

MAIN FEATURES

- Universal input voltage range (90 – 305 V_{AC})
- Input surge current limiting (< 20 A at 230 V_{AC} nominal)
- 340 W at natural convection 460 W forced air cooling ratings
- Open frame, 3 x 5" industrial standard foot print
- High efficiency up to 94.5%
- 24, 48 and 56 V_{DC} standard output voltages
- Low stand-by consumption (<0.35 W)
- Active PFC, EN61000-3-2 compliant (Class C, >20% load)
- Low earth / touch leakage current (<250 / 100 μA)
- Over temperature, OV, OC and SC protections.
- Stand by +5 V, 1 A output
- Remote On / Off signal
- Power good and remote sense signals
- IT Audio Video IEC 62368-1 2nd edition compliant
- Design compliant to UL8750 for LED lighting
- Design compliant to IEC 60335-1 for House Hold Appliances
- RoHS 3 compliant (Directive EU 2015/863)
- Operable up to 5000 m altitude



DESCRIPTION

The DDP460 series of Industrial and LED lighting grade AC-DC power supplies provides the compact form factor and high efficiency that the marketplace demands.

The series can provide up to 460 W of regulated DC power from 90 to 305 V_{AC} input operative range, in a 3.0 x 5.0 x 1.51" form factor. The DDP460 series comes in an open frame compact package to facilitate system integration and thermal management in space constraint and closed environments, thanks also to its 94% high efficiency which generate less heat.

The series comes in 24, 48 and 56 V_{DC} standard output voltages with additional 12 and 36 V_{DC} output voltages variant which will be available upon business case evaluation. It offers a +5 V_{DC} stand-by output capable of 1 A. Available control signals include Power Good (P_OK), Remote On / Off (-PS_On) and Remote Sense terminals (RS+, RS-).

The series can be operated over the -40 to 70 °C ambient temperature range with output power derating factor applied above 50 °C and below -20 °C start up.

Protection features include, slow blow fuses on both AC lines, input under voltage lockout (IUV), output over-current (OC), output short-circuit (SC), output over-voltage (OV) and over-temperature (OT).

The series is compliant and certified to the latest IEC 62368-1 standard for IT and Audio/Video equipment. Its design and construction make it compatible with UL 8750, for LED lighting applications, and IEC 60335-1 / 61558-1 safety standard for household appliance.

The series meets the EN55032/11 EMC limits of Class B for conducted and Class A for radiated emissions as well as the IEC/EN 61000-3 for harmonic content and EN 55024, EN 61000-6-2 standards for immunity.

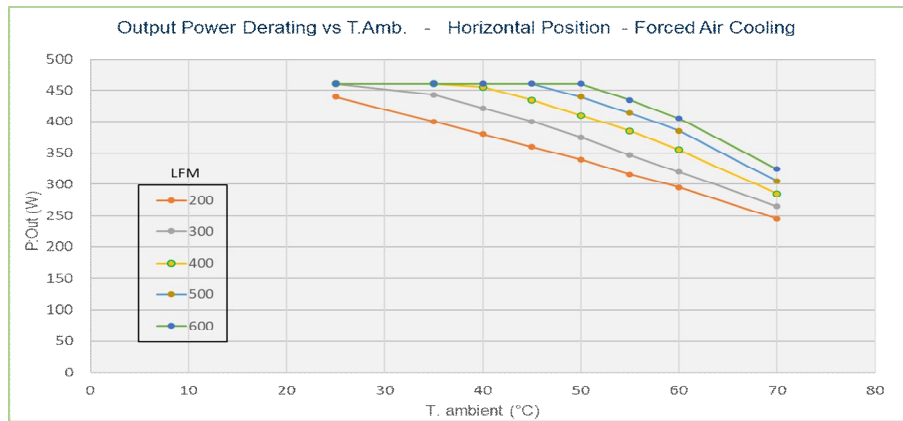
MARKET SEGMENTS AND APPLICATIONS

- LED Video Wall Display and SSL Lighting
- Industrial Process Control and Automation
- Telecommunications
- Laboratory / Analysis Equipment
- Test and Measurement Equipment
- Household appliance

