



Product Specification

XL65 series

65W AC-DC

Power Supplies

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1.

Introduction

1.1 Introduction

This specification defines the XL65 series of universal input, single output 65W switch mode power supplies. It includes information regarding the mechanical details, electrical and environmental ranges for storage and operation of the power supply. These power supplies achieve very high packaging densities. All of the XL65 family models are listed in Table 3-1.

All models of the XL65 series can be used as standalone power supplies and have different chassis options – XLO65 for **O**pen frame, XLU65 for **U** Chassis, XLE65 for **E**nclosure and XLD65 for **D**in rail.



XLO65



XLU65



XLE65



XLD65

Figure 1-1 XL65 Series

1.2 Agency Compliance

All of the XL65 models comply with the following international agency standards:

Safety	Complies with Standard	Remarks
United States	UL 60950-1 2 nd Ed + A1:2009 + A2:2013 (Information Technology equipment)	I/P-O/P: 3000VAC; I/P-GND: 2500VAC
Canada	CSA 22.2 60950-1 62368-1	
International	IEC/EN 60950-1 Second Edition 62368-1	
EU Council	2014/35/EU	Low Voltage Directive
EMC	Complies with Standard	Remarks
International	EN61204-3 : 2000 (refer to the following) EN55011: 2009+A1 Class B Group 1 EN55024: 1998 + A1: 2001_ A2:2003 EN61000-3-2:Class D EN61000-3-3 EN61000-4-3 Ed 3.2 EN61000-4-4 Ed 3.0 EN61000-4-5 Ed 3.0 EN61000-4-6 Ed 4.0 EN61000-4-8 Ed 2.0 EN61000-4-11 Ed 2.0	Low voltage power supplies – DC output Conducted Emission Standard Immunity Standard Harmonic Current Emissions (PFC) Voltage Fluctuations & Flicker Radio frequency immunity Electrical fast transient burst immunity Power line surge immunity RF Common mode immunity Power frequency magnetic field immunity Voltage dips and short interruptions immunity
Reduction of Hazardous Substances (RoHS)	Complies with Standard	Remarks
EU Council	2002/95/EC 2011/65/EU 2015/863/EU	RoHS Directive RoHS 2 Directive Amending Annex II to Directive 2011/65/EU

Marks of Conformance

United States & Canada



Underwriters Laboratories File E211115 (Industrial)

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 XL65 models which are 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	85VAC	100–240VAC	264VAC
RMS Input Current	-	-	1.6A / 100VAC 0.9A / 240VAC
Input Frequency	47Hz	50/60Hz	63Hz

Table 2-1 XL65 Series Input Parameters

2.2 Input Over Current Protection

The XL65 series incorporate 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 (25°C) inrush current at 90° input phase angle (i.e. AC switch is closed at the peak of the AC sine wave input) is limited to less than 60 Amps peak for 230 VAC.

Repetitive ON-OFF cycling of the AC input voltage should not damage the power supply or cause the input fuse to open.

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 is less than 75uA at 264VAC.

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, load and environmental conditions contained herein.

Model	Rated Voltage (VDC)	Load Regulation	Output voltage accuracy range		
			Minimum (VDC)	Nominal (VDC)	Maximum (VDC)
XL#65-05	5	±0.7%	4.95	5	5.05
XL#65-7P5	7.5	±0.5%	7.42	7.5	7.58
XL#65-09	9	±0.5%	8.91	9	9.09
XL#65-12	12	±0.5%	11.88	12	12.12
XL#65-15	15	±0.5%	14.85	15	15.15
XL#65-18	18	±0.5%	17.82	18	18.18
XL#65-24	24	±0.5%	23.76	24	24.24
XL#65-28	28	±0.5%	27.72	28	28.28
XL#65-36	36	±0.5%	35.64	36	36.36
XL#65-48	48	±0.5%	47.52	48	48.48
XL#65-53	53	±0.5%	52.47	53	53.53

Table 3-1 Output Voltage Specifications

Note: “#” denotes the type of chassis, which can be
O =Open frame, U=U Chassis, E=Enclosure, D=Din Rail

3.2 No Load Operation

The power supply will operate under no load condition and will not result in damage to the supply. The power supply will remain stable and operate normally after application of loads.

3.3 Output Current/Power

The maximum available output power is always a function of the input voltage and ambient temperature. The maximum output currents of all models of XL65 are listed in Table 3-2. Refer to Section 3.3.1 and 3.4.1 for input voltage range and ambient temperature at which XL65 can deliver these maximum output powers.

Model	Voltage VDC	Current (Max) A
XL#65-05*	+5	10
XL#65-7P5	+7.5	8.67
XL#65-09	+9	7.23
XL#65-12	+12	5.42
XL#65-15	+15	4.34
XL#65-18	+18	3.62
XL#65-24	+24	2.71
XL#65-28	+28	2.33
XL#65-36	+36	1.81
XL#65-48	+48	1.36
XL#65-53	+53	1.24

Table 3-2 Max Load Currents

*Maximum output power of all XL#65-05 models is 50W and the rest of the models can deliver total output power of up to 65W.

3.3.1 Input Voltage Derating

The XL65 series can be operated at the minimum input voltage of 85VAC with the maximum load of 80% of the total maximum output power. From 85VAC to 90VAC, the output load can be increased by 4%/VAC and from 90VAC onwards, the output load can be 100%.

