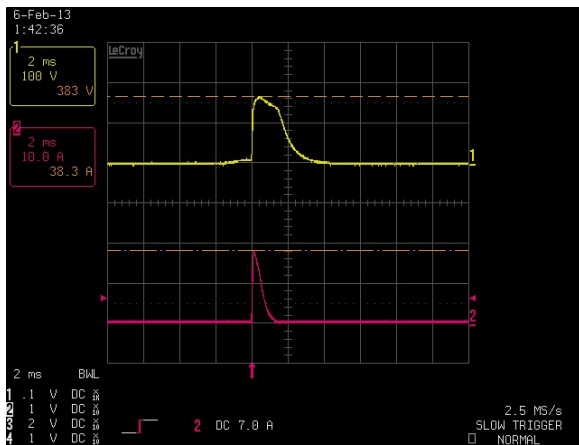


Figure 47: LPS108-M Inrush Current  
 Vin = 230Vac Load: Io = 0A, IFAN = 0A, Turn on at 90 deg  
 Ch 1: VIN Ch 2: IIN

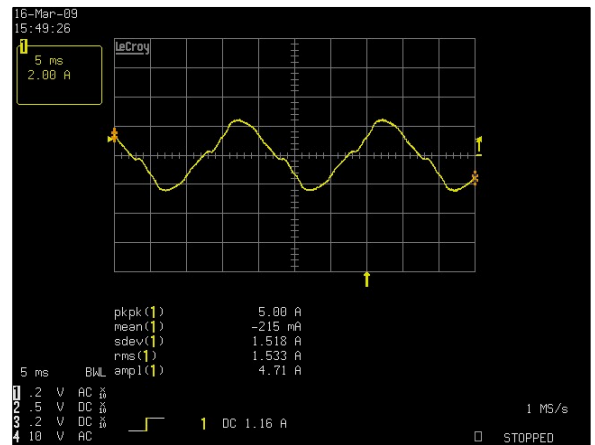


Figure 48: LPS108-M Input Current Waveform  
 Vin = 115Vac Load: Io = 3.1A, IFAN = 0A  
 Ch 1: IIN

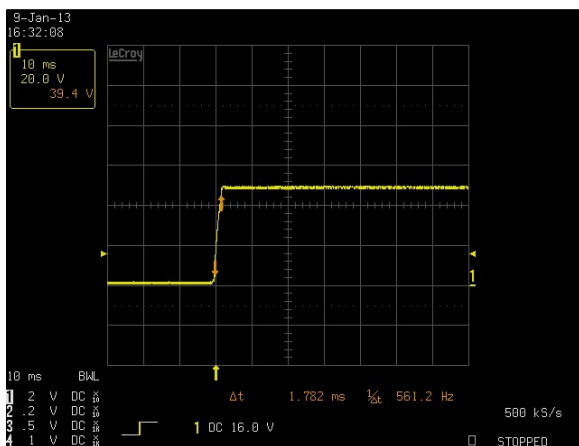


Figure 49: LPS108-M Output Voltage Startup Characteristic  
 Vin = 90Vac Load: Io = 3.1A, IFAN = 0A  
 Ch 1: Vo Output Capacitance = 330μF/A

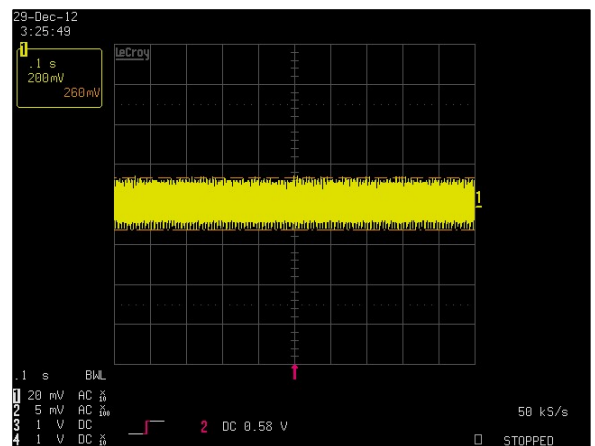


Figure 50: LPS108-M Ripple and Noise Measurement  
 Vin = 115Vac Load: Io = 3.1A, IFAN = 0A  
 Ch 1: Vo

# ELECTRICAL SPECIFICATIONS

## LPS108-M Performance Curves

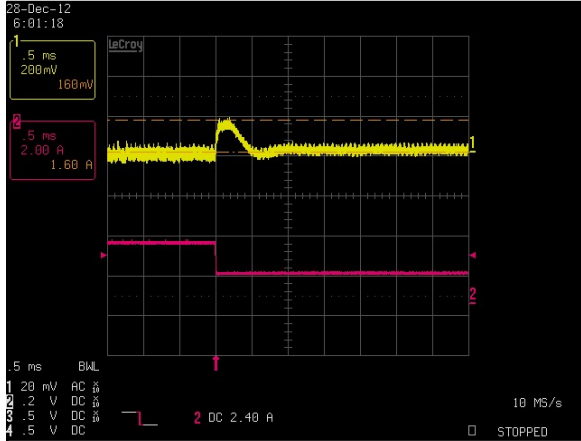


Figure 51: LPS108-M Transient Response – Vo Deviation  
 Vin = 115Vac Load: Io = 100% to 50%, 1A/ $\mu$ s slew rate  
 Ch 1: Vo Ch 2: Io

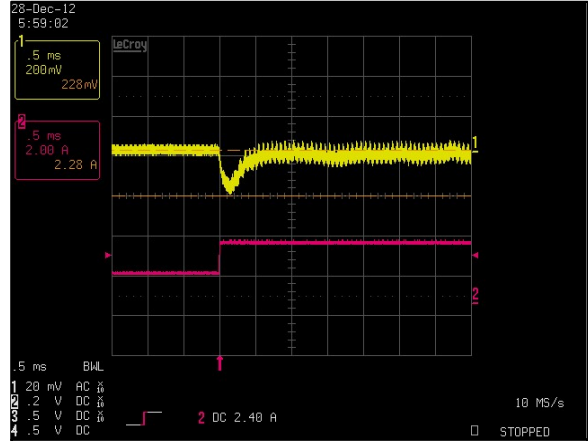


Figure 52: LPS108-M Transient Response – Vo Deviation  
 Vin = 115Vac Load: Io = 50% to 100%, 1A/ $\mu$ s slew rate  
 Ch 1: Vo Ch 2: Io

