ARTESYN AIQ00ZPFC-01NL SERIES

75Watts Power Factor Correction

PRODUCT DESCRIPTION

The AIQ00ZPFC-01NL is a new high performance Power Factor Correction module and has the high power density. The product offers fully 75W in a shielded package with dimensions of just 2.3”x1.45”x 0.5”.

AIQ00ZPFC-01NL can provide a very high efficiency up to 90% which allows the operating temperature range from -20^{O}C to +100^{O}C (Baseplate temperature). Further features include module enable On/Off, trimmable output voltage as well as overvoltage protection and over-temperature protection.

AT A GLANCE

Total Power

75 Watts

Input Voltage

100 to 122 Vac

# of Outputs

Single

RoHS

SPECIAL FEATURES

- Unity power factor
- High efficiency up to 90%
- Civil/Aviation supply frequency range 50-800Hz
- Up to 75W output power
- Negative enable function
- RTCA-DO 160 compliant
- 100^{O}C baseplate operating temperature
- Enable output to control DC to DC converter
- Internal active switch bypassing external inrush current components

SAFETY

- UL/cUL 60950-1 Recognized
- TUV EN60950 Licensed
- CE Mark

TYPICAL APPLICATIONS

- Industrial

MODEL NUMBERS

Model	Input Voltage	Output Voltage	Minimum Load	Maximum Load	Efficiency[1]
AIQ00ZPFC-01NL	100-122Vac	390Vdc	0A	0.19A	90%

Note 1 - Efficiency measured @115Vac input, 75W output power.

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 Operating - Continuous	AIQ00ZPFC-01NL	$V_{IN,AC}$	100	-	122	Vac
Input Frequency Operating - Continuous	AIQ00ZPFC-01NL		50	-	800	Hz
Maximum Output Power	AIQ00ZPFC-01NL	$P_{O,max}$	-	-	75	W
Isolation Voltage Input to Baseplate Output to Baseplate	AIQ00ZPFC-01NL		- -	- -	2700 2700	Vdc Vdc
Insulation Resistance 500Vdc	AIQ00ZPFC-01NL		100	-	-	MΩ
Operating Temperature (Baseplate)	AIQ00ZPFC-01NL	T_A	-20	-	100[1]	°C
Storage Temperature	AIQ00ZPFC-01NL	T_{STG}	-40	-	120	°C
Humidity (non-condensing) Operating Non-operating	AIQ00ZPFC-01NL		15 0	- -	95 95	% %

Note 1 - PFC module have a thermal sensor to monitor its internal temperature and will shut down when temperature is detected to be above 105°C. PFC module will resume normal operation when the temperature is detected to have fallen back to below 95°C.

ELECTRICAL SPECIFICATIONS

Input Specifications

Table 2. Input Specifications

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Input Voltage Operating - Continuous Non-operating - 30mS	 All All	$V_{IN,DC}$	 100 -	 115 -	 122 170	 Vac Vac
Operating Input Frequency	All	f_{IN}	50	360/400	800	Hz
Maximum Input Current ($I_O = I_{O,max}$)	$V_{IN,AC}$ = 100V_{ac}	$I_{IN,max}$	-	-	1	A_{RMS}
No Load Input Current (V_O On, I_O = 0A)	$V_{IN,AC}$ = 115V_{ac} F_{IN} = 60Hz	I_{IN,no_load}	-	-	0.1	A_{RMS}
No Load Input Power (V_O On, I_O = 0A)	$V_{IN,AC}$ = 100V_{ac} - 122V_{ac} F_{IN} = 60Hz - 800Hz	P_{IN,no_load}	-	-	2	W
Maximum AC Input Power	$I_O = I_{O,max}$	P_{IN}	-	-	100	W
Harmonic Line Currents	All	THD	RTAC-DO 160			
Power Factory @ Different AC Frequency (Io=0.19A)	$V_{IN,AC}$ = 115V_{ac} f_{IN} = 50Hz/360Hz/400Hz	PF	-	0.99	-	
	$V_{IN,AC}$ = 115V_{ac} f_{IN} = 800Hz	PF	-	0.97	-	
Startup Surge Current (Inrush) @ 25°C (A 33 Ohm power resistor of 7 Watts connected to the – Vout and INRUSH pin of the PFC)	$V_{IN,AC}$ = 115V_{ac}	$I_{IN,surge}$	-	-	6.7	A_{PK}
Input AC Low Line Start-up Voltage	$I_O = I_{O,max}$	V_{IN,AC_start}	91	96	100	Vac
Input AC Undervoltage Lockout Voltage	$I_O = I_{O,max}$	V_{IN,AC_stop}	81	85	90	Vac
Operating Efficiency @ 390Vout, 25°C	$I_O = I_{O,max}$ $V_{IN,AC}$ = 100V_{ac} - 122V_{ac}	η	90	-	-	%
Turn On Delay Time	$I_O = I_{O,max}$	$t_{turn\text{-}on}$	-	-	1	Sec
Leakage Current To Safety Ground	V_{IN} = 122V_{ac} f_{IN} = 800Hz	$I_{IN,leakage}$	-	-	1	mA

ELECTRICAL SPECIFICATIONS

Output Specifications

Table 3. Output Specifications

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output Voltage VADJ pin short to S_GND VADJ pin open	A	V_O	385 295	390 300	397 306	V V
Output Power Range	$I_O = I_{O,max}$	P_O	-	-	75	W
Output Power Limit	$P_O = P_{O,max}$	$\%P_O$	-	-	115	%
V_O Load Capacitance	Start up	-	-	440	-	uF
Line/Output Regulation	Inclusive of set-point, temperature change, warm-up drift and dynamic load	V_O	385	390	397	V
Output Voltage Ripple, pk-pk	Measure with a 0.1µF ceramic capacitor in parallel with a 10µF tantalum capacitor, 0 to 20MHz bandwidth	V_O	-	-	600	mV_{PK-PK}
V_O Dynamic Response Peak Deviation	25% load change	$\pm\%V_O$	-	-	0.5	%
Output Current, Continuous	All	I_O	0	-	0.19	A
Over Voltage Protection		Vo	-	-	430	V
Over Temperature Protection	All	Auto Recovery				

