



Product Specification

# **XL375 Series**

**375-Watt AC to DC**

**Power Supplies**

704601 Rev 08-28-17

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# 1.

# Introduction

## 1.1 Introduction

This specification defines the design and performance characteristics of an open frame U-channel single-phase (3 wire) universal input, power factor corrected 375-watt switch mode power supply. The XL375 models are listed in Table 3-1 and they provide either 260 or 360-watts (model dependent) of filtered and regulated main DC output power at 12V, 24V, 28V, 36V, 40V, 48V, 54V or 56V. When supplied with the Convection Cooling Option, the power supplies deliver 260-watts without fans. It is the extremely high efficiency of these supplies that enable them to be packaged in their small 3.3" x 5" x 1.5" form factor. They all have universal AC inputs to enable operation from 90VAC to 264VAC with power-factor correction to minimize the input current requirements.

All models provide a +5V<sub>standby</sub> output (1.0A max.) whenever AC power is applied. The main and +12V<sub>standby</sub> outputs are enabled by grounding the Remote Enable input. The +12V<sub>standby</sub> may be configured to remain on whenever AC power is applied. These single-output models can be used as standalone power supplies or can be used in redundant or N+1 configuration with up to 4 units connected in parallel. An optional accessory OR-ing board is available – see Section 3.12 for details. The +5V<sub>standby</sub> and +12V<sub>standby</sub> outputs may be wired directly together with other XL375s to provide redundancy, but the combined output currents are limited to the single-supply values.



## 1.2 Agency Compliance

The XL375 complies with the following international agency standards:





<b>Safety</b>	<b>Complies with Standard</b>	<b>Remarks</b>
United States	UL 60950-1 (2007) Second Edition (Information Technology Equipment)	Leakage Current – see table 2-2 Hi-pot – 2121vdc for 1 second
Canada	CSA 22.2: 60950-1	
EU Council	2006/95/EC	Low Voltage Directive
International	IEC 60950-1 (2005) 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	RoHS Directive
<b>Marks of Conformance</b>		
United States & Canada	 (Underwriters Laboratories File E211115)	
EU Council		
RoHS	 	

Table 1-1 Agency Compliance

# 2.

# AC Input

## 2.1 Input Line Requirements

The following table defines the voltage and frequency requirements for the AC line inputs to the XL375 power supply. The XL375 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	Rated	Maximum
RMS Input Voltage	90 VAC	100–240 VAC	264 VAC
RMS Input Current	–	–	4.1 A @ 100 V 1.7 A @ 240 V
Input Frequency	47 Hz	50–60 Hz	63 Hz

Table 2-1 XL375 AC Input Parameters

## 2.2 Input Over Current Protection

The XL375 series incorporates a 6.3A 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 at a 90-degree phase angle (the AC switch is closed at the peak of the AC waveform) is limited to 14-amps peak at 240 VAC input voltage and 7-amps peak at 120 VAC @ 25C.

Repetitive ON/OFF cycling of the AC input voltage should not damage the power supply or cause the input fuse to fail as long as the power remains off for two or more seconds when the outputs are unloaded (less depending upon the output loads). The delay is required for the AC inrush relay to open its contact, upon turning OFF on the power supply, which allows the inrush current limiter to limit the inrush current to the specification of 14-amps at 240 VAC and 7-amps at 120 VAC. If you do not wait for at least 2 seconds the power supply will not be damaged, however the inrush current will not meet the specification.

## 2.4 Low Input Voltage

The application of an input voltage below the minimums specified in Table 2-1 shall not damage the XL375.

## 2.5 Leakage Current

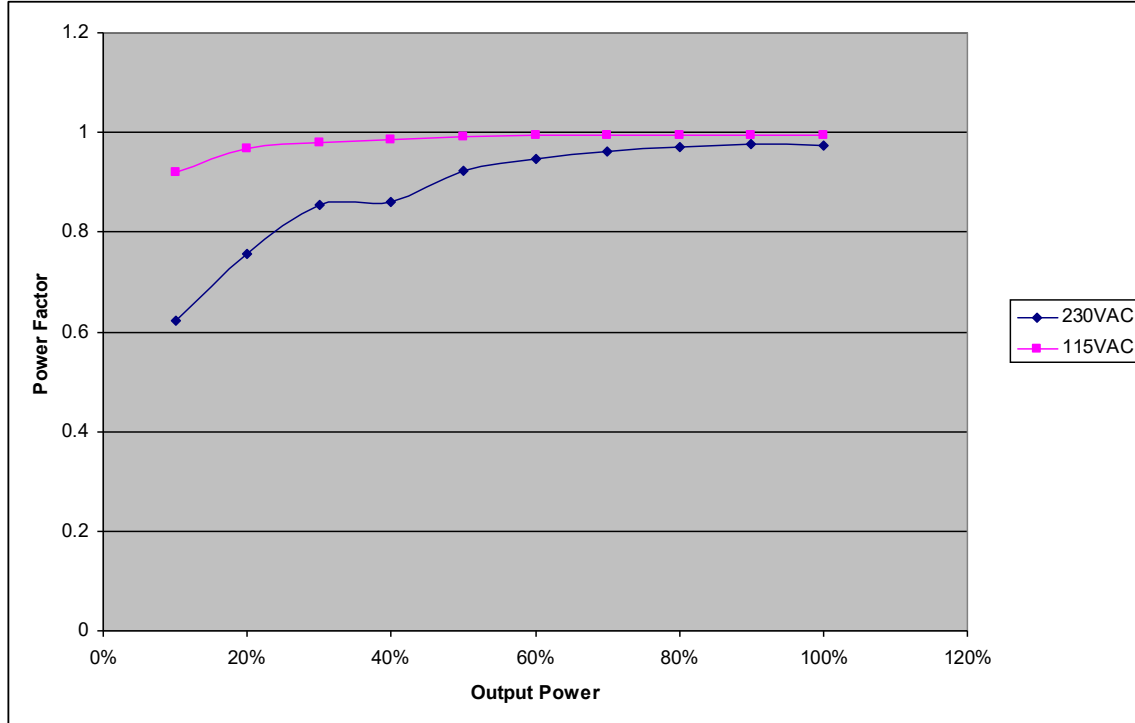
The leakage current from AC line or AC Neutral inputs to Protective Earth varies linearly with the input voltage and frequency (see operating column of Table 2-2). The leakage currents of multiple power supplies are additive. Consult the appropriate electrical safety specification for the maximum leakage current permitted in your product. The leakage current will always go to zero when a DPDT switch simultaneously disconnects both the line and neutral circuits. A single fault can occur when the AC power is applied to only the Neutral input terminal.