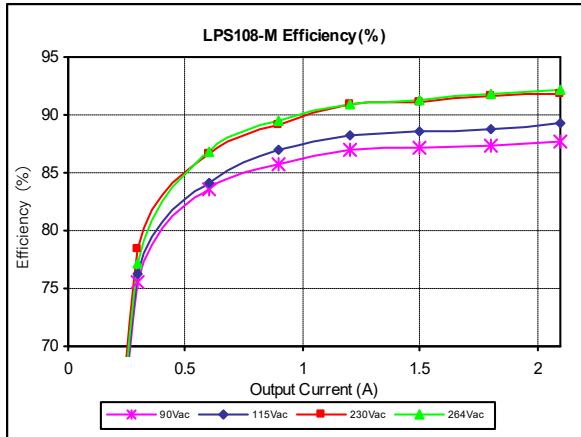


Figure 53: LPS108-M Efficiency Curves @ 25 degC  
 Convection Cooling  
 Vin = 90 to 264Vac Load: Io = 0 to 2.1A, IFAN = 0A

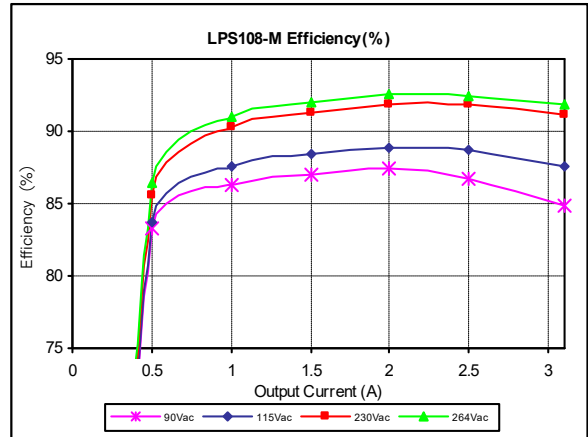


Figure 54: LPS108-M Efficiency Curves @ 25 degC  
 30 CFM Forced Air  
 Vin = 90 to 264Vac Load: Io = 0 to 3.1A, IFAN = 0A

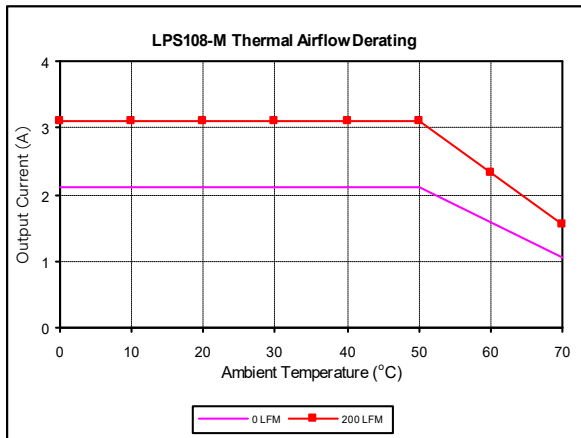


Figure 55: LPS108-M Derating Curves  
 Vin = 115Vac Load: Io = 0 to 3.1A, IFAN = 0A



# ELECTRICAL SPECIFICATIONS

## LPS109-M Performance Curves

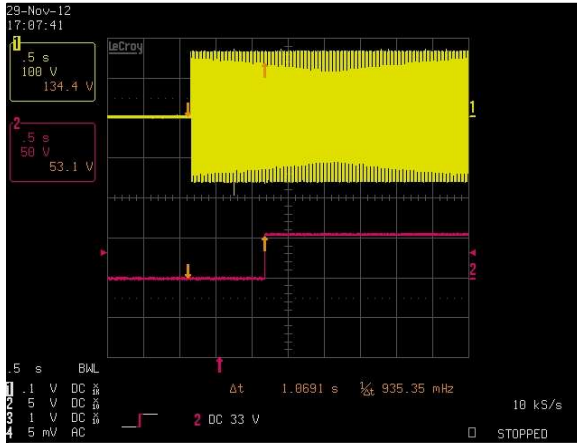


Figure 56: LPS109-M Turn-on delay  
 Vin = 115Vac Load: Io = 2.8A, IFAN = 0A  
 Ch 1: VIN Ch 2: Vo

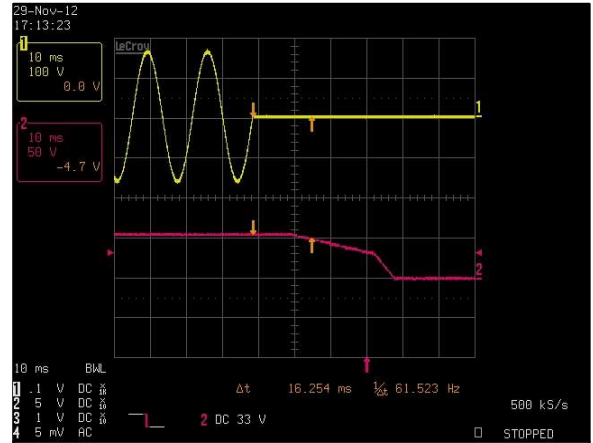


Figure 57: LPS109-M Hold-up Time (time to decay)  
 Vin = 115Vac Load: Io = 2.8A, IFAN = 0A  
 Ch 1: VIN Ch 2: Vo

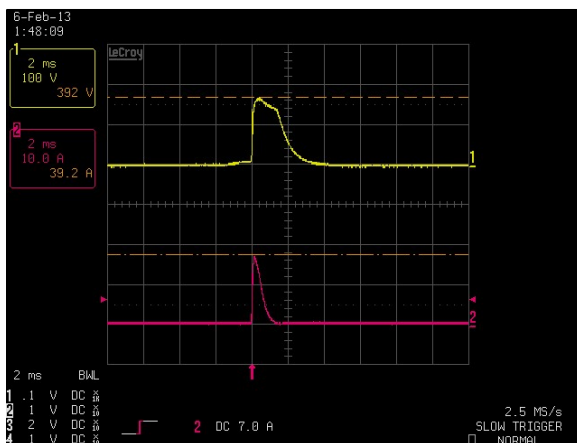


Figure 58: LPS109-M Inrush Current  
 Vin = 230Vac Load: Io = 0A, IFAN = 0A, Turn on at 90 deg  
 Ch 1: VIN Ch 2: IIN

