MHP650 Series

- Medical Safety Approvals
- End Fan, Top Fan & ' U' Channel Mechanical Options
- -20 ° C to +70 ° C Operation
- 5 V Standby
- AC OK, Remote On/Off and Active Current Share
- Load Dependant Variable Fan Speed
- Screw Terminals
- 3 Year Warranty

The MHP650 AC-DC power supply provides upto 650 W of output power in three mechanical packages to provide installation flexibility in a range of medical applications.

The unit comprises of a main output with voltages from 12-48 VDC and two peripheral outputs providing a 12 VDC fan supply and a 5 VDC standby supply which can be utilitsed with the signals and control features of the unit to provide detection of loss of AC input and remote on/off control.

Multiple units can used in parallel via the current share facility, providing higher power solutions. Inherently low earth leakage current, and conducted EMC compliance to Class B also simplify higher power system design.

Packaged in a compact 8" (203 mm) x 4" (102 mm) x 2.6" (65 mm) and carrying IEC60601 family safety approvals, the MHP650 has a load dependant variable speed fan, is fully protected with overtemperature shutdown and provides full power from -20 ºC to 50 ºC and 50% power at +70 ºC.

Models and Ratings

End Fan Models (-EF)

Output Voltage V1	Max Output Current V1	Fan Supply V2	Standby Supply V3	Max Output Power	Model Number
12 V	50.0 A	Not Available	5 V / 0.2 A	607 W	MHP650PS12-EF
15 V	40.0 A	Not Available	5 V / 0.2 A	607 W	MHP650PS15-EF
24 V	27.0 A	Not Available	5 V / 0.2 A	657 W	MHP650PS24-EF
28 V	23.0 A	Not Available	5 V / 0.2 A	651 W	MHP650PS28-EF
36 V	18.0 A	Not Available	5 V / 0.2 A	657 W	MHP650PS36-EF
48 V	13.5 A	Not Available	5 V / 0.2 A	657 W	MHP650PS48-EF

Top Fan Models (-TF)

Output Voltage V1	Max Output Current V1	Fan Supply V2	Standby Supply V3	Max Output Power	Model Number
12 V	50.0 A	Not Available	5 V / 0.2 A	607 W	MHP650PS12-TF
15 V	40.0 A	Not Available	5 V / 0.2 A	607 W	MHP650PS15-TF
24 V	27.0 A	Not Available	5 V / 0.2 A	657 W	MHP650PS24-TF
28 V	23.0 A	Not Available	5 V / 0.2 A	651 W	MHP650PS28-TF
36 V	18.0 A	Not Available	5 V / 0.2 A	657 W	MHP650PS36-TF
48 V	13.5 A	Not Available	5 V / 0.2 A	657 W	MHP650PS48-TF

U Channel Models

Output Voltage V1	Max Output Current V1	Fan Supply V2	Standby Supply V3	Max Output Power(1)	Model Number
12 V	50.0 A	12 V / 0.5 A	5 V / 0.2 A	601 W	MHP650PS12
15 V	40.0 A	12 V / 0.5 A	5 V / 0.2 A	601 W	MHP650PS15
24 V	27.0 A	12 V / 0.5 A	5 V / 0.2 A	651 W	MHP650PS24
28 V	23.0 A	12 V / 0.5 A	5 V / 0.2 A	655 W	MHP650PS28
36 V	18.0 A	12 V / 0.5 A	5 V / 0.2 A	651 W	MHP650PS36
48 V	13.5 A	12 V / 0.5 A	5 V / 0.2 A	651 W	MHP650PS48

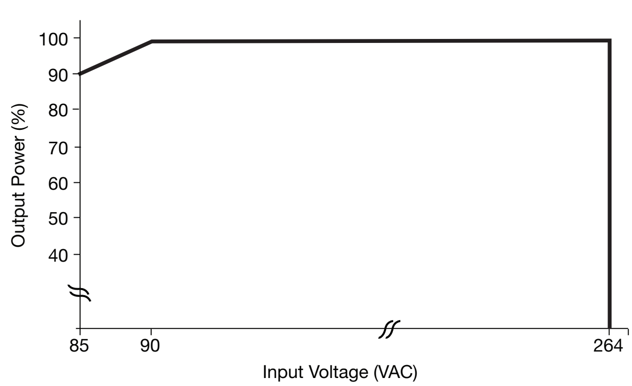
1. U Channel models require a minimum of 5.5 ms airflow from the system for cooling