Line Voltage Frequency	Operating	Single Fault (see text)
120VAC, 60Hz	0.40 mA	0.75 mA
240VAC, 60Hz	0.80 mA	1.50 mA
240VAC, 50Hz	0.65 mA	1.25 mA

**Table 2-2 Leakage Current – Single XL375**

## 2.6 Power Factor

The XL375 power factor exceeds 0.94 with loads of 225-watts or greater at 230VAC. It exceeds 0.98 with loads of 225-watts or greater at 115VAC



**Figure 2-1 Power Factor, Typical**



## 2.7 Safety Warning

### **WARNING**

The XL375 is a component, not a stand-alone power supply. It must be mounted inside a protective enclosure to prevent accidental shock by contact with the supply. Lethal voltages are present while and after AC power is applied to the XL375. Allow 1-minute for storage capacitors to discharge after removing AC power before handling the XL375.

The safety ground connection is the chassis itself and it must be connected to Protective Earth. All four bottom-side mounting screws must always be installed and torqued to 5 in-lb.

The user must keep any bare metal at least 2.6mm from the AC input connector J1. An insulator can be used between J1 and the bare metal to decrease this spacing.

# 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 the power supply connector under all specified line and environmental conditions contained herein. The regulation accuracy is measured with load currents between zero and the maximum load currents listed in CS = Current Sharing, CC = Convection Cooling

Table 3-3

Model	Output	Rated Voltage	Regulation	Minimum (VDC)	Nominal (VDC)	Maximum (VDC)	Remote Sense
XL375-12	V1	+12 V	±3%	11.64	12.0	12.36	V1/RTN
XL375-24	V1	+24 V	±3%	23.28	24.0	24.72	V1/RTN
XL375-28	V1	+28 V	±3%	27.16	28.0	28.84	V1/RTN
XL375-36	V1	+36 V	±3%	34.92	36.0	37.08	V1/RTN
XL375-40	V1	+40 V	±3%	38.80	40.0	41.20	V1/RTN
XL375-48	V1	+48 V	±3%	46.56	48.0	49.44	V1/RTN
XL375-54	V1	+54 V	±3%	52.40	54.0	55.62	V1/RTN
XL375-56	V1	+56 V	±3%	54.32	56.0	57.68	V1/RTN
All	V2	+12 V <sub>standby</sub>	±5%	11.40	12.0	12.60	None
	V3	+5 V <sub>standby</sub>	±5%	4.75	5.0	5.25	None

Table 3-1 XL375 Output Voltage Specifications

## 3.2 Grounding

All DC outputs, status outputs and control inputs share a common DC Return found on all output connectors. DC Return floats from the chassis (Protective Earth) with a 68nF, 630V capacitor between them.

## 3.3 No Load Operation

A no load condition will not damage the supply or cause a hazardous condition. The power supply will remain stable and operate normally after application of a load. The Power Good logic output will indicate normal operation when the supply is unloaded.

## 3.4 Overshoot at Turn On/Turn Off

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

## 3.5 Voltage Trim

If voltage trim is not required, the TRIM input should be left unconnected. The voltage trim input pin is provided to allow the user to adjust the V1 output up or down by up to 5%. Connecting a resistor between this pin and DC Return will increase the output voltage while connecting a resistor between this pin and the V1 output will decrease the output voltage. The ability of the V1 output to maintain its specified regulation accuracy under severe load or line conditions could be diminished by trimming the output to a higher than nominal voltage. The trim range is limited to +/- 5% as determined by the Up/Down 5% resistor values listed in Table Table 3-2. For increased output voltage, use only resistance values greater than or equal to those listed.

Model	V1 Up 3%	V1 Up 5%	V1 Down 3%	V1 Down 5%
Connect Trim pin to	to DC Return	to DC Return	V1 Output	V1 Output
XL375-12 (12V)	133K	Zero	1.27M	549K
XL375-24 (24V)	133K	Zero	2.80M	1.43M
XL375-28 (28V)	133K	Zero	3.32M	1.74M
XL375-36 (36V)	133K	Zero	4.42M	2.43M
XL375-40 (40V)	133K	Zero	4.87M	2.67M
XL375-48 (48V)	133K	Zero	5.90M	3.24M
XL375-54 (54V)	133K	Zero	6.65M	3.65M
XL375-56 (56V)	133K	Zero	6.98M	3.92M

**Table 3-2 Minimum Trim Resistors for Maximum Trim**

When two or more XL375's are operating in parallel, each unit should be trimmed with the same resistor value. The TRIM input is connected through a 200K resistor to the voltage control loop input of the XL375 and should never be connected to anything but a resistor mounted as close as possible to J204. Long wiring to a trim resistor can pickup noise and could find its way to the output terminals. Do not connect the TRIM inputs from multiple supplies together.

## 3.6 Output Current/Power

The maximum available output power is always a function of the cooling airflow and its temperature. The maximum of 375-watts combined total power from all outputs is only available with a minimum of 10-CFM of forced air-cooling at no more than 50°C. Each individual output is also limited: V1 output is limited to 360-watts, +12 V<sub>standby</sub> is limited to 12-watts and +5 V<sub>standby</sub> is limited to 5-watts.

Model	Output	Rated Voltage	Maximum Load
XL375-12 CS	V1 (main)	12 V	30.0A
XL375-12 CS CC	V1 (main)	12 V	21.6A
XL375-24 CS	V1 (main)	24 V	15.0 A
XL375-24 CS CC	V1 (main)	24 V	10.8 A
XL375-28 CS	V1 (main)	28 V	12.8 A
XL375-28 CS CC	V1 (main)	28 V	9.2 A
XL375-36 CS	V1 (main)	36 V	10.0 A
XL375-36 CS CC	V1 (main)	36 V	7.2 A
XL375-40 CS	V1 (main)	40 V	9.0 A
XL375-40 CS CC	V1 (main)	40 V	6.5 A
XL375-48 CS	V1 (main)	48 V	7.5 A
XL375-48 CS CC	V1 (main)	48 V	5.4 A
XL375-54 CS	V1 (main)	54 V	6.7 A
XL375-54 CS CC	V1 (main)	54 V	4.8 A
XL375-56 CS	V1 (main)	56 V	6.4 A
XL375-56 CS CC	V1 (main)	56 V	4.6 A
All	+5 V <sub>standby</sub>	5 V	1.0 A
All	+12 V <sub>standby</sub>	12 V	1.0 A

CS = Current Sharing, CC = Convection Cooling

**Table 3-3 Maximum Individual Continuous Load Currents  
(sum limited to 375W for CS and 260W for CC)**

### 3.7 Efficiency

The power supply efficiency varies with the output load and the line voltage. Higher voltage power supplies will exhibit slightly higher efficiencies due to lower output currents (less I x R losses). Efficiency data is measured at 25C with 10-CFM of cooling air after a 15-minute warm-up period. The measurements were taken at 10% intervals to 360W (100%) main output power. The +5 V<sub>standby</sub> and +12 V<sub>standby</sub> outputs were unloaded.