ELECTRICAL SPECIFICATIONS

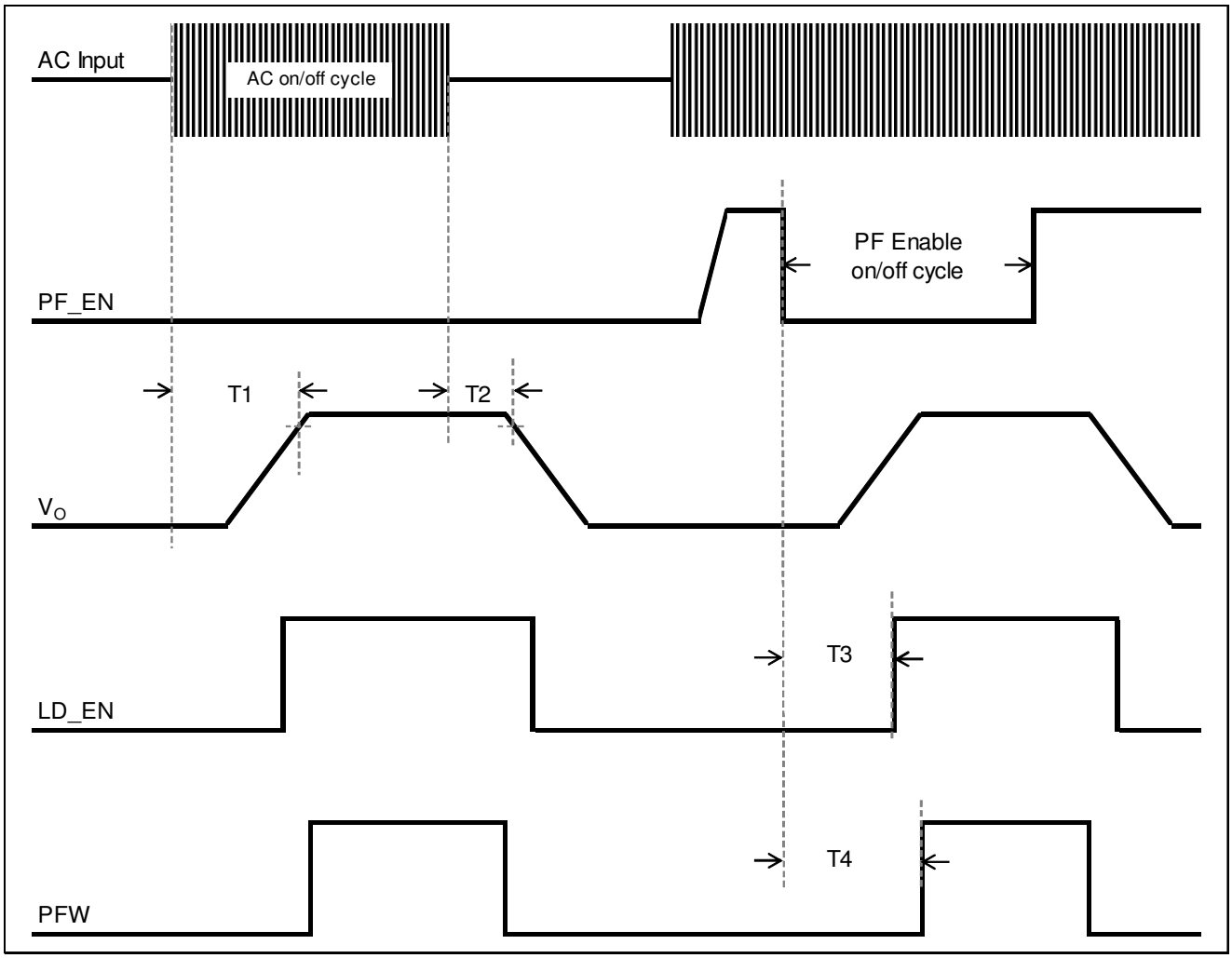
System Timing Specifications

Table 4. System Timing Specifications

Label	Parameter	Min	Typ	Max	Unit
T1	Delay from AC being applied to V_O being within regulation	-	-	1000	mSec
T2	Delay from AC input off to Vo out of its regulation	200[1]	-	-	mSec
T3	LD_EN delay time is from the turn on PF_EN to the turn on of the LD ENABLE	50	-	1000	mSec
T4	PFW delay time is from the turn on PF_EN to the turn on of the PFW	50	-	1000	mSec

Note 1 - Measured the hold up time with 2*150uF/450V e-cap connected to the output.

System Timing Diagram



ELECTRICAL SPECIFICATIONS

AIQ00ZPFC-01NL Performance Curves

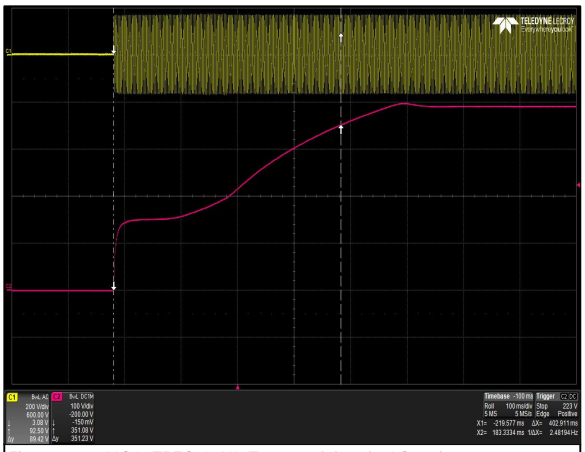


Figure 1: AIQ00ZPFC-01NL Turn-on delay via AC mains
Vin = 115Vac/400Hz Load: Io = 0.19A Vo = 390V
Ch 1: Vin Ch 2: Vo

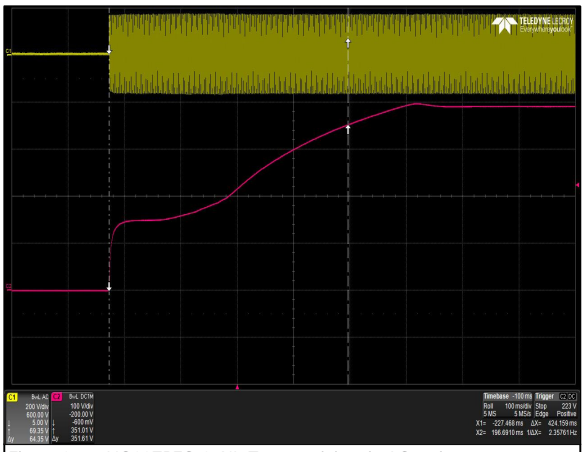


Figure 2: AIQ00ZPFC-01NL Turn-on delay via AC mains
Vin = 115Vac/800Hz Load: Io = 0.19A Vo = 390V
Ch 1: Vin Ch 2: Vo

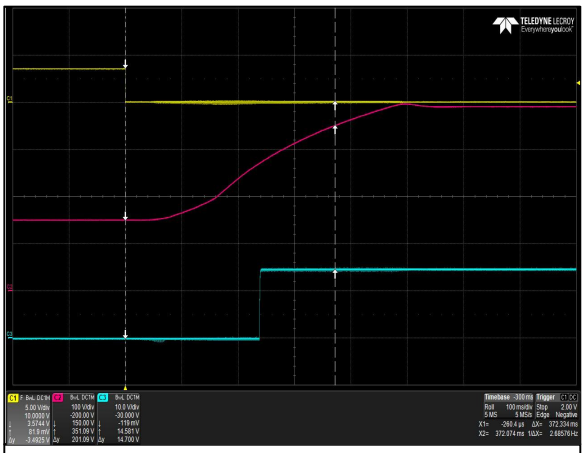


Figure 3: AIQ00ZPFC-01NL Turn-on delay via PF ENABLE
Vin = 115Vac/400Hz Load: Io = 0.19A Vo = 390V
Ch 1: PF ENABLE Ch 2: Vo Ch 3: LD_EN

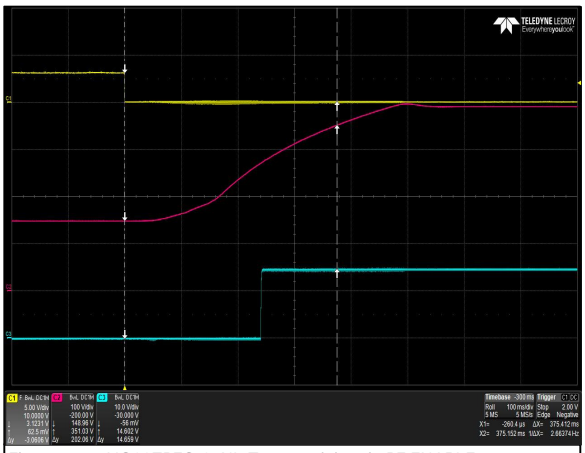


Figure 4: AIQ00ZPFC-01NL Turn-on delay via PF ENABLE
Vin = 115Vac/800Hz Load: Io = 0.19A Vo = 390V
Ch 1: PF ENABLE Ch 2: Vo Ch 3: LD_EN

