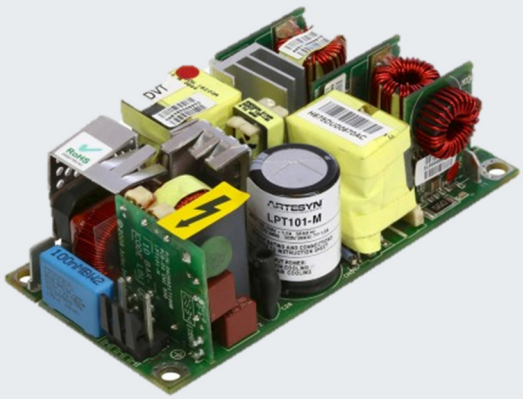
TECHNICAL REFERENCE NOTE

ARTESYN LPT100-M SERIES

130 Watts (forced air)



PRODUCT DESCRIPTION

Advanced Energy's Artesyn LPT100-M series features a universal 90 to 264 Vac input. The main output can deliver up to 130W continuously with 30CFM forced air cooling. The main output can be adjusted over the range +/-10% over nominal set output voltage. LPT100-M series is comprehensively protected against overvoltage, over temperature and short-circuit conditions, and features a 'power fail' signal for remote monitoring purposes which will change state at least 6 ms before the main output loses regulation. The power supplies have a full load ambient operating temperature range of 0 to +50 degrees Celsius without de-rating, up to 70 degrees Celsius with derating, and can cold-start from temperatures as low as -20 degrees Celsius.

AT A GLANCE

Total Power

130 Watts

Input Voltage

90 to 264 Vac

# of Outputs

Triple

RoHS

SPECIAL FEATURES

- Medical and ITE safeties
- 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
- LPX100 enclosure kit available
- RoHS complaint

SAFETY

TUV	62368 / 60601-1
UL	62368 / 60601-1
CSA	62368 / 60601-1
NEMKO	62368 / 60691-1
AUSTEL	62368 / 60601-1
CB	Certificate and report
CE	Mark (LVD)
UKCA	Mark

MODEL NUMBERS

Standard	Output Voltage	Minimum Load	Maximum Load Forced Air (30CFM)	Peak Load[1]
LPT101-M	+3.3 V	0A	18 A	20 A
	+5 V	0A	9 A	10 A
	+12 V	0A	2.3A	2.3 A
LPT102-M	+5 V	0A	18 A	20 A
	+12 V	0A	9 A	10 A
	-12 V	0A	2 A	2 A
LPT103-M	+5 V	0A	18 A	20 A
	+15 V	0A	7.2 A	8 A
	-15 V	0A	1.5A	2 A
LPT104-M	+5 V	0A	18A	20A
	+24 V	0A	3A	3.5 A
	+12 V	0A	2.3A	2.3 A

Note 1 - Peak current lasting <15 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	$V_{IN,DC}$	127	-	300	Vdc
Maximum Output Power Force air continuos operation - 30CFM	All models	$P_{O,maxFA}$	-	-	130	W
Isolation Voltage						
Input to outputs	All models		-	-	4000	Vac
Input to safety ground	All models		-	-	1500	Vac
Outputs to safety ground	All models		-	-	500	Vdc
Ambient Operating Temperature[1]	All models	T_A	0	-	+70	ºC
Cold Start-up Temperature	All models	T_{ST}	-20	-	-	ºC
Storage Temperature	All models	T_{STG}	-40	-	+85	ºC
Humidity (non-condensing)						
Operating	All models		10	-	90	%
Non-operating	All models		10	-	95	%
Altitude						
Operating[2]	All models		-500	-	13,000	feet
Non-operating	All models		-1,000	-	50,000	feet

Note 1 - Derate each output at 2.5% per degree C from 50ºC to 70ºC.
Note 2 - Derate maximum operating temperature by 1ºC per 1,000 feet above 13,000 feet.

ELECTRICAL SPECIFICATIONS

Input Specifications

Table 2. Input Specifications

Parameter		Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, AC		All	$V_{IN\ AC}$	90	115/230	264	Vac
Input AC Frequency		All	f_{IN}	47	50/60	63	Hz
Operating Input Voltage, DC		All	$V_{IN,DC}$	120	-	300	Vdc
Maximum steady state Input Current		$V_{IN,AC}$ = 90Vac	$I_{IN,max}$	- -	- -	2.2	Aac
No Load Input Current (V_O = nominal, I_O = 0)		$V_{IN,AC}$ = 90Vac $V_{IN,AC}$ = 264Vac	$I_{IN,no-load}$	- -	- -	150 150	mAac
Harmonic Line Currents		All	THD	Per EN61000-3-2			
Power Factor		$V_{IN,AC}$ = 90-264Vac P_O = $P_{O,maxFA}$	PF	0.90	-	-	
Startup Surge Current (Inrush) @ 25°C		$V_{IN,AC}$ = 230Vac	$I_{IN,surge}$	-	-	50	A_{PK}
Input Fuse		Internal, L and N F2A5, 250V, Type 392		-	-	2.5	A
Input AC Low Line Start-up Voltage		P_O = $P_{O,maxFA}$	$V_{IN,AC-start}$	70	-	80	Vac
Input AC Undervoltage Lockout Voltage		P_O = $P_{O,maxFA}$	$V_{IN,AC-stop}$	65	-	75	Vac
Input DC Low Line Start-up Voltage		P_O = $P_{O,maxFA}$	$V_{IN,DC-start}$	100	-	110	Vdc
Input DC Undervoltage Lockout Voltage		P_O = $P_{O,maxFA}$	$V_{IN,DC-stop}$	95	-	105	Vdc
No Load Input Power (V_O = nominal, I_O = 0)		$V_{IN,AC}$ = 115/230Vac	$P_{IN,no-load}$	-	-	10	W
PFC Switching Frequency		All	$f_{SW,PFC}$	45	-	270	kHz
DCDC Switching Frequency		All	$f_{SW,DC-DC}$	115	-	145	kHz
Efficiency (T_A = 25°C, forced air cooling)	LPT101-M LPT102-M LPT103-M LPT104-M	$V_{IN,AC}$ = 230Vac I_O = 0.75 * $I_{O,maxFA}$	η	- - - -	81.5 82.5 82.5 81.0	- - - -	%
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
Leakage Current to safety ground	All models	(V_{IN} = 264Vac, f_{IN} = 50/60 Hz)	$I_{IN,leakage}$	-	-	275	µA
System Stability: Phase Margin Gain Margin		330mF/A Capacitive Load		 45 10		 - -	 ∅ dB

ELECTRICAL SPECIFICATIONS

Output Specifications

Table 3. Output Specifications

Parameter		Conditions	Symbol	Min	Typ	Max	Unit
Output Regulation	LPT101-M	Inclusive of setpoint, line, load temperature change, warm-up drift and cross regulation	V_o1 V_o2 V_o3	3.234 4.9 11.4	3.30 5.0 12.0	3.336 5.1 12.6	V
	LPT102-M		V_o1 V_o2 V_o3	4.9 11.4 -11.4	5.0 12.0 -12.0	5.1 12.6 -12.6	V
	LPT103-M		V_o1 V_o2 V_o3	4.9 14.25 -14.25	5.0 15.0 -15.0	5.1 15.75 -15.75	V
	LPT104-M		V_o1 V_o2 V_o3	4.9 22.32 11.4	5.0 24.0 12.0	5.1 25.68 12.6	V
Output Ripple, pk-pk	All models	Measure with a 0.1µF ceramic capacitor in parallel with a 10µF tantalum capacitor	V_o1 V_o2 V_o3	- - -	- - -	50mV 1%V_o2 1%V_o3	mV_{PK-PK}
Force Air Output Current, continuous	LPT101-M	30 CFM force air cooling	$I_{O,maxFA}$	0 0 0	- - -	18 9 2.3	A
	LPT102-M			0 0 0	- - -	18 9 1.5	A
	LPT103-M			0 0 0	- - -	18 7.2 1.5	A
	LPT104-M			0 0 0	- - -	18 4.5 1.5	A
Maximum Force air Output Power, continuous	LPT101-M LPT102-M LPT103-M LPT104-M	Main output , 30 CFM	$P_{O,maxFA}$	-	-	130	W
Output Current, peak	LPT101-M	Maximum duration <15 seconds, maximum duty cycle <10%	$I_{O,peak}$	- - -	- - -	20 10 2.3	A
	LPT102-M			- - -	- - -	20 10 2	A
	LPT103-M			- - -	- - -	20 8 2	A
	LPT104-M			- - -	- - -	20 5 2	A

ELECTRICAL SPECIFICATIONS

Output Specifications

Table 3. Output Specifications Con't

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Output Adjust Range	LPT101-M	$V_{IN,AC}$ = 115V_{AC} I_O = 50% of $I_{O,maxFA}$	V_o1 V_o2 V_o3	-15 -20 -20	- - -	+10 +10 +10	%
	LPT102-M LPT103-M		V_o	-20	-	+10	%
	LPT104-M		V_o1 V_o2 V_o3	-20 -10 -20	- - -	+10 +20 +10	%
V_O Capacitive Load[1]		Startup	-	0	-	330	µF/A
V_O Dynamic Response - Peak Deviation	All models	50% (50% to 100% of $I_{O,maxFA}$) load change Slew rate = 1A/µs Output capacitance = 100µF/A	V_o1 V_o2 V_o3	-5 -5 -5	- - -	+5 +5 +5	%
V_O Dynamic Response - Setting Time	All models	50% (50% to 100% of $I_{O,maxFA}$) load change Slew rate = 1A/µs Output capacitance = 100µF/A	T_s	-	-	500	µSec
V_O Turn On Overshoot	All models	I_O = 0	V_O	-	-	3%Vo or 150mV which ever is great	V
V_O Long Term Stability	All models	Max change over 24 hours after thermal equilibrium (30 mins)	±%V_O	-	-	1.0	%
V_O Over Voltage Protection		Latch off (AC recycle to reset)	%V_O	115	-	135	%
V_O Over Current Protection		For V_o1 and V_o2	%I_O	110	-	160	%
		For V_o3	%I_O	150	-	250	%
Over Temperature Protection		All		Auto Recovery			
Short Circuit Protection		All		Auto Recovery			
Remote Sense, + and -		Maximum compensation at each output line	V_{SENSE}	-	-	500	mV

Note 1 - For 12V output or higher, the maximum capacitive load is 1500uF.