Input Characteristics

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Input Voltage - Operating	85	115/230	264	VAC	Derate output power < 90 VAC. See fig. 1.
Input Frequency	47	50/60	63	Hz	
Power Factor		>0.9			EN61000-3-2 class A compliant
Input Current - No Load		0.15/0.3		A	115/230 VAC
Input Current - Full Load		6.5/3.2		A	115/230 VAC
Inrush Current			40	A	230 VAC cold start, 25 °C
Earth Leakage Current		90/175	250	µA	115/230 VAC/50 Hz (Typ.), 264 VAC/60 Hz (Max.)
Input Protection	T20 A/250 V internal fuse in both line and neutral				

Input Derating Curve

Figure 1



Output Characteristics

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage - V1	12		48	VDC	See Models and Ratings table
Initial Set Accuracy			±1 (V1), ±5 (V3)	%	50% load, 115/230 VAC
Output Voltage Adjustment			±10	%	V1 only. See mechanical details.
Minimum Load	0			A	
Start Up Delay		0.5		s	230 VAC full load
Hold Up Time	20			ms	
Drift			±0.2	%	After 20 min warm up
Line Regulation			±0.5	%	90-264 VAC
Load Regulation			±1 (V1), ±5 (V3)	%	0-100% load.
Transient Response - V1			4	%	Recovery within 1% in less than 500 µs for a 50-75% and 75-50% load step
Ripple & Noise			1	% pk-pk	V1: 20 MHz bandwidth
Overvoltage Protection	115		140	%	Vnom DC. Output 1 only, recycle input to reset
Overload Protection	110		145	% I nom	Output 1 only, auto reset. See fig 2.
Short Circuit Protection					Auto Recovery, hiccup mode
Temperature Coefficient			0.02	%/°C	
Overtemperature Protection				°C	Protects unit from overtemperature. Auto reset.

Output Overload Characteristic

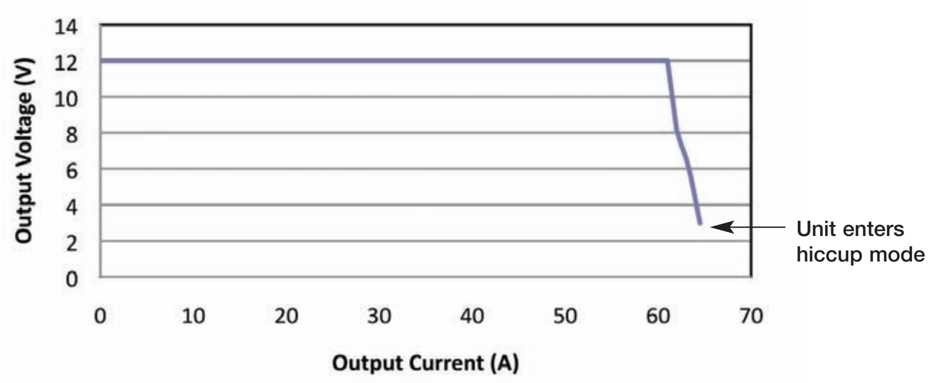


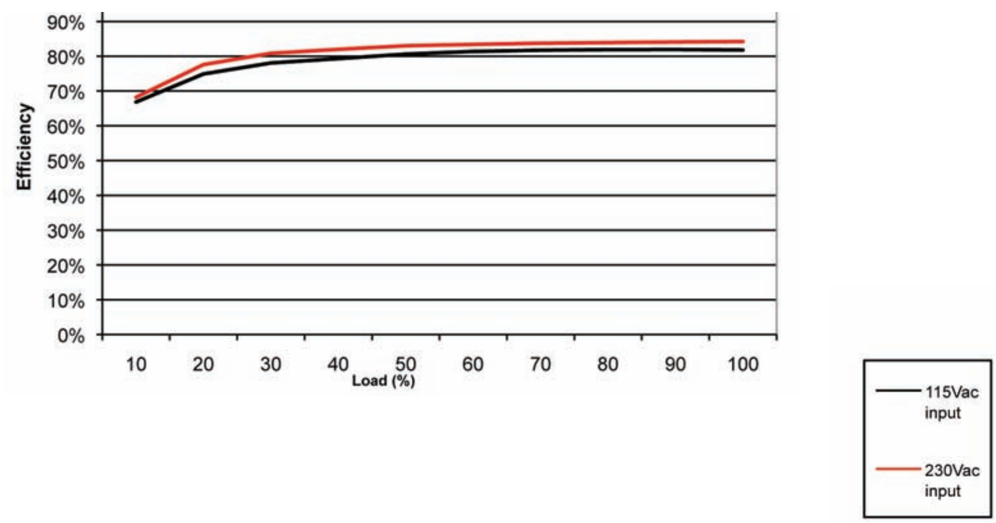
Figure 2
Typical V1 Overload Characteristic (MHP650PS12 shown)