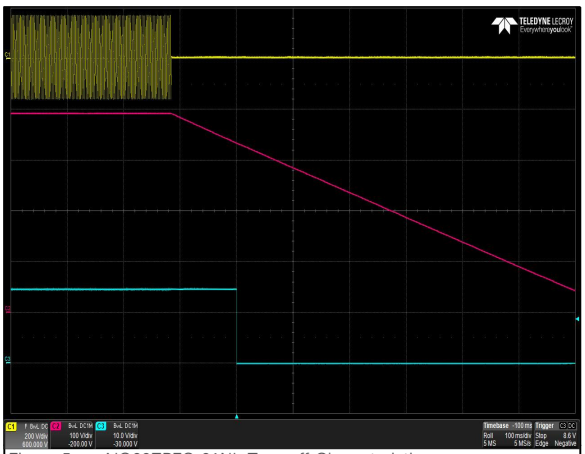


Figure 5: AIQ00ZPFC-01NL Turn-off Characteristic
Vin = 115Vac/400Hz/0° Load: Io = 0.19A Co = 2*150uF/450V
Ch 1: Vin Ch 2: Vo Ch 3: PFW

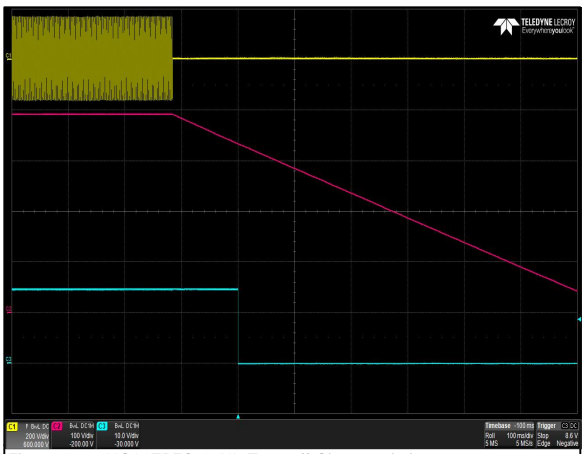


Figure 6: AIQ00ZPFC-01NL Turn-off Characteristic
Vin = 115Vac/800Hz/0° Load: Io = 0.19A Co = 2*150uF/450V
Ch 1: Vin Ch 2: Vo Ch 3: PFW

ELECTRICAL SPECIFICATIONS

AIQ00ZPFC-01NL Performance Curves

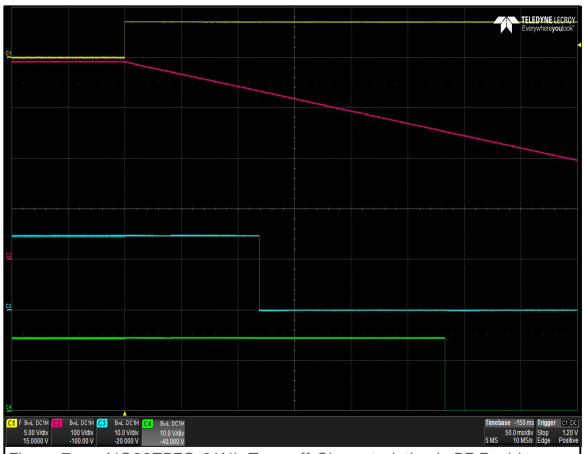


Figure 7: AIQ00ZPFC-01NL Turn-off Characteristic via PF Enable
Vin = 115Vac/400Hz Load: Io = 0.19A Vo = 390V Cout = 2*150uF/450V
Ch 1: PF ENABLE Ch 2: Vo CH 3: PFW Ch 4: LD_EN

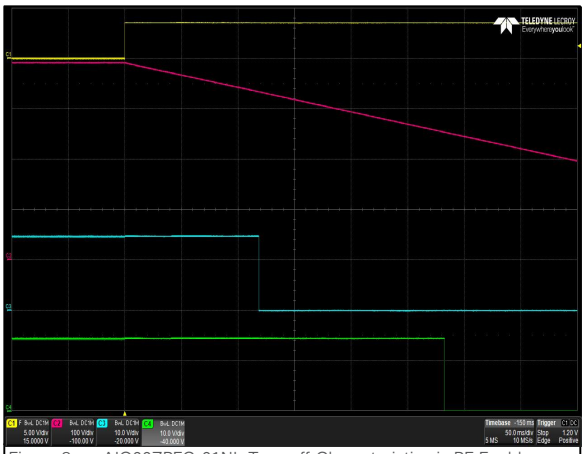


Figure 8: AIQ00ZPFC-01NL Turn-off Characteristic via PF Enable
Vin = 115Vac/800Hz Load: Io = 0.19A Vo = 390V Cout = 2*150uF/450V
Ch 1: PF ENABLE Ch 2: Vo CH 3: PFW Ch 4: LD_EN

Figure 9: AIQ00ZPFC-01NL Ripple and Noise Measurement
Vin = 115Vac/400Hz Load: Io = 0.19A Vo = 390V
Ch 2: Vo

Figure 10: AIQ00ZPFC-01NL Ripple and Noise Measurement
Vin = 115Vac/800Hz Load: Io = 0.19A Vo = 390V
Ch 2: Vo

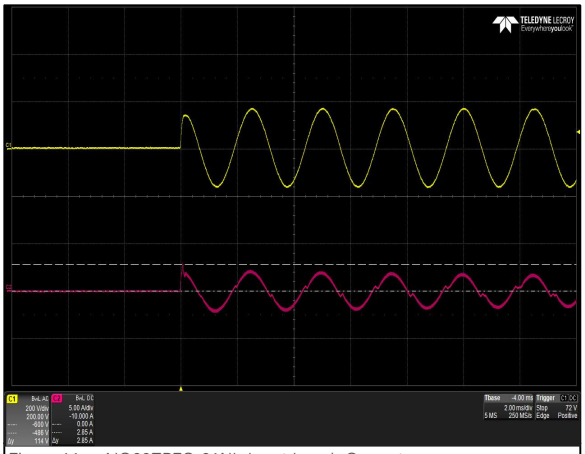


Figure 11: AIQ00ZPFC-01NL Input Inrush Current
Vin = 115Vac/400Hz/90° Load: Io = 0A Cout = 2*150uF/450V
Ch 1: Vin Ch 2: Iin

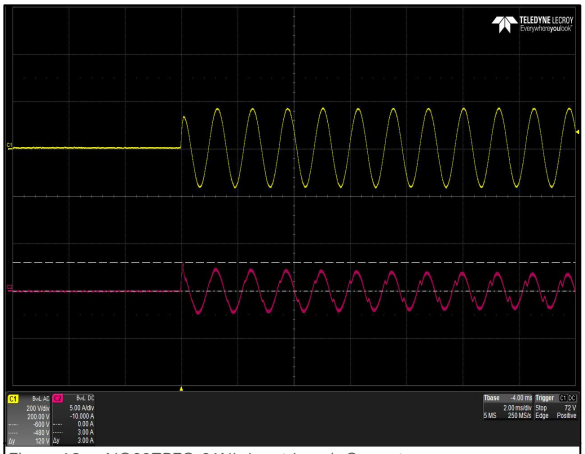


Figure 12: AIQ00ZPFC-01NL Input Inrush Current
Vin = 115Vac/800Hz/90° Load: Io = 0A Cout = 2*150uF/450V
Ch 1: Vin Ch 2: Iin