MODEL CODING AND OUTPUT RATINGS

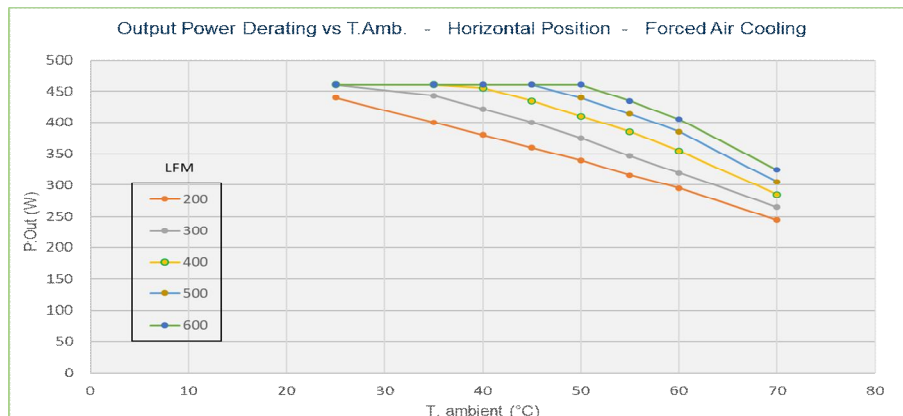
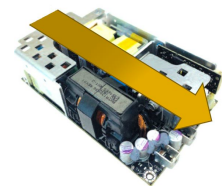
Model Code	V1 Nominal [V _{DC}]	V _{AC} Range [V]	I1 [A]	I _{SB} [A]	Cooling Mode	Max Combined Output Power [W]
DDP460-US12-OF	12	≥90	TBD	1.0	Natural convection	TBD
		≥100	TBD	1.0		TBD
		≥180	TBD	1.0		TBD
		90-305	TBD	1.0	>600 LFM forced air	TBD
DDP460-US24-OF	24	≥90	14.1	1.0	Natural convection	340
		≥100	15	1.0		360
		≥180	17.3	1.0		415
		90-305	19.2	1.0	>600 LFM forced air	460
DDP460-US36-OF	36	≥90	TBD	1.0	Natural convection	TBD
		≥100	TBD	1.0		TBD
		≥180	TBD	1.0		TBD
		90-305	TBD	1.0	>600 LFM forced air	TBD
DDP460-US48-OF	48	≥90	7.1	1.0	Natural convection	340
		≥100	7.5	1.0		360
		≥180	9.6	1.0		460
		90-305	9.6	1.0	>600 LFM forced air	460
DDP460-US56-OF	56	≥90	6.25	1.0	Natural convection	350
		≥100	6.6	1.0		370
		≥180	8.2	1.0		460
		90-305	8.2	1.0	>600 LFM forced air	460