General Specifications

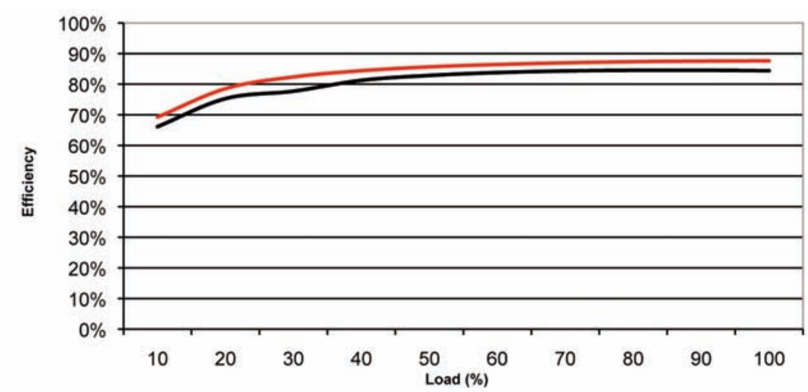
Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency		84		%	See fig 3 & 4
Isolation: Input to Output	4000			VAC	
Input to Ground	1500			VAC	
Output to Ground	500			VDC	
Switching Frequency		70/200		kHz	PFC converter / Main converter
Power Density			8.2	W/in³	
Mean Time Between Failure		260		kHrs	MIL-HDBK-217F at 25 °C GB
Weight			2.8 (1.25)	lb (kg)	See mechanical details

Efficiency vs Load

MHP650PS12
Figure 3



MHP650PS48
Figure 4



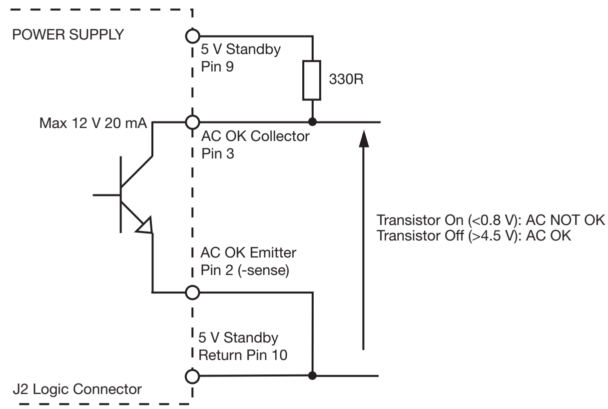
Signals & Control

Characteristic	Notes & Conditions
Signals & Control	
Remote Sense	Compensates for 0.5 V total voltage drop
AC OK / Power Fail	Open collector referenced to negative sense, transistor normally off when AC is good (see fig. 5 & 8) AC OK: Provides ≥ 5 ms warning of loss of output from AC failure
Remote On/Off (Inhibit/Enable)	Uncommited isolated optocoupler diode, powered diode inhibits both V1 & V2 (fan supply) (see fig.6 & 9)
Current Share	Connecting pins 5/6 and 2/3 of like voltage units will force the current to share between the outputs. Units share current within 10% of each other at full load. See fig 7.
Standby Supply V3	Isolated 5 V/0.2 A supply, always present when AC supplied.