ELECTRICAL SPECIFICATIONS

AIQ00ZPFC-01NL Performance Curves

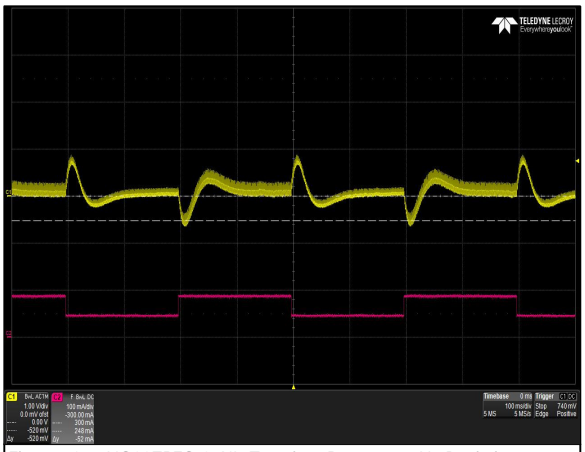


Figure 13: AIQ00ZPFC-01NL Transient Response - Vo Deviation
25% to 50% load change 1A/uS slew rate Vin = 115Vac
Ch 1: Vo Ch 2: Io

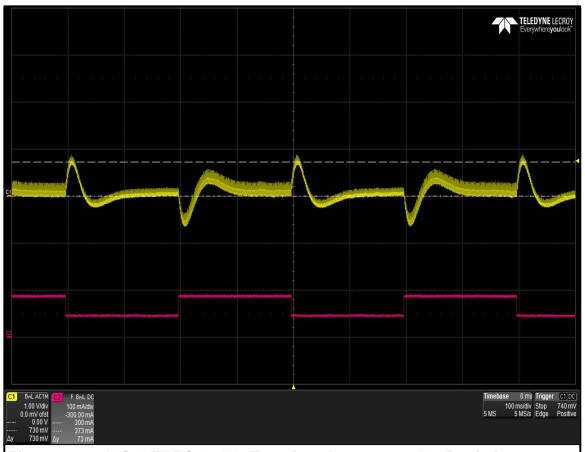


Figure 14: AIQ00ZPFC-01NL Transient Response - Vo Deviation
50% to 25% load change 1A/uS slew rate Vin = 115Vac
Ch 1: Vo Ch 2: Io

ELECTRICAL SPECIFICATIONS

Protection Function Specifications

Input Fuse

The AIQ00ZPFC-01NL series module do not have an in-line fuse fitted internally. In order to comply with CSA, VDE and UL safety regulations, it is recommended that a fuse of 250Vac, 2A be fitted at the module's input.

Over Voltage Protection (OVP)

The maximum over voltage point is 430Vdc (typical output at 390Vdc). The power supply latches off during output over voltage with the AC line recycled to reset the latch.

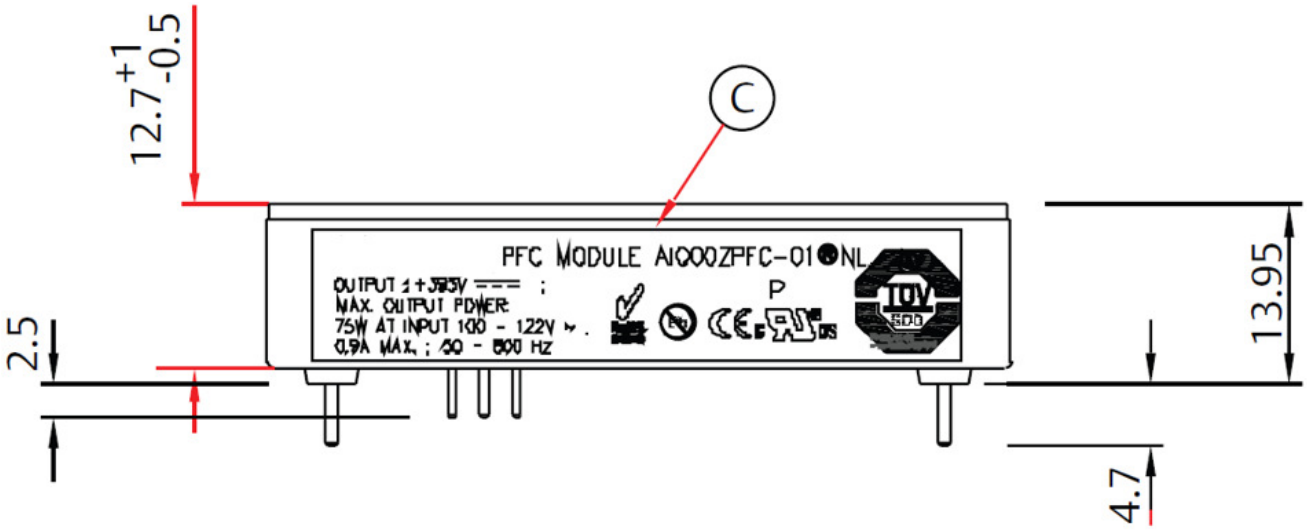
Parameter	Min	Typ	Max	Unit
V_O Output Overvoltage	-	-	430	Vdc

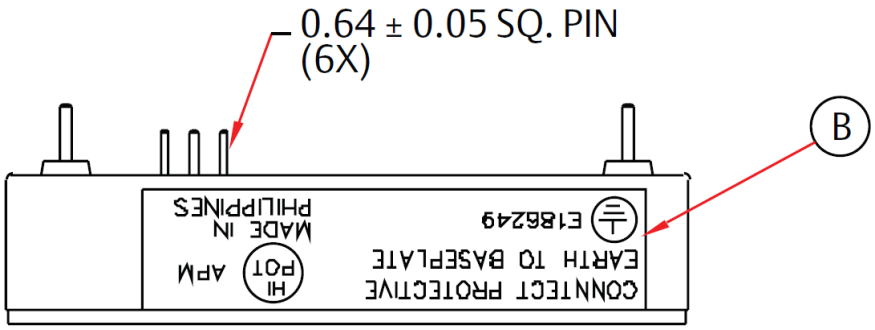
Over Temperature Protection (OTP)

The power supply have a thermal sensor to monitor its internal temperature. It uses LM235DT thermal sensor device to shut down the power supply when the temperature on the baseplate is detected to be above 105degC. The power supply will resume normal operation when the temperature is detected to have fallen back to below 95degC.