OUTPUT POWER DERATING CURVES



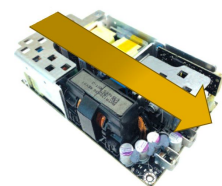
V_{OUT}: 24 V_{DC}

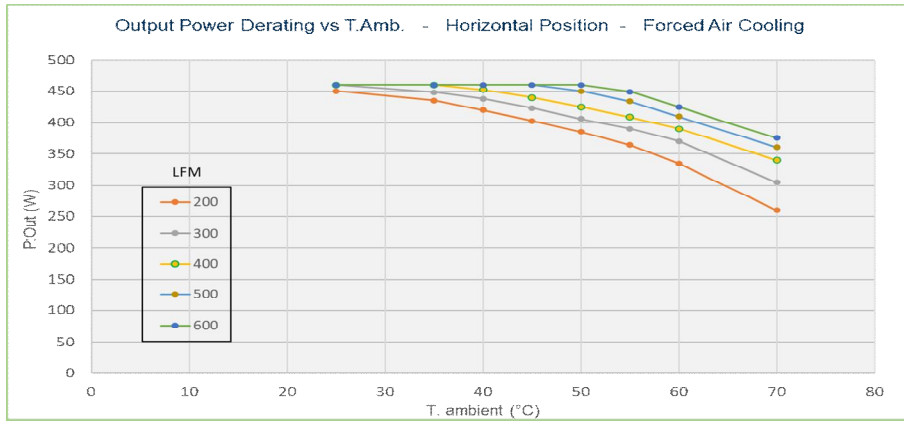
V_{IN}: ≥90V_{AC}



V_{OUT}: 48, 56 V_{DC}

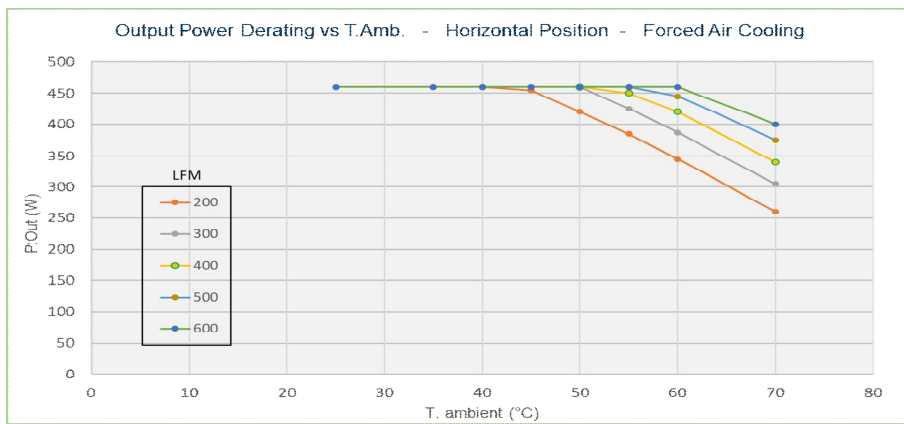
V_{IN}: ≥90V_{AC}





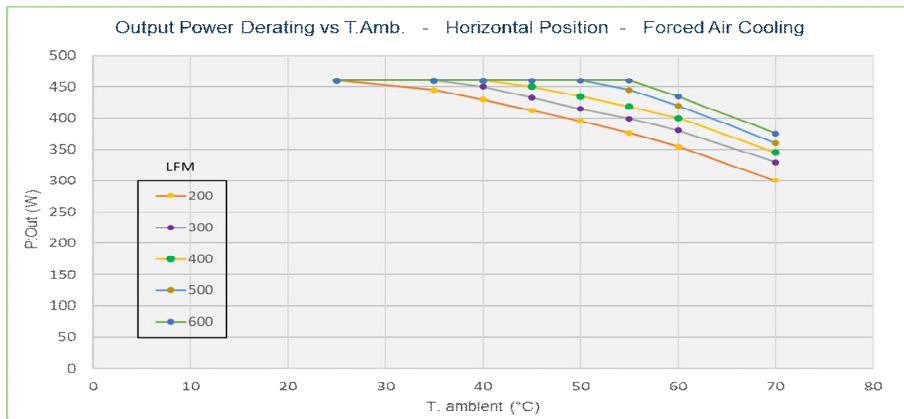
V_{OUT}: 24 V_{DC}

V_{IN}: ≥115V_{AC}



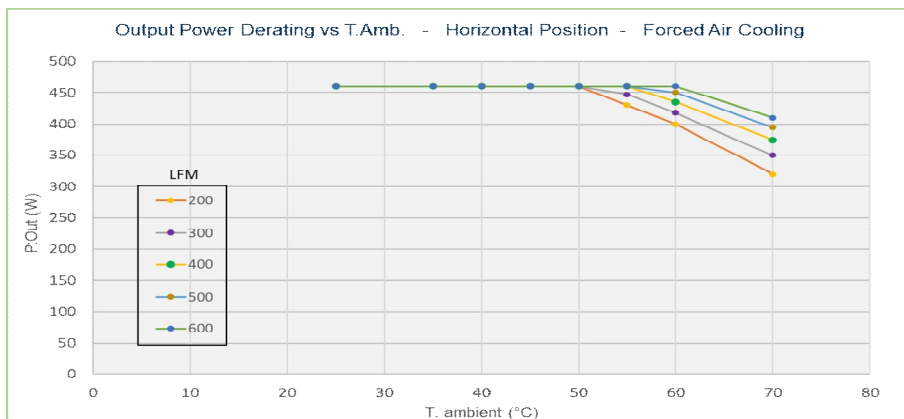
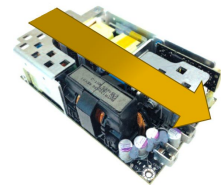
V_{OUT}: 48, 56 V_{DC}