Signals & Control

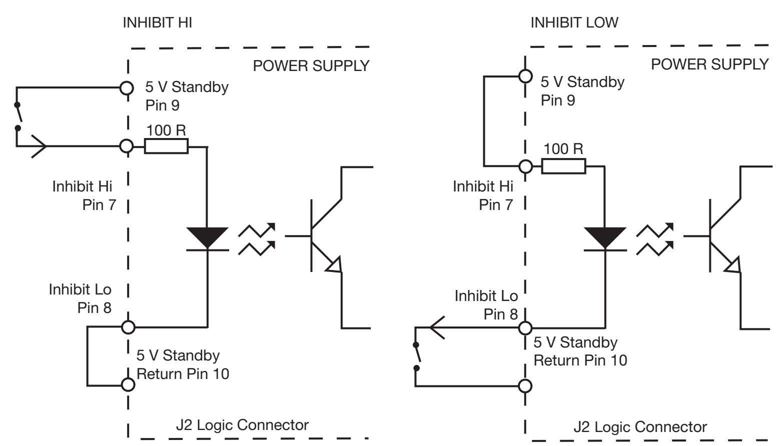
AC OK/Power Fail

Figure 5



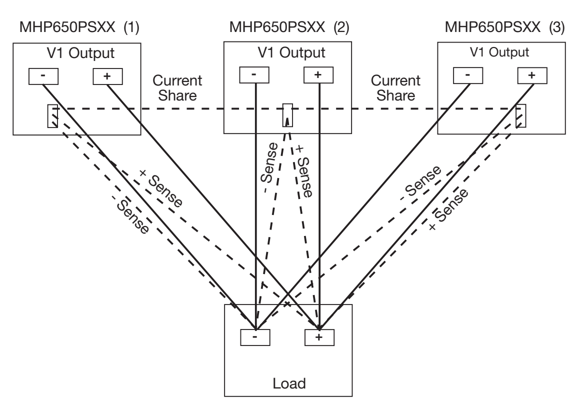
Remote On/Off (Inhibit)

Figure 6



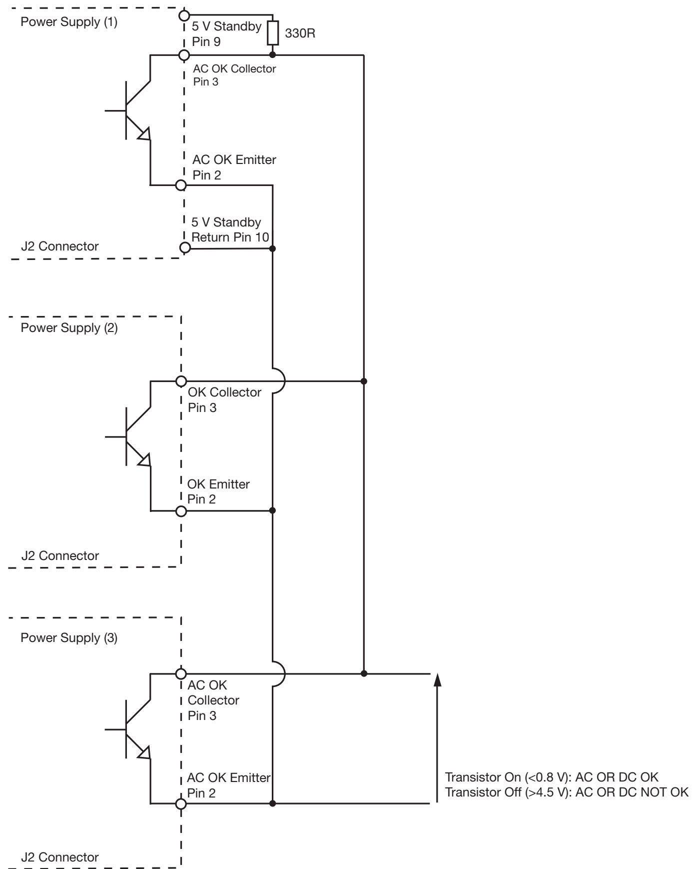
Signals - Parallel Load & Current Share Connection Example

Figure 7



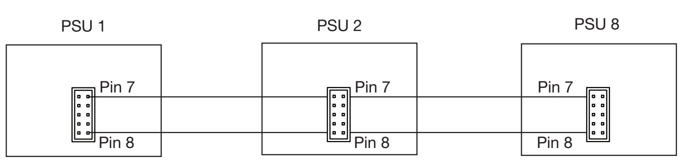
Parallel AC OK Connection

Figure 8



Parallel Remote Inhibit Connection

Figure 9



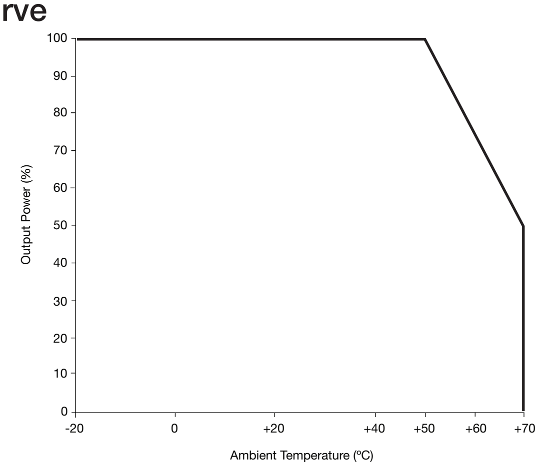
Open or TTL high = PSU On
Short circuit or TTL Low = PSU Off

