



Product Specification

# **XL220-1ATX**

220-Watt AC to AC  
Power Supply

Document No. 703127 Rev 07-01-19

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# 1.

# Introduction

## 1.1 Introduction

This specification defines the design and performance characteristics of the XL220-1ATX open frame, single-phase (3-wire), universal input, power factor corrected, multiple output, 220-watt switch mode power supply. It includes information regarding its installation, cooling requirements, connector configurations, electrical and signal specifications, and environmental ranges for storage and operation of the power supply. The XL220-1ATX is a multiple-output supply with a 5V, 1A standby supply that remains on, even when the main outputs are shut-off remotely.

## 1.2 Agency Compliance

The XL220-1ATX complies with the following international agency standards:

<b>Safety</b>	<b>Complies with Standard</b>	<b>Remarks</b>
United States	UL 60950-1 Second Edition UL 62368-1 Second Edition (Information Technology Equipment)	Leakage Current Hi-pot – 2121vdc for 1 second
Canada	CAN/CSA-C22.2 No. 60950-1 (2007) Second Edition	
EU Council	2006/95/EC (August 2007)	Low Voltage Directive
International	IEC 60950-1 (2005) Second Edition IEC 62368-1 (2014) Second Edition	
<b>EMC</b>	<b>Complies with Standard</b>	<b>Remarks</b>
United States	FCC part 15, subpart B	Conducted emissions Limits per CISPR 22 Class B Tested to ANSI C63.4: 2003
EU Council	2004/108/EC	EMC Directive
International	EN 61204-3 (refers to the following) EN 55022 Class B  EN 55024 (refers to the following) EN 61000-3-2 Class D  EN 61000-3-3 EN 61000-4-3 EN 61000-4-4 EN 61000-4-5 EN 61000-4-6 EN 61000-4-11	Low Voltage Power Supplies – DC Output  Conducted emissions Limits per CISPR 22 Class B  Immunity Harmonic Current Emissions (Power Factor Correction – PFC) Voltage Fluctuations & Flicker Radiated Susceptibility Fast Transient/Burst Immunity Power Mains Surge Immunity RF Immunity Voltage Dips, Short Interruptions
<b>Reduction of Hazardous Substances (RoHS)</b>	<b>Complies with Standard</b>	<b>Remarks</b>
EU Council	2002/95/EC 2011/65/EU	RoHS Directive RoHS 2 Directive

**Marks of Conformance**

United States & Canada



Europe



EU Council



RoHS



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**Table 1-1 Agency Compliance**

# 2.

# AC Input

## 2.1 Input Line Requirements

The XL220-1ATX is capable of supplying full rated power in continuous operation throughout the specified ranges of voltages and frequencies. The power supply will automatically recover from AC power loss and is capable of starting under maximum load at the minimum AC input voltage described below.

Parameter	Minimum	Nominal	Maximum
RMS Input Voltage	90 VAC	100-240 VAC	264 VAC
RMS Input Current	–	–	3.0 A @ 100 V
RMS Input Current	–	–	1.3 A @ 240 V
Input Frequency	47 Hz	50/60 Hz	63 Hz

Table 2-1 AC Input Parameters

## 2.2 Input Over Current Protection

The XL220-1ATX incorporates a primary AC line fuse for input over current protection to prevent damage to the power supply and meet product safety requirements as outlined in Section 1.2.

## 2.3 Inrush Current Limiting

The cold start inrush current is limited to 13-amps peak at 240 VAC. Repetitive ON/OFF cycling of the AC input voltage shall not damage the power supply or cause the input fuse to fail.

## 2.4 Low Input Voltage

The application of an input voltage below the minimums specified in Table 2-1 shall not cause damage to the power supply.

## 2.5 Leakage Current

The leakage current from AC line or AC Neutral inputs to Earth Ground (mounting holes) at 240 VAC, 50Hz is less than 750-microamps.

# 3.

# DC Outputs

## 3.1 Output Voltage Regulation

The DC output voltages shall remain within the Minimum and Maximum limits of Table 3-1 when measured at J2 connector under all specified line, load\* and environmental conditions contained herein.

\*refer to Table 3-2 for Min/Max load currents for each output.

