

# SHP350 Series



- 420 W High Line Output Power
- Rugged Industrial Construction
- Variable Speed Fan for Noise Reduction
- -40 °C to +70 °C Operation
- 5 V Standby
- AC OK, Remote On/Off and Active Current Share
- Screw Terminals
- SEMI F47 Compliant
- 3 Year Warranty

The SHP350 AC-DC power supply provides upto 420 W of output power in a compact rugged mechanical package, suitable for a range of industrial applications.

The unit comprises of a main output with voltages from 12-48 VDC and a 5 VDC standby supply which can be utilised 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 be 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 7" (178 mm) x 3.6" (91 mm) x 2.1" (53 mm) and carrying IEC60950 family safety approvals, the SHP350 has a load dependant variable speed fan, is fully protected with overtemperature shutdown and provides -40 °C start up and full power from -20 °C to 50 °C and 50% power at +70 °C.

## Models and Ratings

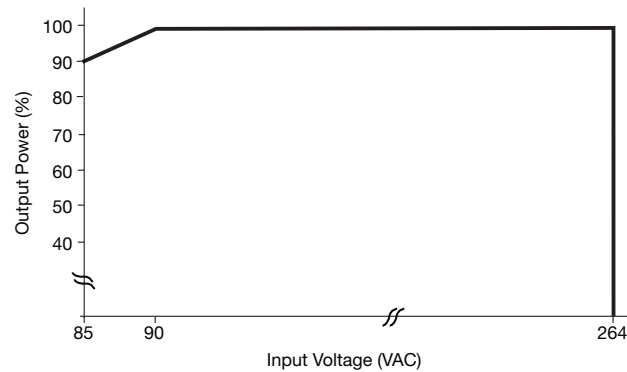
| Output Voltage V1 | Output Current V1 | Standby Supply V2 | Output Power |       | Model Number |
|-------------------|-------------------|-------------------|--------------|-------|--------------|
|                   |                   |                   | Continuous   | Peak  |              |
| 12 V              | 26.5 A            | 5 V / 0.2 A       | 318 W        |       | SHP350PS12   |
| 15 V              | 22.0 A            | 5 V / 0.2 A       | 330 W        |       | SHP350PS15   |
| 24 V              | 14.5 A            | 5 V / 0.2 A       | 348 W        | 417 W | SHP350PS24   |
| 28 V              | 12.5 A            | 5 V / 0.2 A       | 350 W        | 420 W | SHP350PS28   |
| 36 V              | 9.7 A             | 5 V / 0.2 A       | 350 W        | 420 W | SHP350PS36   |
| 48 V              | 7.3 A             | 5 V / 0.2 A       | 350 W        | 420 W | SHP350PS48   |

## 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,<br>Class C compliant ≥10% load |
| Input Current - No Load           |                                         | 0.15    |         | A     |                                                               |
| Input Current - Full Load (350 W) |                                         | 3.8/2.1 |         | A     | 115/230 VAC                                                   |
| Inrush Current                    |                                         |         | 60      | A     | 230 VAC cold start, 25 °C                                     |
| Earth Leakage Current             |                                         | 150/260 | 500     | μA    | 115/230 VAC/50 Hz (Typ.), 264 VAC/60 Hz (Max.)                |
| Input Protection                  | T10 A/250 V internal fuse in both lines |         |         |       |                                                               |

## 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       |         |         | $\pm 1^{(V1)}$ , $\pm 5^{(V2)}$ | %       | 50% load, 115/230 VAC                                                         |
| Output Voltage Adjustment  |         |         | $\pm 10$                        | %       | 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                      |         |         | $\pm 0.2$                       | %       | After 20 min warm up                                                          |
| Line Regulation            |         |         | $\pm 0.5$                       | %       | 90-264 VAC                                                                    |
| Load Regulation            |         |         | $\pm 1^{(V1)}$ , $\pm 5^{(V2)}$ | %       | 0-100% load.                                                                  |
| Transient Response - V1    |         |         | 4                               | %       | Recovery within 1% in less than 500 $\mu$ s for a 50-75% and 75-50% load step |
| Ripple & Noise             |         | 1%      |                                 | % pk-pk | V1: 20 MHz bandwidth                                                          |
| Overvoltage Protection     | 115     |         | 145                             | %       | Vnom DC. Output 1 only, recycle input to reset                                |
| Overload Protection        | 110     |         | 140                             | % 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