V_{IN}: ≥115V_{AC}



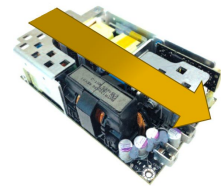
V_{OUT}: 24 V_{DC}

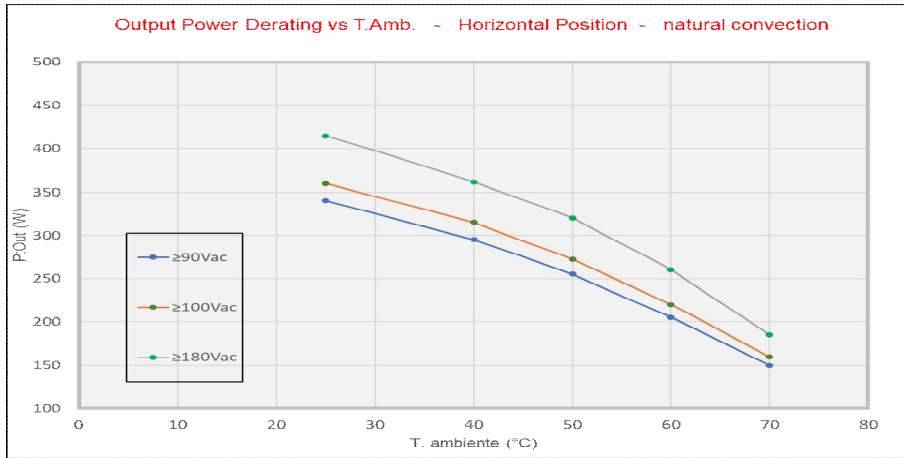
V_{IN}: ≥180V_{AC}



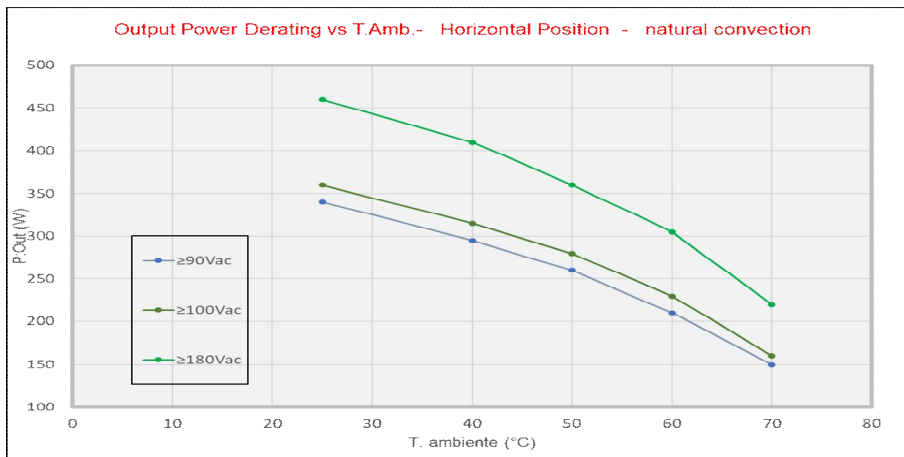
V_{OUT}: 48, 56 V_{DC}

V_{IN}: ≥180V_{AC}

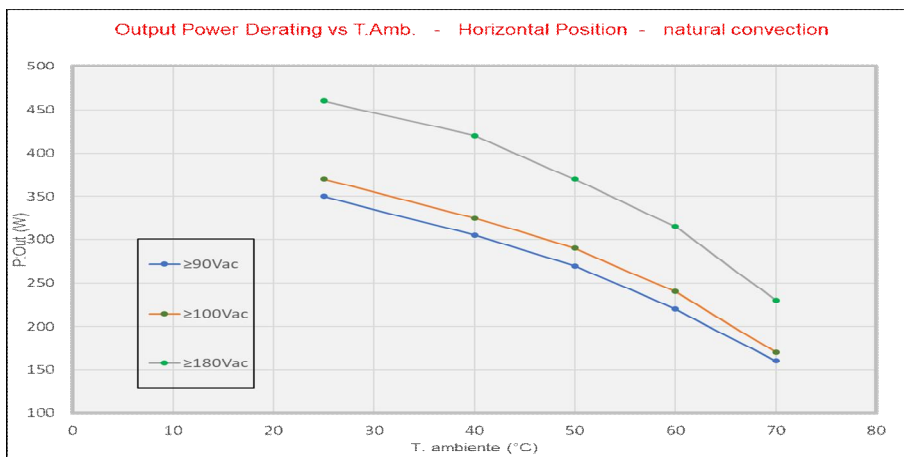




V_{OUT}: 24 V_{DC}



V_{OUT}: 48 V_{DC}



V_{OUT}: 56 V_{DC}



The above curves come from a climatic static chamber and a specific set up therefore they represent a thermal performance approximation of a DDP460 installed into a system where not all the variables can be controlled. Although they are a reasonable reference, it is always a recommended practice to monitor the power supply critical components temperature when operating into a system (see below hot-spots thermal map).

INPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
AC Input Voltage	PS starts and operates at 85 V _{AC} at all load conditions	90	100-277	305	V _{RMS}
Input Frequency	440 Hz with reduced PFC and output power rating - Consult factory for details.	47	50/60	440	Hz
Input Current	RMS at 180 V _{AC} , maximum load, 50 / 60 Hz RMS at 85 V _{AC} , maximum load, 50 / 60 Hz	-	-	3.5 7.0	A
Inrush Current (peak)	Cold start, 25 °C ambient, full load				
	115 V _{AC}	-	-	10	A
	230 V _{AC}	-	-	20	
	277 V _{AC}	-	-	24	
Fusing	Time Lag, 8A, 300V, on each AC lines	-	-	8	A
Efficiency (24V_{DC})	At 115 V _{AC} , 20% rated load	-	91	-	
	50% rated load	-	93.5	-	
	100% rated load	-	92	-	%
	At 230 / 277 V _{AC} , 20% rated load	-	91.5	-	
	50% rated load	-	94	-	
	100% rated load	-	94.5	-	
Efficiency (48, 56V_{DC})	At 115 V _{AC} , 20% rated load	-	90.5	-	
	50% rated load	-	94	-	
	100% rated load	-	93.5	-	%
	At 230 / 277 V _{AC} , 20% rated load	-	91	-	
	50% rated load	-	94.5	-	
	100% rated load	-	95.5	-	
Input Power Consumption	Power on, 115 V _{AC} , no load	-	-	4	
	Power on, 230 V _{AC} , no load	-	-	4	W
	Stand by, 115, 230 V _{AC} , no load	-	-	0.35	
Power Factor	From 50 to 100% of rated load, At 277, 230, 115 V _{AC} , 50 / 60 Hz	0.90	-	-	-
THDi	From 50 to 100% rated load, 115/230/277 V _{AC} 50/60 Hz	-	-	20	%
Harmonic Current Fluctuations and Flicker	Complies with EN 61000-3-2 at 230 V _{AC} , 50/60 Hz, Class A, any load Complies with EN 61000-3-2 at 230 V _{DC} , 50/60 Hz, Class D, > 35 W load Complies with EN 61000-3-2 Class C at 230 V _{AC} , 50/60 Hz, >150 W load Complies with EN 61000-3-3 at nominal voltages and full load				
Earth Leakage Current	Normal conditions				
	115 V _{RMS} , 60 Hz	-	100	-	
	230 V _{RMS} , 50 Hz	-	180	-	μA
	264 V _{RMS} , 60 Hz	-	200	-	
	277 V _{RMS} , 60 Hz	-	250	290	
Touch Leakage Current	264 V _{RMS} , 60 Hz				
	Normal Condition (NC)	-	-	100	μA
	Single Fault Condition (SFC)	-	-	500	