Output	Voltage	Regulation	Minimum (VDC)	Nominal (VDC)	Maximum (VDC)	Remote Sense
V1	+24V	±4%	23.04	24.00	24.96	
V2	+5V	±4%	4.85	5.05	5.25	+V2 only
V3	+12V	±5%	11.40	12.00	12.60	
V4	+12V	±5%	11.40	12.00	12.60	
V5	+5V <sub>standby</sub>	±5%	4.75	5.00	5.25	

Table 3-1 Output Voltage Specifications

## 3.2 No Load Operation

The power supply will operate with reduced output voltage regulation on V1 and V2 with all outputs unloaded (loads are unattached). V1 can be up to 28V and V2 can be up to 6V, V3, V4 and V5 will be well regulated (+/-5%) even under no load conditions. This no load condition will not damage the XL220-1ATX or cause a hazardous condition. The power supply will remain stable and operate normally after application of the minimum loads specified in Table 3-2.

### CAUTION

*Remove AC power prior to attaching or removing secondary loads.*

## 3.3 Output Current and Power

The maximum available output power is always a function of the cooling air's flow and temperature. The total available output power is reduced with unrestricted natural convection cooling at an ambient temperature of 50°C or less (see Sections 3.3.1).

### 3.3.1 Output Power and Cooling

The maximum combined output power is limited to 220-watts with 20 CFM of forced air-cooling at no more than 50°C impinging on the center-top of the unit. The 5V<sub>standby</sub> output is limited to 5-watts under the same conditions. Under these cooling conditions, the individual outputs have the following limitations:

Output	Rated Voltage	Minimum Load	Maximum Load	Maximum Watts
V1	24 V	50.0mA	6.0 A*	144.0
V2	+5 V	1.0 A	10.0 A	50.0
V3	+12 V	0.0 A	1.0 A	12.0
V4	+12 V	0.0 A	0.2 A	2.4
V5	+5 V <sub>standby</sub>	0.0 A	1.0 A	5.0

\* Also pulse rated, see Section 3.3.3 below

**Table 3-2 Individual Min/Max Load Currents**

### 3.3.2 Natural Convection Cooling

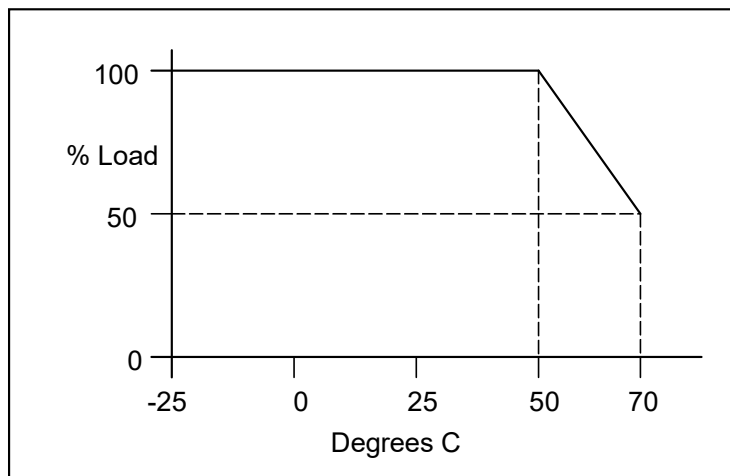
With unrestricted natural convection cooling, the maximum combined output power of V1 through V4 is reduced from 220-watts to 100-watts while the +5V<sub>standby</sub> output is limited to 0.5A for a total of 102.5-watts.

### 3.3.3 24V Output Pulse Current

In addition to its continuous rating of 6A (144-watts), the +24V output can provide a peak output of 15A (360-watts) for 0.5-second period provided the load pulse is not repeated for at least 20-seconds.

### 3.3.4 High Temperature Derating

The XL220-1ATX can be operated at elevated temperatures by derating the total average output power by 2.5% per degree-centigrade from 50°C to 70°C (see Figure 3-1). Operating within this elevated temperature range still requires cooling air flow as described in Section 3.3.1.