ELECTRICAL SPECIFICATIONS

LPT101-M Performance Curves

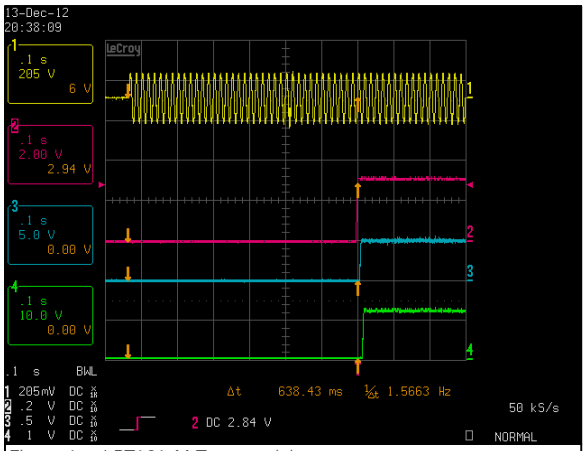


Figure 1: LPT101-M Turn-on delay
Vin = 90Vac Load: Pout = 130W
Ch 1: V_{IN} Ch 2: 3.3V Ch 3: 5.0V Ch 4: 12.0V

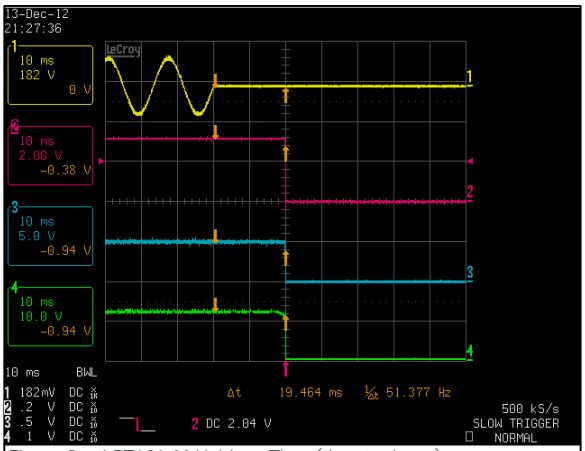


Figure 2: LPT101-M Hold-up Time (time to decay)
Vin = 90Vac Load: Pout = 130W
Ch 1: V_{IN} Ch 2: 3.3V Ch 3: 5.0V Ch 4: 12.0V

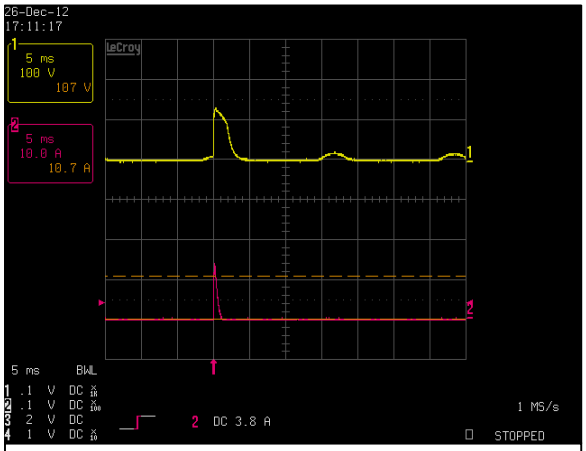


Figure 3: LPT101-M Inrush Current
Vin = 264Vac Load: Io = 0A, Turn on at 90 deg
Ch 1: V_{IN} Ch 2: I_{IN}

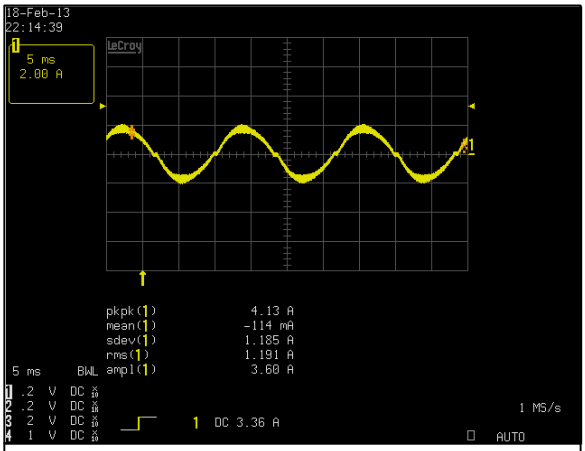


Figure 4: LPT101-M Input Current Waveform
Vin = 115Vac Load: Pout = 130W
Ch 1: I_{IN}

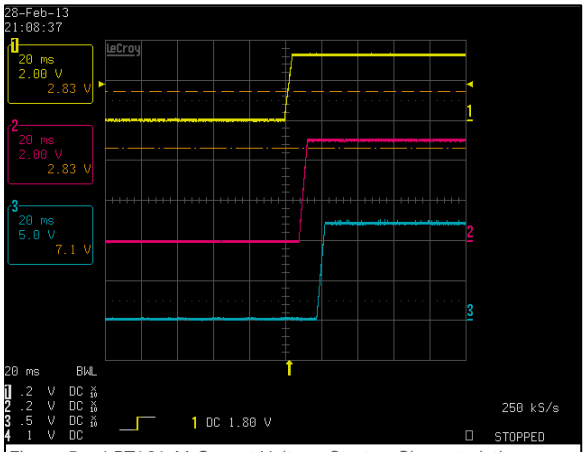


Figure 5: LPT101-M Output Voltage Startup Characteristic
Vin = 115Vac Load: Pout = 130W Output Capacitance = 330uF/A
Ch 1: 3.3V Ch 2: 5.0V Ch3: 12.0V

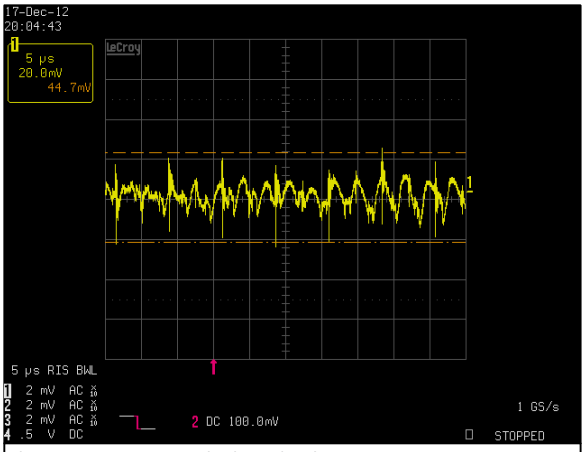


Figure 6: LPT101-M Ripple and Noise Measurement
Vin = 115Vac Load: Pout = 130W
Ch 1: 3.3V

ELECTRICAL SPECIFICATIONS

LPT101-M Performance Curves

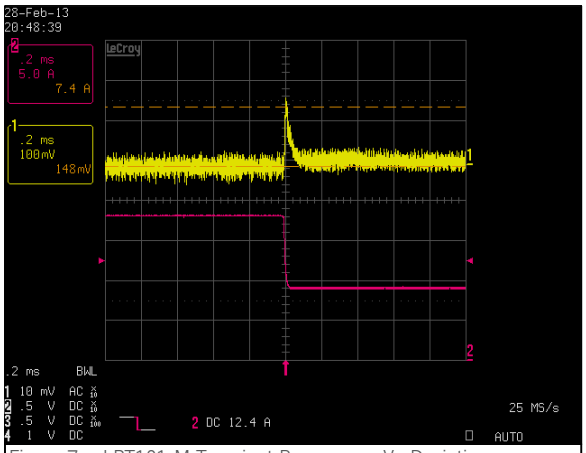


Figure 7: LPT101-M Transient Response – Vo Deviation
Vin = 90Vac Load: Io = 100% to 50%, 1A/us slew rate
Ch 1: 3.3V Ch 2: Io

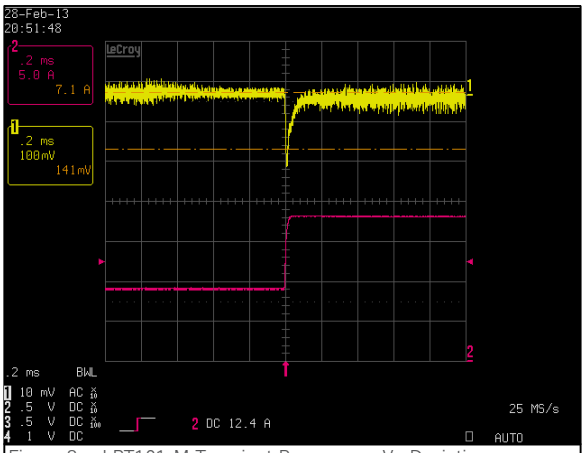


Figure 8: LPT101-M Transient Response – Vo Deviation
Vin = 90Vac Load: Io = 50% to 100%, 1A/us slew rate
Ch 1: 3.3V Ch 2: Io