MECHNICAL SPECIFICATIONS

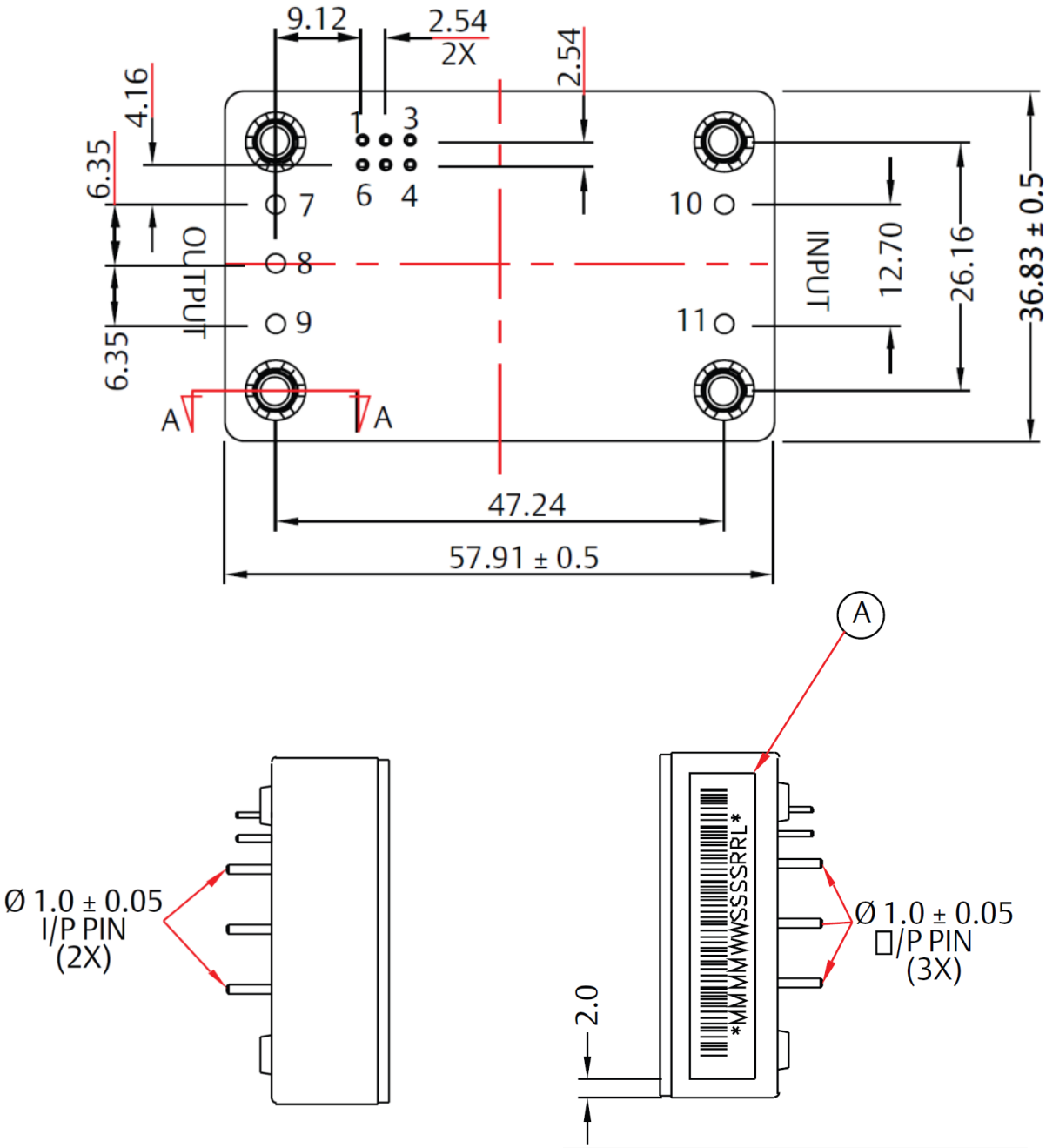
Mechanical Outlines (unit: mm)





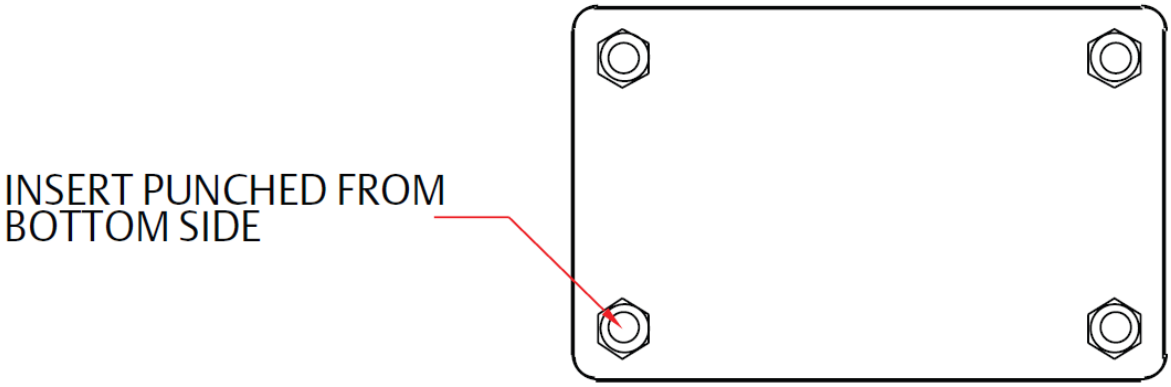
MECHNICAL SPECIFICATIONS

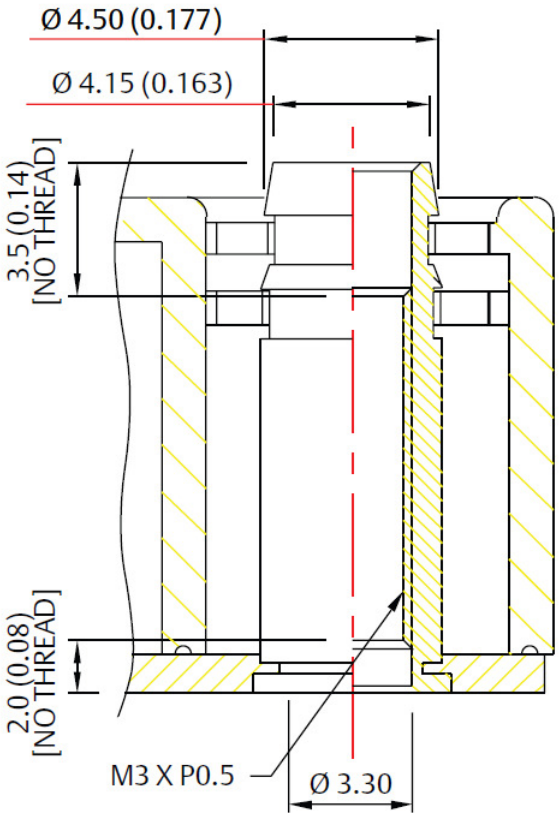
Mechanical Outlines (unit: mm)



MECHNICAL SPECIFICATIONS

Mechanical Outlines (unit: mm)





MECHNICAL SPECIFICATIONS

Pin Assignments

Pin Assignments		
Input (AC)	Output (DC)	Control Pin
10. L1	7. +	1. PF_EN
11. L2	8. -	2. VADJ
	9. INRUSH	3. TMON
		4. LD_EN
		5. PFW
		6. GND

MECHNICAL SPECIFICATIONS

Weight

The AIQ00ZPFC-01NL weight is 0.1411lbs/64g maximum.

ENIVIRONMENTAL SPECIFICATIONS

EMC Immunity

AIQ00ZPFC-01NL power supply (with external EMI filter) is designed to meet the following EMC immunity specifications:

Table 5. Environmental Specifications:

Document	Description
RTCA/DO-160E Section 16.5.1.4	Electromagnetic Compatibility (EMC) – Momentary Power Interruption
Airbus ABD0100.1.2 Section 3.4.2	Electromagnetic Compatibility (EMC) – Voltage Spike, 1000V peak
Boeing Specification D6-16050-5 and Airbus Technical Specification 4421 M1F 0000 00, Section 2.2.24.2	Electromagnetic Interference (EMI) – Lighting Requirements
RTCA/DO-160E, Section 18 for Category Z equipment	Electromagnetic Interference (EMI) – Audio Frequency Conducted Susceptibility - Power Inputs
RTCA/DO-160E, Section 19 for Category Z equipment	Electromagnetic Interference (EMI) – Induced Signal Susceptibility
RTCA/DO-160E, Section 20 for Category T equipment	Electromagnetic Interference (EMI) – RF Radiated and Conducted Susceptibility
Boeing Specification D6-36440 Section 7.3.3.5	Electromagnetic Interference (EMI) – AF Conducted Emission
RTCA/DO-160E, with change 1,2&3; Section 21, for Category H(Modified)Equipment and Boeing Spec D6-36440 Section 7.3.3.6	Electromagnetic Interference (EMI) – RF Radiated and Conducted Emission
RTCA/DO-160E, Section 25 for Category A equipment; Boeing Specification D6-36440, Section 7.3.3.8; Airbus TN-ESK/020/97, Issue 3	Electromagnetic Compatibility (EMC) – Electrostatic Discharge (ESD) +15KV,3KV step starting from 3KV for Boeing specification +8KV,500V step starting from 3KV for Airbus specification
Boeing Specification D6-44588 Paragraph 3.5.4	Electrical Bonding & Grounding