**Figure 3-1 Output Power vs. Ambient Temperature Envelope**



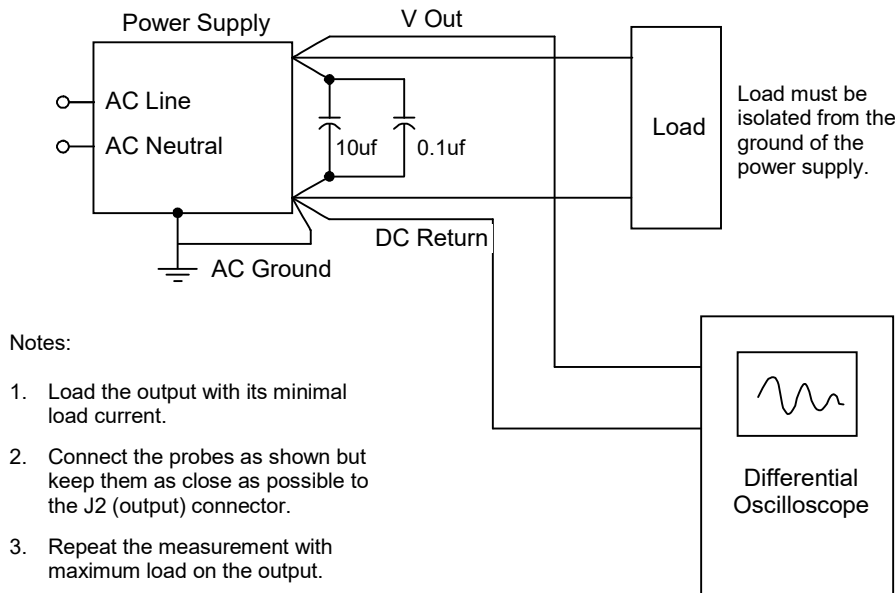
### 3.4 Output Ripple and Noise

Output ripple voltage and noise are defined as periodic or random signals over a frequency band of 10 Hz to 20 MHz. Measurements are to be made with an oscilloscope with at least 20 MHz bandwidth. The measured output must be bypassed at the connector with a 0.1  $\mu$ F ceramic disk capacitor and a 10 $\mu$ F tantalum capacitor to simulate system loading (see Figure 3-2). Ripple and noise shall not exceed the limits specified in Table 3-3 under any condition of line voltage and frequency specified in Section 2.1 and DC loading specified in Table 3-2.

Output	Voltage	Maximum Ripple+Noise (peak-to-peak)
V1	24 V	240 mV
V2	+5 V	50 mV
V3, V4	+12 V	120 mV
V5	+5 V <sub>standby</sub>	50 mV

**Table 3-3 Output Ripple and Noise Specification**

#### 3.4.1 Ripple and Noise Measurement

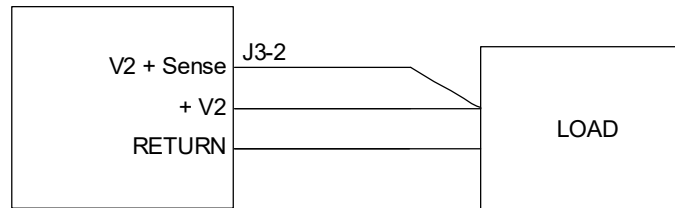


**Figure 3-2 Ripple and Noise Measurement Setup**

### 3.5 Remote Sensing

A remote sense input is provided to compensate for the normal voltage drops in the external +5V output wiring. If the +5V Sense input is left open, the 5V output will meet its load regulation specification on the J2 terminals. Connecting the +5V Sense pin to the +5V output terminal at the load will raise the +5V output voltage to help compensate for the voltage drop in the external +5V wiring. The difference between the V2 output and sense pins must be limited to 0.3-volts. This feature does not compensate for the voltage drop in the external RETURN wiring.

Figure 3-3 shows the optional remote sensing connections. Refer to Table 4-6 for the pin definition of the XL220-1ATX connectors.



**Figure 3-3 Remote 5V Sensing:**

### 3.6 Output Protection

There are four different output protection schemes designed to protect the load and the XL220-1ATX from component failures and extraordinary circumstances.

#### 3.6.1 Over Temperature Protection

If the XL220-1ATX is operated without adequate cooling, it will sense an over-temperature condition and shut itself down. It will automatically restart after it has cooled down to a safe operating temperature.

#### 3.6.2 Over Voltage Protection

No single component fault will cause a sustained over-voltage condition on any output. When an over-voltage condition occurs, the power supply will shut down and will not restart until AC power is turned off and back on. The XL220-1ATX will shut down under the following over voltage conditions:

Output	Minimum	Nominal	Maximum
5 V	5.74 V	6.3 V	7.0 V
12 V	13.5 V	15.0 V	16.5 V
24 V	27.0 V	30.0 V	33.0 V

**Table 3-4 Over Voltage Protection Thresholds**

### **3.6.3 Over Power Protection**

Excessive loads currents (including shorting an output) applied to V1 or V2 will shut down the V1 through V4 outputs. A short circuit on the V3 or V4 outputs will not cause the power supply to shut down and this output will resume normal operation when the short circuit is removed. An excessive load on the V5 output (+5Vstandby) will shut down the entire power supply. The power supply will periodically attempt to restart and should succeed after all overload conditions are removed.