The least efficient model is the XL375-12 and its main output efficiency is greater than 89% for 115VAC and 90% for 230VAC inputs with loads ranging from 50% to 100% of the rated main output power. Peak efficiencies are approximately 90% and 91.5% respectively.

The XL375-48 is typical of the higher output voltage models and its main output efficiency is greater than 90.5% for 115VAC and 91.5% for 230VAC inputs with loads ranging from 50% to 100% of the rated main output power. Peak efficiencies are approximately 91.6% and 93.3% respectively.

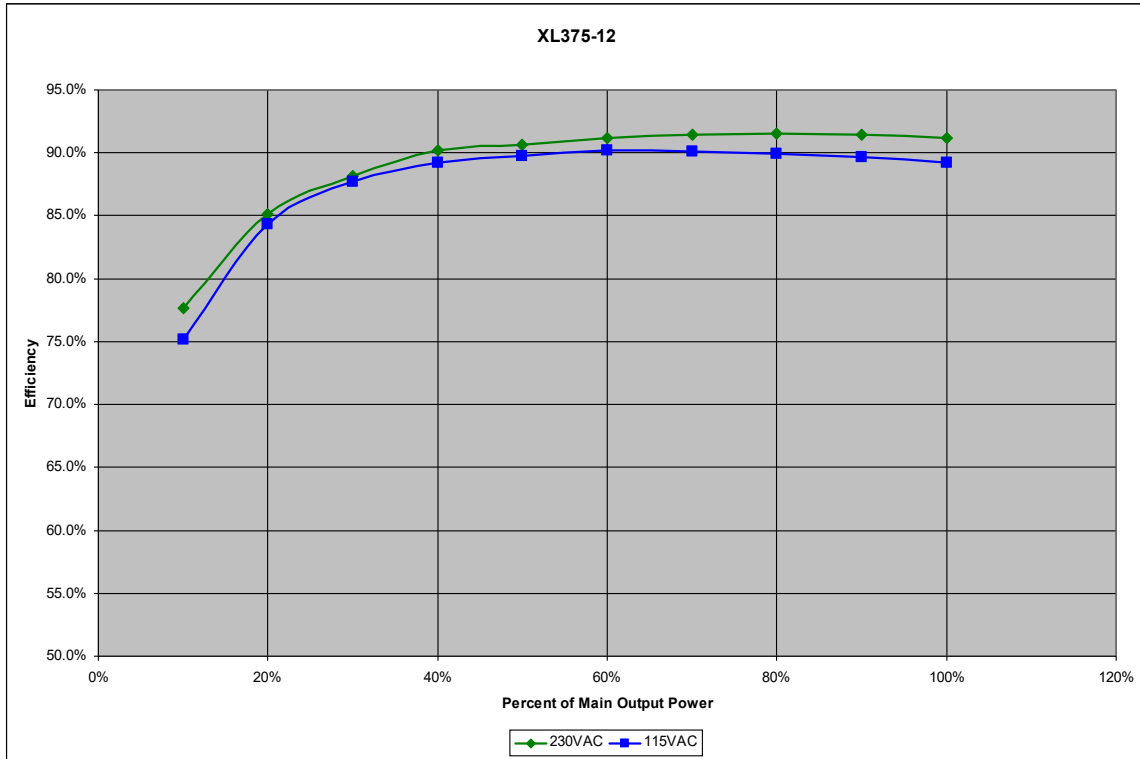


Figure 3-1 Typical XL375-12 (12V, worst-case) Efficiency Curves (note expanded Y-axis)

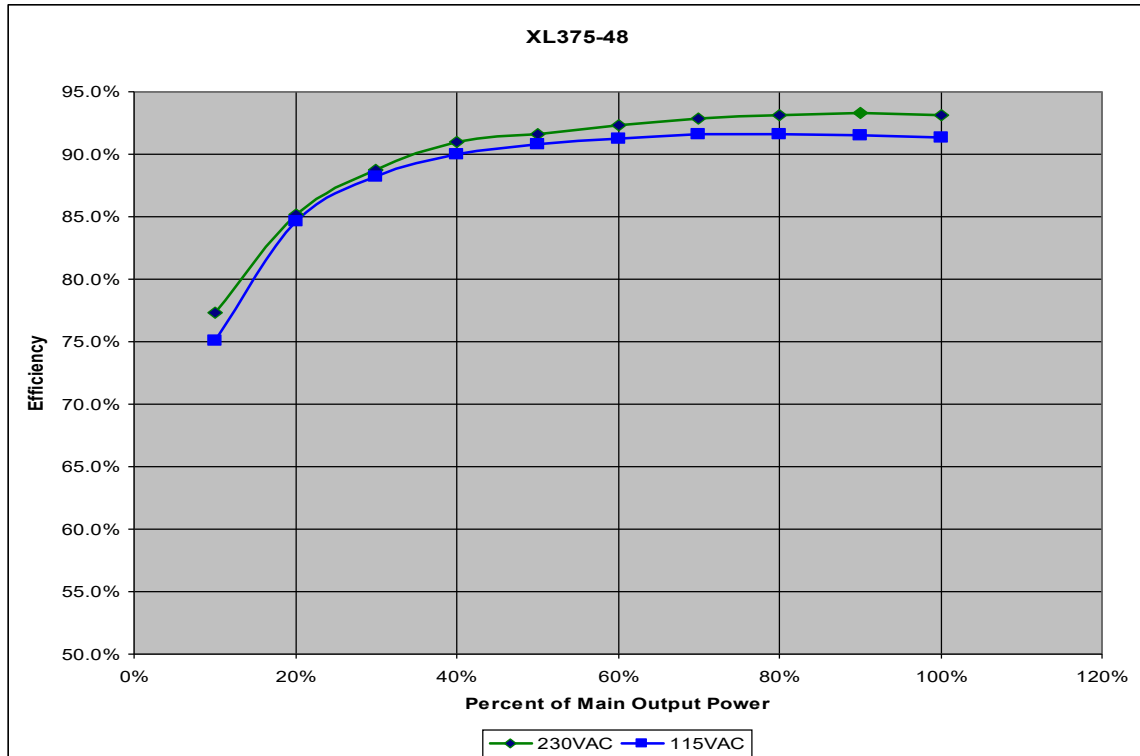


Figure 3-2 Typical XL375-48 Efficiency (note expanded Y-axis)