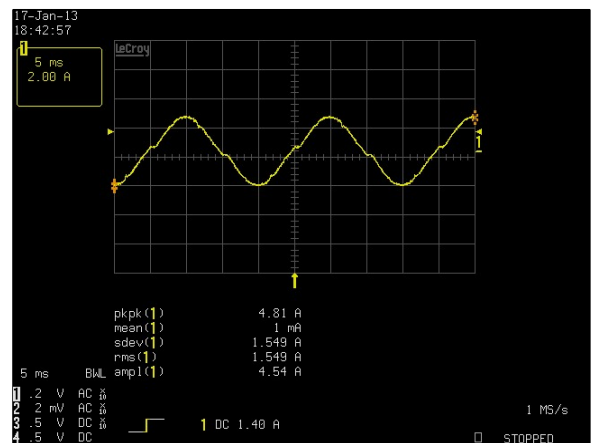


Figure 59: LPS109-M Input Current Waveform  
 Vin = 115Vac Load: Io = 2.8A, IFAN = 0A  
 Ch 1: IIN

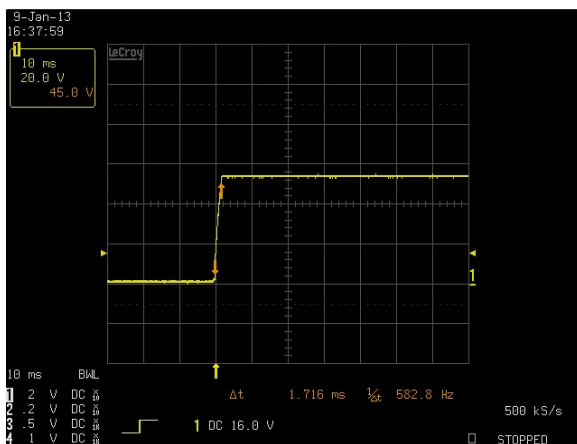


Figure 60: LPS109-M Output Voltage Startup Characteristic  
 Vin = 90Vac Load: Io = 2.8A, IFAN = 0A  
 Ch 1: Vo Output Capacitance = 330μF/A

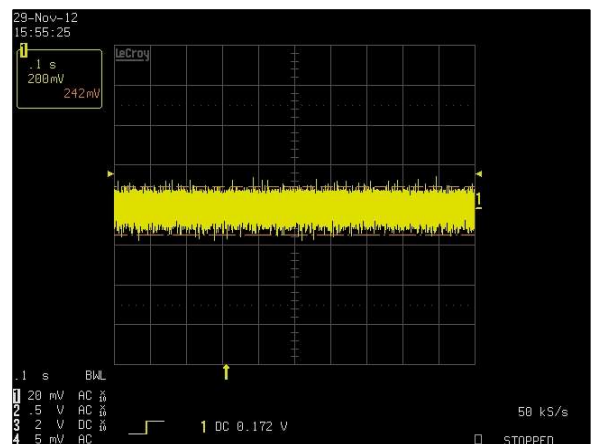


Figure 61: LPS109-M Ripple and Noise Measurement  
 Vin = 115Vac Load: Io = 2.8A, IFAN = 0A  
 Ch 1: Vo

# ELECTRICAL SPECIFICATIONS

## LPS109-M Performance Curves

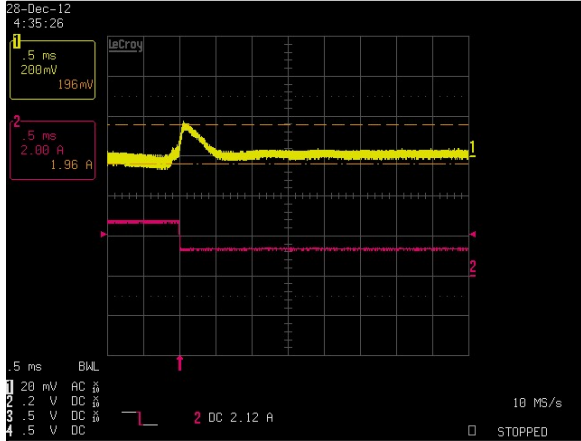


Figure 62: LPS109-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 100% to 50%, 1A/ $\mu$ s slew rate  
 Ch 1: Vo Ch 2: Io

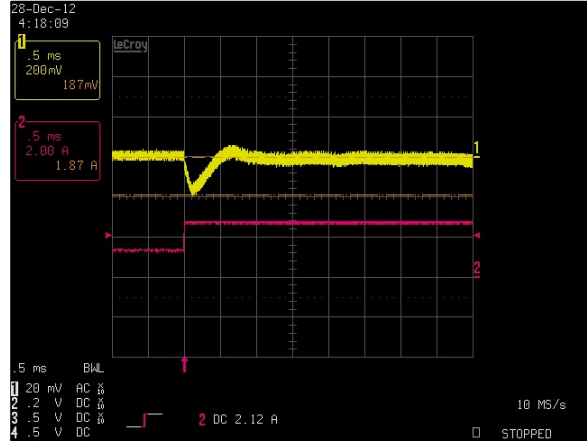


Figure 63: LPS109-M Transient Response - Vo Deviation  
 Vin = 115Vac Load: Io = 50% to 100%, 1A/ $\mu$ s slew rate  
 Ch 1: Vo Ch 2: Io

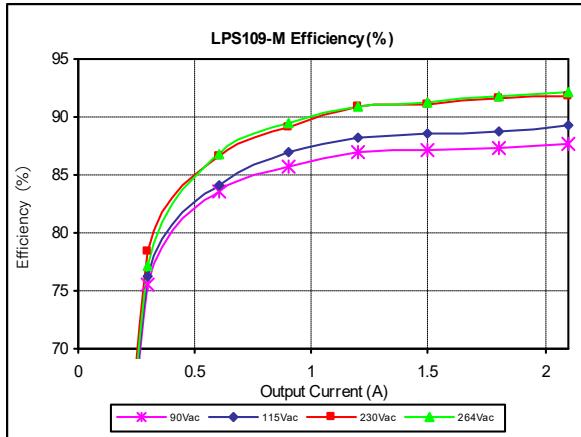


Figure 64: LPS109-M Efficiency Curves @ 25 degC  
 Convection Cooling  
 Vin = 90 to 264Vac Load: Io = 0 to 1.85A, I<sub>FAN</sub> = 0A