The V1 output is also rated for an intermittent output of approximately 360-watts for 500-milliseconds. This excessive load must not be repeated for at least 20-seconds. Exceeding this intermittent pulse duration will cause an over-power shutdown as described in the above paragraph.

### **3.7 Output Rise Time**

All output voltages shall rise from 10% to 90% of nominal output voltage (as specified in Table 3-1) within 0.2ms to 20ms. The rising output waveforms are monotonic from 10% to 90% under the maximum steady-state load conditions specified in Table 3-2.

### **3.8 Output Overshoot**

The output voltages may overshoot less than 10% above the nominal voltage upon the application or removal of the input power. No opposite polarity voltage is present on any output during turn-on or turn-off.

### **3.9 Output Transients**

The maximum output voltage transient caused by stepped load changes will not exceed the output voltage regulation limits by more than 5% of the nominal output voltage. With an AC input as specified in Section 2.1, the power supply will remain stable when subjected to the load transients described below:

Load changes between 75% and 100% on any output from 50 to 333 cycles per second

Transient load slew rate used in verification testing is 1.0-amp per microsecond

Capacitive loading per Table 3-5

### **3.10 Closed Loop Stability**

The power supply is unconditionally stable under all line/load/transient load conditions including the capacitive loads specified in Table 3-5. The power supply shall exhibit a minimum of 45-degrees phase margin and 6 dB gain margin.

### 3.11 Capacitive Load

The XL220-1ATX will startup and operate normally with external load capacitance on the outputs do not exceed those listed in Table 3-5.

Output	Capacitive Load ( $\mu\text{f}$ )
24 V	2,000 $\mu\text{F}$
+5 V	10,000 $\mu\text{F}$
+12 V	1,000 $\mu\text{F}$
+5 V <sub>standby</sub>	100 $\mu\text{F}$

**Table 3-5 Capacitive Loading**

### 3.12 Efficiency

The XL220-1ATX is at least 85% under the following loading conditions with an input voltage of 230VAC 60Hz and 20 CFM of cooling air at 25°C. Efficiency is calculated as the total DC output power divided by the RMS input power.

Output	Load Current
24V	6.0 A
5V	10.0 A
12V	1.2 A
5Vsb	1.0 A

**Table 3-6 Output Currents Used for Efficiency Rating**

# 4.

# General Specifications

## 4.1 Environmental

The XL220-1ATX meets or exceeds the following environmental specifications:

Parameter	Conditions	Specification	Remarks
Temperature	Operating	-25°C to 50°C	See cooling requirements
	Non-Operating	-40°C to 85°C	
Relative Humidity	Operating	95% Maximum	Non-Condensing
	Non-Operating	95% Maximum	Non-Condensing
Altitude	Operating	10,000 feet MSL Max.	3048 meters
	Non-Operating	50,000 feet MSL Max.	15,240 meters
Vibration	No damage	2.4G RMS Maximum	5-500Hz, 10-min. each axis
Mechanical Shock	No damage	15G half-sine, 11mS	Six shocks each axis

Table 4-1 Environmental Specifications

## 4.2 Component Derating

The XL220-1ATX was designed with the following component-derating guidelines at an operating ambient temperature of 50°C: semiconductor junction temperatures shall not exceed ninety (90) percent of manufacturer's rating. Inductor winding temperatures shall not exceed safety agency requirements. Electrolytic capacitor case temperatures shall not exceed 95% of rated temperature. Resistor power dissipation shall not exceed 70% of rated while other components will not be operated at more than 90% of their rated voltage or current.

## 4.3 Mean Time between Failures

The calculated MTBF of the power supply is equal to or greater than 200,000 hours of continuous operation at maximum output loading and worst case input line voltage with forced-air cooling at 25°C. N2Power does not warrant the MTBF to be representative of any particular unit. The MTBF of the power supply is calculated with an 80% confidence level in accordance with Bellcore, TR-332, Issue 6. Actual failure rates vary from unit to unit.