### 3.8 Unloaded Power Consumption

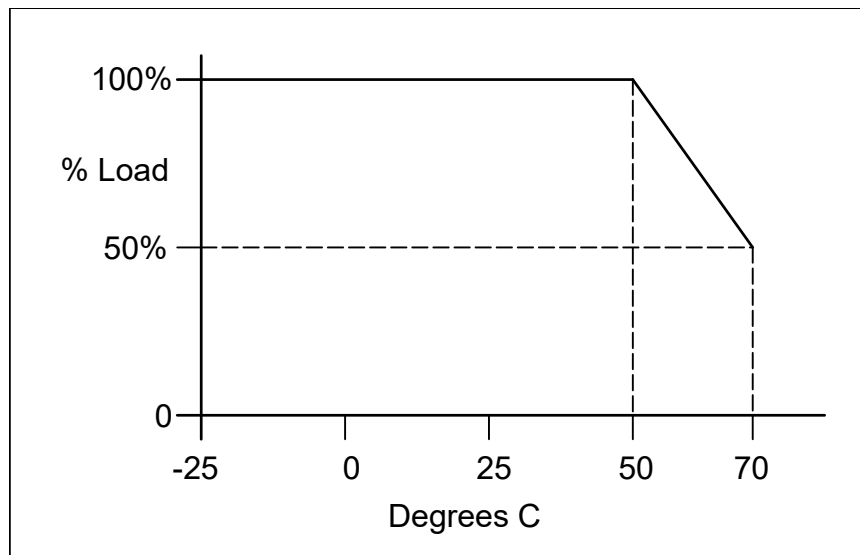
When completely unloaded and at any normal input voltage, the XL375 consumes about 3-watts with a high (open) Remote Enable input (standby state) and about 9-watts with a low (grounded) Remote Enable input (V1 on but unloaded). The power-factor does not meet its specification under these conditions.

### 3.9 Cooling

The XL375 can operate with the Convection Cooling Option at temperatures below 50°C when total power output is less than 260 watts and it is mounted open side up. 10-CFM of forced-air cooling at a maximum of 50°C is required when the output power exceeds 260-watts. The cooling airflow must be either co-planar with the circuit board or it must impinge downward in the center of the open topside. The XL375 may be mounted in any attitude when forced-air cooled.

#### 3.9.1 Output Power Derating at Elevated Temperatures

The XL375 can be operated with cooling air temperatures above 50°C by linearly derating the total maximum output power (or current) by 2.5%/°C from 50°C to 70°C (see Figure 3-3).



**Figure 3-3 XL375 Output Power vs. Ambient Temperature Envelope**

### 3.9.2 Over-temperature Shutdown

The power supply is equipped with an internal temperature sensor. Failure to provide adequate cooling airflow below the maximum operating temperature will result in the power supply shutting down the V1 output while the +5V<sub>standby</sub> and +12V<sub>standby</sub> outputs will remain operational. The V1 output will be automatically restored when the temperature of the built-in temperature sensor cools sufficiently.

### 3.10 Output Ripple/Noise

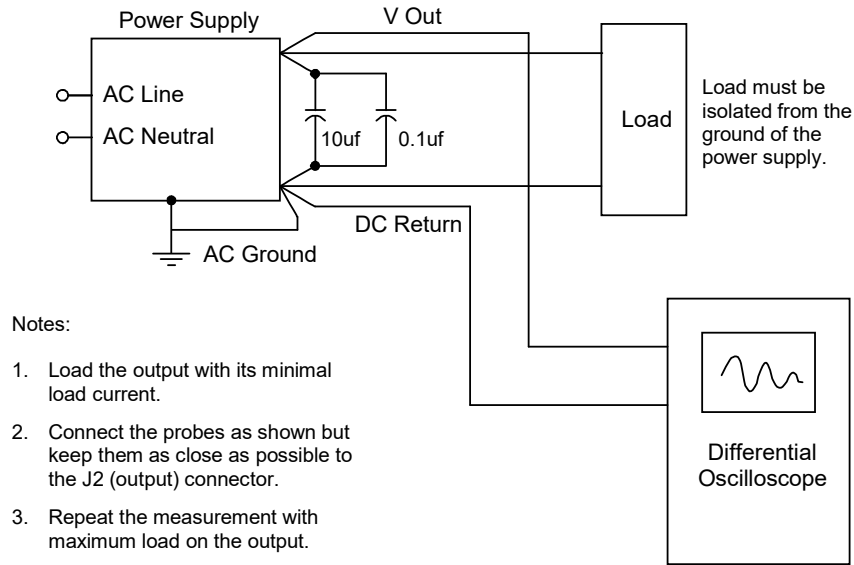
Output ripple voltage and noise are defined as periodic or random signals over a frequency band of 10 Hz to 20 MHz. Measurements are to be made with an oscilloscope with a 20 MHz bandwidth. Outputs should be bypassed at the connector with a 0.1 μF ceramic disk capacitor and a 10 μF tantalum capacitor to simulate system loading (see Figure 3-4). Ripple and noise shall not exceed the limits specified in the following tables.

The ripple voltage of the output is measured at the pins of the mating connector. Ripple and noise shall not exceed the limits specified in Table 3-4 under any condition of line voltage and frequency specified in Section 2.1 and DC loading specified in Section 3.5.

Model	Output	Rated Voltage	Maximum Ripple+Noise (peak-to-peak)
XL375-12	V1 (main)	+12 V	100 mV
XL375-24	V1 (main)	+24 V	200 mV
XL375-28	V1 (main)	+28 V	200 mV
XL375-36	V1 (main)	+36 V	200 mV
XL375-40	V1 (main)	+48 V	200 mV
XL375-48	V1 (main)	+48 V	200 mV
XL375-54	V1 (main)	+54 V	200 mV
XL375-56	V1 (main)	+56 V	200 mV
All	V2 (+12 V <sub>standby</sub> )	+12 V	80 mV
All	V3 (+5 V <sub>standby</sub> )	+5 V	50 mV

**Table 3-4 Ripple + Noise Output Voltage**

### 3.10.1 Ripple/Noise Test Setup

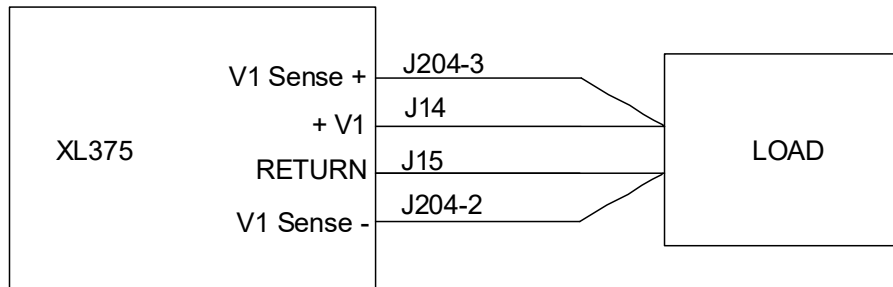


**Figure 3-4 Ripple Noise Measurement Setup**

### 3.11 Local and Remote Sensing

Remote sensing is provided to compensate for voltage drops in the V1+ Output and the DC Return wiring to the V1 load. The voltage droop (wiring loss) between the XL375 output terminals and their respective remote sense inputs should be kept to a maximum of 0.4-volts. Reversing the + and - sense lines may permanently damage the XL375.