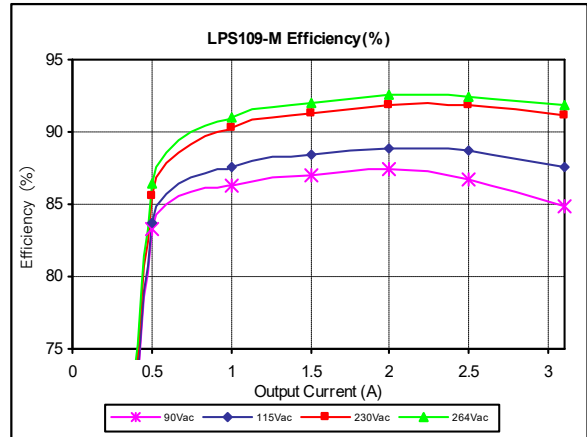


Figure 65: LPS109-M Efficiency Curves @ 25 degC  
 30 CFM Forced Air  
 Vin = 90 to 264Vac Load: Io = 0 to 2.8A, I<sub>FAN</sub> = 0A

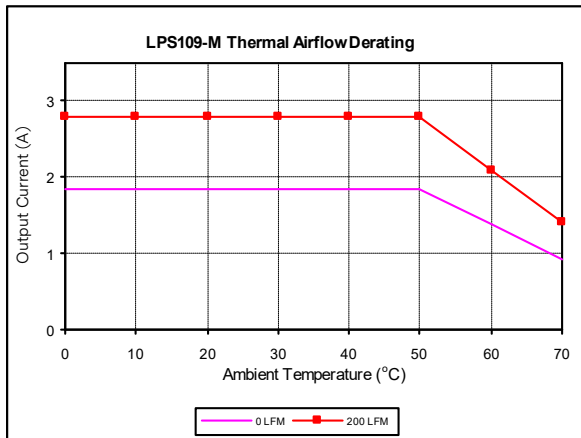


Figure 66: LPS109-M Derating Curves  
 Vin = 115Vac Load: Io = 0 to 2.8A, I<sub>FAN</sub> = 0A

## ELECTRICAL SPECIFICATIONS

### Protection Function Specifications

#### Input Fuse

LPS100-M series power supply is equipped with an internal non user serviceable 2.5 A, 250 Vac, type 392 fuse for fault protection in both the 'line' and 'neutral' lines input.

#### Over Voltage Protection (OVP)

The power supply main output will latch off during output overvoltage with the AC line recycled to reset the latch.

##### LPS102-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overvoltage	6.5	/	7.5	V

##### LPS103-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overvoltage	15.6	/	18.0	V

##### LPS104-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overvoltage	19.5	/	22.5	V

##### LPS105-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overvoltage	31.2	/	36.0	V

##### LPS108-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overvoltage	62.4	/	72.0	V

##### LPS109-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overvoltage	70.2	/	81.0	V

#### Short Circuit Protection (SCP)

The power supply will withstand a continuous short circuit with no permanent damage. The power supply will automatically restart when the short circuit is removed. A short is defines as impedance less than 50 milliohms.

## ELECTRICAL SPECIFICATIONS

### Protection Function Specifications

#### Over Current Protection (OCP)

LPS100-M series power supply includes internal current limit circuitry to prevent damage in the event of overload or short circuit. In the event of overloads, the output voltage may deviate from the regulation band but recovery is automatic when the load is reduced to within specified limits.

##### LPS102-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overcurrent	26.4	/	38.4	A

##### LPS103-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overcurrent	13.7	/	18.0	A

##### LPS104-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overcurrent	11.0	/	16.0	A

##### LPS105-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overcurrent	6.9	/	10.0	A

##### LPS108-M

Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overcurrent	3.4	/	5.0	A

##### LPS109-M

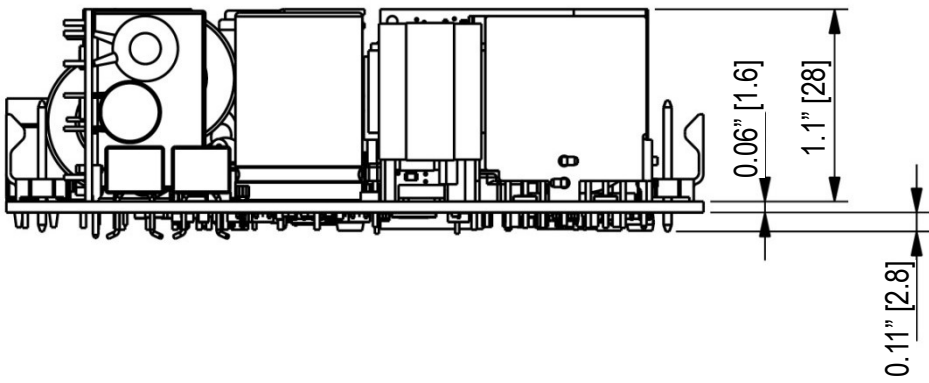
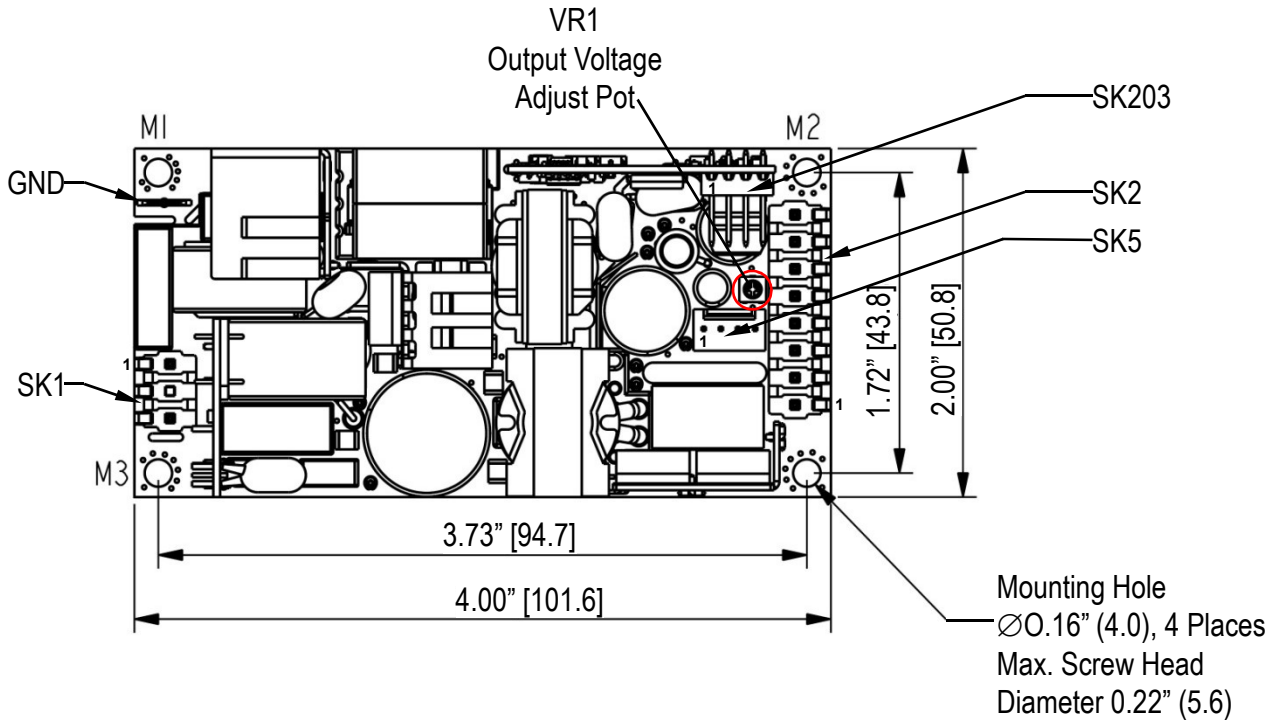
Parameter	Min	Typ	Max	Unit
V <sub>O</sub> Output Overcurrent	3.1	/	4.5	A