## 4.4 Labeling/Marking

The power supply is marked and labeled with the N2Power logo and part number, model number, input and output specifications, production code, appropriate safety agency logos, CE mark, patent number, and country of origin. See Figure 4-1.

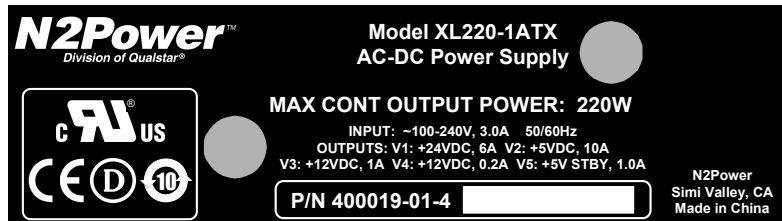
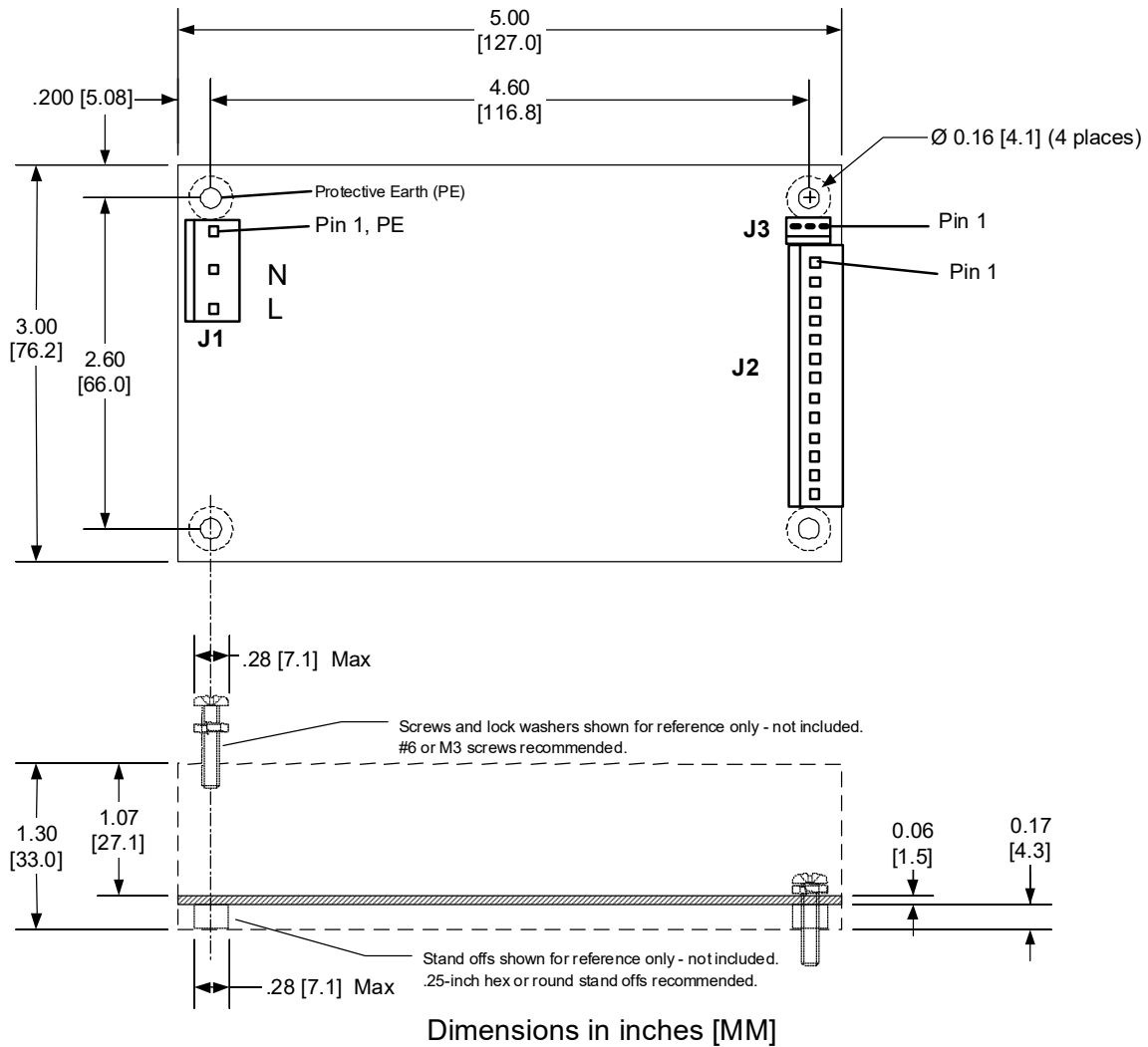