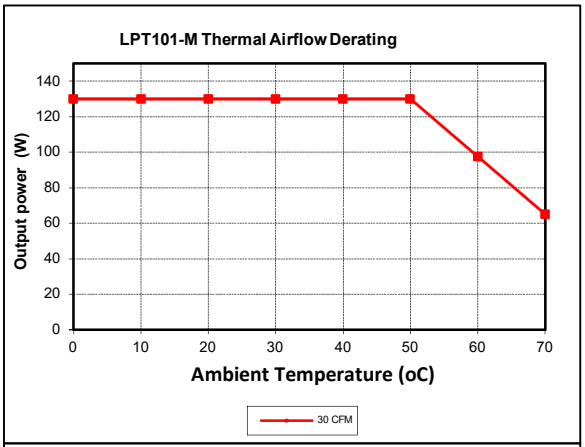


Figure 9: LPT101-M Derating Curve
30 CFM Forced Air
Vin = 115Vac Load: Pout = 0 to 130W

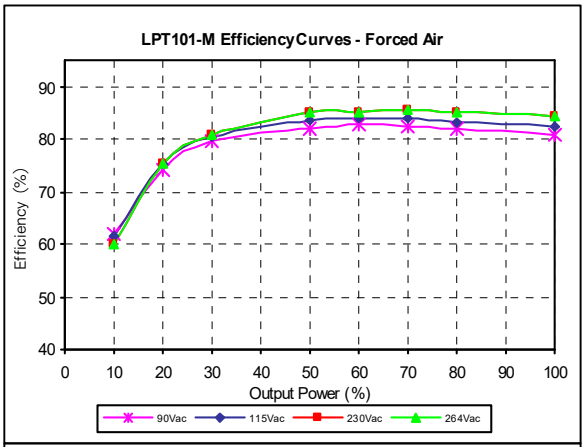


Figure 10: LPT101-M Efficiency Curves @ 25 degC
30 CFM Forced Air
Vin = 90 to 264Vac Load: Pout = 0 to 130W

ELECTRICAL SPECIFICATIONS

LPT102-M Performance Curves

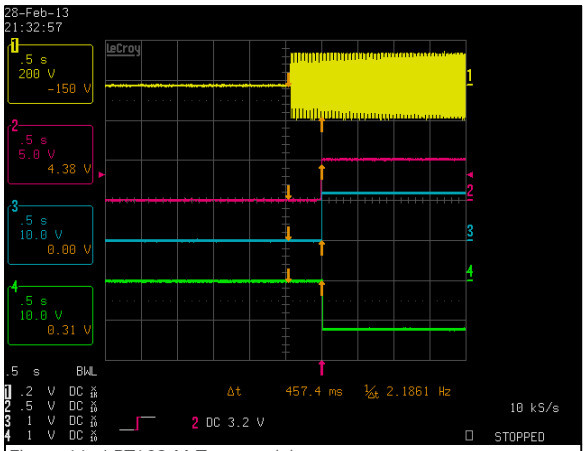


Figure 11: LPT102-M Turn-on delay
Vin = 90Vac Load: Pout = 130W
Ch 1: V_{IN} Ch 2: 5.0V Ch 3: 12.0V Ch 4: -12.0V

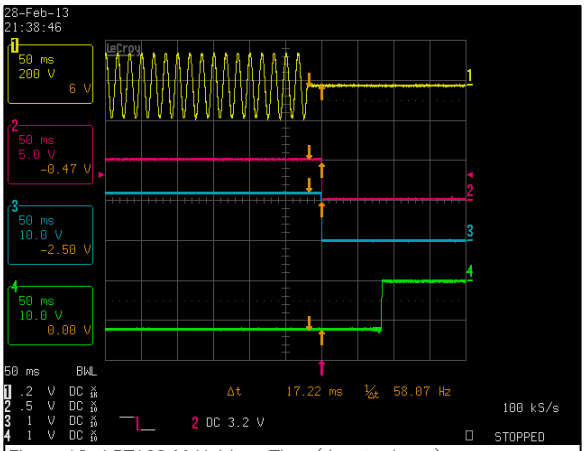


Figure 12: LPT102-M Hold-up Time (time to decay)
Vin = 90Vac Load: Pout = 130W
Ch 1: V_{IN} Ch 2: 5.0V Ch 3: 12.0V Ch 4: -12.0V

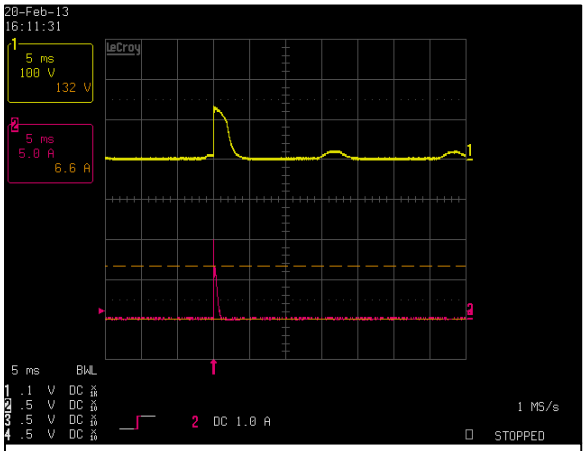


Figure 13: LPT102-M Inrush Current
Vin = 90Vac Load: Io = 0A, Turn on at 90 deg
Ch 1: V_{IN} Ch 2: I_{IN}

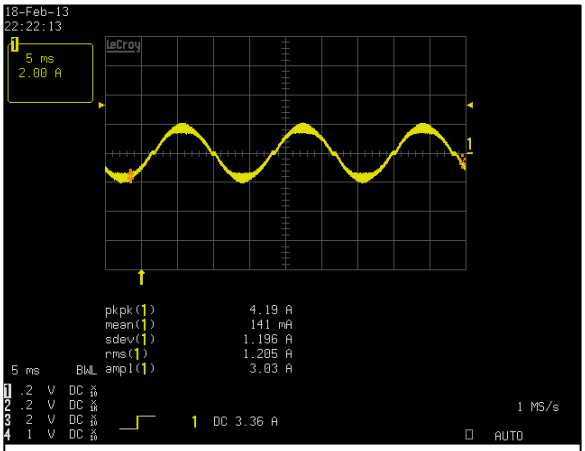


Figure 14: LPT102-M Input Current Waveform
Vin = 115Vac Load: Pout = 130W
Ch 1: I_{IN}

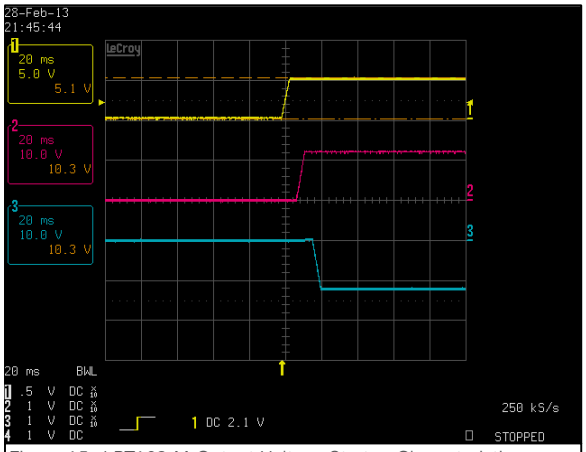


Figure 15: LPT102-M Output Voltage Startup Characteristic
Vin = 90Vac Load: Pout = 130W Output Capacitance = 330uF/A
Ch 1: 5.0V Ch 2: 12.0V Ch3: -12.0V

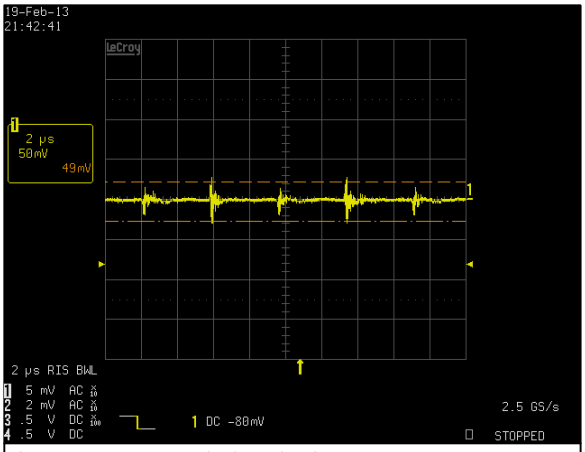


Figure 16: LPT102-M Ripple and Noise Measurement
Vin = 115Vac Load: Pout = 130W
Ch 1: 5.0V

ELECTRICAL SPECIFICATIONS

LPT102-M Performance Curves

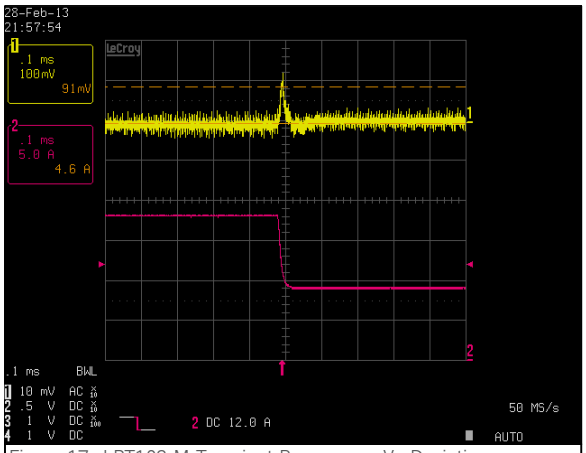


Figure 17: LPT102-M Transient Response – Vo Deviation
Vin = 90Vac Load: Io = 100% to 50%, 1A/us slew rate
Ch 1: 5.0V Ch 2: Io