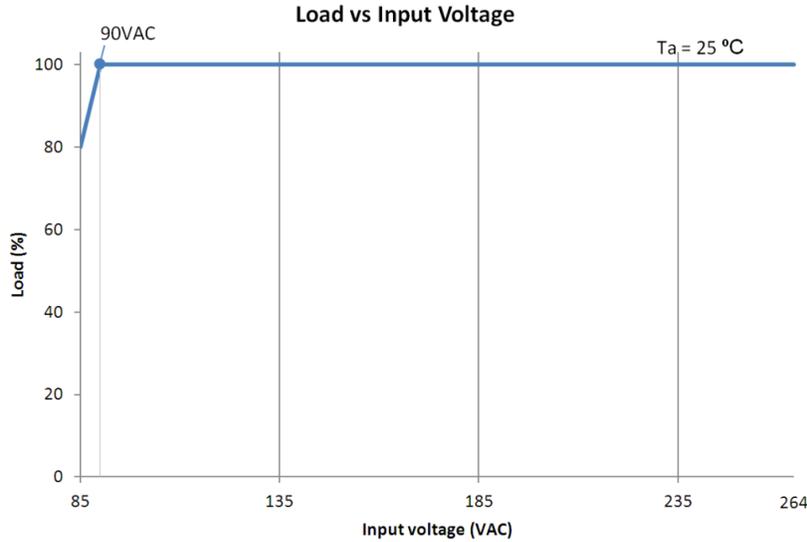


Figure 3-1 Load vs. Input Voltage

3.4 Cooling

XL65 can deliver maximum output power with unrestricted convection cooling. “Unrestricted” means there are no nearby obstructions that would impede the convection cooling process.

3.4.1 High Temperature Derating

The XL65 series can be operated at elevated temperatures by derating the total maximum output power (or current). Refer to below graphs to get the maximum output power at a specific ambient temperature.

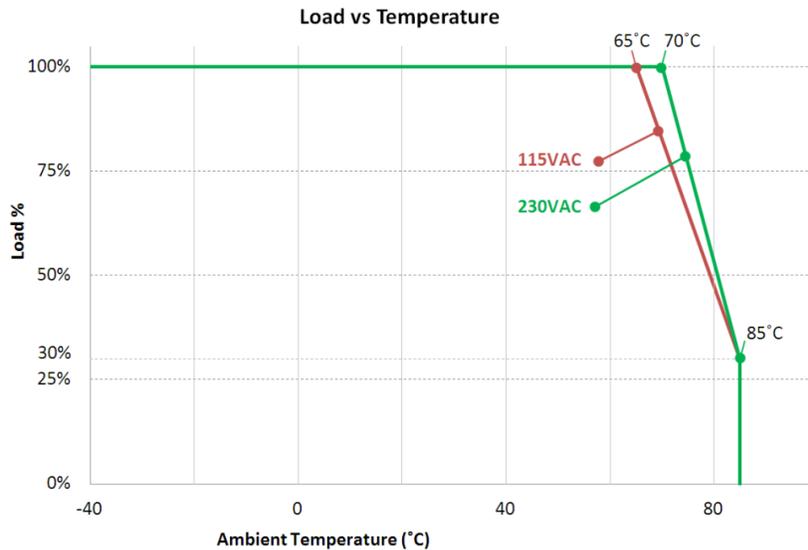


Figure 3-2 Temperature Derating Curve for XL#65-XX where XX refers to 7P5 and 9

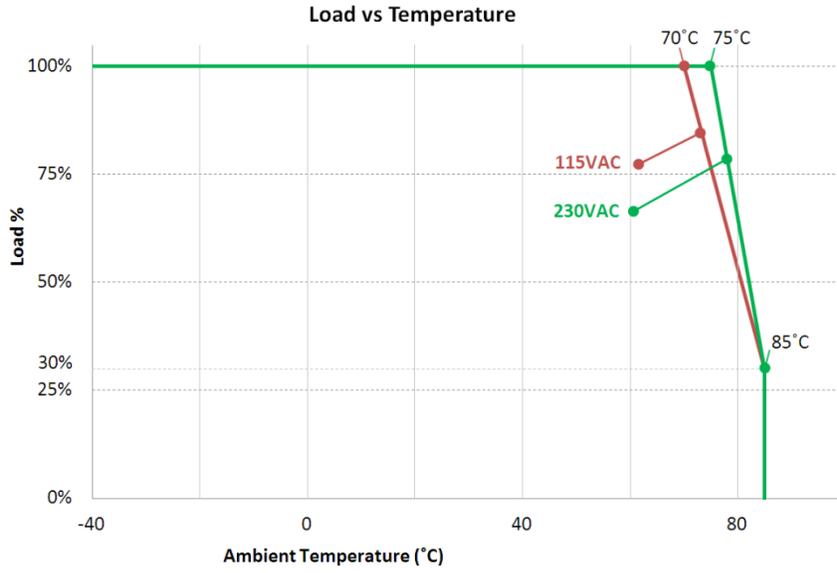


Figure 3-3 Temperature Derating Curve for XL#65-XX where XX refers to 5, 12, 36, 48 and 53

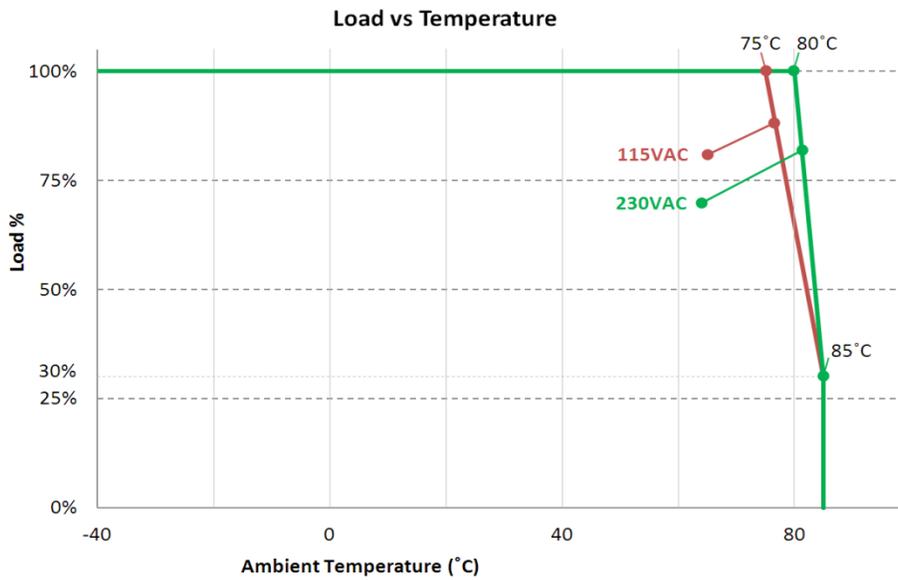


Figure 3-4 Temperature Derating Curve for XL#65-XX where XX refers to 15, 24 and 28