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Temperature	-20		+70	°C	Derate linearly from +50 °C at 2.5%/°C to 50% at 70 °C. See fig 10.
Low Temperature Start Up	-40			°C	Some specification parameters maybe exceeded until after 20 minutes warm up period.
Storage Temperature	-40		+85	°C	
Cooling					2 x integral variable speed fans load dependant. See fig 11.
Humidity	5		95	%RH	Non-condensing
Operating Altitude			3000	m	
Shock					3 x 30 g/11 ms shocks in both +ve & -ve directions along the 3 orthogonal axis, total 18 shocks.
Vibration					Single axis 10-500 Hz at 2 g x 10 sweeps

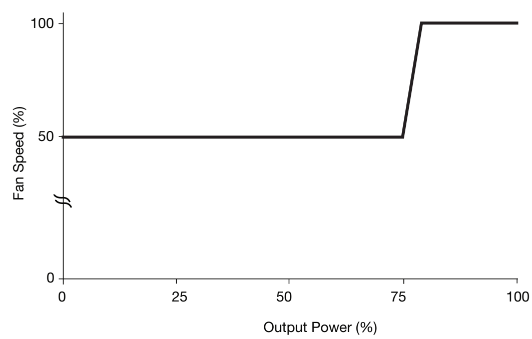
Temperature Derating Curve

Figure 10



Fan Speed Control

Figure 11



Electromagnetic Compatibility - Immunity

Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
Harmonic Current	EN61000-3-2	Class A		
ESD	EN61000-4-2	3	A	
Radiated	EN61000-4-3	3	A	
EFT	EN61000-4-4	3	A	
Surges	EN61000-4-5	Installation class 3	A	
Conducted	EN61000-4-6	3	A	
Magnetic	EN61000-4-8	3	A	
Dips and Interruptions	EN61000-4-11	Dip: 30% 10 ms	A	
		Dip: 60% 100 ms	B	
		Dip: 100% 5000 ms	B	
	EN60601-1-2	Dip: 30% 500 ms	A	
		Dip: 60% 100 ms	A	115 VAC input requires 50% load derating otherwise criteria B
		Dip: 100% 10 ms	A	
		Dip: 100% 5000 ms	B	

Electromagnetic Compatibility - Emissions

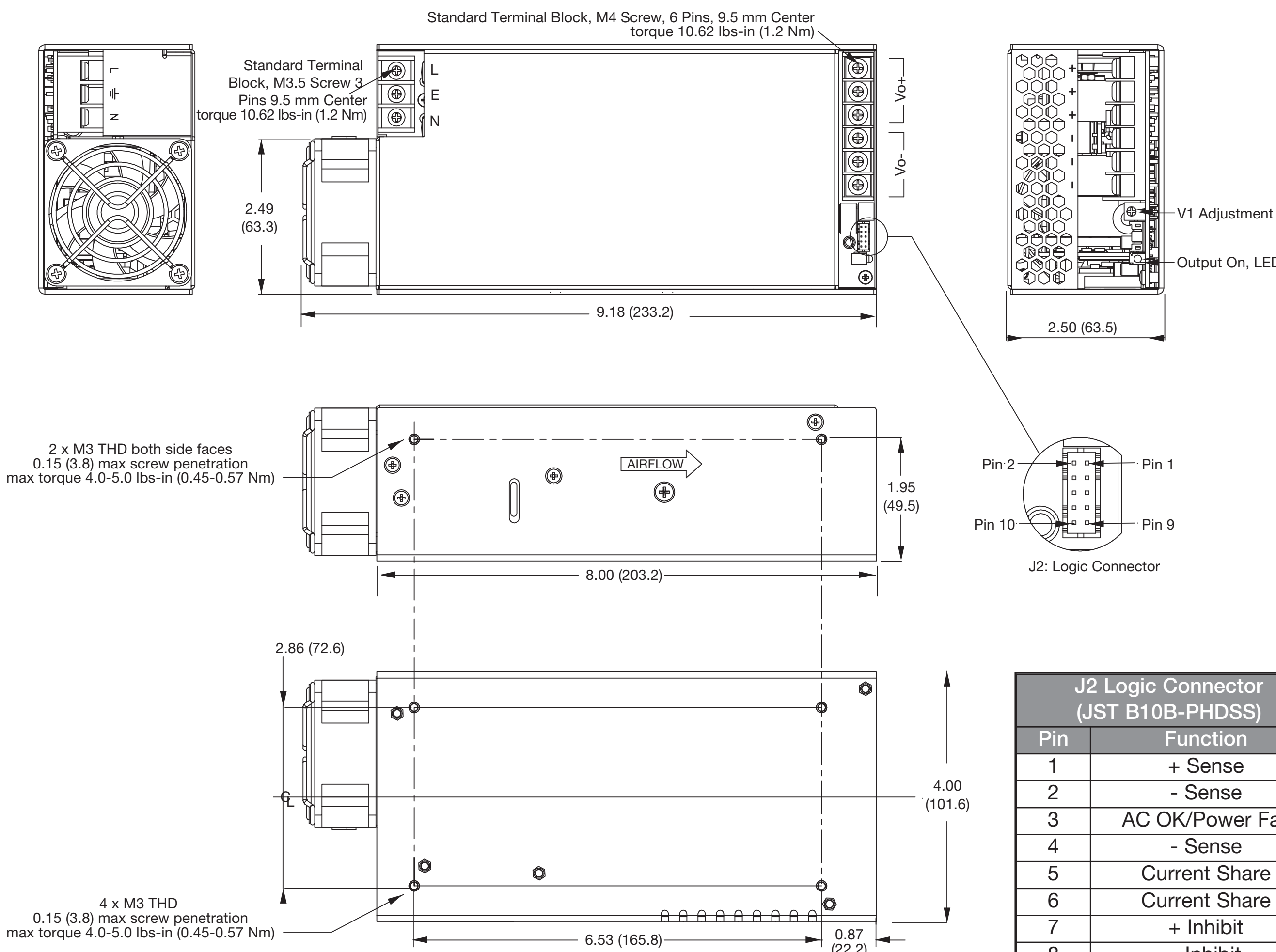
Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
Conducted	EN55022	Class B		
Radiated	EN55022	Class A		
Voltage Fluctuations	EN61000-3-3			