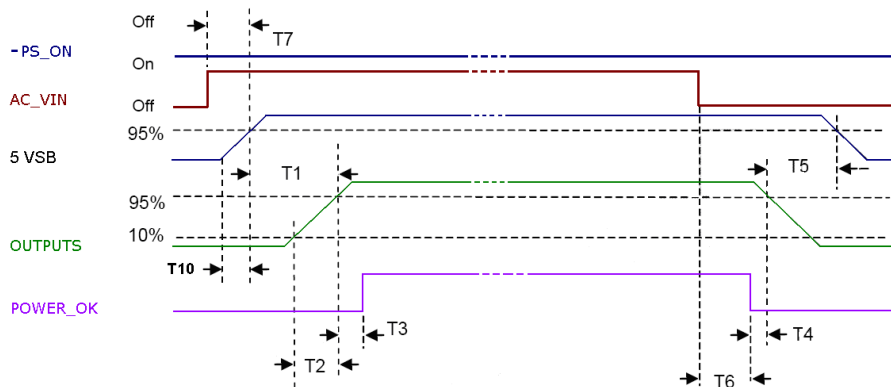
OUTPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Min.	Nom.	Max.	Units
V1 Output Voltages	±0.5% set point accuracy, 20% load	-	12	-	V
			24		
			36		
			48		
			56		
V1 Output Power Rating	Natural Convection (see graph above)	-	-	460	W
	Forced air cooling (see graph above)	-	-	460	
	Peak power	-	-	520	
5V_{SB} Output Voltage	±3% set point accuracy, 20% load	-	5	-	V
5V_{SB} Output Current		-	-	1.0	A
V1 Voltage Adjustment Range	Manually by potentiometer	-	-	±5	%V1
V1 Load-Line-Cross Regulation	V _{AC} : 85 – 305 V _{RMS} ; I ₁ : 0 – 100%	-	-	±2	%V1
5V_{SB} Load-Line-Cross regulation	V _{AC} : 85 – 305 V _{RMS} ; I _{5SB} : 0 – 100%	-	-	±5	%5V _{SB}
V1 Line Regulation	V _{AC} : 85 – 305 V _{RMS}	-	-	±0.1	%V1
Transient Response: V1, 5V_{SB} Voltage Deviation	50% load changes at 1 A/μs	-	-	±5	%V1
	0.5 A load minimum load applied				%5V _{SB}
V1 Ripple and Noise	Rated load, Peak-to-peak, 20 MHz BW. (100 nF ceramic, 10 μF tantalum at load)	-	-	1	%V1
V1 Start-up Rise Time	85 < V _{IN} < 305, any load conditions.	10	-	100	ms
Start-up Delay	V1 in regulation after de-asserting PS_ON	-	-	200	ms
	V1 in regulation after AC is applied (worst case: 85 V _{AC})	-	-	750	
	5V _{SB} in regulation after AC is applied (worst case: 85 V _{AC})	-	-	500	
Turn-on Overshoot		-	-	5	%V1
		-	-	5	%V _{SB}
V1 Hold-up Time	At nominal V _{IN} , full load	16	-	-	ms
Minimum Load	V1 and 5V _{SB}	0	-	-	A
Maximum Load Capacitance	V1: 12 V _{DC}	-	-	28000	μF
	V1: 24 V _{DC}	-	-	14000	
	V1: 36 V _{DC}	-	-	12000	
	V1: 48 V _{DC}	-	-	10000	
	V1: 54 V _{DC}	-	-	8000	