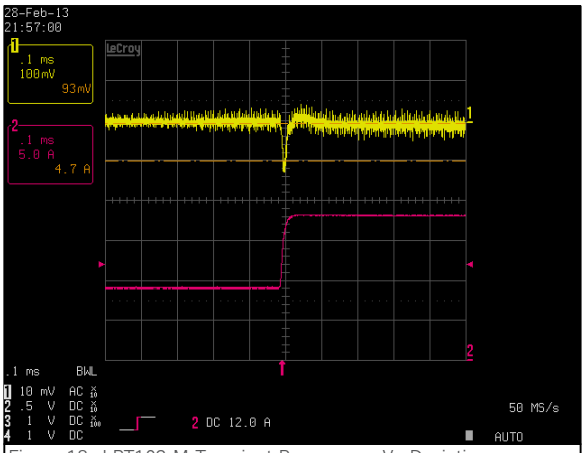


Figure 18: LPT102-M Transient Response – Vo Deviation
Vin = 90Vac Load: Io = 50% to 100%, 1A/us slew rate
Ch 1: 5.0V Ch 2: Io

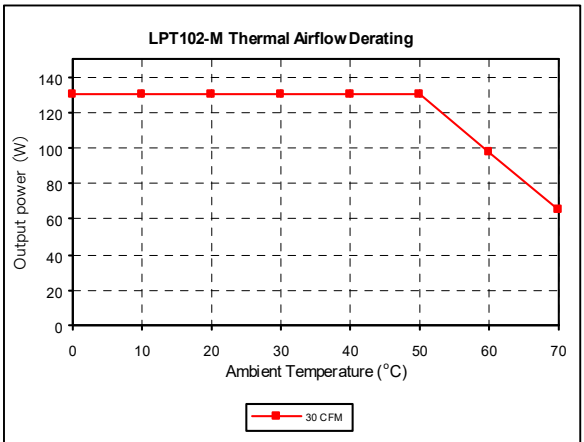


Figure 19: LPT102-M Derating Curve
30 CFM Forced Air
Vin = 115Vac Load: Pout = 0 to 130W

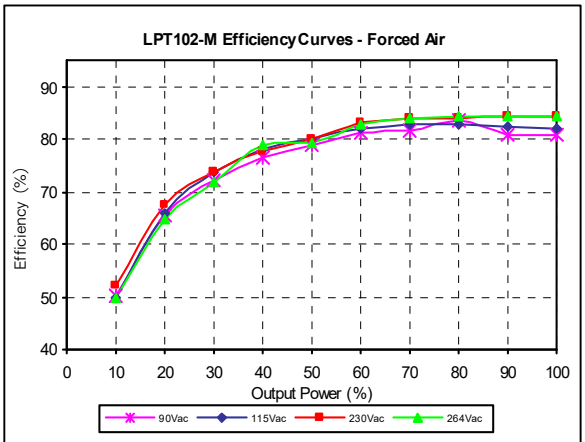


Figure 20: LPT102-M Efficiency Curves @ 25 degC
30 CFM Forced Air
Vin = 90 to 264Vac Load: Pout = 0 to 130W

ELECTRICAL SPECIFICATIONS

LPT103-M Performance Curves

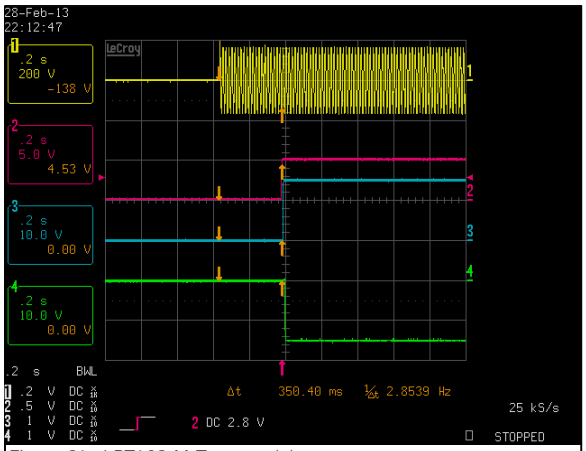


Figure 21: LPT103-M Turn-on delay
Vin = 90Vac Load: Pout = 130W
Ch 1: V_{IN} Ch 2: 5.0V Ch 3: 15.0V Ch 4: -15.0V

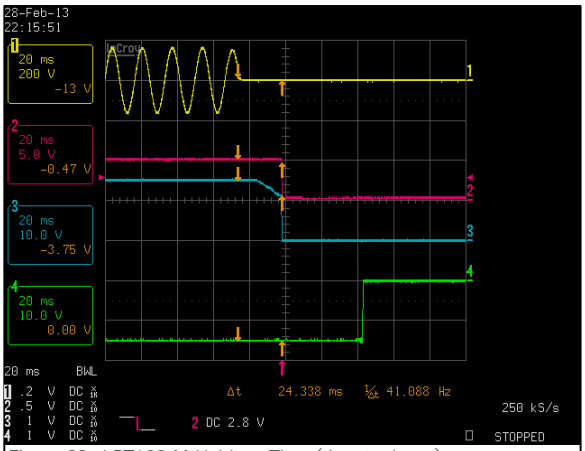


Figure 22: LPT103-M Hold-up Time (time to decay)
Vin = 90Vac Load: Pout = 130W
Ch 1: V_{IN} Ch 2: 5.0V Ch 3: 15.0V Ch 4: -15.0V

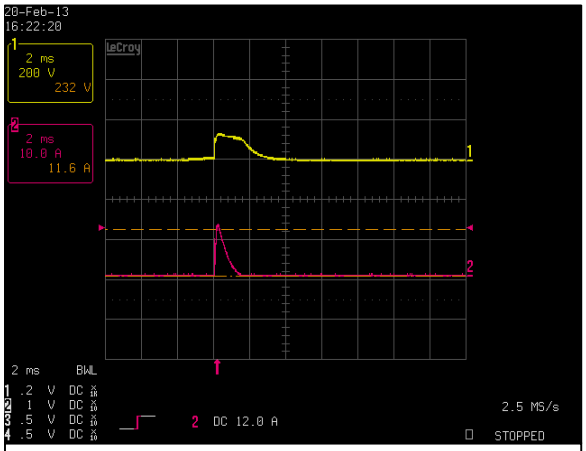


Figure 23: LPT103-M Inrush Current
Vin = 264Vac Load: Io = 0A, Turn on at 90 deg
Ch 1: V_{IN} Ch 2: I_{IN}

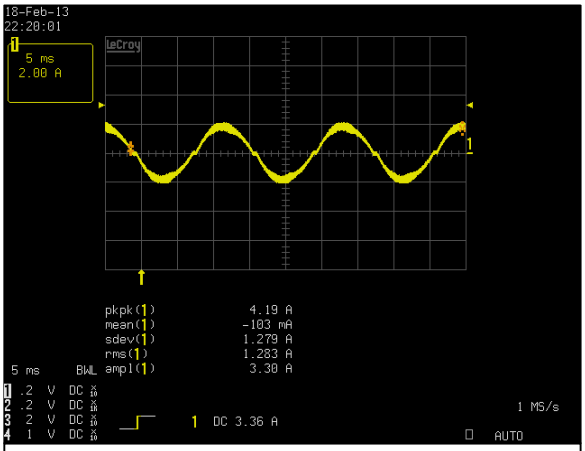


Figure 24: LPT103-M Input Current Waveform
Vin = 115Vac Load: Pout = 130W
Ch 1: I_{IN}

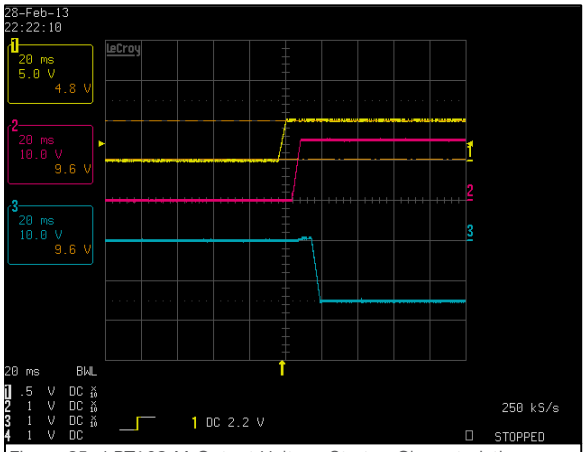


Figure 25: LPT103-M Output Voltage Startup Characteristic
Vin = 115Vac Load: Pout = 130W Output Capacitance = 330uF/A
Ch 1: 5.0V Ch 2: 15.0V Ch3: -15.0V