If the Remote Sense inputs are left open, the output voltage at the J14 and J15 terminals may not meet the voltage regulation specification. The remote sense lines should either be connected to the XL375 output terminals or extended through the bulkhead connectors up to the critical load within a user's system. Connecting the remote sense inputs lifts the voltage at the load to within the specification voltage regulation limits but may increase the V1 voltage at J14 and J15 above the regulation limits. See Figure 3-5.



**Figure 3-5 Remote Sense Wiring**



### 3.12 Parallel Operation

By using the built-in active current-sharing, the V1 output of two, three or four XL375 power supplies may be connected in parallel to provide higher V1 output power as shown in Table 3-5. They can also be used in an N+1 configuration to provide greater reliability. Remote V1 sensing may still be used in parallel operation. The V2 and V3 outputs may also be paralleled for improved reliability, but doing so does not increase the available current beyond 1A.

Only the main output is capable of current sharing. Because of the inherent limitations of current sharing, it is recommended that the total load not exceed 92%-94% of the sum of the rated outputs (see Table 3-5). Current sharing accuracy drops with the total load power, thus a minimum V1 load of 35-watts per power supply is recommended. The following table lists the recommended maximum V1 output power.

Number of XL375s	N+1 Configuration
2	670 watts
3	995 watts
4	1325 watts

**Table 3-5 Recommended Main Output Power for N+1 Configurations**

XL375s running in parallel are capable of starting with a V1 load that exceeds the capability of an individual XL375. They will also tolerate the dramatic load fluctuations encountered in an N+1 redundant configuration when supplies are removed and replaced.

Current-sharing operates normally when the V1 outputs of two XL375 are hard-wired in parallel, but this is not considered an N+1 connection. If the two V1 outputs (wired in parallel) were producing half-power each and the input power fails on one of the supplies, the other supply will continue to provide full power to the load. However, if the output synchronous rectifiers failed on one of the supplies, then the V1 output would most likely be shorted and the load would be without power. Hot swapping two units connected in parallel will likely create voltage transients well outside of the voltage regulation tolerance.

The above scenario did not make use of an OR-ing diode on the V1 output of each supply. N2Power can supply an active OR-ing Diode accessory board that bolts onto the V1 output terminals and provides two new output screw terminals (see Figure 3-6). The ground connections are wired directly together, but there is a MOSFET (or pair of MOSFETs) between the supply's output terminal and the OR-ing board's output terminal. A sophisticated analog controller monitors the voltage difference between the supply's voltage and the bus voltage and then controls the MOSFET gate voltage to simulate a near-perfect diode with a forward voltage drop of less than 50mV. For further details, see document 704693. Use of this OR-ing board facilitates hot-swapping and prevents a shorted supply output from dragging down the bus voltage.

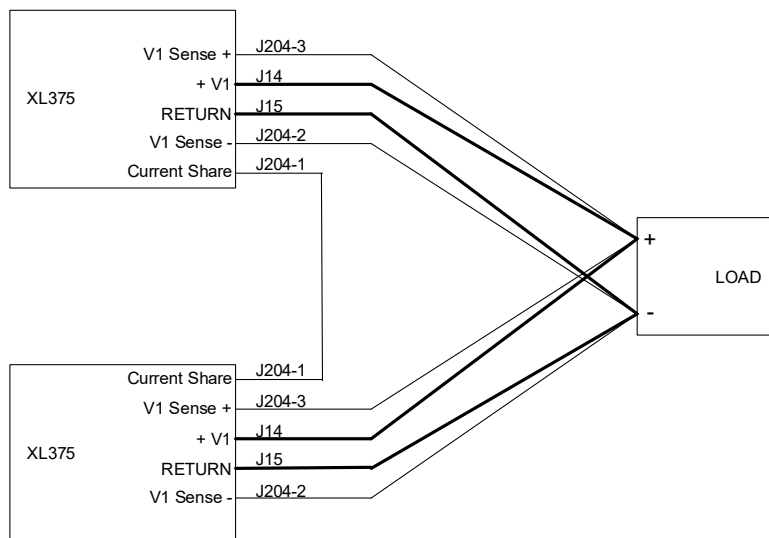


**Figure 3-6 XL375 with optional OR-ing Diode Accessory Board Attached**

### 3.12.1 Current Sharing Connections

The Current Share signal (V1 I-Share) of each supply operating in parallel must be connected together. Power sharing does not require the Remote Sense signals be connected together, but the sharing accuracy will be reduced unless they are all connected together.

Individual Power Good signals must not be wire ORed together. Each individual Power Good signal should be monitored separately by the user's system.



**Figure 3-7 Current Sharing Wiring Example**

### 3.12.2 Current Share Accuracy

When all the current share signals are connected together and all the Remote Sense signals are connected together, the load delivered by any two of the sharing supplies will not vary by more than 10% at full load. Sharing accuracy deteriorates with declining load power.

### 3.12.3 +5 V<sub>standby</sub> Parallel Operation

The +5 V<sub>standby</sub> output has a series Schottky rectifier just before the output connector that allows this output to be connected in parallel with the same output on like supplies. By doing so, the +5 V<sub>standby</sub> output will remain alive as long as one of the paralleled supplies is functioning. The output current rating does not increase beyond the single supply rating.

### 3.12.4 +12 V<sub>standby</sub> Parallel Operation

The +12 V<sub>standby</sub> output has a series Schottky rectifier just before the output connector that allows this output to be connected in parallel with other the same output on like supplies. By doing so, the +12 V<sub>standby</sub> output will remain alive as long as one of the paralleled supplies is functioning. The output current rating does not increase beyond the single supply rating.

### 3.12.5 Transients

The output rise time and monotonic requirements of Section 5.5 may not be met when the main load exceeds 360-watts, because of the difference in start-up times of the paralleled power supplies.

## 3.13 Power Supply Protection

There are several different protection circuits designed to protect the load and the XL375 from component failures and extraordinary circumstances.

### 3.13.1 Over Temperature Protection (OTP)

If the XL375 is operated without adequate cooling, it will sense an over-temperature condition and shut down the V1 (main) output. It will restart after it has cooled down to below its maximum operating temperature. The PG signal and LED go false about 2mS before the V1 output is disabled. The V2 and V3 outputs are unaffected by a V1 OTP condition.