#### Over Temperature Protection (OTP)

The power supply latches off during over-temperature condition and returns back to normal operation when the power supply is cooled down. The power supply might experience over-temperature conditions during a persistent overload on the output. Overload conditions can be caused by external faults. OTP might also be entered due to a loss of control of the environmental conditions, e.g. an increase in the converter's ambient temperature due to a failing fan or external cooling system etc.

# MECHANICAL SPECIFICATIONS

## Mechanical Outlines (Dimensioning and Mounting Locations)



- All dimensions in inches [mm], tolerance is +/-0.02" [0.5mm]
- Mounting holes M1 and M2 should be grounded for EMI purpose
- Mounting hole M1 is safety ground connection
- Requires mounting on standoffs 0.20" [5.0mm] in height

## MECHANICAL SPECIFICATIONS

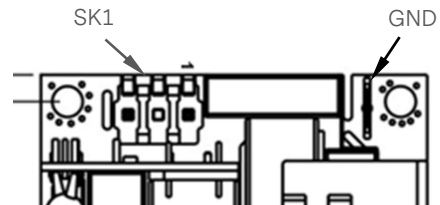
### Connector Definitions

#### AC Input Connector - SK1

Pin 1 - Neutral

Pin 3 - Line

Earth Ground - GND



#### Output Connector - SK2

Pin 1 - Output Return

Pin 2 - Output Return

Pin 3 - Output Return

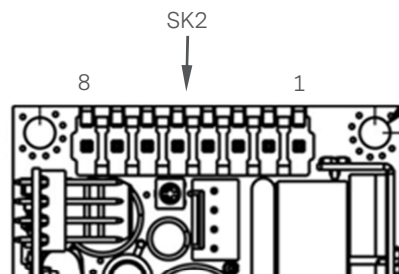
Pin 4 - Output Return

Pin 5 - +Vo

Pin 6 - +Vo

Pin 7 - +Vo

Pin 8 - +Vo



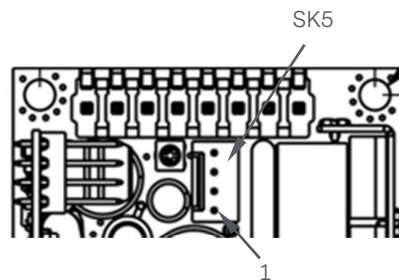
#### 12V Fan Supply Header - SK5

Pin 1 - +12V VFAN

Pin 2 - +12V VFAN

Pin 3 - FAN Return1

Pin 4 - FAN Return1



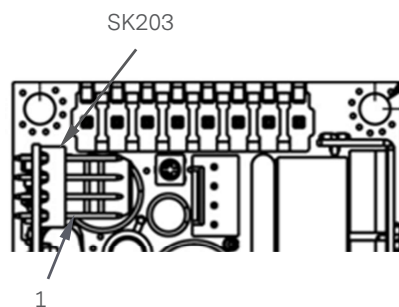
#### Control Signal Header - SK203

Pin 1 - Output Return

Pin 2 - Power Fail

Pin 3 - - Remote Sense

Pin 4 - + Remote Sense



Note - FAN Return is isolated from the main Output Return

## MECHANICAL SPECIFICATIONS

### Power / Signal Mating Connectors and Pin Types

Table 4. Mating Connectors for LPS100-M Series			
Reference	Vendor	Mating Connector or Equivalent	Mating Pins/Terminals or Equivalent
SK1	Molex	09-50-8031	08-52-0113
	Landwin	3060S0302	3360T011P
GND	Molex	01-90020001	/
SK2	Molex	09-50-8081	08-52-0113
	Landwin	3060S0802	3360T011P
SK5	Molex	22-01-1042	08-70-0049
	Landwin	2510S04A0	2543T011P
SK203	Molex	35155-0400	08-70-0057
	Landwin	2640S04A0	2543T011P

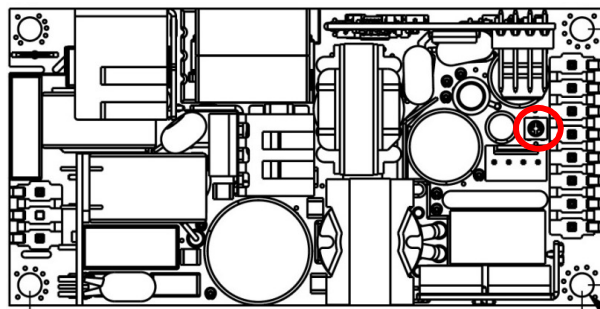
LPS100-M connector kit can be ordered separately. Connector Kit #: 70-841-025.