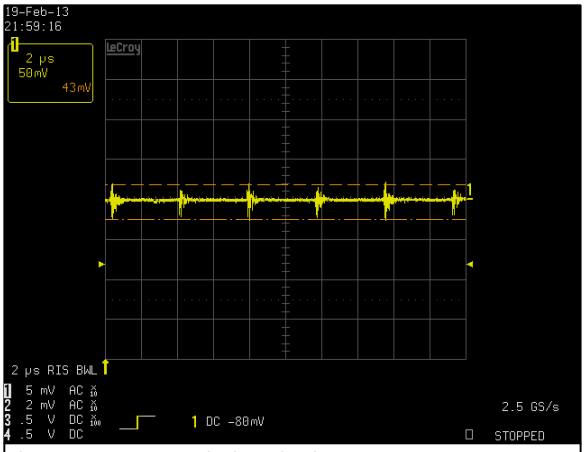


Figure 26: LPT103-M Ripple and Noise Measurement
Vin = 115Vac Load: Pout = 130W
Ch 1: 5.0V

ELECTRICAL SPECIFICATIONS

LPT103-M Performance Curves

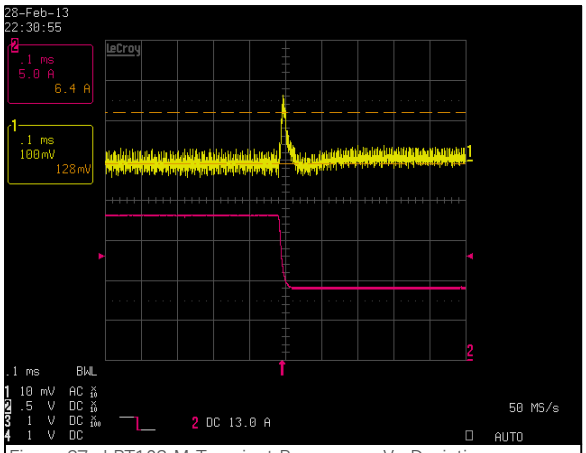


Figure 27: LPT103-M Transient Response – Vo Deviation
Vin = 90Vac Load: Io = 100% to 50%, 1A/us slew rate
Ch 1: 5.0V Ch 2: Io

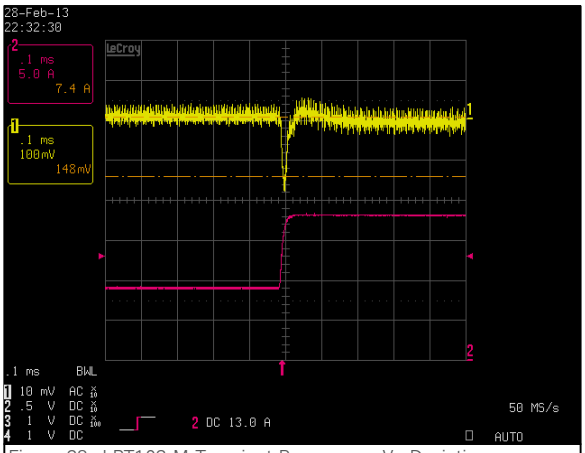


Figure 28: LPT103-M Transient Response – Vo Deviation
Vin = 90Vac Load: Io = 50% to 100%, 1A/us slew rate
Ch 1: 5.0V Ch 2: Io

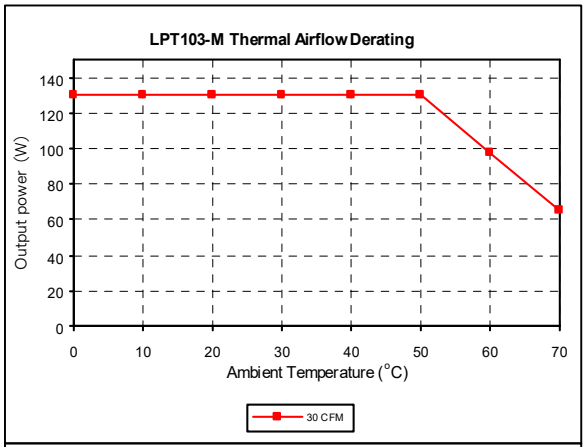


Figure 29: LPT103-M Derating Curve
30 CFM Forced Air
Vin = 115Vac Load: Pout = 0 to 130W

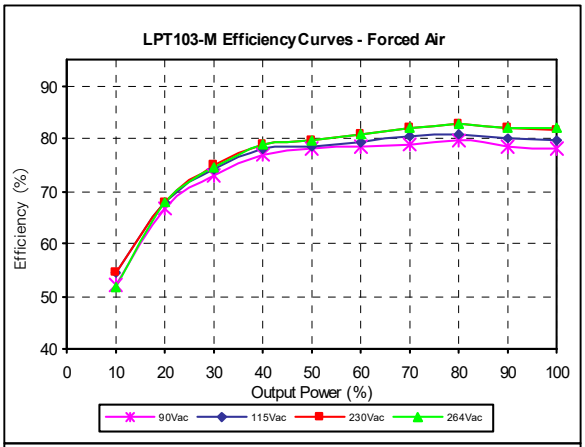


Figure 30: LPT103-M Efficiency Curves @ 25 degC
30 CFM Forced Air
Vin = 90 to 264Vac Load: Pout = 0 to 130W

ELECTRICAL SPECIFICATIONS

LPT104-M Performance Curves

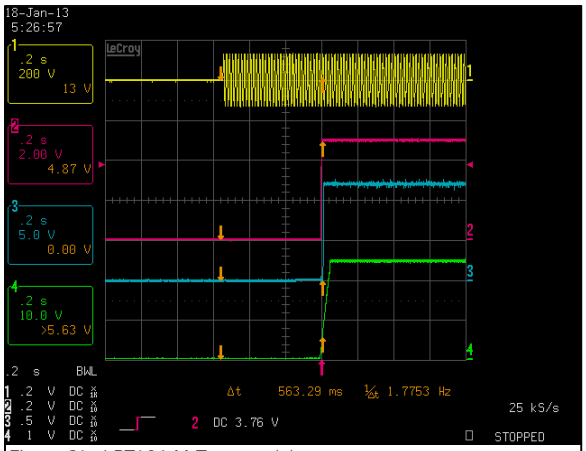


Figure 31: LPT104-M Turn-on delay
Vin = 90Vac Load: Pout = 130W
Ch 1: V_{IN} Ch 2: 5.0V Ch 3: 12.0V Ch 4: 24.0V

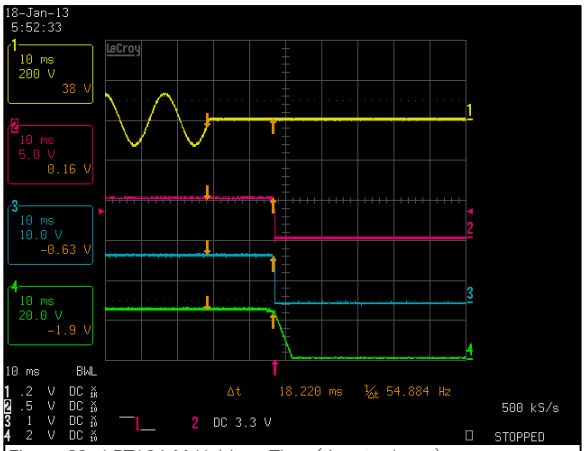


Figure 32: LPT104-M Hold-up Time (time to decay)
Vin = 90Vac Load: Pout = 130W
Ch 1: V_{IN} Ch 2: 5.0V Ch 3: 12.0V Ch 4: 24.0V

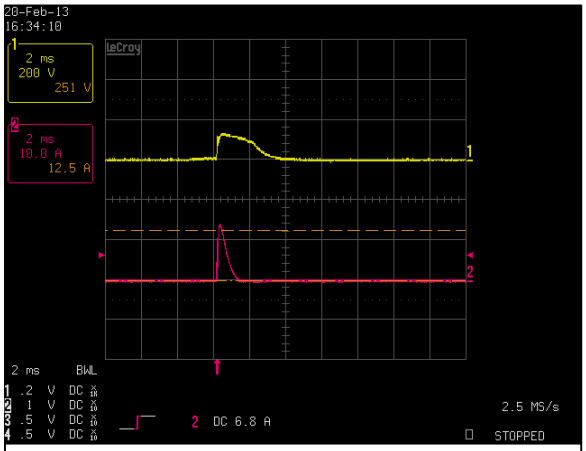


Figure 33: LPT104-M Inrush Current
Vin = 264Vac Load: Io = 0A, Turn on at 90 deg
Ch 1: V_{IN} Ch 2: I_{IN}

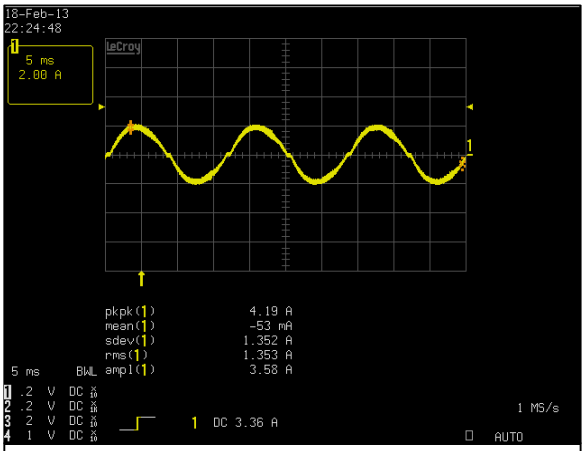


Figure 34: LPT104-M Input Current Waveform
Vin = 115Vac Load: Pout = 130W
Ch 1: I_{IN}