### 3.13.2 Over-Voltage Protection (OVP)

Over-voltage protection is only provided on the V1 (main) output. When an over-voltage condition occurs (approximately 114% of rated output voltage), the power supply will shut down and will not restart until AC power is turned off and back on. The XL375 will shut down under the following over voltage conditions:

Model	Main Output	Over-Voltage Protection Threshold		
		Minimum	Nominal	Maximum
XL375-12	12 V	12.8 V	13.4 V	14.0 V
XL375-24	24 V	26.0 V	27.3 V	28.7 V
XL375-28	28 V	29.2 V	31.2 V	33.2 V
XL375-36	36 V	40.1 V	43.1 V	46.1 V
XL375-40	40 V	44.7 V	47.0 V	49.4 V
XL375-48	48 V	53.2 V	56.0 V	58.8 V
XL375-54	54 V	59.2 V	62.3 V	65.4 V
XL375-56	56 V	60.1 V	63.2 V	66.3 V

**Table 3-6 Over Voltage Protection Limits**

### 3.13.3 Over Current Protection (OCP)

An excessive load on the V1 output will induce constant-current limiting which will cause the output voltage to droop. The constant-current limiter has a threshold of approximately 115% (+/- 5%) of the rated output current. The V1 current-limiter is not affected by the V2 and V3 loads.

An under-voltage detector (UVD) turns off the Power Good output signal and LED when the output voltage falls below about 83% of the specified nominal and restores them to the on state when the output voltage rises above about 86%.

The under-voltage protection (UVP) circuit will shut the output off when the output voltage falls below about 67%. The XL375 will attempt to restart approximately 6-seconds after the UVP event. If the load current is low enough to allow the output voltage to exceed 67%, the supply will remain on. If not, it will attempt another restart in another 6-seconds.

### 3.13.4 Short Circuit Protection (SCP)

A short circuit on any output will disable that output but will not damage the XL375. A short on the V2 (+12 V<sub>standby</sub>) output will disable all outputs. The XL375 will periodically attempt to restart until the short circuit condition is removed. After successfully restarting, the power supply will operate normally.

### 3.14 Output Transients

The maximum output voltage transient caused by step load changes will not exceed the output voltage regulation limits by more than 5%. With an AC input as specified in Section 2.1, the power supply will remain stable when subjected to the load transients described below with capacitive loading per Table 3-7:

- Load changes between 75% and 100% on any output
- Load changing repetition of 50 to 333 cycles per second
- Transient load slew rate = 1.0 A/microsecond

### 3.15 Capacitive Loading

The XL375 will startup and operate normally with load capacitances simultaneously present on the all outputs not exceeding those listed in Table 3-7.

<b>Output</b>	<b>XL375-12</b>	<b>XL375-24/28</b>	<b>XL375-36...56</b>
V1 (12 V)	50,000 $\mu$ F		
V1 (24 V...28 V)		12,000 $\mu$ F	
V1 (36V...56 V)			3,000 $\mu$ F
V2 (+12 V <sub>standby</sub> )	180 $\mu$ F	180 $\mu$ F	180 $\mu$ F
V3 (+5 V <sub>standby</sub> )	220 $\mu$ F	220 $\mu$ F	220 $\mu$ F

**Table 3-7 XL375 Maximum Capacitive Loading**

# 4.

# General Specifications

## 4.1 Environmental

The XL375 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	6,561 feet MSL Max.	2,000 meters
	Non-Operating	50,000 feet MSL Max.	15,240 meters
Vibration	No damage	2.4G RMS Maximum	5-500Hz, 10-min. each axis per MIL-PRF-28800F: 3.8.4.1 (Class 3,4)
Mechanical Shock	No damage	30G half-sine, 11mS	Six shocks each axis per MIL-PRF-28800F: 4.5.5.4.1

**Table 4-1 Environmental Specifications**

The XL375 will start and meet its performance specifications within the environmental conditions listed in Table 4-1. It has also been demonstrated that the XL375 will start reliably at -40°C with an input voltage of 100VAC or greater. Consult N2Power for technical details.

## 4.2 Mean Time between Failures

The calculated MTBF of the power supply is equal to or greater than 376,644 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, SR-332, Issue 2. Actual failure rates vary from unit to unit.

## 4.3 Component Stress

The XL375 was designed with the following component-derating guidelines at an operating ambient temperature of 50°C: semiconductor junction temperatures shall not exceed ninety 90 % 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.

## 4.4 Labeling/Marking

The power supply is marked and labeled with the N2Power logo model number, part number, input and output specifications, production code, appropriate safety agency logos, CE mark, and country of origin. An example label is pictured below.



Figure 4-1 Sample XL375 Label

## 4.5 Physical Dimensions

3D CAD models are available by contacting sales@n2power.com.