A LPS100-M connector kit contains the following:

- 1pcs Molex 09-50-8031 header housing for SK1
- 1pcs Molex 09-50-8081 header housing for SK2
- 12pcs Molex 08-52-0113 crimp pins for Molex 09-50-8031 and Molex 09-50-8081
- 1pcs Molex 01-90020001 insulated female lug for GND
- 1pcs Molex 22-01-1042 header housing for SK5
- 4pcs Molex 08-70-0049 crimp pins for Molex 22-01-1042
- 1pcs Molex 35155-0400 header housing for SK203
- 4pcs Molex 08-70-0057 crimp pins for Molex 35155-0400

### Potentiometer Definitions

VR1 - Main output voltage adjustment



## MECHANICAL SPECIFICATIONS

### Weight

The LPS100-M series weight is 0.44lb / 200g maximum.



## ENVIRONMENTAL SPECIFICATIONS

### EMC Immunity

LPS100-M series power supply is designed to meet the following EMC immunity specifications.

Table 5. Environmental Specifications											
Document	Description										
EN60601-1-2: 2001											
EN 55022	Conducted Level B (stand alone) and Radiated Level B (in system)										
IEC 61000-4-2	ESD up to 4kV contact, 8kV discharge										
IEC 61000-4-3	RFI 3V/m										
IEC 61000-4-4	Electrical Fast Transients level 3 minimum										
IEC 61000-4-5	Surge level 3 minimum										
IEC 61000-4-6	Radio frequency common mode, Levels 3V (rms) Modulated AM 80%, 1 kHz, 150 ohm source impedance										
IEC 61000-4-8	Power Frequency Magnetic Immunity, 1 A/m										
IEC 61000-4-11	AC Input transients  <table border="0"> <thead> <tr> <th><u>Condition</u></th> <th><u>Criteria</u></th> </tr> </thead> <tbody> <tr> <td>&gt; 95% dip, 0.5 period</td> <td>A</td> </tr> <tr> <td>60% dip, 5.0 periods</td> <td>B (A when Vin &gt;160 VAC)</td> </tr> <tr> <td>30% dip, 25 periods</td> <td>A</td> </tr> <tr> <td>&gt; 95% dip, 5 Sec</td> <td>B</td> </tr> </tbody> </table>	<u>Condition</u>	<u>Criteria</u>	> 95% dip, 0.5 period	A	60% dip, 5.0 periods	B (A when Vin >160 VAC)	30% dip, 25 periods	A	> 95% dip, 5 Sec	B
<u>Condition</u>	<u>Criteria</u>										
> 95% dip, 0.5 period	A										
60% dip, 5.0 periods	B (A when Vin >160 VAC)										
30% dip, 25 periods	A										
> 95% dip, 5 Sec	B										
IEC 61000-3-2	Harmonic currents emission										
FCC Part 15, Subpart J, Class B	Conducted & radiated <sup>1</sup> emissions										
CISPR22 (EN55032), Class B	Conducted & radiated <sup>1</sup> emissions										
IEC601-1 and International Electrotechnical Commission.											
EN60601											
CE Marking	LVD and EMC										

Note 1 – To be tested with system enclosure.

## ENVIRONMENTAL SPECIFICATIONS

### Safety Certifications

The LPS100-M series power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 6. Safety Certifications for LPS100-M Series Power Supply System		
Standard	File #	Description
UL/cUL	E182560-A60-UL-X1	US and Canada Requirements
EN62368-1	/	European Requirements
IEC62368-1	/	International Requirements
CB Certificate and Report	211-21180290-000	(All CENELEC Countries)
CE	19141	CE Marking (LVD)
UKCA	/	UKCA Marking
CQC	CQC12001084865	GB4943.1-2011

## ENVIRONMENTAL SPECIFICATIONS

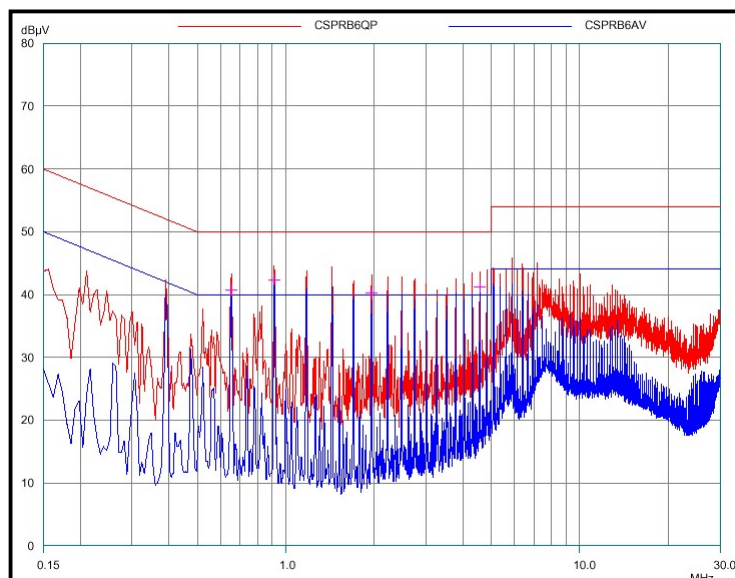
### EMI Emissions

The LPS100-M series has been designed to comply with the Class B limits of EMI requirements of EN55032 (FCC Part 15) and CISPR 22 (EN55032) for emissions and relevant sections of EN61000 (IEC 61000) for immunity.

The unit is enclosed inside a metal box, tested at 150W using resistive load with cooling fan.

### Conducted Emissions

The applicable standard for conducted emissions is EN55022 (FCC Part 15). Conducted noise can appear as both differential mode and common mode noise currents. Differential mode noise is measured between the two input lines, with the major components occurring at the supply fundamental switching frequency and its harmonics. Common mode noise, a contributor to both radiated emissions and input conducted emissions, is measured between the input lines and system ground and can be broadband in nature.



The LPS100-M series power supply have internal EMI filters to ensure the convertor's conducted EMI levels comply with EN55022 (FCC Part 15) Class B and EN55022 (CISPR 22) Class B limits. The EMI measurements are performed with resistive loads under forced air convection at maximum rated loading.

Sample of EN55022 Conducted EMI Measurement at 100Vac input.

Note: Red Line refers to Advanced Energy Quasi Peak margin, which is 6dB below the CISPR international limit. Blue Line refers to Advanced Energy Average margin, which is 6dB below the CISPR international limit.