ENIVIRONMENTAL SPECIFICATIONS

Safety Certifications

The AIQ00ZPFC-01NL 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 AIQ00ZPFC-01NL Power Supply System

Document	Description
UL 60950-1 and BLO-QOP-22-01/02.	BLO-QOP document take precedent over the UL standard
ABD0100.1.2	Environmental Conditions and Test Requirements Associated to Qualification
ABD0100.1.8	Electrical and Installation Requirement – mainly concerned with harmonics, transients, on ground generator status ,etc.
TM-ESK-49-01	Determination of Flame Propagation and After Flame Times of Aircraft Circuit Boards
D6-16050-5 (Boeing)	Electromagnetic Interface Control Requirements for Composite Airplanes
D6-36440, Rev D (Boeing)	Standard Cabin System Requirements Document – not very relevant to Electrical
D6-44588 (Boeing)	Electrical Requirement for Utilization Equipment Installed on Commercial Transport Airplanes – Acceptable practices, Tan caps, Assembly numbering, bonding resistance, etc.
RTCA/DO-160E with change 1, 2 7 3	Radio Technical Commission for Aeronautics Environmental Conditions and Test Procedures for Airborne Equipment
UL 60950-01 * AN/CSA C22.2 No. 60950-01 First Edition	Safety of Information Technology Equipment
EN60950-1	CE marking by internal verification/certificate
IEC/EN 60950-1, First Edition – 2001 with Corrigendum 1	Information Technology Equipment – Safety – Part 1: General requirements
Telcordia GR-63-CORE, Issue 2	Network Equipment-Building System (NEBS), Physical Protection.
Federal Aviation Regulation (FAR)	Wires and Components

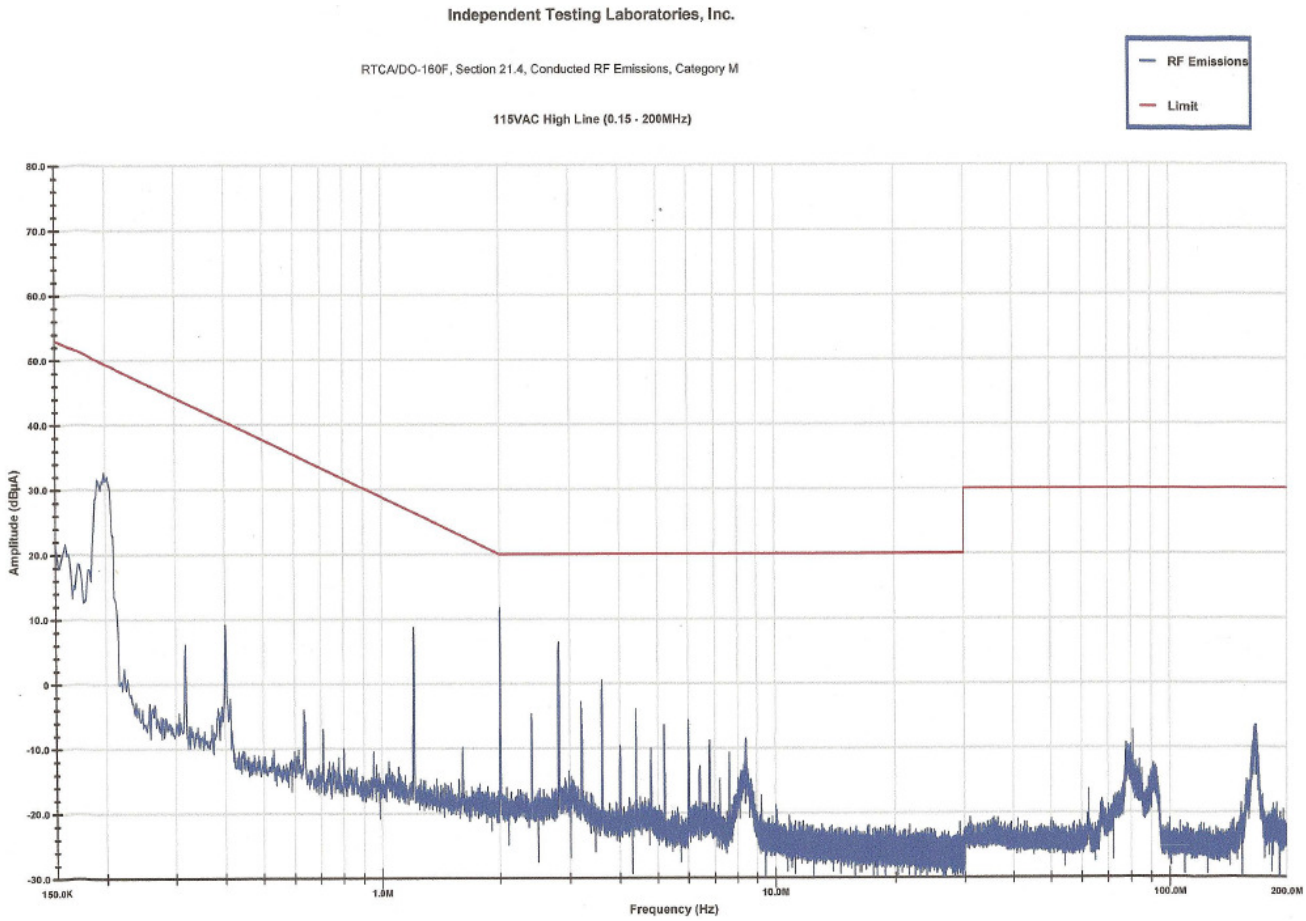
ENIVIRONMENTAL SPECIFICATIONS

EMI Emissions

The AIQ00ZPFC-01NL and AIQ02R300L has been designed to comply with the EMI requirements of RTCA/DO-160E and relevant sections of Boeing specification D6-16050-5 and airbus technical specification for immunity.