Safety Agency Approvals

Safety Agency	Safety Standard	Category
CB Report	UL US/14649/UL IEC60601-1	Medical
UL	UL File # E146893 UL60601-1, CSA22.2 No.601-1 M90	Medical
TUV	Certificate # B1O 02 57396 069 EN60601-1	Medical
CE	LVD	

Equipment Protection Class	Safety Standard	Notes & Conditions
Class I	IEC60601-1	See safety agency conditions of acceptibility for details

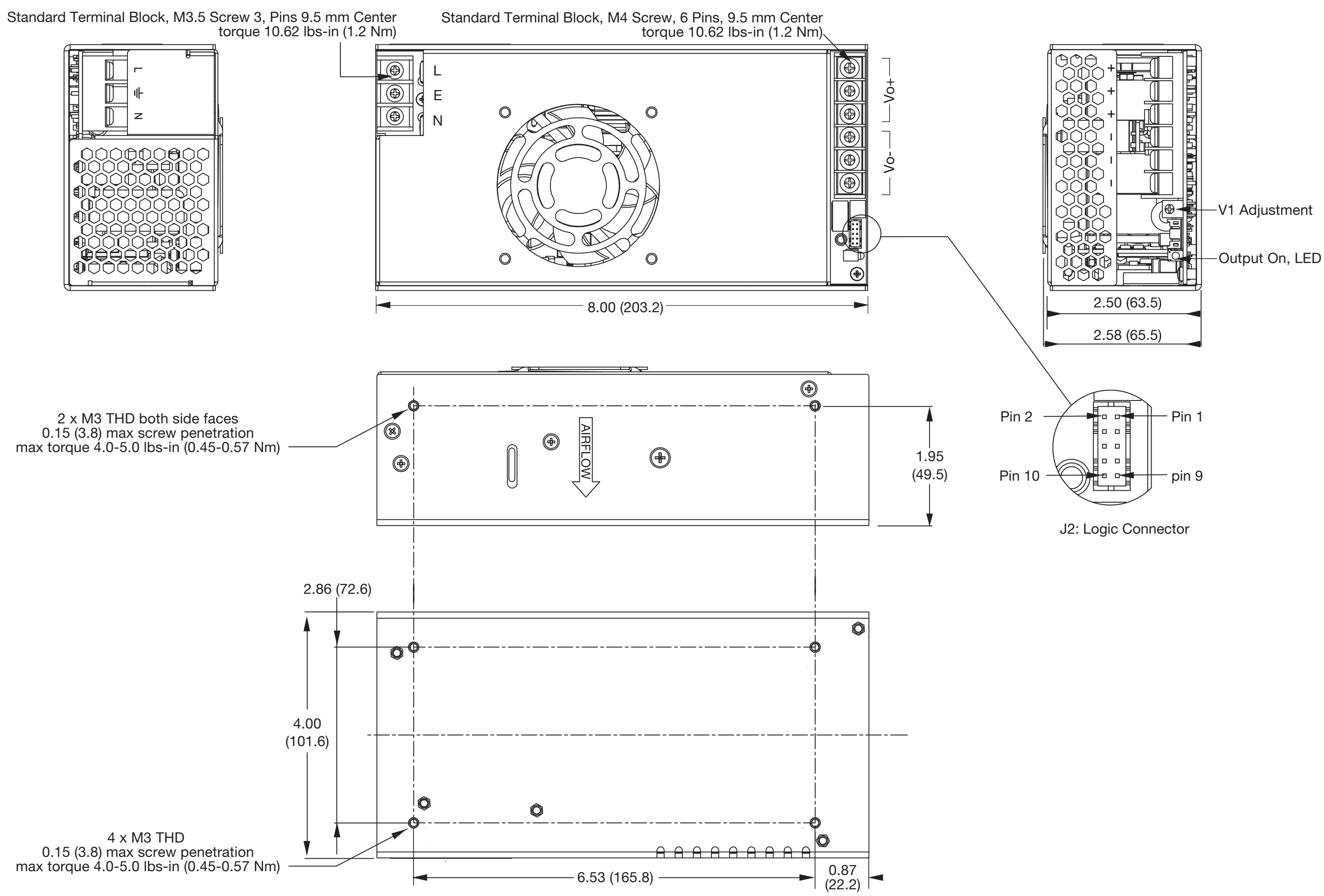
Mechanical Details - End Fan (Suffix -EF)