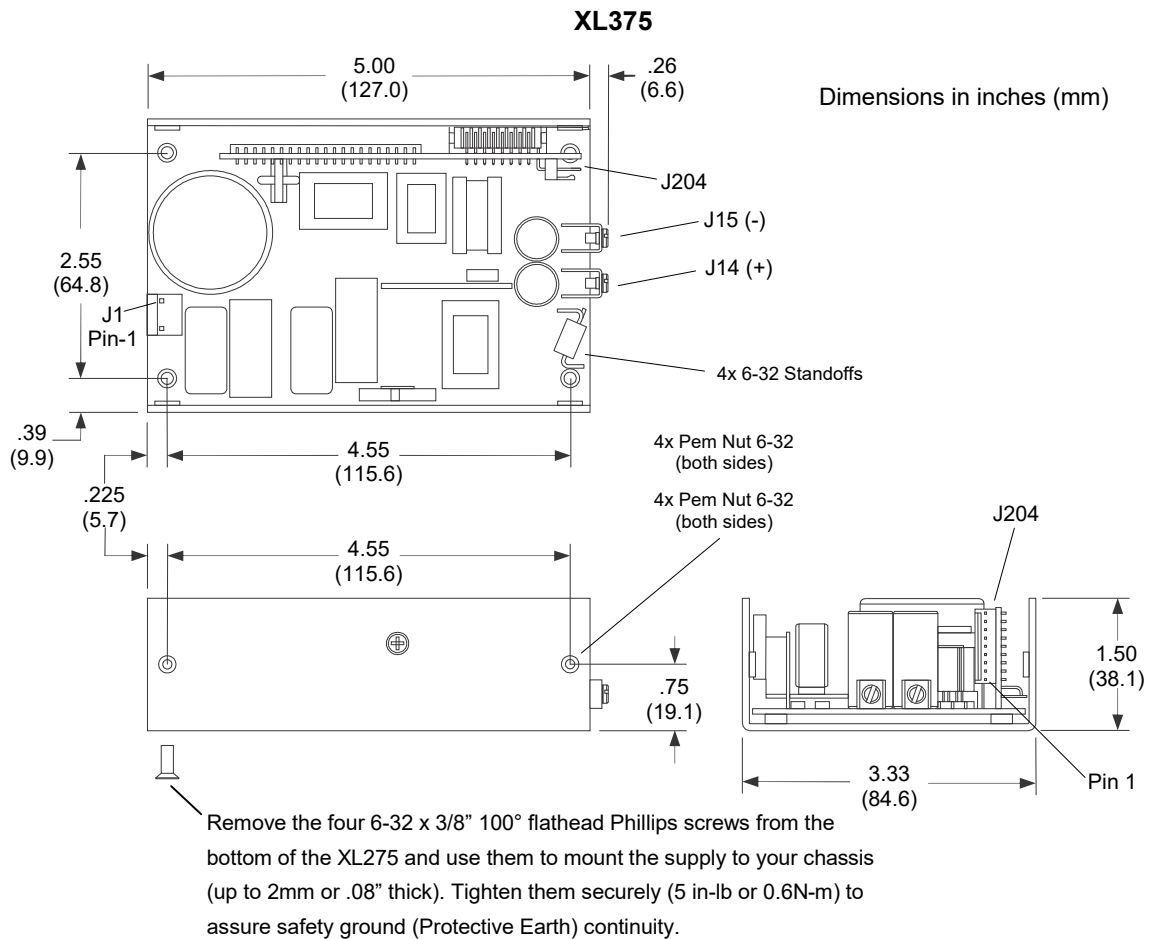


Figure 4-2 XL375 Series Dimensions

## 4.6 Weight

Units	Net Weight
Pounds	0.94
Ounces	15
Kilograms	0.43

**Table 4-2 XL375 Weight**

## 4.7 Mating Connectors

The user must furnish all mating connectors. The mating connectors must meet the requirements of all applicable safety agencies (notably UL).

Note that the female contacts that mate to the power supply are only rated for 25-30 mating cycles. Excessive mating cycles causes dramatically increased terminal resistance and heating resulting in the eventual failure of the mating terminal and possibly the header on the power supply.

### 4.7.1 AC Input Mating Connector (J1)

The AC input connector to the XL375 is a 3-pin Molex™ (Molex is a trademark of the Molex Corporation) KK style header with 0.156" centers. The center pin is 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. A minimum of AWG 18 wire is recommended.

J1	Molex P/N	
Connector Circuits (pins)	2 of 3	
Mating Housing	09-50-8031	
	Rated Contact Current	7.0 A
Crimp Terminal (tin)	08-50-0113	
Rated Wire Size	AWG 18 or 20	

**Table 4-3 J1 Mating Connector**

### 4.7.2 Protective Earth (J2)

The chassis must be connected to protective earth at either J2 or the mounting hole next to J2. J2 is a quarter-inch male push-on (Faston) terminal.

### 4.7.3 DC Output Terminals (J14 and J15)

The DC output terminals are designed to accept a ring-lug terminal. There are many sources available. A minimum of AWG 16 wire is recommended. The lugs must have a minimum I.D. of 0.140" [3.53mm] and a maximum O.D. of 0.32" [8.1mm]. The lugs must be contaminant free and should be tightened to a torque of approximately 8-inch-



pounds [0.9 N-m]. The positive terminal is on the left. These terminals use 6-32 UNC screws.

### 4.7.4 Auxiliary Connector (J204)

The auxiliary connector on the XL375 is a Molex KK 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.

J204	Molex P/N
Connector Circuits (pins)	9
Mating Housing	22-01-3097
Crimp terminal (selective gold)	08-55-0102
Rated Contact Current	2.5 A
Rated Wire Size	AWG 22 thru 30

**Table 4-4 J204 Mating Connectors**

## 4.8 Signal Descriptions and Remarks

Signal	Description/Remarks
AC Line	Highest in potential compared to earth ground. Should be connected to the AC power switch.
AC Neutral	Closest in potential to earth ground. Should not be connected to a single-pole power switch.
DC Return	XL375 ground for all outputs and status/control signals.
V1	The main output (+)
V1 Sense (+)	Remote sense for V1 at load (compensates for wiring losses)
V1 Sense (-)	Remote sense for DC Return at load (affects V1, see above)
V1 Trim	Adjusts V1 output voltage up to +/- 5% using an external resistor. See Section 3.5
V1 I-Share	Current Share Signal common to all sharing XL375s
V2 (+12V <sub>standby</sub> )	Provides 1A of 12V power for fans. Uses common ground DC Return.
V3 (+5 V <sub>standby</sub> )	Provides 1A of 5V power whenever AC power is presents. Uses common ground DC Return
Remote Enable	Low-true logic input enables V1 output
Power Good	A high-logic level (4.5V) indicates the output power is in regulation for at least the next 2mS. See Section 5.2

**Table 4-5 Signal Descriptions and Remarks** (All outputs and inputs are referenced to DC Return)

<b>Pin</b>	<b>Signal</b>
J1-1	AC Neutral
J1-2	No Pin
J1-3	AC Line
<b>Pin</b>	<b>Signal</b>
J2	Protective Earth
<b>Pin</b>	<b>Signal</b>
J14	V1 + Output
J15	V1 DC Return (Output Ground)
<b>Pin</b>	<b>Signal</b>
J204-1	V1 I-Share
J204-2	V1 Sense (-)
J204-3	V1 Sense (+)
J204-4	V3 (+5V <sub>standby</sub> )
J204-5	V1 Trim Input
J204-6	V2 (+12V <sub>standby</sub> )
J204-7	DC Return (Output Ground)
J204-8	Remote Enable (logic input, low-true)
J204-9	Power Good (logic output, high-true)