SIGNALS / CONTROLS

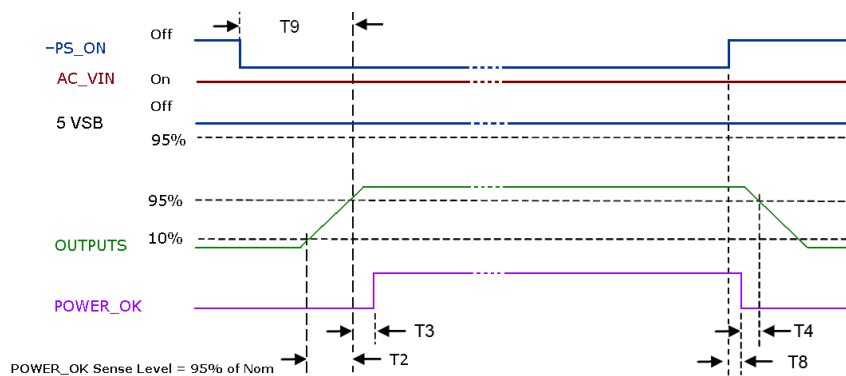
Signal	Notes	Min	Typ	Max	Unit
-PS_ON	Active low, +5 V TTL signal compatible. Input low voltage	0	-	2.0	V
	Input high voltage ($I_{IN} = 200 \mu A$)	3.0	-	-	V
	V1 and V2 disabled when PS_ON is open				
P_OK	5V _{SB} not affected by PS_ON				
	V1 and V2 enabled with PS_ON connected to RTN				
	+5 V TTL compatible				
	Logic level low (<10 mA sinking)	-	-	0.7	V
	Logic level high (100 μA sourcing)	2.4	-	5	V
5V_{SB} output	Low to high time after V1 in regulation	0.05	-	0.1	s
	Power down warning time	1	-	-	ms
	Active and in regulation after a $90 < V_{AC} < 264$ is applied	-	-	200	ms
	5V _{SB} not affected by PS_ON				

SIGNALS TIMING



Above waveforms are expected with AC Input ON/OFF:

5 V _{SB} On – V1 On	$50 \text{ ms} \leq T1 \leq 250 \text{ ms}$
V1 Rise Time	$5 \text{ ms} \leq T2 \leq 85 \text{ ms}$
5 V _{SB} Rise Time	$1 \text{ ms} \leq T10 \leq 10 \text{ ms}$
V1 On – P_OK delay	$30 \text{ ms} \leq T3 \leq 100 \text{ ms}$
Power down warning ¹	$T4 \geq 5 \text{ ms}$
V1 Off – 5V _{SB} Off ²	$T5 \geq 1.2 \text{ s}$
AC Off – P_OK Low	$T6 \geq 10 \text{ ms} (115/ 230 V_{AC})$
AC_ON – 5V _{SB} turn On time	$T7 \leq 1000 \text{ ms}$



Above waveforms are expected with PS_ON Signal ON/OFF state change:

V1 Rise Time	$5 \text{ ms} \leq T2 \leq 85 \text{ ms}$
V1 On – P_OK delay	$30 \text{ ms} \leq T3 \leq 100 \text{ ms}$
Power down warning ¹	$1 \text{ ms} \leq T4 \leq 5 \text{ ms}$
-PS_ON – P_OK down	$T8 \leq 1 \text{ ms}$
-PS_ON – V1 On Timing	$T9 \leq 200 \text{ ms}$

¹ T4 parameter measurement setup will assume at least 10% of the maximum load on each output.

² T5 parameter measurement setup will assume at least 50% of the maximum load on main output.

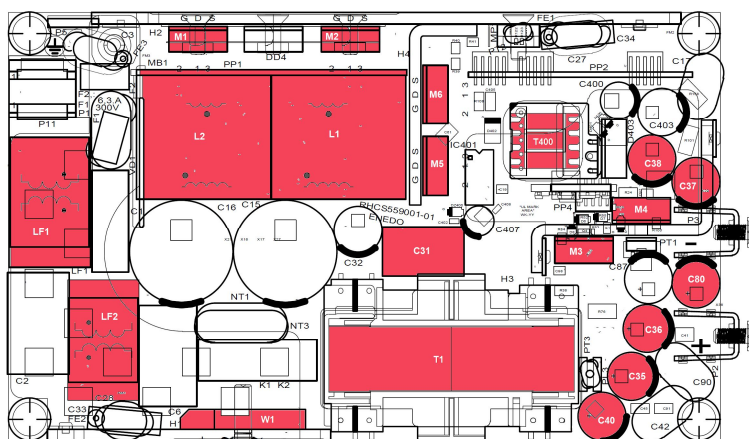
PROTECTION FEATURES

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
Input Under Voltage	Auto-recovering, hiccup mode.	58	65	75	V _{AC}
Input Fuse	Time lag, 8A, 300V on both AC lines	-	-	8	A
Over Current	At nominal input voltages V1: Hiccup mode, auto-recovering 5V _{SB} : Hiccup mode, auto-recovering:	115	-	160	%I _{Rated}
Short Circuit	At nominal input voltages V1: Hiccup mode, auto-recovering. 5V _{SB} : Hiccup mode, auto-recovering.	-	-	-	
Over Voltage	V1, Power shut down, latch off. 5V _{SB} , Hiccup mode, auto-recovering.	110	-	145	%V _{NOM}
Over Temperature (on primary and secondary side)	Hiccup mode, auto-recovering.	-	-	-	°C
Isolation: Input-to-Output	Reinforced	5000	-	-	V _{DC}
		3535	-	-	V _{AC}
Isolation: Input-to-Earth	Basic	2500	-	-	V _{DC}
		1768	-	-	V _{AC}
	Production tested at 2500 V _{DC}				
Isolation: Output-to-Earth	Basic	2121	-	-	V _{DC}
		1500	-	-	V _{AC}
Equipment Protection Class		Class I			