J2 Logic Connector (JST B10B-PHDSS)	
Pin	**Function**
1	+ Sense
2	- Sense
3	AC OK/Power Fail
4	- Sense
5	Current Share
6	Current Share
7	+ Inhibit
8	- Inhibit
9	+5 V Standby (V3)
10	5 V Standby Return (V3)

Notes:
1. Dimensions shown in inches (mm).
2. Weight: 2.8 lb (1.25 kg).
3. J2 Mating plug: JST part no. PHDR-10VS, contact: 26-22 AWG JST part no. SPHD-001T-P0.5.

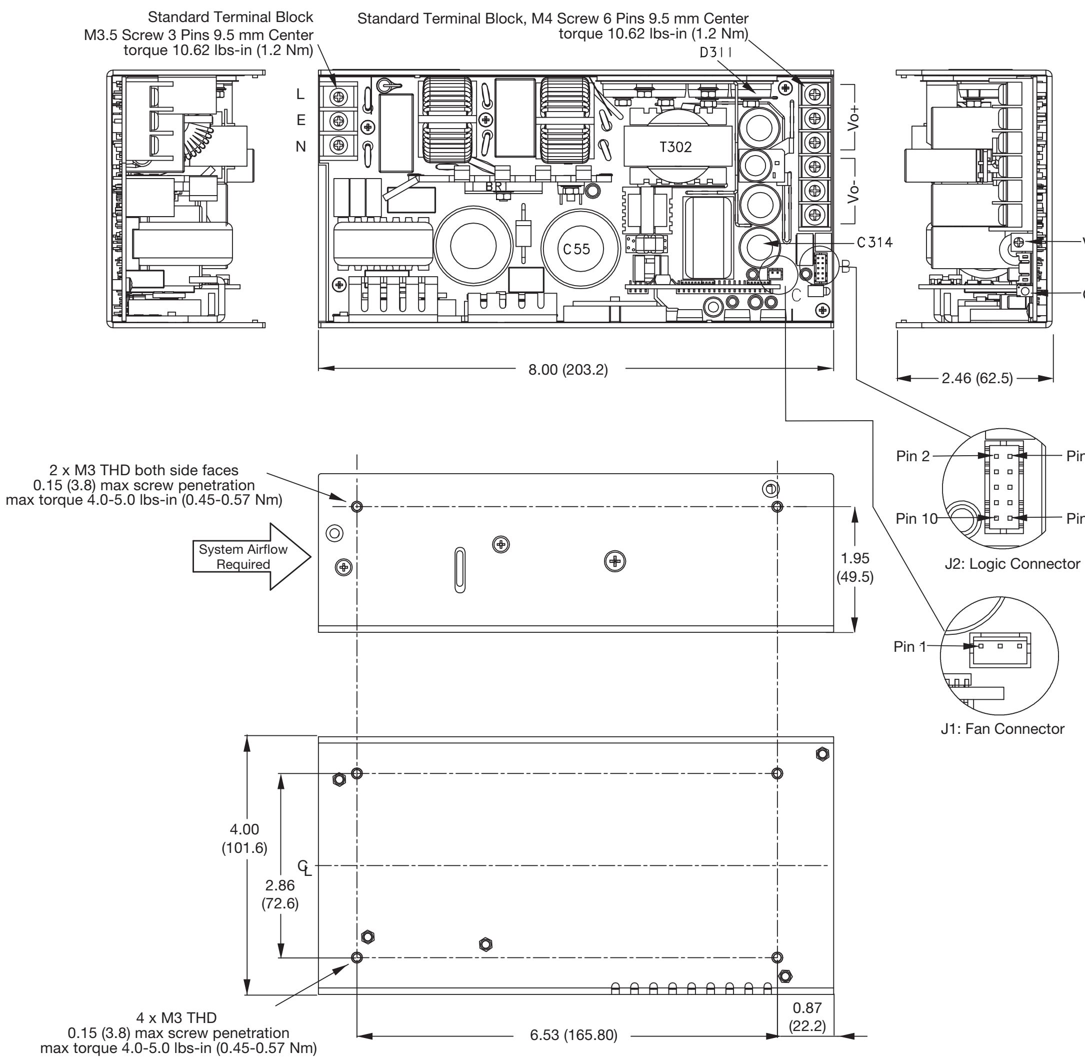
Mechanical Details - Top Fan (Suffix -TF)