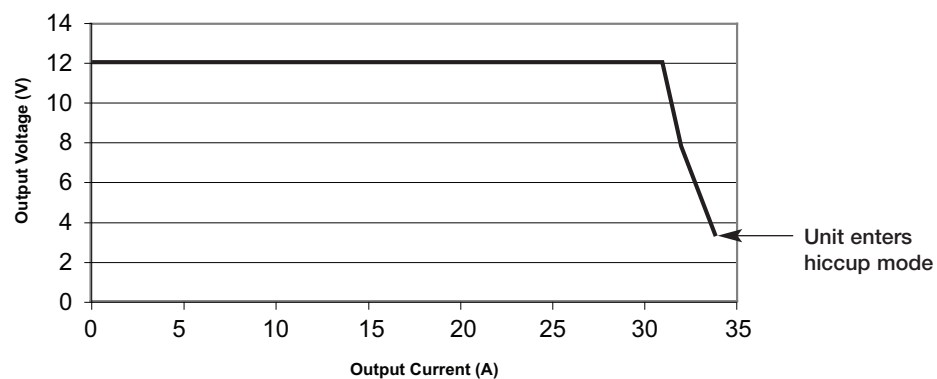


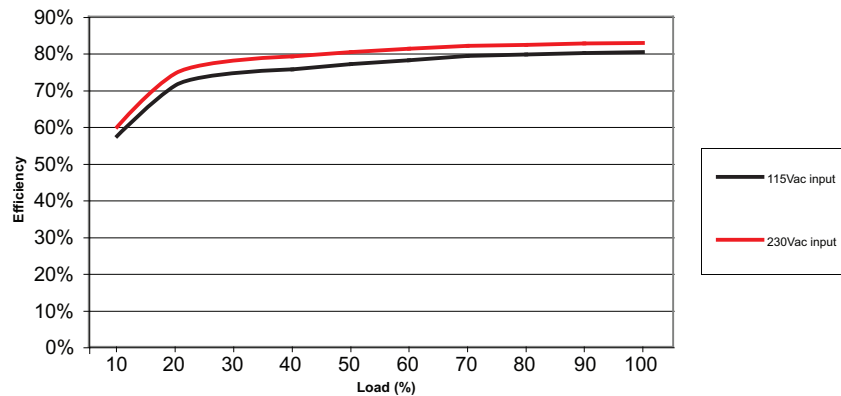
Figure 2  
Typical V1 Overload Characteristic (SHP350PS12 shown)

## General Specifications

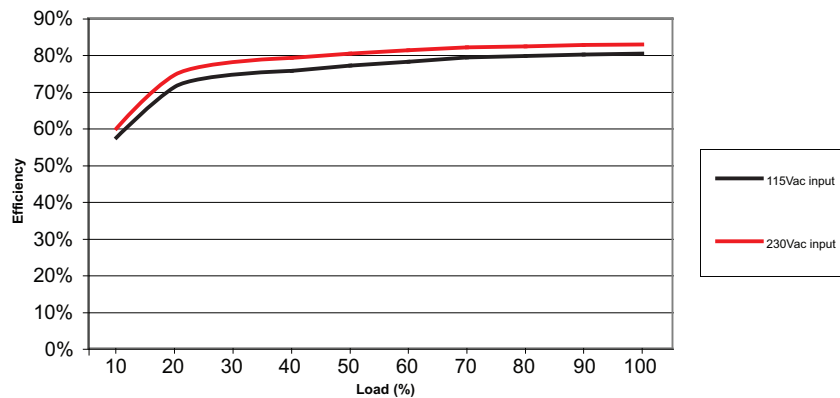
| Characteristic                                                    | Minimum | Typical    | Maximum | Units             | Notes & Conditions                       |
|-------------------------------------------------------------------|---------|------------|---------|-------------------|------------------------------------------|
| Efficiency                                                        |         | 85         |         | %                 | See fig 3 & 4                            |
| Isolation: Input to Output<br>Input to Ground<br>Output to Ground | 3000    |            |         | VAC               |                                          |
|                                                                   | 1500    |            |         | VAC               |                                          |
|                                                                   | 500     |            |         | VDC               |                                          |
| Switching Frequency                                               |         | 70/200/130 |         | kHz               | PFC converter / Main converter / Standby |
| Power Density                                                     |         |            | 6.6     | W/in <sup>3</sup> |                                          |
| Mean Time Between Failure                                         |         | 216        |         | kHrs              | MIL-HDBK-217F at 25 °C GB                |
| Weight                                                            |         | 2.1 (940)  |         | lb (g)            | See mechanical details                   |