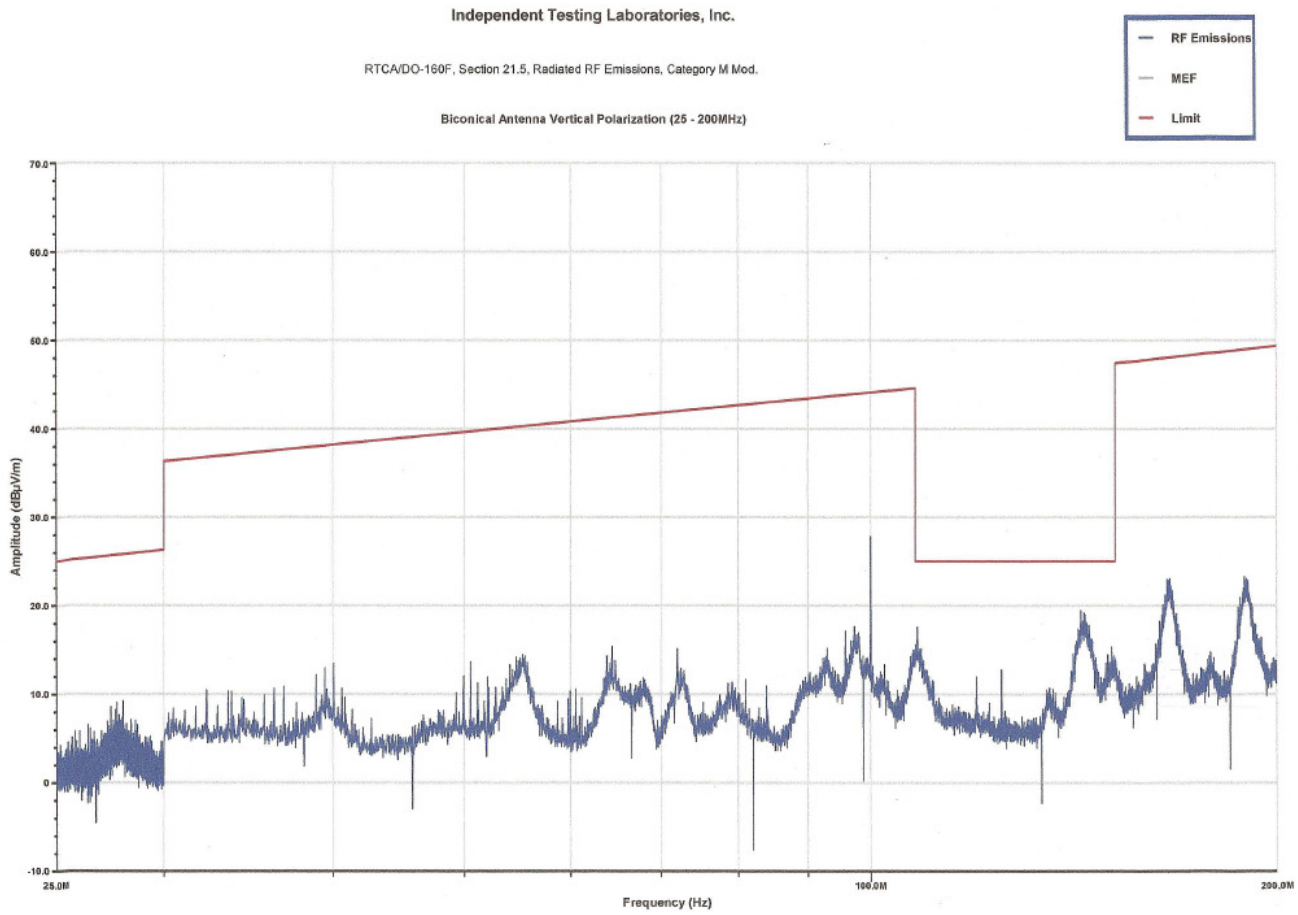
The AIQ00ZPFC-01NL is enclosed inside a metal box with external filtering mounted on PCB, tested at AIQ02R300L DC/DC module with 65W resistive load.

Conducted Emissions



ENIVIRONMENTAL SPECIFICATIONS

Radiated Emissions



ENVIRONMENTAL SPECIFICATIONS

Storage and Shipping Temperature

The AIQ00ZPFC-01NL power supplies can be stored or shipped at temperatures between –40°C to +110°C and relative humidity from 0 to 95%, non-condensing.

Altitude and Pressure

The power supply module will confirm to the altitude requirement of RTCA/DO-160E, Section 4.6.1, for Category A1 (Controlled temperature area).

Decompression

The power supply module conform to the decompression requirements with altitude limit of 3100 meters.

Overpressure

The power supply module conform to the overpressure requirements of RTCA/DO-160E, Section 4.6.3 and figure 4-7, for Category A1 equipment at absolute pressure equipment to -17000ft(26.5psia) and also conform to Airbus 4421 MIF 0000 00, section 2.2.4.3.

Humidity

The AIQ00ZPFC-01NL power supply will operate within specifications when subjected to a relative humidity from 15% to 95% non-condensing. The AIQ00ZPFC-01NL power supply can be stored in a relative humidity from 0 to 95% non-condensing.

ENVIRONMENTAL SPECIFICATIONS

Vibration

The AIQ00ZPFC-01NL power supply will pass the following vibration specifications:

Operating Random Vibration

Acceleration	5.85264		gRMS
Frequency Range	10 - 2000		Hz
Duration	3		Hrs/axis
Direction	3 mutually perpendicular axis		
PSD Profile	FREQ (Hz)	SLOPE (db/oct)	PSD (g^2/Hz)
	10	/	0.024
	40	/	0.024
	51.7	/	0.04
	500	/	0.04
	2000	/	0.002

Operating Sine Vibration

Acceleration	0.5, 1.0, 3.0	G
Frequency Range	5-14, 14-40, 40-767	Hz
Duration	1.0	Hrs/axis
Pulse	Sine	

Shock

Operating Half-Sine Shock

The AIQ00ZPFC-01NL series power supply will pass the following vibration specifications:

Acceleration	6	G
Duration	11	mSec
Pulse	Half-Sine	
Number of Shock	3 shocks in each of 6 faces	

POWER AND CONTROL SIGNAL DESCRIPTIONS

AC Input Pin

These pins provide the AC Mains to the AIQ00ZPFC-01NL series module.

Pin 10 - L1 AC Input Line / Return
Pin 11 - L2 AC Input Line / Return

DC Output Pin

The three connectors provide the main output for the AIQ00ZPFC-01NL. The "+" and the "-" pins are the output positive and output negative rails. The Output (V_O) connectors are electrically isolated from the power supply chassis.

Pin 7 - (+) Output Positive
Pin 8 - (-) Output Negative
Pin 9 - INRUSH

A power inrush resistor or thermistor of 10 to 90Ohm of 5 watts or above (depending on the output capacitance) should be connected from INRUSH pin to the output negative pin. An internal MOSFET bypasses this external thermistor/resistor during normal operation.

Control Signals

The AIQ00ZPFC-01NL contains a 6 pins control signal header providing an analogue control interface, temperature monitor and PFC module status warning interface.

PF_EN - (pin 1)

This pin is to control the PFC module output voltage on/off. When pull this pin low to GND to enable the PFC module.

VADJ - (pin 2)

This pin is used to adjust the output voltage. With this pin shorted to GND, the output voltage is about 390Vdc. With a resistor connected to GND, the output voltage can be adjusted from 303Vdc to 390Vdc. With this pin open(floating), the output voltage will be from 295Vdc to 306Vdc.

Condition	Min	Nom	Max	Unit
Vo (VADJ pin short to GND)	385	390	397	Vdc
Vo (VADJ pin open)	295	300	306	Vdc

POWER AND CONTROL SIGNAL DESCRIPTIONS

TMON - (pin 3)

The temperature monitor pin provides an indication of the module's internal temperature. The voltage at the TMON pin is proportional to the temperature of the module baseplate with the below formulation:

$$V_{TEMP} = \left(-3.479\times10^{-6}\times(T-30)^{2}\right)+\left(-1.082\times10^{-2}\times(T-30)\right)+1.8015V$$

(T: ambient temperature, ^{O}C)

LD_EN - (pin 4)

This pin output a signal that can drive an opto-coupler to provide an isolated signal for the system to enable the load. This signal can direct drive a MOSFET with a 17V zener clamping the gate voltage.

Condition	Min	Nom	Max	Unit
LD_EN_ON (Load Enable on voltage)	13.7	-	15.3	V
LD_EN_OFF (Load Enable off voltage)	0	-	0.4	V
LD_EN_SC (Load Enable short circuit current	0.5	-	3.2	mA

PFW - (pin 5)

This pin output a signal that can drive an LED to provide the power fail warning of the unit. When the output voltage is out of regulation, this signal will go from high to low.