J2 Logic Connector (JST B10B-PHDSS)	
Pin	Function
1	+ Sense
2	- Sense
3	AC OK/Power Fail
4	- Sense
5	Current Share
6	Current Share
7	+ Inhibit
8	- Inhibit
9	+5 V Standby (V3)
10	5 V Standby Return (V3)

Notes:
1. Dimensions shown in inches (mm).
2. Weight: 2.6 lb (1.2 kg).
3. J2 Mating plug: JST part no. PHDR-10VS, contact: 26-22 AWG JST part no. SPHD-001T-P0.5.

Mechanical Details - U Channel (No Suffix)



J2 Logic Connector (JST B10B-PHDSS)	
Pin	**Function**
1	+ Sense
2	- Sense
3	AC OK/Power Fail
4	- Sense
5	Current Share
6	Current Share
7	+ Inhibit
8	- Inhibit
9	+5 V Standby (V3)
10	5 V Standby Return (V3)

J1 Fan Connector (JST B2B-PH-KL (LF) (SN))	
Pin	**Function**
1	+V
2	NC
3	-V

Notes:
1. Dimensions shown in inches (mm).
2. Weight: 2.4 lb (1.1 kg).
3. Requires system airflow, see thermal considerations.
4. J1 Mating plug: JST part no. PHR-2, contact: JST part no. SPH-002T-P0.5S.
5. J2 Mating plug: JST part no. PHDR-10VS, contact: 26-22 AWG JST part no. SPHD-001T-P0.5.

Thermal Considerations (U Channel)

Temperature Measurements (Ambient ≤50 ° C)		
Component	**Recommended Temperature °C**	**Maximum Temperature °C**
C55 Capacitor	70	105
T302 Transformer	90	120
C314 Capacitor	70	105
D311 Diode	100	120

In order to ensure reliable operation in the end use application the recommended component temperatures listed should not be exceeded. Higher temperatures up to the maximum stated can be used but product lifetime may be reduced.

North American HQ

XP Power
990 Benecia Avenue, Sunnyvale, CA 94085
Phone : +1 (408) 732-7777
Fax : +1 (408) 732-2002
Email : nasales@xppower.com

North American Sales Offices

Toll Free........................+1 (800) 253-0490
Central Region..............+1 (972) 578-1530
Eastern Region ....+1 (973) 658-8001
Western Region............+1 (408) 732-7777

European HQ

XP Power
Horseshoe Park, Pangbourne,
Berkshire, RG8 7JW, UK
Phone : +44 (0)118 984 5515
Fax : +44 (0)118 984 3423
Email : eusales@xppower.com

German HQ

XP Power
Auf der Höhe 2, D-28357
Bremen, Germany
Phone : +49 (0)421 63 93 3 0
Fax : +49 (0)421 63 93 3 10
Email : desales@xppower.com

European Sales Offices

Austria ....+41 (0)56 448 90 80
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Asian HQ

XP Power
401 Commonwealth Drive, Haw Par Technocentre, Lobby B,
#02-02, Singapore 149598
Phone : +65 6411 6900
Fax : +65 6741 8730
Email : apsales@xppower.com
Web : www.xppowerchina.com / www.xppower.com

Asian Sales Offices

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