3.5 Output Ripple/Noise

Output ripple voltage and noise are measured at 20MHz of bandwidth by using a 12” twisted pair-wire terminated with a ceramic capacitor (MLCC) in parallel. The capacitance value of this MLCCs are 10 μ F for 5V, 7.5V, 9V, 12V, 15V output models, 1 μ F for 24V, 28V, 36V output models or 0.1 μ F for 48V and 53V output models. The ripple noise is measured from the output pin connectors.

3.5.1 Ripple/Noise Limits

The ripple voltage of the outputs is measured at the pins of the mating connector. 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 Section 3-2.

Model	Output Voltage	Maximum Ripple+Noise (peak-to-peak)
XL#65-05	5 V	75 mV
XL#65-7P5	7.5 V	75 mV
XL#65-09	9 V	75 mV
XL#65-12	12 V	75 mV
XL#65-15	15 V	75 mV
XL#65-18	18 V	75 mV
XL#65-24	24 V	75 mV
XL#65-28	28 V	75 mV
XL#65-36	36 V	75 mV
XL#65-48	48 V	150 mV
XL#65-53	53 V	150 mV

Table 3-3 Ripple Voltage of XL65

3.5.2 Ripple/Noise Test Setup

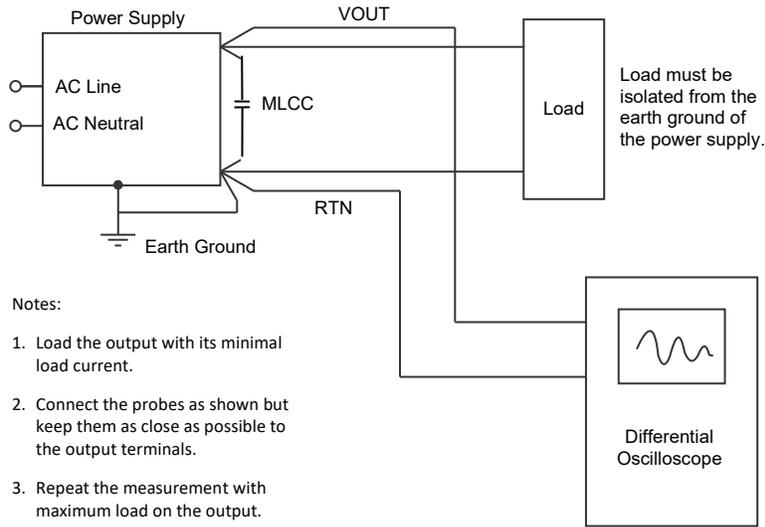


Figure 3-5 Ripple Noise Measurement Setup

3.6 Output Protection

There are output protection schemes designed to protect the load and the XL65 series from component failures and extraordinary circumstances.

3.6.1 Over Voltage Protection (OVP)

No single fault is able to cause a sustained over voltage condition on the output. When an over-voltage condition occurs at output, the power supply will shut down. Following an OVP event, the XL65 will not restart until AC power is turned off and back on.

Model	Output (VDC)	OVP Voltage		
		Minimum (VDC)	Nominal (VDC)	Maximum (VDC)
All	5 V	6.3	6.6	7.0
	7.5 V	9.4	9.9	10.5
	9 V	11.3	11.9	12.6
	12 V	15.0	15.9	16.8
	15 V	18.8	19.9	21.0
	18 V	22.5	23.8	25.2
	24 V	30.0	31.8	33.6
	28 V	35.0	37.1	39.2
	36 V	45.0	47.7	50.4
	48 V	60.0	63.6	67.2
	53 V	66.3	70.2	74.2

Table 3-4 Over Voltage Protection Limits

3.6.2 Over Current Protection (OCP)

An excessive load will cause the output to shut down. The maximum output power before the power supply shuts down is about 145% (typical) of the rated output power. The power supply will periodically attempt to restart until the over-current condition is removed.

3.6.3 Short Circuit Protection

A short circuit is defined as an impedance of less than 0.1 ohms placed between RTN and output. A short circuit will cause no damage to the power supply, but will cause it to shut down. The power supply will periodically attempt a restart until the short circuit condition is removed. After successfully restarting, the power supply will operate normally.

3.7 Output Rise Time

Output voltage shall rise from 10% to 90% of nominal output voltage within 20ms. The output voltage waveform must be a monotonic ramp from 10% to 90% of final set point within the regulation band under any loading conditions specified in the respective load current tables in Table 3-2.

For the purposes of this specification, a monotonic ramp is defined as always having a positive slope from zero to $10 \times V_{OUT}$ volts/millisecond. During any 5-millisecond portion of the ramp, its slope must be greater than 5% of its rated voltage per millisecond.

3.8 Overshoot at Turn On/Turn Off

The output voltage overshoot upon the application or removal of the input mains voltage is less than 5% for all XL65 models above the nominal voltage. No opposite polarity voltage will be present on any output during turn on or turn off.

3.9 Voltage Trim

A potentiometer (see picture below) is provided to allow the user to adjust the output up or down by up to 10%. The ability of the 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 load current and power should not exceed the maximum limits described in Section 3.3.