## Efficiency vs Load

SHP350PS12  
Figure 3



SHP350PS48  
Figure 4



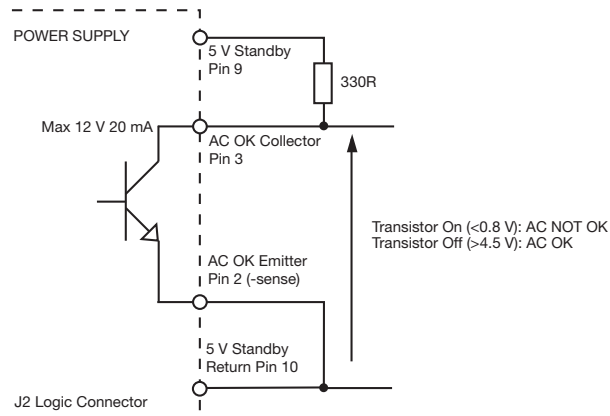
## Signals & Control

| Characteristic                 | Notes & Conditions                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Signals &amp; Control</b>   |                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 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)<br>AC OK: Provides ≥ 5 ms warning of loss of output from AC failure                                                                                                                                                                                                                                           |
| Remote On/Off (Inhibit/Enable) | Uncommitted isolated optocoupler diode, powered diode inhibits both V1 & V2 (fan supply) (see fig.6 & 9)                                                                                                                                                                                                                                                                                                            |
| Current Share                  | When more than one unit (with the same output voltage) is used in parallel to increase output current, the current share pins 5/6 of one unit should be connected to pins 5/6 of the other unit(s). This will force the current to share between the outputs. Similarly pins 2/4 of each unit should also be connected as a ground reference. Units share current within 10% of each other at full load. See fig 7. |
| Standby Supply V2              | Isolated 5 V/0.2 A supply, always present when AC supplied.                                                                                                                                                                                                                                                                                                                                                         |