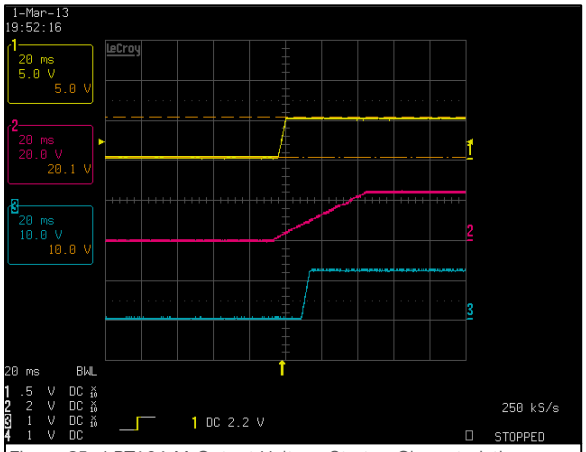


Figure 35: LPT104-M Output Voltage Startup Characteristic
Vin = 115Vac Load: Pout = 130W Output Capacitance = 330uF/A
Ch 1: 5.0V Ch 2: 24.0V Ch3: 12.0V

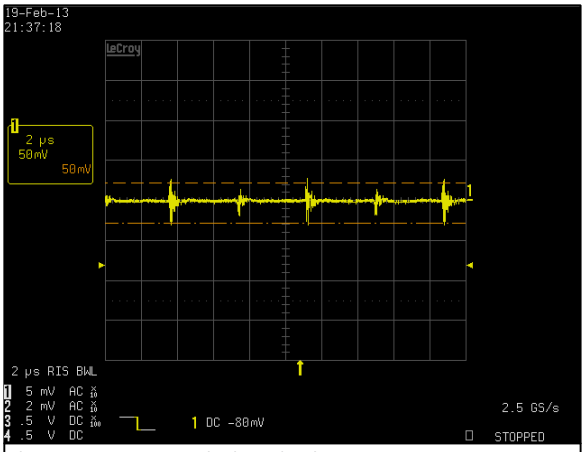


Figure 26: LPT104-M Ripple and Noise Measurement
Vin = 115Vac Load: Pout = 130W
Ch 1: 5.0V

ELECTRICAL SPECIFICATIONS

LPT104-M Performance Curves

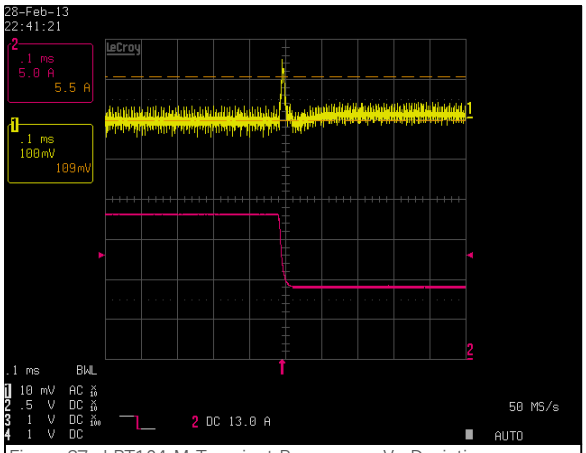


Figure 37: LPT104-M Transient Response – Vo Deviation
Vin = 90Vac Load: Io = 100% to 50%, 1A/us slew rate
Ch 1: 5.0V Ch 2: Io

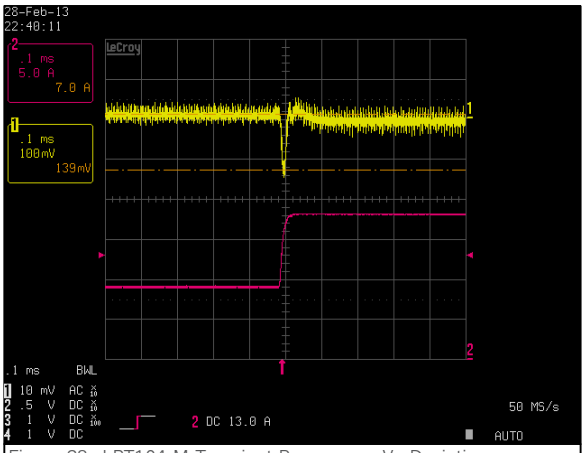


Figure 38: LPT104-M Transient Response – Vo Deviation
Vin = 90Vac Load: Io = 50% to 100%, 1A/us slew rate
Ch 1: 5.0V Ch 2: Io

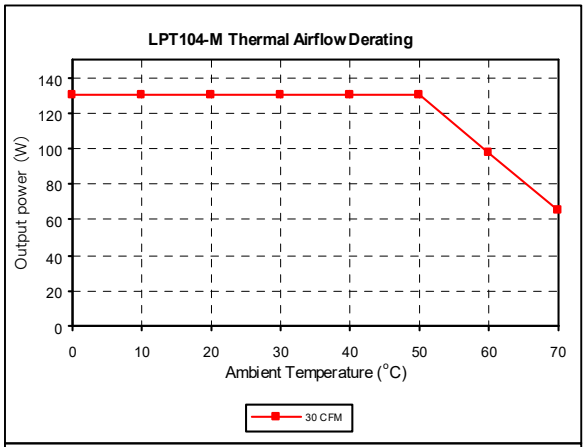


Figure 39: LPT104-M Derating Curve
30 CFM Forced Air
Vin = 115Vac Load: Pout = 0 to 130W

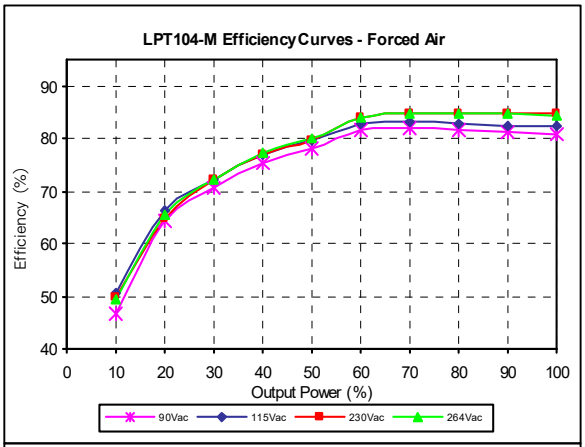


Figure 40: LPT104-M Efficiency Curves @ 25 degC
30 CFM Forced Air
Vin = 90 to 264Vac Load: Pout = 0 to 130W

ELECTRICAL SPECIFICATIONS

Protection Function Specifications

Input Fuse

LPT100-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 LPT100-M series main output will latch off during output overvoltage with the AC line recycled to reset the latch.

LPT101-M

Parameter	Min	Typ	Max	Unit
3.3V Output Overvoltage	4.29	/	4.95	V
5V Output Overvoltage	6.5	/	7.5	V
12V Output Overvoltage	15.6	/	18	V

LPT102-M

Parameter	Min	Typ	Max	Unit
5V Output Overvoltage	6.5	/	7.5	V
12V Output Overvoltage	15.6	/	18	V
-12V Output Overvoltage	-15.6	/	-18	V

LPT103-M

Parameter	Min	Typ	Max	Unit
5Vo Output Overvoltage	6.5	/	7.5	V
15Vo Output Overvoltage	19.5	/	22.5	V
-15Vo Output Overvoltage	-19.5	/	-22.5	V

LPT104-M

Parameter	Min	Typ	Max	Unit
5Vo Output Overvoltage	6.5	/	7.5	V
24Vo Output Overvoltage	31.2	/	36	V
12Vo Output Overvoltage	15.6	/	18	V

ELECTRICAL SPECIFICATIONS

Over Current Protection (OCP)

LPT100-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.

LPT101-M

Parameter	Min	Typ	Max	Unit
3.3Vo Output Overcurrent	19.8	/	28.8	A
5Vo Output Overcurrent	9.9	/	14.4	A
12Vo Output Overcurrent	2.53	/	3.68	A

LPT102-M

Parameter	Min	Typ	Max	Unit
5Vo Output Overcurrent	19.8	/	28.8	A
12Vo Output Overcurrent	9.9	/	14.4	A
-12Vo Output Overcurrent	1.65	/	2.4	A