Figure 4-1 Sample XL220-1ATX Label

## 4.5 Mounting

The XL220-1ATX may be mounted in any attitude but must be mounted on all four corners using M3 or 6-32 UNC hardware. Any mounting hardware (screwheads, washers, standoffs, etc.) must not exceed .282-inches (7.16-mm) in diameter to assure adequate safety agency spacing requirements with components and the printed circuit board traces.

### 4.6 Physical Dimensions



**Figure 4-2 Dimensions**

### 4.7 Weight

Weight	Units
.83	Pounds
13.3	Ounces
.375	Kilograms

**Table 4-2 Weight of Individual Supply**

## 4.8 Mating Connectors

The user must furnish all mating connectors. The mating connectors must meet the requirements of all applicable safety agencies (notably UL). Molex<sup>™</sup> (Molex is a trademark of the Molex Corporation) did not change their part numbers when they took the lead out of their contacts. The Molex part numbers in this section should yield RoHS compliant contacts. The largest wire size accepted by each contact should be used for all power connections to help dissipate the heat generated by the resistive connections.

Note that the female contacts that mate to the power supply are only rated for 25-30 mating cycles. Excessive mating cycles will cause a dramatic increase in terminal resistance resulting in local heating that will cause eventual failure of the mating terminal and possibly the header on the power supply.

### *CAUTION*

**The pin-1 location differs amongst connector manufacturers. Sometimes pin-1 differs between the header (on the power supply) and the mating housing from the same manufacturer. Disregard the manufacturer's pin-1 location and follow only the pin-1 locations in Figure 4.2**

### 4.8.1 AC Input Mating Connector J1

The AC input connector to the XL220-1ATX is a 5-pin Molex KK-156 style header with 0.156" centers. The pins 2 and 4 are omitted to provide adequate insulation spacing. The Molex part numbers for the mating housing and crimp-style snap-in terminals are listed below. There may be equivalent connectors available from other manufacturers.

<b>J1</b>	<b>Molex P/Ns</b>
Connector Circuits (pins)	3 of 5
Mating Housing	09-50-8051
Crimp Terminal (tin)	08-50-0113
Rated Contact Current	6.3 A @ AWG 20
Rated Wire Size	AWG 18 or 20

**Table 4-3 J1 Mating Connector**



#### 4.8.2 DC Output Connector J2

The DC output connector is a Molex KK-156 style header with 0.156” centers. The Molex part numbers for the mating housing and crimp-style snap-in terminals are listed below. There may be equivalent connectors available from other manufacturers.

<b>J2</b>	<b>Molex P/Ns</b>
Connector Circuits (pins)	13
Mating Housing	09-50-8131
Crimp Terminal (tin)	08-50-0113
Rated Contact Current	7.0 A @ AWG 18
Rated Wire Size	AWG 18 or 20

**Table 4-4 J2 Mating Connector**

#### 4.8.3 Remote Sense / Fan Connector J3

The Remote Sense/Fan connector is a Molex KK-100 style header with 0.100” centers. The Molex part numbers for the mating housing and crimp-style snap-in terminals are listed below. There may be equivalent connectors available from other manufacturers.

<b>J3</b>	<b>Molex P/Ns</b>
Connector Circuits (pins)	3
Mating Housing	22-01-3037
Crimp terminal (tin)	08-50-0114
Rated Contact Current	2.5 A
Rated Wire Size	AWG 22 thru 30

**Table 4-5 J3 Mating Connector**

#### 4.9 Output Grounding

The DC RETURN signal may be connected to the power supply chassis ground (safety ground) at the plated through mounting hole nearest the J1 input connector.