Conducted EMI emissions specifications of the LPS100-M series:

Parameter	Model	Symbol	Min	Typ	Max	Unit
FCC Part 15, Class B	All	Margin	-	-	6	dB
CISPR 22 (EN55022) Class B	All	Margin	-	-	6	dB
EN 60601-1-2: 2001	All	Margin	-	-	6	dB
VCCI Class II	All	Margin	-	-	6	dB

### Radiated Emissions

Unlike conducted EMI, radiated EMI performance in a system environment may differ drastically from that in a stand-alone power supply. The shielding effect provided by the system enclosure may bring the EMI level from Class A to Class B. It is thus recommended that radiated EMI be evaluated in a system environment. The applicable standard is EN55022 Class A (FCC Part 15). Testing ac-dc convertors as a stand-alone component to the exact requirements of EN55022 can be difficult, because the standard calls for 1m leads to be attached to the input and outputs and aligned such as to maximize the disturbance. In such a set-up, it is possible to form a perfect dipole antenna that very few ac-dc convertors could pass. However, the standard also states that 'an attempt should be made to maximize the disturbance consistent with the typical application by varying the configuration of the test sample'.

## ENVIRONMENTAL SPECIFICATIONS

The LPS100-M series power supply is designed to meet all of its specifications during any combination of operating ambient conditions and after exposure to any combination of non-operating ambient conditions specified in this section.

Table 7. Maximum Ambient Conditions						
Parameter	Model	Symbol	Min	Typ	Max	Unit
Ambient Operating Temperature	All	$T_A$	0	-	+70 <sup>1</sup>	°C
Cold Start-up Temperature	All	$T_{ST}$	-20	-	-	°C
Storage Temperature	All	$T_{STG}$	-40	-	+85	°C
Shock			Accordance to IEC 68-2-27 Three positive and negative pulses in each axis			
Operating	All		4G, half sine, 22mSec duration			
Non-operating	All		30G, half sine, 18mSec duration			
Vibration			Accordance to IEC 68-2-6 to levels IEC 721-3-2 Tested in three mutually perpendicular axes			
Operating	All		Random - 1.0g rms, 10-500Hz, 20 minutes/axis			
Non-operating	All		Sine - 1.0g rms, 10-500Hz, 15 minutes/axis Random - 2.7 g rms, 10-2000Hz, 20 minutes/axis			
MTBF						
Convection 25°C	All		$V_{IN,AC} = 115Vac$	>200,000hrs		
			$V_{IN,AC} = 230Vac$	>300,000hrs		
Forced air 25°C	All		$V_{IN,AC} = 115Vac$	>400,000hrs		
			$V_{IN,AC} = 230Vac$	>500,000hrs		

Note 1 - Derate each output at 2.5% per degree C from 50°C to 70°C.

## POWER AND CONTROL SIGNAL DESCRIPTIONS

### AC Input (SK1)

This connector supplies the AC Mains to the LPS100-M series power supply.

Pin 1 - Neutral

Pin 3 - Line

### Earth Ground (GND)

This tab connector is the safety ground connection and should be connected to AC input earth ground.

GND - Earth Ground (Safety Ground)

### Main Output (SK2)

These terminals provide the main output for the LPS100-M. The Vo and the Output Return terminals are the positive and negative rails, respectively of the main output of the LPS100-M series power supply. The Main Output is electrically isolated from the Earth Ground and can be operated as a positive or negative output.

Pin 1 to 4 - Output Return

Pin 5 to 8 - +Vo

### Vo Output voltage adjustment

The main output of the LPS100-M series power supply can be adjusted by +/- 10% from its nominal output voltage via the potentiometer VR1. Since the 12V Fan Supply is not independently regulated (except on LPS102-M and LPS104-M), its output voltage may change according to Vo set point.

### 12V Fan Supply (SK5)

The LPS100-M series power supply contains an isolated 12V output for powering a cooling fan or as a aux power source. This 12V Fan Supply is provided in a 4 pin header connector SK5.

Pin 1 and 2 - +12V VFAN

Pin 3 and 4 - FAN Return

## POWER AND CONTROL SIGNAL DESCRIPTIONS

### Control Signals (SK203)

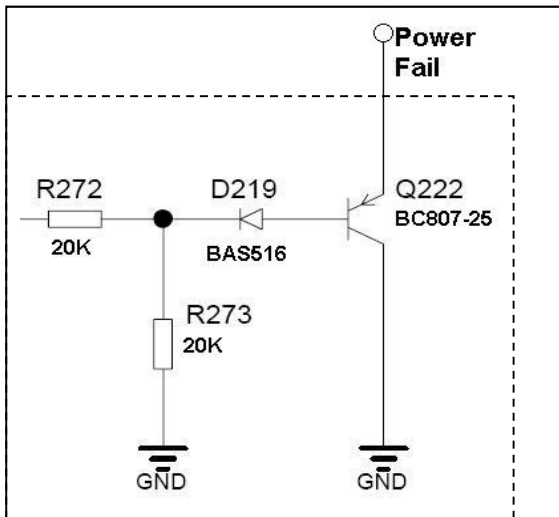
The LPS100-M series contains a 4-pin control signal header providing analogy control interface.

#### Output Return - (SK203 - Pin 1)

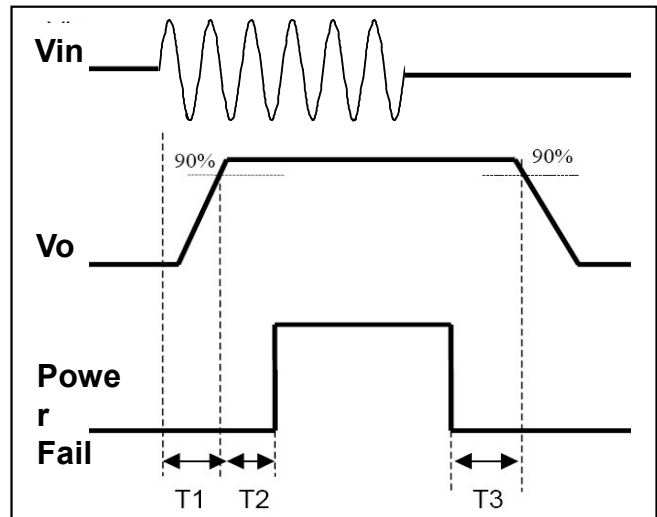
This pin is the control signal ground reference in the SK203 control header. It is electrically connected to the main output return.

#### Power Fail - (SK203 - Pin 2)

Power Fail is an open emitter output capable of sinking 10A maximum at 0.9V. This signal is referenced to output return. Add a pull-up resistor (10K) to an external supply (12V max) for the Power Fail signal.