LPT103-M

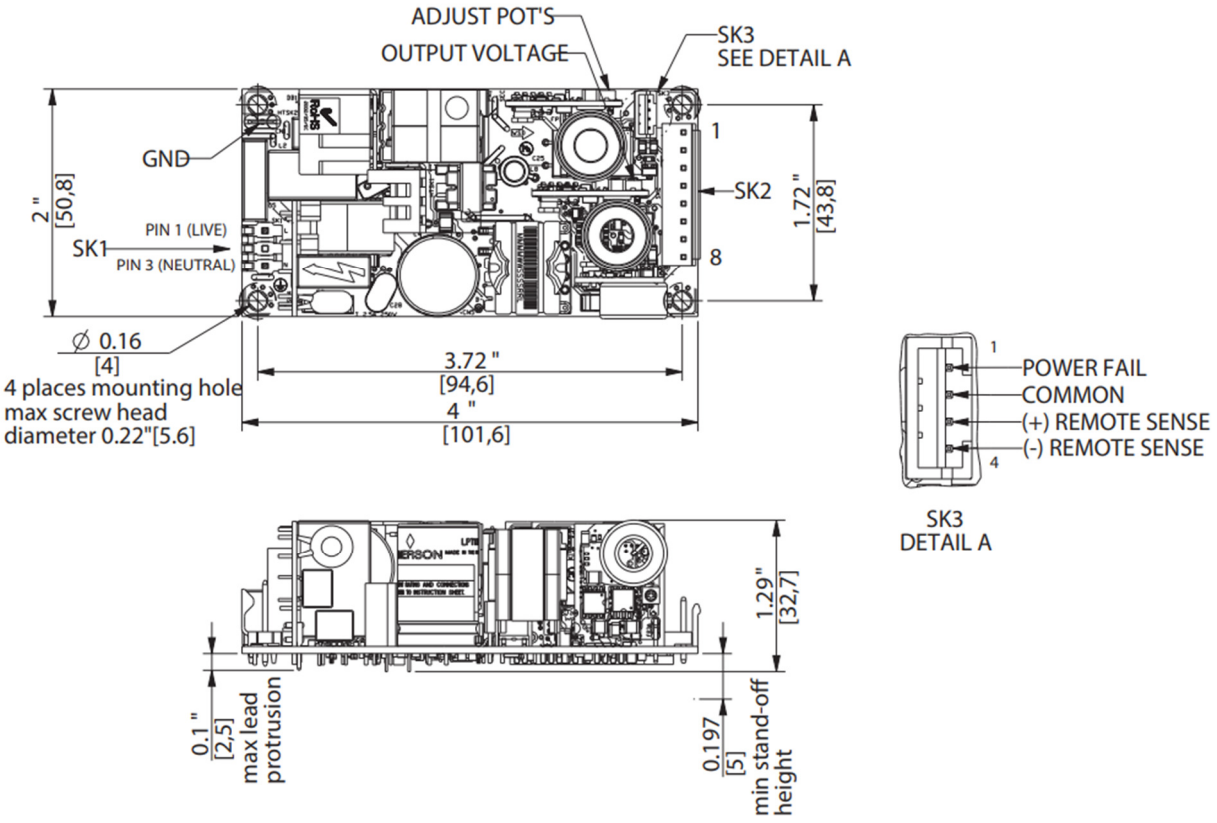
Parameter	Min	Typ	Max	Unit
5Vo Output Overcurrent	19.8	/	28.8	A
15Vo Output Overcurrent	7.92	/	11.52	A
-15Vo Output Overcurrent	1.65	/	2.4	A

LPT104-M

Parameter	Min	Typ	Max	Unit
5Vo Output Overcurrent	19.8	/	28.8	A
24Vo Output Overcurrent	4.95	/	7.2	A
12Vo Output Overcurrent	1.65	/	2.4	A

MECHANICAL SPECIFICATIONS

Mechanical Outlines (Dimensioning and Mounting Locations)



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

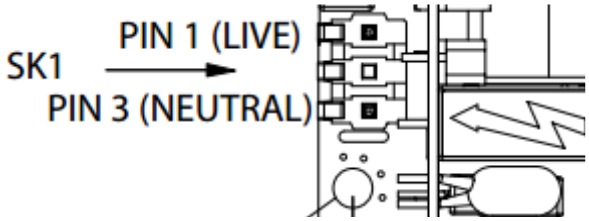
MECHANICAL SPECIFICATIONS

Connector Definitions

AC Input Connector – SK1

Pin 1 - Live

Pin 3 - Neutral



Output Connector – SK2

Pin 1 – V1out

Pin 2 – V1out

Pin 3 – GND

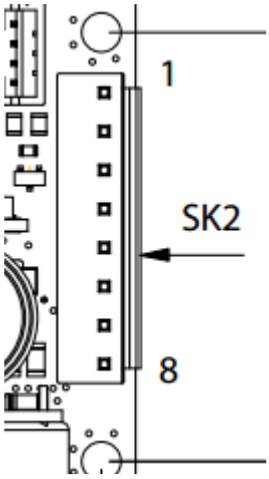
Pin 4 – GND

Pin 5 – GND

Pin 6 – GND

Pin 7 – V2out

Pin 8 – V3out



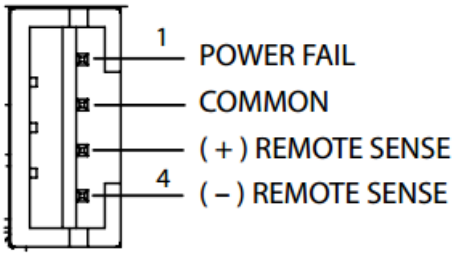
Control Signal Header – SK3

Pin 1 – Power Fail

Pin 2 – GND

Pin 3 – + Remote Sense

Pin 4 – - Remote Sense



MECHANICAL SPECIFICATIONS

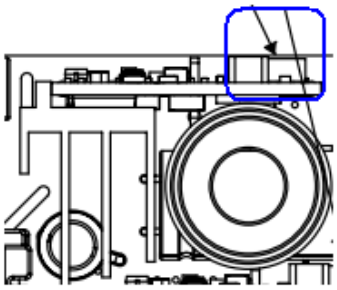
Power / Signal Mating Connectors and Pin Types

Table 4. Mating Connectors for LPT100-M Series			
Reference	**Vendor**	**Mating Connector or Equivalent**	**Mating Pins/Terminals or Equivalent**
SK1	Molex	09-50-3031	08-52-0072
GND	Molex	01-90020001	
SK2	JST	VHR-8N	SVH-21T-P1.1
SK3	JST	PHR-4	SPH-002T-PO.5S
	LANDWIN	2001S0400	2005T

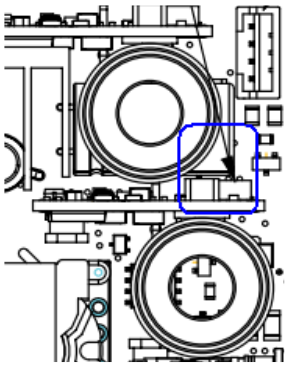
Note 1 - Advanced Energy Connector Kit #70-841-026, includes all of the above.

Potentiometer Definitions

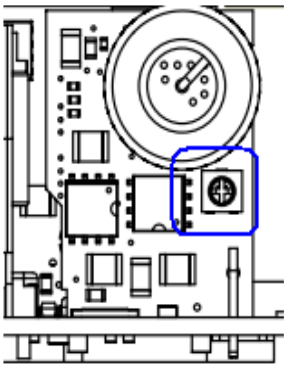
VR1- V1out Output adjust



VR2- V2out Output adjust



VR3- V3out Output adjust



ENVIRONMENTAL SPECIFICATIONS

EMC Immunity

LPT100-M series power supply is designed to meet the following EMC immunity specifications.

Table 5. Environmental Specifications

Document	Description
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 (Reference EN 60601-1:2001) Condition — Criteria > 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 Note: For conditions where Criteria A cannot be met, characterize the boundary condition (Line and/or Load) where Criteria A becomes Criteria B.
IEC 61000-3-2	Harmonic currents emission
EN60601-1 Latest amendment	European Community Safety investigated and marketed by TUV or VDE
CSA -C22.2 No. 601-1	M90 Medical Equipment
CE Marking	LVD and EMC

ENVIRONMENTAL SPECIFICATIONS

Safety Certifications

The LPT100-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 LPT100-M Series Power Supply System

Document	File #	Description
UL 62368-1, 2nd Ed, 2014-12-01, CAN/CSA C22.2 No. 62368-1-14, 2nd Ed	E186249-A6019-UL-X10	US and Canada Requirements
UL60601-1 1st Ed; CAN/CSA-C22.2 No. 601.1-M90	E182560-A9-UL	Safety of Medical Electric Equipment.
EN 62368-1:2014/A11:2017, EN 60601-1:2006/A1:2013	B 013890 3103 Rev. 00	European Community Safety investigated
IEC 62368-1:2014 (Second Edition), EN 62368-1:2014+A11:2017	211-21190283-000	International Requirements
CE Mark	19277	LVD
UKCA Mark		UK Requirements
IEC 60601-1:2005 (Third Edition) + CORR. 1 (2006) + CORR. 2 (2007) + AM1 (2012) or IEC 60601-1 (2012 reprint), EN 60601-1/A1:2013	211-600560-000	International Requirements

ENVIRONMENTAL SPECIFICATIONS

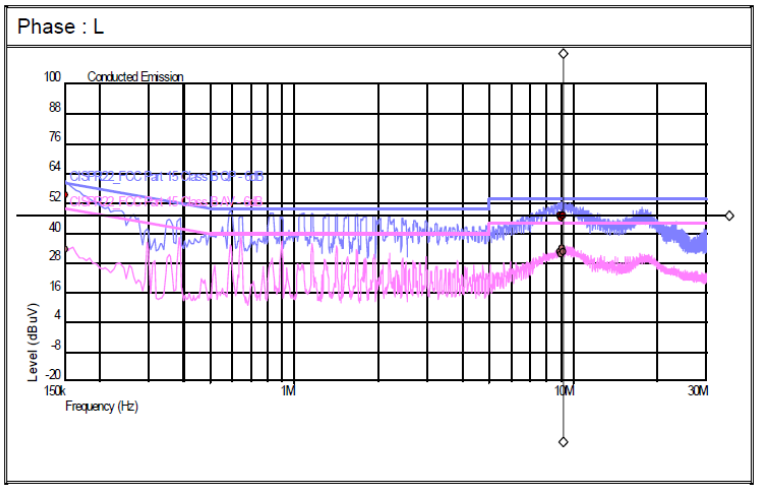
EMI Emissions

The LPT100-M series has been designed to comply with the Class B limits of EMI requirements of EN55032 (FCC Part 15) and CISPR 22 (EN55022) for emissions and relevant sections of EN61000 (IEC 61000) for immunity.