ENVIRONMENTAL SPECIFICATIONS

Specification	Test Conditions / Notes	Min	Nominal	Max	Units
Operating Temperature Range	Start up at -40 °C at <20% load. No de-rating up to 50°C at >600 LFM	-40	-	50	°C
Operating Temperature Range with De-rating	See de-rating curves and conditions in the Output Specifications section	-	-	70	°C
Storage Temperature		-40	-	85	°C
Humidity	RH, Non-condensing Operating. Non-operating	-	-	90	%
Operating Altitude	Power de-rating above 1800 m	-	-	5000	m
Shock	EN 60068-2-27 Operating: Half sine, 30 g, 18 ms, 3 axes, 6x each (3 positive and 3 negative). Non-Operating: Half sine, 50 g, 11 ms, 3 axes, 6x each (3 positive and 3 negative).				
Vibration	EN 60068-2-64 Operating: Sine, 10 – 500 Hz, 1 g, 3 axes, 1 oct/min., 60 min. Random, 5 – 500 Hz, 0.02 g ² /Hz, 1 g _{RMS} , 3 axes, 30 min. Non-Operating: 5 – 500 Hz, 2.46 g _{RMS} (0.0122 g ² /Hz), 3 axes, 30 min.				
MTBF	Full Load, 40 °C ambient 80% Duty cycle, Telcordia SR-332 Issue 2	400.000	-	-	Hours
Useful Life	Worst nominal V _{IN} , 80% load, 40 °C ambient.	-	5	-	Years

To ensure the power supply proper operation when installed in a system or device, the hot-spots components operating temperature should not exceed the corresponding maximum limits shown in the table alongside.



Hot Components PCB Reference	Maximum Operating Temperature [°C]
T1	130
T400	110
W1	125
LF1, LF2	120
L1, L2	120
M1, M2	120
M3, M4	120
M5, M6	120
C31	105
C35, C36, C40, C80	105
C37, C38	105

ELECTROMAGNETIC COMPATIBILITY (EMC) – EMISSIONS

Phenomenon	Conditions / Notes	Standard	Equipment/Performance Class
Conducted	115, 230, 277 V _{RMS} . Maximum load.	EN 55032 (ITE) EN 55011 (ISM) FCC Part 15	B
Radiated	At 3 m distance	EN 55022 (ITE) EN 55011 (ISM) FCC Part 15	A*
Line Voltage Fluctuation and Flicker	At 20%, 50% and 100% maximum load. Nominal input voltages	EN 61000-3-3	
Harmonic Current	230 V _{AC} input voltage, 50 / 60 Hz	EN 61000-3-2	A, D
Emission	230 V _{AC} 50 / 60 Hz, >150 W load	EN 61000-3-2	C

(*) Radiated emission should be assessed at system level.

ELECTROMAGNETIC COMPATIBILITY (EMC) – IMMUNITY

Phenomenon	Conditions / Notes	Standard	Test Level	Criteria
	Reference standards for ITE	EN 55024		
	Reference standard for Industrial/IMS equipment	EN 61000-6-2		
ESD	15 kV air discharge, 8 kV contact, at any point of the system.	EN 61000-4-2	4	A
Radiated Field	10 V/m, 80-1000 MHz, 1 KHz, 80% AM.	EN 61000-4-3	3	A
Electric Fast Transient Surge	±2 kV on AC power port for 1 minute	EN 61000-4-4	3	A
Surge	±2 kV line to line; ± 4 kV line to earth on AC power port	EN 61000-4-5	4	A
Conducted RF Immunity	10 V _{RMS} , 0,15-80 MHz, 1 kHz/2 Hz 80% AM	EN 61000-4-6	3	A
Dips and Interruptions	200 – 277 V_{AC}: Drop-out to 0% for 10 ms Dip to 40% for 5 cycles (100 ms) Dip to 70% for 25 cycles (500 ms) Drop-out to 0% for 5 s	EN61000-4-11 EN61000-4-11 EN61000-4-11 EN61000-4-11		A A A B
	100 – 127 V_{AC}: Drop-out to 0% for 10 ms Dip to 40% for 5 cycles (100 ms) Dip to 70% for 25 cycles (500 ms) Drop-out to 0% for 5 s	EN 61000-4-11 EN 61000-4-11 EN 61000-4-11 EN 61000-4-11		A A (<100 W), B (>100 W) A B