Power Fail signal output equivalent circuit



Power Fail signal timing diagram

#### Low to High Transition (Power OK)

Mains AC Application - Delay time measurement between the application of the Mains AC at the power supply input to the availability of the regulated  $V_o$  - T1 (Turn On Delay) and the delay time T2 to when Power Fail signal indicates output voltage  $V_o$  is OK. AC line should be considered at 0 degrees at time of initial application to the AC input.

#### High to Low Transition (Power Fail)

Loss of Main AC - The high to low transition of the Power Fail signal shall be an indication of the impending loss of  $V_o$  regulation due to a shutdown condition such as the loss of Mains AC, Overvoltage Protection or Over Temperature Protection. The AC line should be considered at 0 degrees at the time of removal from the power supply input.

**Table 8. Timing specifications of the Power Fail signal**

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Turn On Delay	$V_{IN,AC} = 90V_{ac}$ $P_O = P_{O,maxFA}$	T1	-	-	2	Sec
Power OK Delay	$V_{IN,AC} = 115V_{ac}$ $P_O = P_{O,maxFA}$	T2	100	-	500	mSec
Power Fail Delay	$V_{IN,AC} = 115V_{ac}$ $P_O = P_{O,maxFA}$	T3	6	-	-	mSec

## POWER AND CONTROL SIGNAL DESCRIPTIONS

### +Remote Sense, -Remote Sense (Remote Sensing) - (SK203 - Pin 3 and Pin 4)

The main output of the LPS100-M series power supply is equipped with a Remote Sensing capability that will compensate for a voltage drop of up to a 0.5V between the output terminals of the supply and the sensed voltage point (load). This feature is implemented by connecting the Vo +Remote Sense (pin 4) and the Vo -Remote Sense (pin 3) terminals to the positive and negative rails of the main output, respectively, at a location that is near to the load. Care should be taken in the routing of the sense lines as any noise sources or additional filtering components introduced into the voltage rail may affect the stability of the power supply. The LPS100-M series power supply will operate appropriately without the sense lines connected; however it is recommended that the sense lines be connected directly to the main output terminals if remote sensing is not required.

The power supply is protected against damage caused by inadvertent reverse connection of the Remote Sense lines.

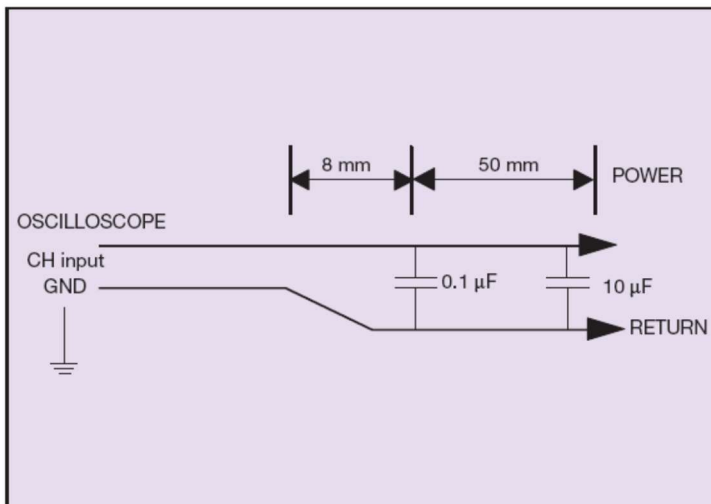
Remote sensing has no effect on the +12V  $V_{FAN}$  output.

Note - The maximum output voltage of the LPS100-M series power supply is limited to +10% above the nominal setting, trimming the main output above the nominal may limit the maximum amount of voltage sense compensation.

## APPLICATION NOTES

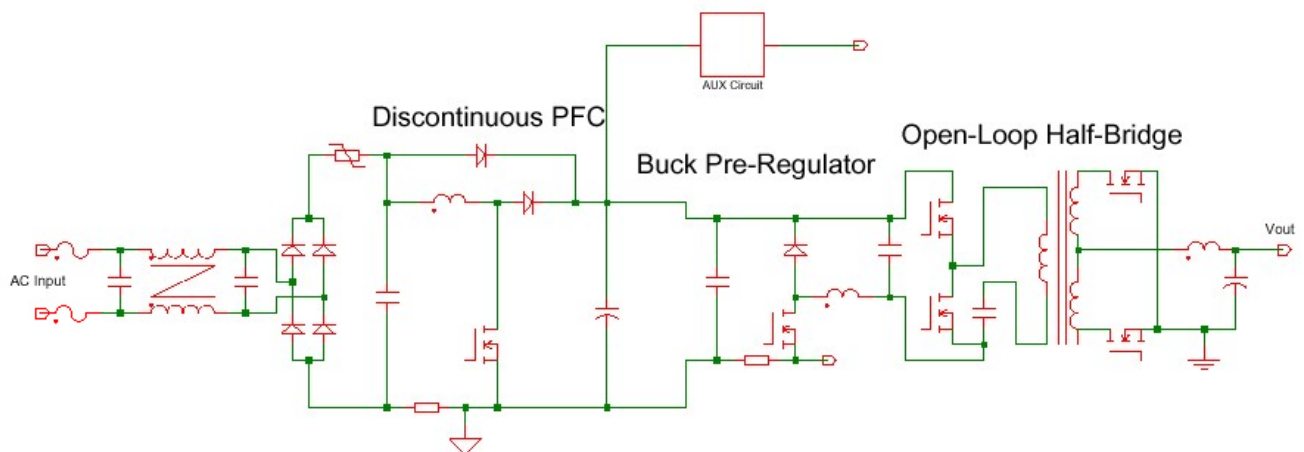
### Output Ripple and Noise Measurement

The setup outlined in the diagram below has been used for output voltage ripple and noise measurements on the LPS100-M series. When measuring output ripple and noise, a scope jack in parallel with a 0.1uF ceramic chip capacitor, and a 10 uF aluminum electrolytic capacitor should be used. Oscilloscope should be set to 20 MHz bandwidth for this measurement.



### Block Diagram

Below is the block diagram of the LPS100-M series power supply.





**RECORD OF REVISION AND CHANGES**

Issue	Date	Description	Originators
1.5	03.25.2013	Add LPS109 performance	K. Wang
1.6	04.08.2020	Remove setting time spec	K. Wang
1.7	06.18.2020	Update safety to 62368-1	A. Zhang
1.8	05.11.2022	Add UKCA mark, update block diagram and some format	A. Zhang



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