Condition	Min	Nom	Max	Unit
PFW_ON (Load Enable on voltage)	13.7	-	15.3	V
PFW_OFF (Load Enable off voltage)	0	-	0.4	V
PFW_SC (Load Enable short circuit current)	0.5	-	3.2	mA

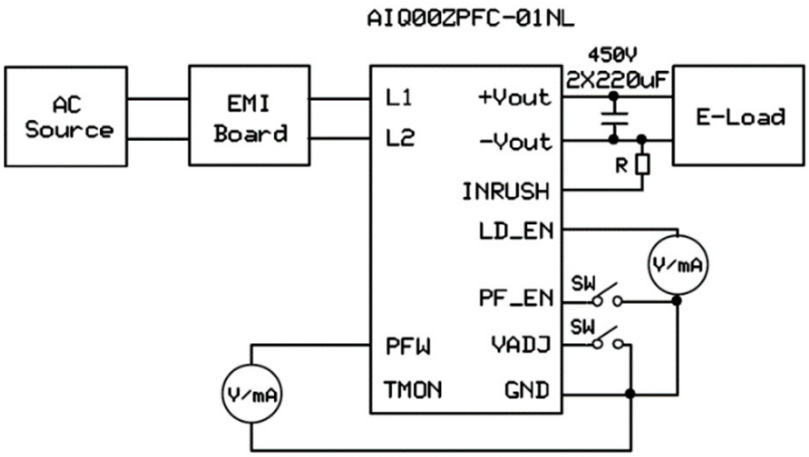
GND - (pin 6)

This is a signal ground pin. Note that this pin is on the primary side.

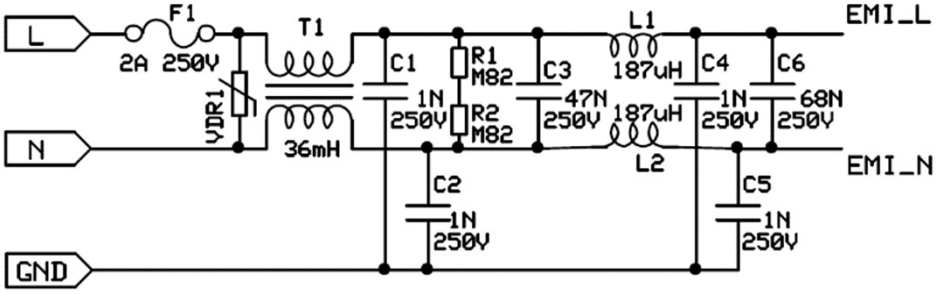
APPLICATION NOTES

PFC Module Testing Diagram

Below block diagram is the application connection of the AIQ00ZPFC-01NL.



Recommended External EMI Filter Schematic



APPLICATION NOTES

Recommended External EMI Filter BOM

Assembly	Part Number	Manufacture	Description	Quantity
F1	80412000440	Littelfuse	250V 2A	1
VDR	ERZ-E10A201	Panasonic	200V 4500A 10mm Straight Leads	1
C1,C2,C4,C5	B81123C1102M189	EPCOS	Film Cap 1.0NF 20% 250V MKP Y1	4
C3	B32523C3473J	EPCOS	Film Cap 0.047uF 250volts 5%	1
C6	B32523C3473J	EPCOS	Film Cap 0.068uF 250volts 5%	1
T1	RS614-2-02	Schaffner	30mH 2A 50mΩ	1
L1,L2	74477020	Wurth Electronics Inc	100uH 2.2A	2
R1,R2	CW120682M0JPTA	Vishay / Dale	SMD 1/4watt 82MΩ 5%	2

Hold-up Time Requirement

The output capacitor value is different for different hold-up time requirements. The minimum capacitance corresponding to the required hold-up time of a system comprised of ASTEC DC/DC power modules and a PFC module can be calculated as follows,

$$C_{o\min} = \frac{2 \times P_o \times T_{hold}}{\left(V_O - V_{Ripple}\right)^2 - \left(V_{\min}\right)^2}$$

Where:

C_{omin} : The minimum output capacitance(uF)

P_o: Input power(W) of the DCDC converter including the DCDC efficiency.

T_{hold}: Hold up time(Sec)

V_o : PFC output voltage(V)

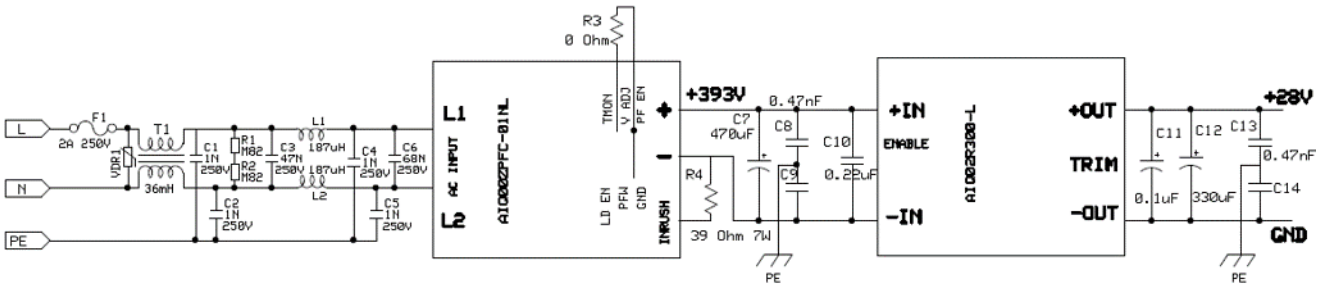
V_{Ripple}: PFC output ripple voltage(V)

V_{min}: The minimum operating input voltage of the DCDC converter.

Note: To allow for capacitor tolerances and aging effects, the actual capacitor value will generally be around 1.5 times greater.

APPLICATION NOTES

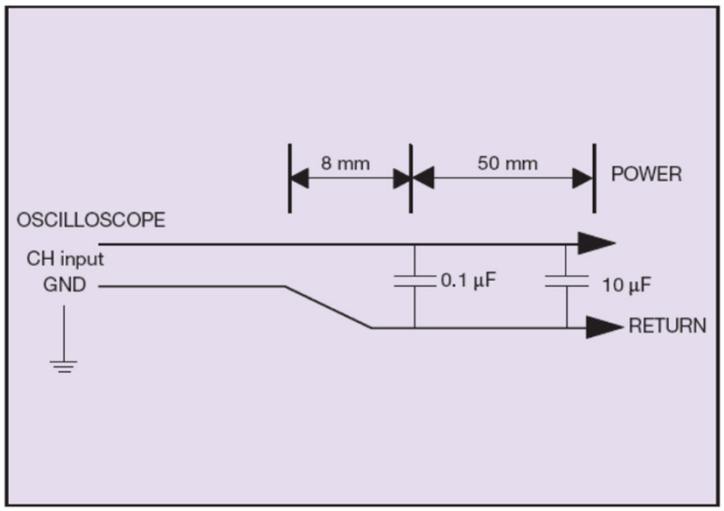
Recommended Application of AIQ00ZPFC-01NL with AIQ02R300-L Module



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 AIQ00ZPFC-01NL series module. When measuring output ripple and noise, a scope jack in parallel with a 0.1uF ceramic chip capacitor, and a 10uF aluminum electrolytic capacitor should be used. Oscilloscope should be set to 20MHz bandwidth for this measurement.



RECORD OF REVISION AND CHANGES

Issue	Date	Description	Originators
1.0	01.19.2015	First Issue	X. Sun
1.1	01.14.2020	Remove the hold time specifications	K. Wang

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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