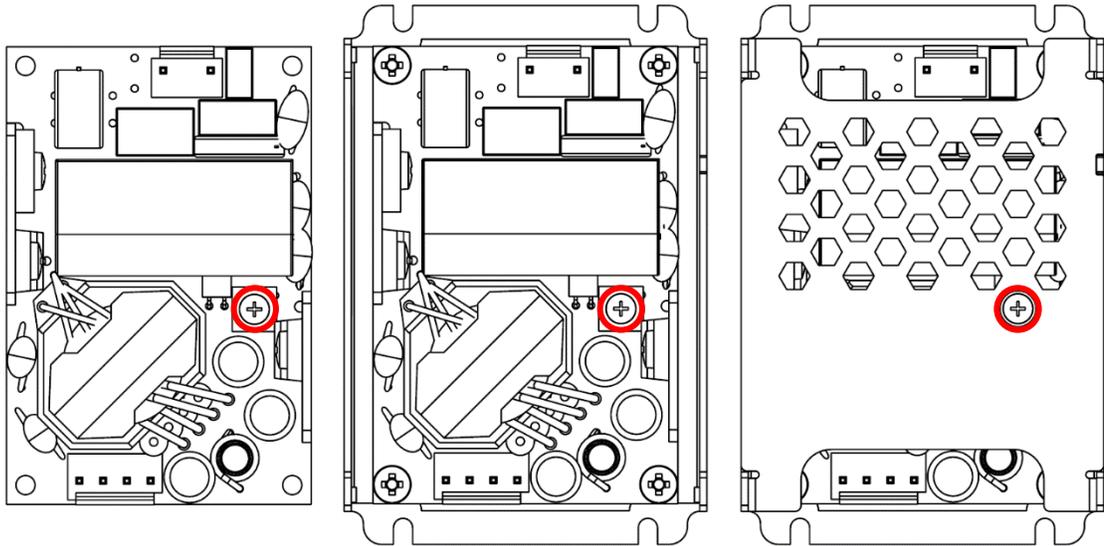


Figure 3-6 Potentiometer to adjust output

4.

General Specifications

4.1 Environmental

The XL65 series meets or exceeds the following environmental specifications:

Parameter	Conditions	Specification	Remarks
Relative Humidity	Operating	-40°C to 85°C*	
	Non-Operating	-40°C to 85°C*	
	Operating	5-95% Maximum	Non-Condensing
	Non-Operating	95% Maximum	Non-Condensing
Altitude	Operating	16404 feet MSL Max.	5,000 meters
Vibration	No damage	2.0 G RMS Maximum 2.0 G RMS Maximum	10-500Hz, 10-min/1cycle, 60 min each along x, y, z axis. Mounting: Compliance to IEC60068-2-6

Table 4-1 Environmental Specifications

Note on (*): Refer to **Figure 3-2** for derating at different temperatures.

4.2 Mean Time between Failures

The calculated MTBF of all models is equal to or greater than 1.059×10^6 hours of continuous operation at maximum output loading and worst-case input line voltage with convection 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 in accordance with (MIL-HDBK-217F). Actual failure rates vary from unit to unit.

4.3 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 and CE mark. A typical label is pictured below.



Figure 4-1 Sample XL65 series Label

4.4 Net Weight

Model	Pound	Ounces	Kilograms
XLO65	0.26	4.13	0.12
XLU65	0.35	5.54	0.16
XLE65	0.38	6.07	0.17
XLD65	0.43	6.81	0.19

Table 4-2 Net Weights

4.5 Mounting and Physical Dimensions

All XL65 models are provided with four mounting holes of the following size.

Model	Millimeter (mm)	Inch (in)
XL#65	3.2	0.126

Table 4-3 Mounting Screw Sizes

See mechanical drawings for mounting hole locations and the dimensions of the power supplies. All the units are in “mm [in]” format with the tolerance of $x.xx \pm 0.5$ [$x.xxx \pm 0.02$].