**Table 4-6 Pin Assignments in Pin Order**

# 5.

# Timing and Control

## 5.1 Power Supply Timing

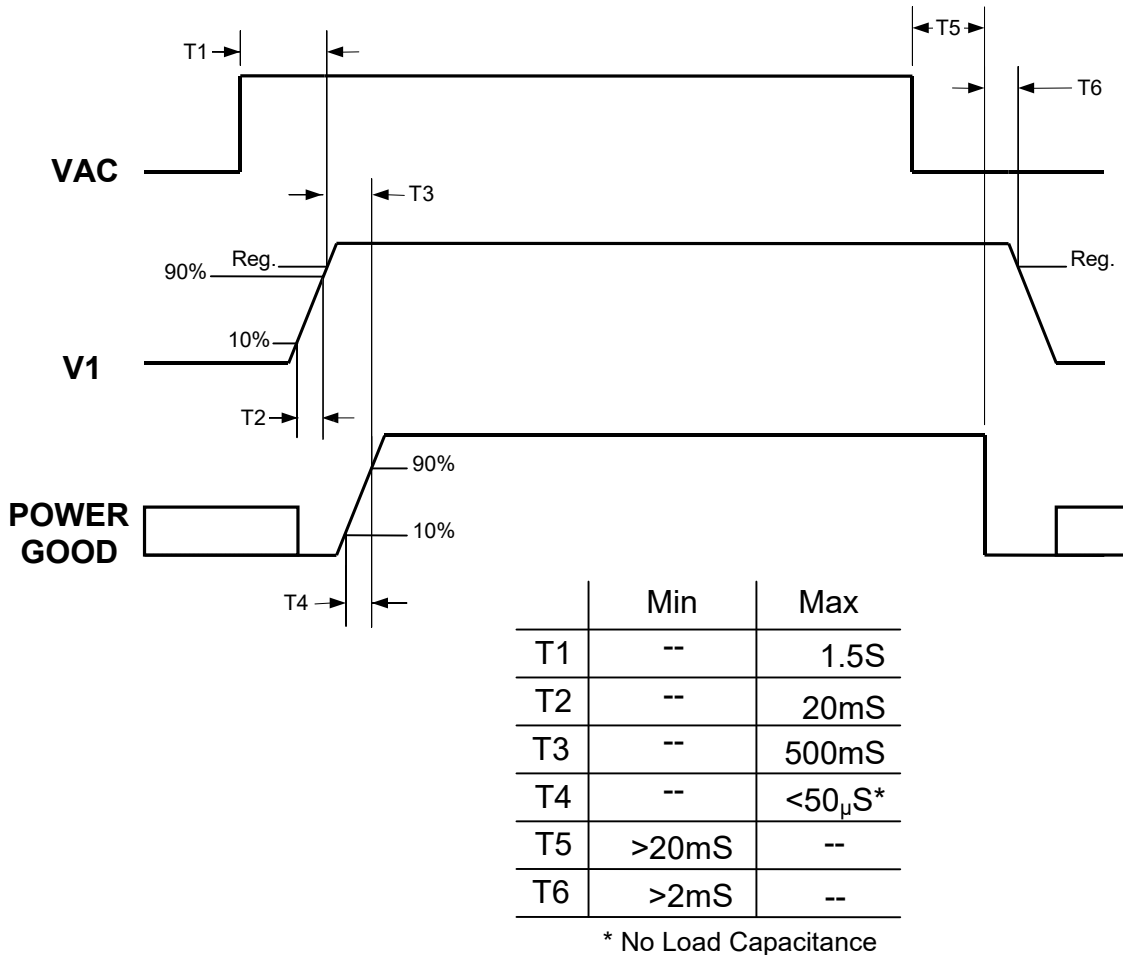


Figure 5-1 XL375 Timing Diagram

## 5.2 Power Good Output

The Power Good signal provides a high logic level to indicate the DC outputs are within their regulation limits and that sufficient mains energy is stored by the power supply to ensure continuous power operation within specification for the duration of the hold-up time. When the AC mains power is removed for a period longer than 20ms, the Power Good signal transitions to a low logic level. The Power Good signal (CMOS output) is capable of sinking or sourcing 4mA from an internal 5.0V supply.

### **5.3 Remote Enable Input**

This input must be grounded to enable the V1 (main) output. It has no effect on the +5V<sub>standby</sub> and +12V<sub>standby</sub> outputs. It is pulled-up to 5.0V through a 6.8K-ohm resistor. The input voltage must be less than 0.4V to activate the V1 output and higher than 3.0V to disable the output.

An optional S91 modification is available on special order that inverts the Remote Enable input to a high-true input with a 6.8K pull-down resistor. Contact sales for details.

### **5.4 Voltage Hold-Up Time**

The power supply will maintain output regulation per Table 3-1 despite a loss of input power at 100VAC/50Hz and 230VAC/50Hz at maximum continuous output load for a minimum of 22-milliseconds.

### **5.5 Output Rise Time**

All output voltages from a single XL375 shall rise monotonically (always positive slope) from 10% to 90% of their nominal output voltage (as specified in Table 3-1) within 0.2ms to 30ms under any loading conditions specified in CS = Current Sharing, CC = Convection Cooling

Table 3-3. The rise of the shared V1 output from two or more XL375s operating in parallel may not be monotonic.

### **5.6 LED Indicators**

There are two LED indicators mounted near the top of the daughter board behind J204 (See Figure 4-2). An amber LED indicates the +5V<sub>standby</sub> is energized (AC input power is present). A green LED illuminates whenever the Power Good signal is true (high). This indicates the main output is on and regulating.

## 6.

# Ordering Information

The CS suffix after the part number stands for Current-Sharing and the CC stands for Convection Cooling. All XL375s are active current-sharing capable but require an external OR-ing diode or an Active OR-ing accessory board to isolate V1 outputs for improved reliability or hot swapping. See Section 3.12. 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>V1</b>	<b>XL375 N2Power Part Number</b>	<b>Optional Active OR-ing Board Part Number</b>
XL375-12 CS	12 V	400040-01-0	400040-02-8
XL375-12 CS CC	12 V	400040-04-0	400040-02-8
XL375-24 CS	24 V	400041-01-8	400041-02-6
XL375-24 CS CC	24 V	400041-05-9	400041-02-6
XL375-28 CS	28 V	400052-01-5	400052-02-3
XL375-28 CS CC	28 V	400052-03-1	400052-02-3
XL375-36 CS	36 V	400046-01-7	400052-02-3
XL375-36 CS CC	36 V	400046-03-3	400052-02-3
XL375-40 CS	40 V	400045-01-9	400052-02-3
XL375-40 CS CC	40 V	400045-03-5	400052-02-3
XL375-48 CS	48 V	400042-01-6	400052-02-3
XL375-48 CS CC	48 V	400042-04-0	400052-02-3
XL375-54 CS	54 V	400044-01-2	400044-02-0
XL375-54 CS CC	54 V	400044-03-8	400044-02-0
XL375-56 CS	56 V	400043-01-4	400044-02-0
XL375-56 CS CC	56 V	400043-03-0	400044-02-0

**Table 6-1 XL375 Part Numbers**

For warranty information refer to [www.n2power.com](http://www.n2power.com)

All XL375 power supplies are RoHS compliant.

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

N2Power Order Desk:	<a href="mailto:orders@n2power.com">orders@n2power.com</a> 805-583-7744 x112
Fax (Attention N2Power):	805-583-7749
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:	N2Power a Qualstar Company 3990-B Heritage Oak Court Simi Valley CA 93063