The unit is enclosed inside a metal box, tested at 130W 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 LPT100-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 condition 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 LPT100-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

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

Storage and Shipping Temperature / Humidity

The LPT100-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	Conditions	Symbol	Min	Typ	Max	Unit
Ambient Operating Temperature[1]	All	T_A	0	-	+70	°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				
Vibration Operating Non-operating	All	Accordance to IEC 68-2-6 to levels IEC 721-3-2 Tested in three mutually perpendicular axes Consumer Class Test Conditions: Frequency Range: 5-350;Hz, 200-2000Hz PSD: 0.0001g2/Hz; 350-500Hz –6dB/Octive, 500Hz 0.000052Hz Acceleration: 0.21.0gRMS (Typical Level) Duration: 20 min per axis Frequency Range: 10-200;Hz, 200-2000Hz PSD: 0.01g2/Hz; 0.003g2/Hz Acceleration: 2.5gRMS (Typical Level) Duration: 20 min per axis				
MTBF Forced air 25°C	All	$V_{IN,AC}$ = 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 LPT100-M series power supply.

Pin 1 - Line

Pin 3 - Neutral

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 LPT100-M. The Vo and the Output Return terminals are the positive and negative rails, respectively of the main output of the LPT100-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 2	- Vout1
Pin 3 to 6	- Common Ground
Pin 7	- Vout2
Pin 8	- Vout3

Vo Output voltage adjustment

Outputs on the Triple models outputs will be adjustable -20%, +10%, except for the 3V3 output which will be -15%, +10% and +24V output which will be -10%, +20%

Control Signal (SK3)

The LPT100-M series contains a 4 pins control signal header providing analogy control interface.

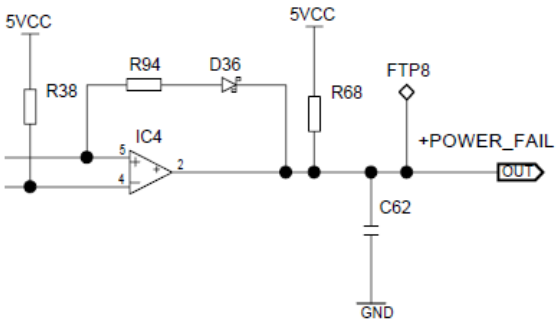
+Remote Sense, -Remote Sense (Remote Sensing) – (SK3 – Pin 3 and Pin 4)

The power supplies provides remote sensing on the low voltage main output. It compensates for up to 500 mV in each load line. There will be reverse sense to the local output and cross charging protection which will not cause damage to the power supply. This will be accomplished by using PTC pull up and pull down resistors to the main output. The output shall remain in regulation regardless of sense configuration. The sensed output shall not change more than 1% between all sense configurations. The maximum terminal voltage under any operational condition will not exceed the maximum specified adjustment range terminal voltage when the unit is operating with local sensing (+20%) provided the total output power does not exceed the maximum rating.

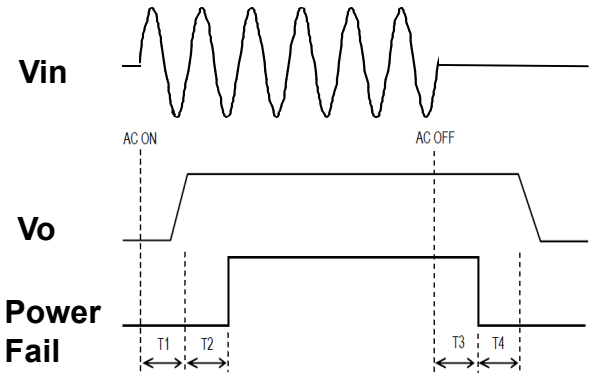
POWER AND CONTROL SIGNAL DESCRIPTIONS

Power Fail – (SK3 – Pin 1)

Power fail signal is an active low TTL signal capable of sinking 10mA maximum at 0.5Vdc. This output is common referenced. It goes high 100-500ms after the V1 output is in regulation.



LPT100-M Power Supply



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 Vo – T1 (Turn On Delay) and the delay time T2 to when Power Fail signal indicates output voltage Vo 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 Vo 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.

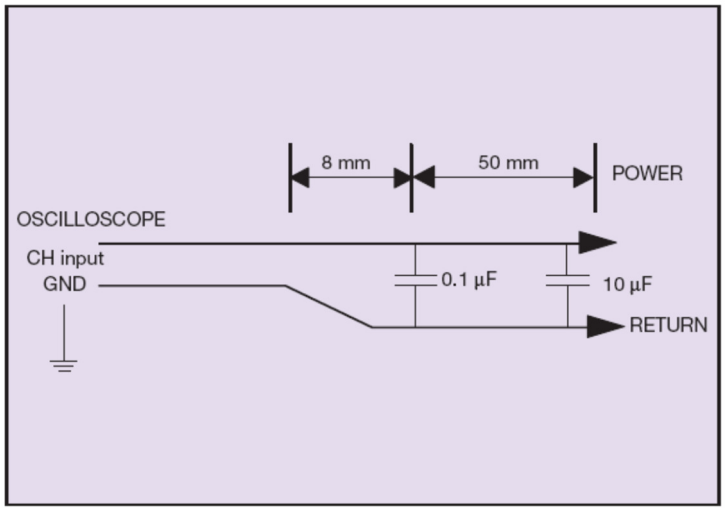
Table 8. Timing specifications of the Power Fail signal

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Turn On Delay	$V_{IN,AC}$ = 100 Vac $P_O = P_{O,maxFA}$	T1	-	-	2	Sec
Power Fail Delay	$V_{IN,AC}$ = 100 Vac $P_O = P_{O,maxFA}$	T2	100	-	500	mSec
Power Fail Warning	$V_{IN,AC}$ = 100 Vac $P_O = P_{O,maxFA}$	T3	4	-	-	mSec
Turn Off Delay	$V_{IN,AC}$ = 100 Vac $P_O = P_{O,maxFA}$	T4	6	-	-	mSec
Hold Up Time	$V_{IN,AC}$ = 100 Vac $P_O = P_{O,maxFA}$	T3+T4	10	-	-	mSec

APPLICATION NOTES

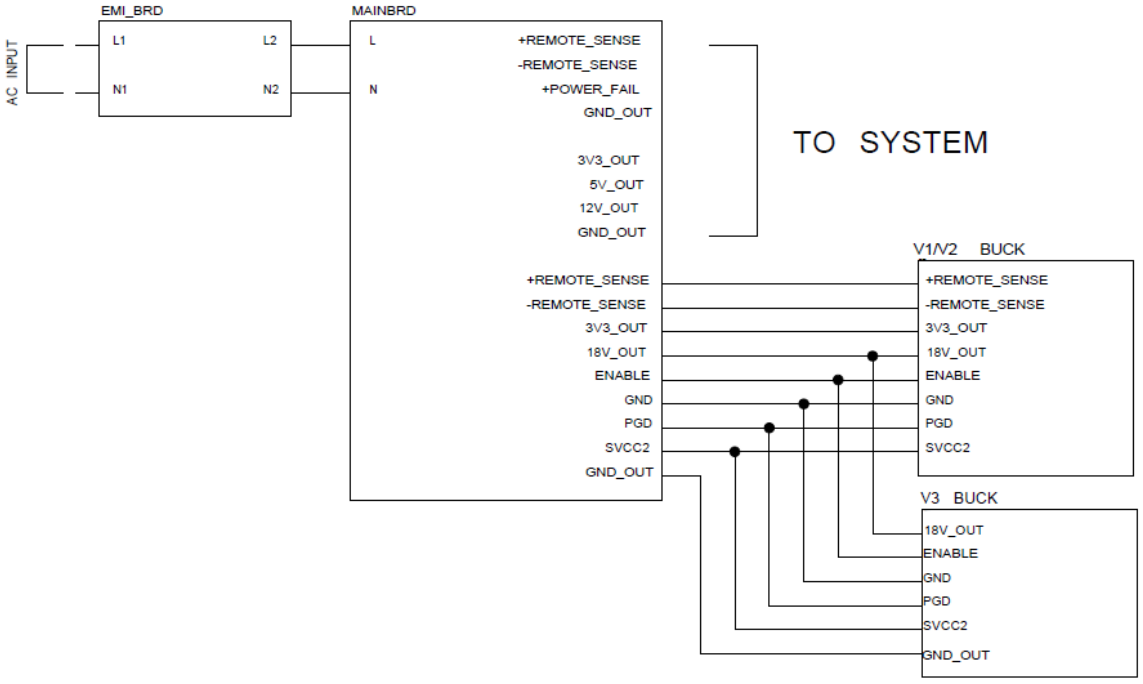
Output Ripple and Noise Measurement

The setup outlined in the diagram below has been used for output voltage ripple and noise measurements on the LPT100-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 LPT100-M series power supply.



RECORD OF REVISION AND CHANGES

Issue	Date	Description	Originators
1.0	03.11.2014	First Issue	L. Lee
1.1	04.15.2014	Update Block Diagram	L. Lee
1.2	07.02.2018	Update the maximum output power	L. Lee
1.3	06.17.2020	Update 62368-1 cert information	L. Lee
1.4	03.11.2022	Update the leakage unit typo; Update the UKCA Mark	L.Lee
1.5	05.10.2022	Update the mechanical drawing	L.Lee

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.

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For international contact information,
visit advancedenergy.com.

powersales@aei.com (Sales Support)
productsupport.ep@aei.com (Technical Support)
+1 888 412 7832

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