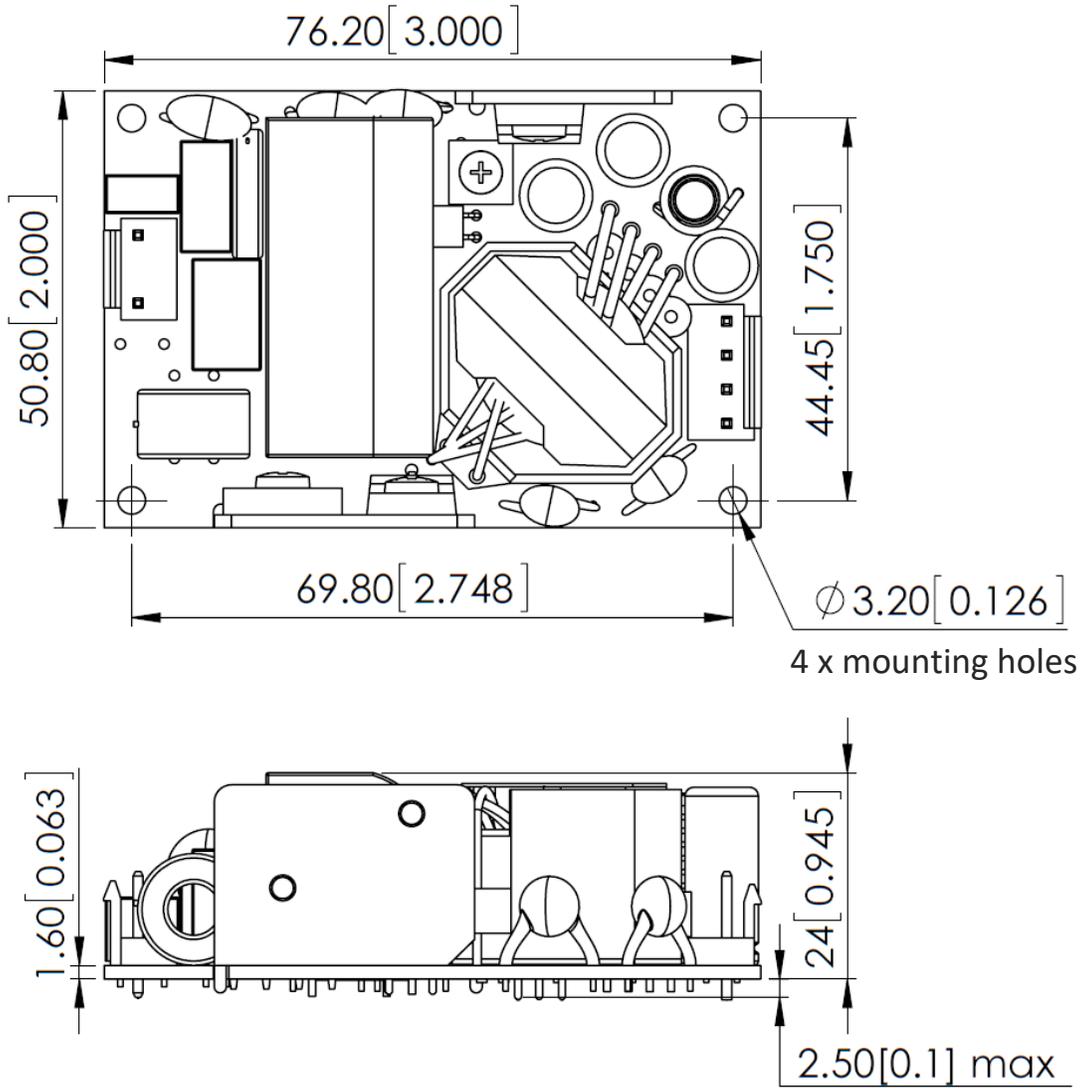


Figure 4-2 XLO65 models: Mounting Hole Locations and Dimensions

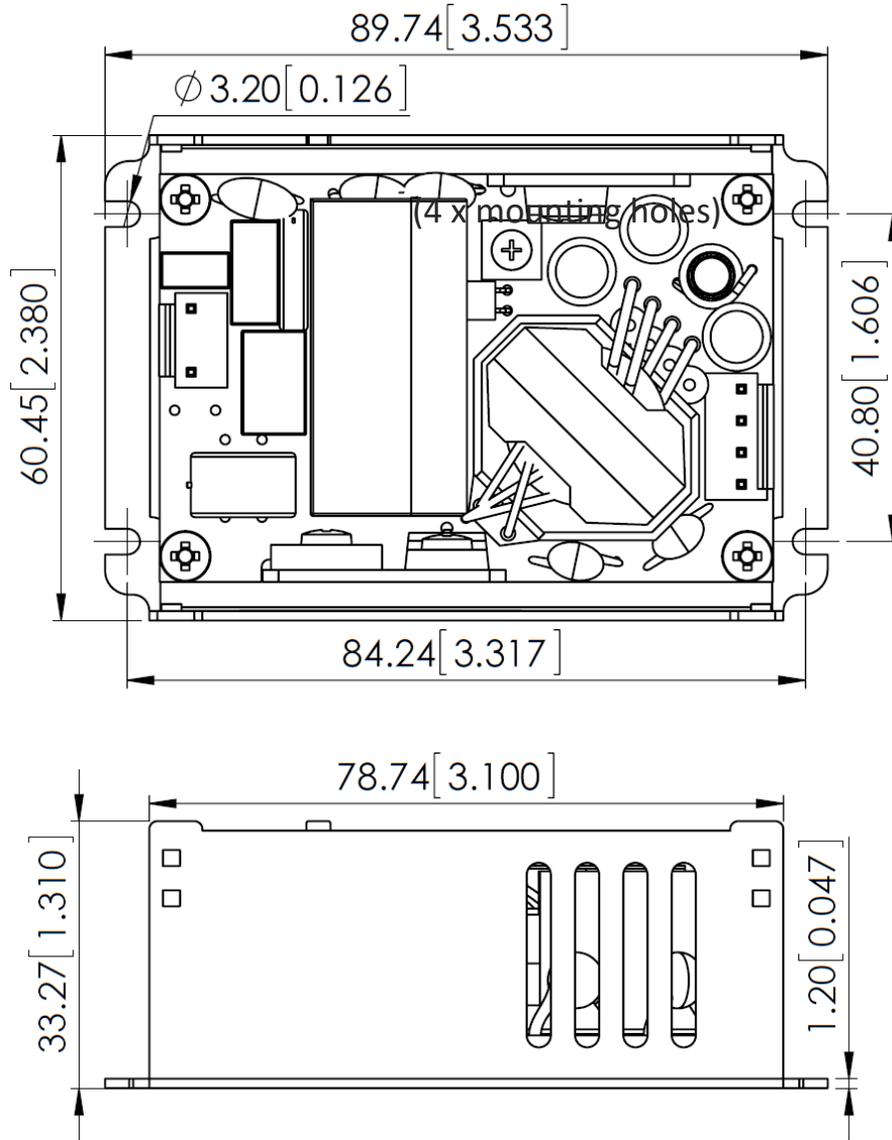


Figure 4-3 XLU65 models: Mounting Hole Locations and Dimensions

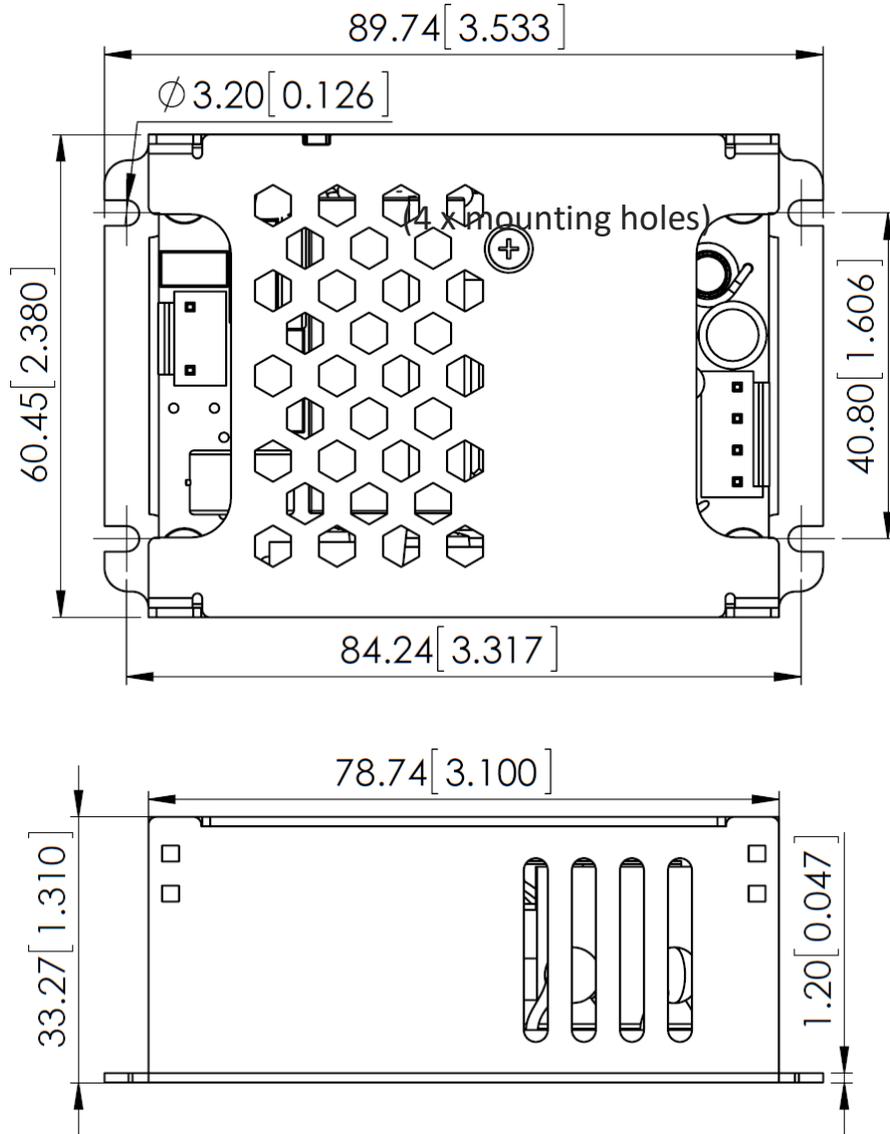


Figure 4-4 XLE65 models: Mounting Hole Locations and Dimensions

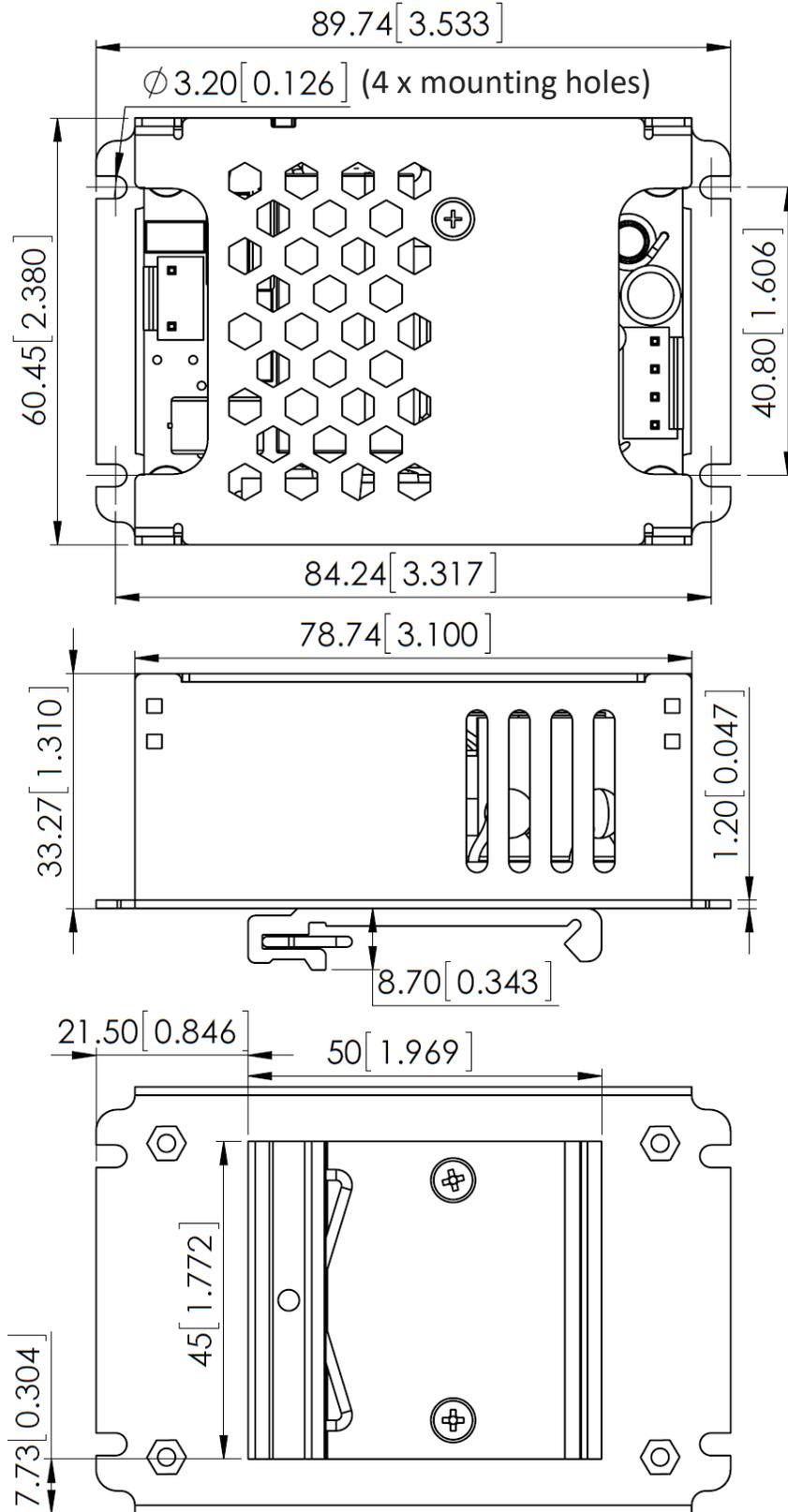


Figure 4-5 XLD65 models: Mounting Hole Locations and Dimensions

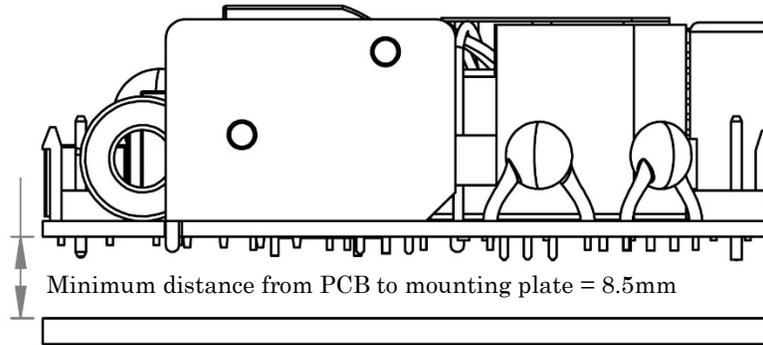


Figure 4-6 XL65 minimum distance requirement from mounting plate

When XL65 models are mounted on the FG mounting plate, the distance from the mounting plate to the PCB must be at least 8.5mm.