## 4.10 Signal Pin Definitions

- Identical signal names are connected together on all connectors
- The safety ground connection is provided by the mounting screw near J1
- Refer to Figure 4-2 for connector and pin-1 locations

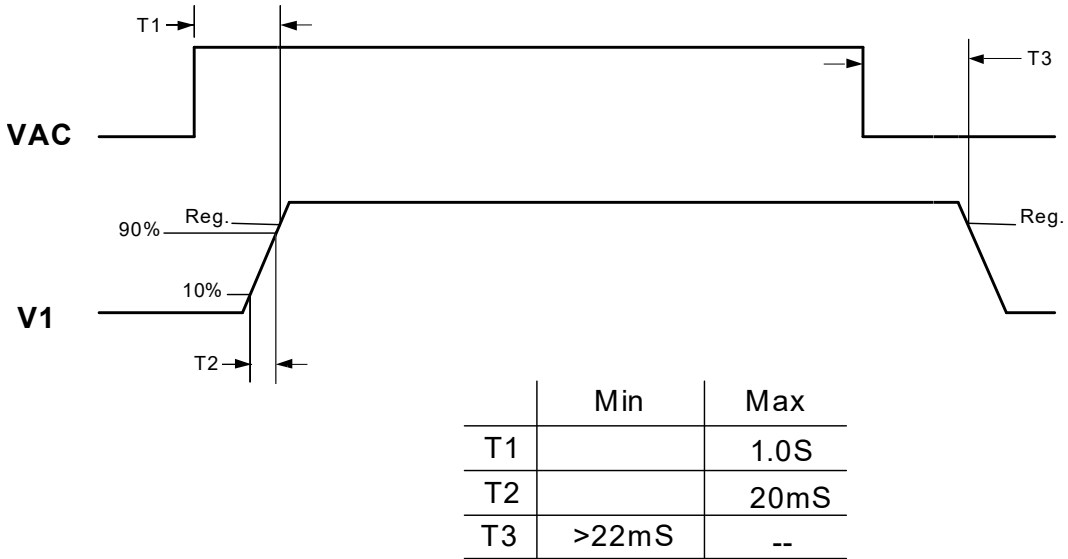
Pin	Signal
J1-1	Protective Earth (PE)
J1-3	AC Neutral Input
J1-5	AC Line Input
J2-1	V3 (+12 V)
J2-2	V2 (+5 V)
J2-3	V2 (+5 V)
J2-4	V2 (+5 V)
J2-5	DC RETURN (0V)
J2-6	DC RETURN (0V)
J2-7	DC RETURN (0V)
J2-8	DC RETURN (0V)
J2-9	DC RETURN (0V)
J2-10	V1 (+24 V)
J2-11	V1 (+24 V)
J2-12	PS_ON/ (low true)
J2-13	V5 (+5 V <sub>standby</sub> )
J3-1	V4 (+12 V)
J3-2	V2 + Sense Input
J3-3	DC RETURN (0V)

**Table 4-6 I/O Pin Definitions**

# 5.

# Timing and Control

## 5.1 Power Supply Timing



\* No Load Capacitance

Figure 5-1 XL220-1ATX Timing Diagram

## 5.2 Remote ON Input

The V1 through V4 outputs are enabled whenever the PS\_ON/ input (J2 pin-12) is grounded to DC RETURN (or J2 pin-5 thru 9). Opening the PS\_ON/ input will disable the three outputs. The PS\_ON/ input has an internal 2 K-ohm pull-up resistor to +5 V<sub>standby</sub>

## 5.3 Hold-Up Time

The power supply will maintain output regulation (per Table 3-1) despite a momentary (lasting up to 20-milliseconds) and complete loss of input power when operating at any rated input voltage (per Table 1-1) at any rated load condition (per Table 3-2).

# 6.

# Ordering Information

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The following table provides the N2Power part numbers that should appear on your purchase order and will appear on any N2Power correspondence:

<b>Model Number</b>	<b>N2Power Part Number</b>
XL220-1ATX	400019-01-4

**Table 6-1 Ordering Information**

The XL220-1ATX is RoHS compliant.

For warranty information refer to [www.N2power.com](http://www.N2power.com)

Direct all questions, orders or requests for quotation as follows:

N2Power Order Desk:	<a href="mailto:orders@n2power.com">orders@n2power.com</a>
Sales:	<a href="mailto:sales@n2power.com">sales@n2power.com</a> 805-583-7744 x122
Technical Support	<a href="mailto:techsupport@n2power.com">techsupport@n2power.com</a> 805-583-7744 x119
Street Address:	1267 Flynn Road Camarillo, CA 93012

# 7.

# Sign off Sheet

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This specification is accepted by the following parties:

**QUALSTAR CORPORATION**

\_\_\_\_\_  
*(Your Company Name)*

By: \_\_\_\_\_

By: \_\_\_\_\_

Name: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_