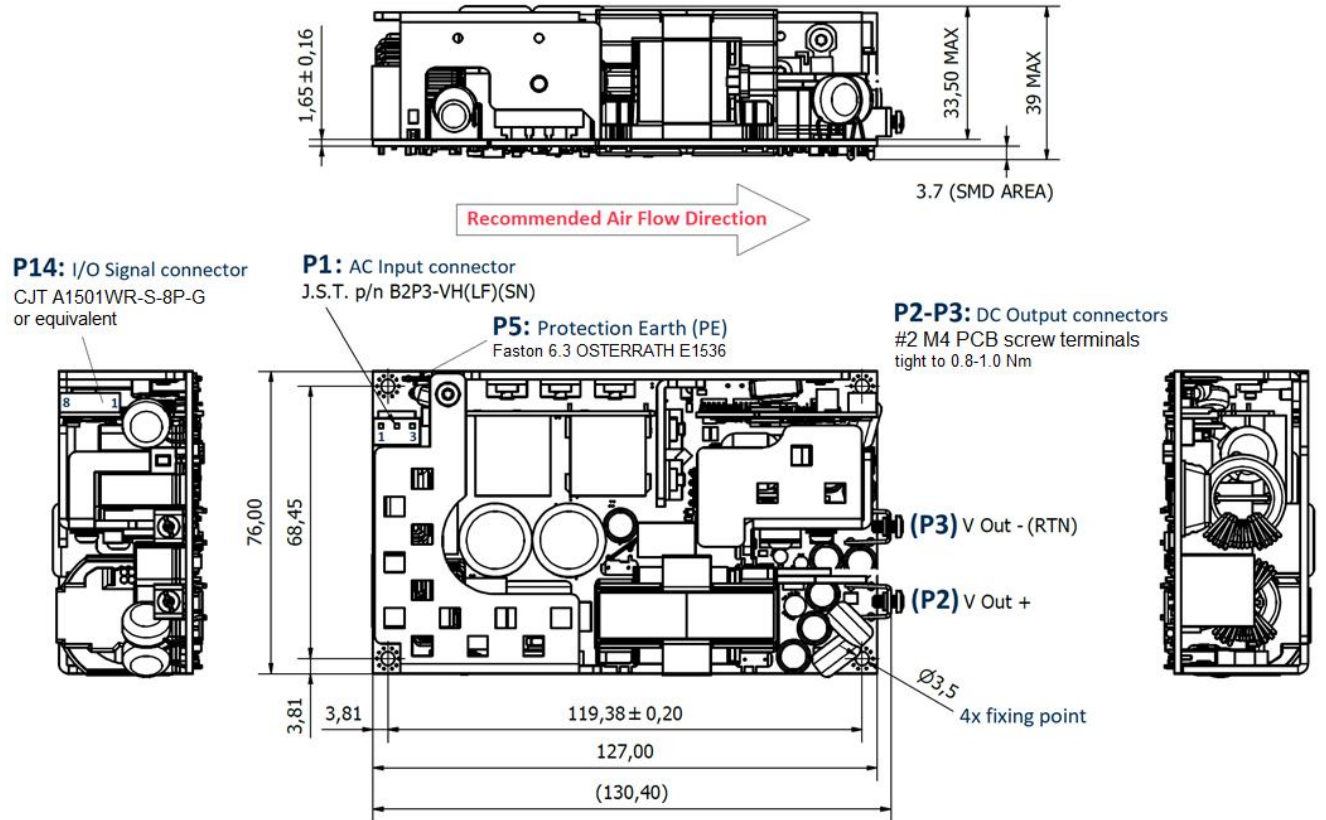
SAFETY AGENCIES APPROVALS

Certification Body	Safety Standards and file numbers	Category
CSA/UL	CSA C22.2 No. 62368-1, UL 62368-1	Audio Video and Information Technology Equipment
IEC IECCE CB Certification	IEC/EN 62368-1	Audio Video and Information Technology Equip.
CE	Directive 2014/35/EU: Electrical Safety: Low Voltage electrical equipment (LVD) Directive 2014/30/EU: Electromagnetic Compatibility (EMC) Directive EU 2015/863: RoHS 3	Audio Video and Information Technology Equipment
Designed to meet IEC/EN/UL/CSA 61010-1, IEC/EN 60335-1 or IEC/EN 61558-1 and UL8750		

OUTLINE DRAWING AND CONNECTIONS – OPEN FRAME CHASSIS (-OF)

Overall dimensions: 76.2 x 127.0 x 38.5 mm (3.00 x 5.00 x 1.51 in)

Weight: 400 g (0.88 lb)



Signals Connector – P14	
Pin Ref.	Function
8	RS ⁻
7	RS ⁺
6	P_OK
5	-PS_On
4	RTN
3	RTN
2	+5V _{SB}
1	+5V _{SB}

AC Input Connector – P1	
P1 Pin Ref.	Function
1	L1
2	NP
3	L2

P5: Protection Earth (PE)

DC Output Connector – P2, P3	
Pin Ref.	Function
P2	+V1
P3	RTN

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