A standoff less than 8.5mm high is acceptable when a thin insulator, 0.4mm thick (polyester, fish paper or equivalent UL rated 94V-2 minimum) is placed between the power supply and the mounting chassis (refer to applicable UL standard for clearance requirements).

4.6 Mating Connectors

The user must furnish all mating connectors. The mating connectors must meet the requirements of all applicable safety agencies (UL and/or TUV).

Model		Designator	Mating Housing	Terminal	
Mains input Options		AC INPUT	VHR-3N	SVH-21T-P1.1	
		+/-VOUT (DC Output)	VHR-4N	SVH-21T-P1.1	
		AC INPUT	09-50-8031	SD-2478	
		+/-VOUT (DC Output)	09-50-8061	SD-2478	
		Terminal Block	AC INPUT +/-VOUT (DC Output)	Screw locked torque- max 2Kgf.cm/0.2N.m	Wire dimension range 26 ~ 16AWG

Table 4-4 Mating connectors

4.7 Output Grounding

For CLASS I protection type power supplies (without suffix “C” at model names), the RTN signal may be connected to the power supply chassis ground (safety earth) screw terminals on the power supplies as shown in Figure 4-7.

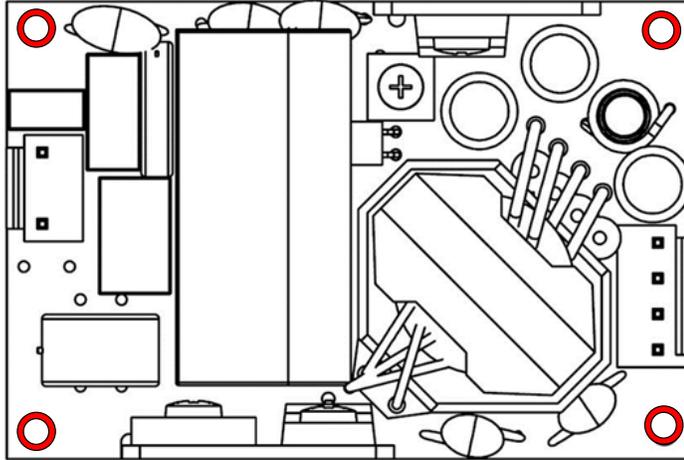


Figure 4-7 Safety ground connection points

4.8 Pin Definitions

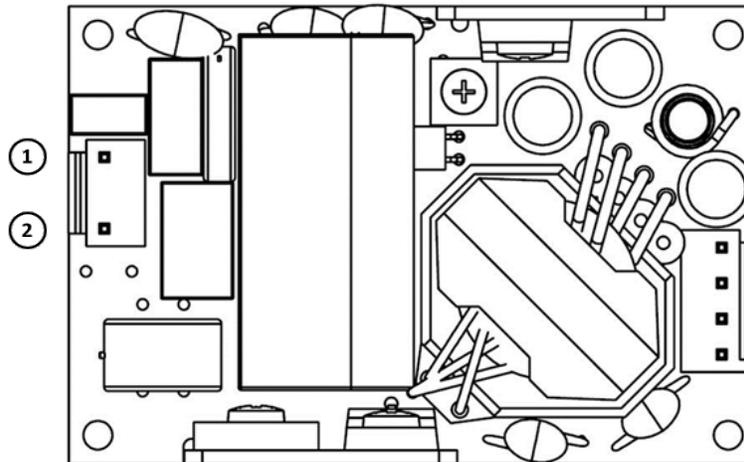


Figure 4-8 Pin Definitions

Model	Connector	Pin No.	Assignment
All	AC Input Terminal	1	AC NEUTRAL
		2	AC LINE
	Output Connector	3, 4	VOUT
		5, 6	RTN (VOUT Return)

Table 4-5 Pin Definitions

5.

Efficiency

The efficiencies for the XL65 power supply models are listed below. They were measured at full load, 25 °C at 230AC.

Model	Output Voltage	Total Load	Efficiency
XL#65-05	5 V	65 W	90 %
XL#65-7P5	7.5 V	65 W	90 %
XL#65-09	9 V	65 W	91 %
XL#65-12	12 V	65 W	92.5 %
XL#65-15	15 V	65 W	93.5 %
XL#65-18	18 V	65 W	93%
XL#65-24	24 V	65 W	93.5 %
XL#65-28	28 V	65 W	93.5 %
XL#65-36	36 V	65 W	92.5 %
XL#65-48	48 V	65 W	93 %
XL#65-53	53 V	65 W	92.5 %

Table 5-1 Efficiency

6.

Timing and Control

6.1 Power Supply Timing

The maximum duration for the output to rise up to regulated output voltage (99% of nominal voltage) from the start of AC input voltage is 1 second.

6.2 Voltage Hold-Up Time

The power supply will maintain output regulation per Table 3-1 despite a loss of input power at 115VAC/60Hz and 230VAC/50Hz at maximum rated continuous output for a minimum of 16ms.

7.

Ordering Information

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

Model	Output Voltage	N2Power Part Number
XLO65-05D	5 V	400574-01-1
XLO65-7P5D	7.5 V	400574-05-2
XLO65-09D	9 V	400574-06-0
XLO65-12D	12 V	400574-02-9
XLO65-15D	15 V	400574-07-8
XLO65-18D	18V	400574-03-7
XLO65-24D	24 V	400574-08-6
XLO65-28D	28 V	400574-09-4
XLO65-36D	36 V	400574-11-0
XLO65-48D	48 V	400574-12-8
XLO65-53D	53 V	400574-13-6
XLU65-05D	5 V	400573-01-1
XLU65-7P5D	7.5 V	400573-05-2
XLU65-09BD	9 V	400573-06-0
XLU65-12D	12 V	400573-02-9
XLU65-15D	15 V	400573-07-8
XLU65-18D	18 V	400573-03-7
XLU65-24D	24 V	400573-08-6
XLU65-28D	28 V	400573-09-4
XLU65-36D	36 V	400573-11-0
XLU65-48D	48 V	400573-12-8
XLU65-53D	53 V	400573-13-6
XLE65-05D	5 V	400572-01-1
XLE65-7P5D	7.5 V	400572-05-2
XLE65-09D	9 V	400572-06-0
XLE65-12D	12 V	400572-02-9
XLE65-15D	15 V	400572-07-8
XLE65-18D	18 V	400572-03-7
XLE65-24D	24 V	400572-08-6
XLE65-28D	28 V	400572-09-4
XLE65-36D	36 V	400572-11-0
XLE65-48D	48 V	400572-12-8
XLE65-53D	53 V	400572-13-6
XLD65-05D	5 V	400571-01-1

Model	Output Voltage	N2Power Part Number
XLD65-7P5D	7.5 V	400571-05-2
XLD65-09D	9 V	400571-06-0
XLD65-12D	12 V	400571-02-9
XLD65-15D	15 V	400571-07-8
XLD65-18D	18 V	400571-03-7
XLD65-24D	24 V	400571-08-6
XLD65-28D	28 V	400571-09-4
XLD65-36D	36 V	400571-11-0
XLD65-48D	48 V	400571-12-8
XLD65-53D	53 V	400571-13-6
XLO65-05C	5 V	400574-14-3
XLO65-7P5C	7.5 V	400574-18-5
XLO65-09C	9 V	400574-19-3
XLO65-12C	12 V	400574-15-1
XLO65-15C	15 V	400574-20-1
XLO65-18C	18V	400574-16-9
XLO65-24C	24 V	400574-21-9
XLO65-28C	28 V	400574-22-7
XLO65-36C	36 V	400574-24-2
XLO65-48C	48 V	400574-25-0
XLO65-53C	53 V	400574-26-8
XLU65-05C	5 V	400573-14-3
XLU65-7P5C	7.5 V	400573-18-5
XLU65-09C	9 V	400573-19-3
XLU65-12C	12 V	400573-15-1
XLU65-15C	15 V	400573-20-1
XLU65-18C	18 V	400573-16-9
XLU65-24C	24 V	400573-21-9
XLU65-28C	28 V	400573-22-7
XLU65-36C	36 V	400573-24-2
XLU65-48C	48 V	400573-25-0
XLU65-53C	53 V	400573-26-8
XLE65-05C	5 V	400572-14-3
XLE65-7P5C	7.5 V	400572-18-5
XLE65-09C	9 V	400572-19-3
XLE65-12C	12 V	400572-15-1
XLE65-15C	15 V	400572-20-1
XLE65-18C	18 V	400572-16-9
XLE65-24C	24 V	400572-21-9
XLE65-28C	28 V	400572-22-7
XLE65-36C	36 V	400572-24-2

Model	Output Voltage	N2Power Part Number
XLE65-48C	48 V	400572-25-0
XLE65-53C	53 V	400572-26-8
XLD65-05C	5 V	400571-14-3
XLD65-7P5C	7.5 V	400571-18-5
XLD65-09C	9 V	400571-19-3
XLD65-12C	12 V	400571-15-1
XLD65-15C	15 V	400571-20-1
XLD65-18C	18 V	400571-16-9
XLD65-24C	24 V	400571-21-9
XLD65-28C	28 V	400571-22-7
XLD65-36C	36 V	400571-24-2
XLD65-48C	48 V	400571-25-0
XLD65-53C	53 V	400571-26-8

Table 7-1 XL65 Part Numbers

The model names in the above table are for CLASS II D protection type. XL65s for CLASS I C protection are also available.

All XL65 power supplies are RoHS compliant. For warranty information, refer to www.n2power.com. Direct all questions, orders or requests for quotation as follows:

N2Power Order Desk:	orders@n2power.com	805-583-7744 x112
Fax (Attention N2Power):		805-978-5212
Sales:	sales@n2power.com	805-583-7744 x122
Technical Support:	techsupport@n2power.com	805-583-7744 x119
Address:	1267 Flynn Road Camarillo, CA 93012	