## Signals & Control

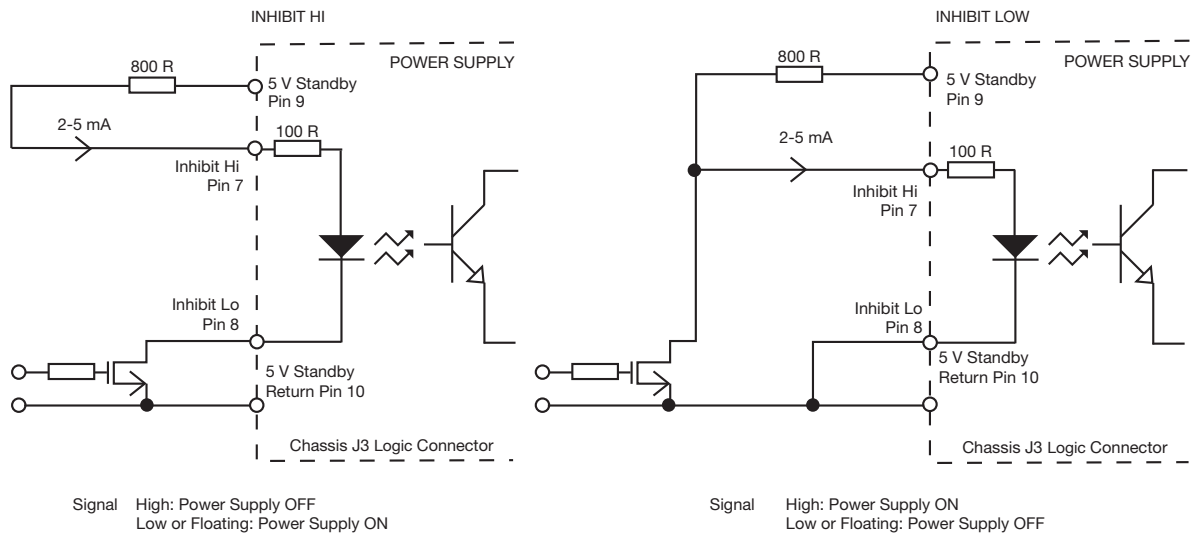
### AC OK/Power Fail

Figure 5



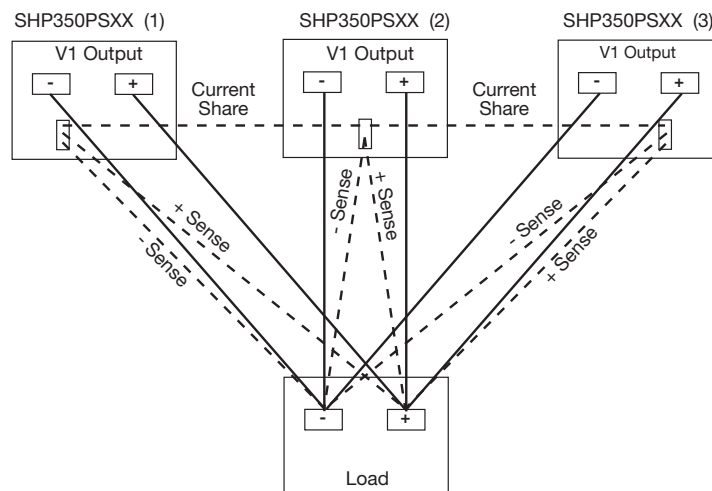
### Remote On/Off (Inhibit)

Figure 6



### Signals - Parallel Load & Current Share Connection Example

Figure 7



## Parallel AC OK Connection

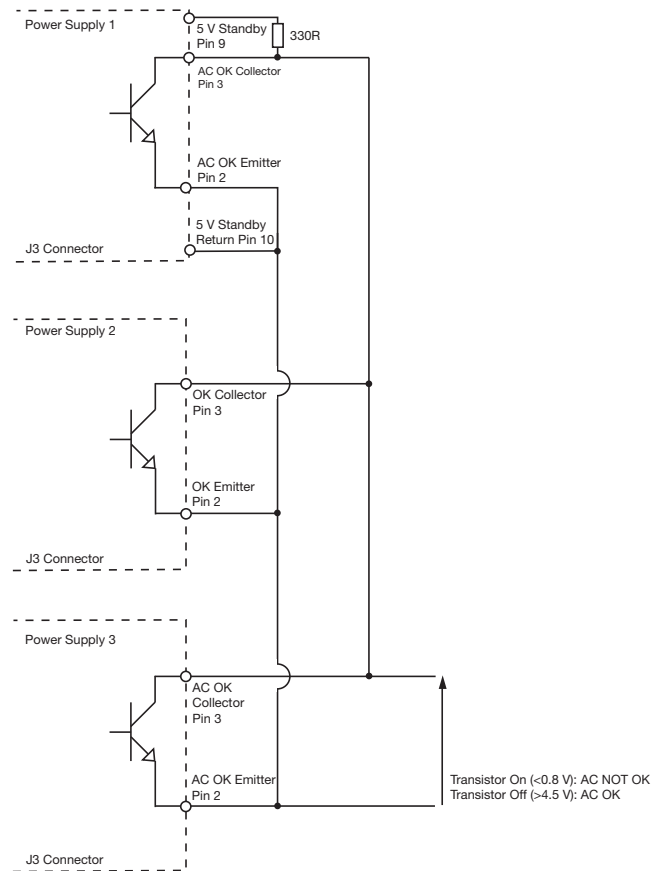


Figure 8

## Parallel Remote Inhibit Connection

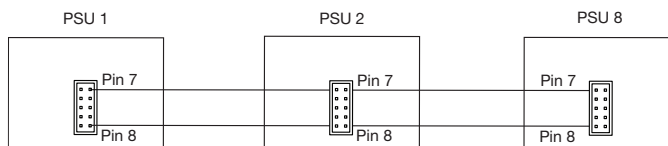


Figure 9

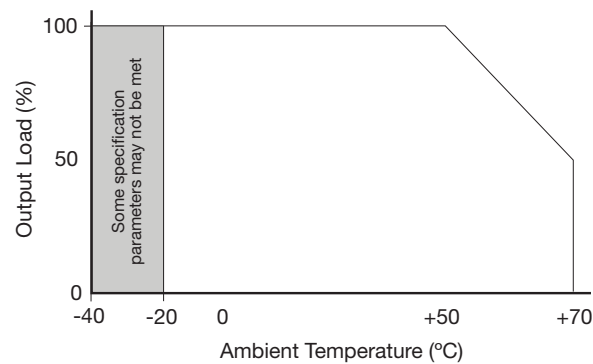
Please see figure 6.

## Environmental

| Characteristic        | Minimum | Typical | Maximum | Units | Notes & Conditions                                                                                                            |
|-----------------------|---------|---------|---------|-------|-------------------------------------------------------------------------------------------------------------------------------|
| Operating Temperature | -40     |         | +70     | °C    | See derating curve, fig 10.                                                                                                   |
| Storage Temperature   | -40     |         | +85     | °C    |                                                                                                                               |
| Cooling               |         |         |         |       | Integral variable speed fan 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. EN60068-2-27 & EN60068-2-47. |
| Vibration             |         |         |         |       | Single axis 10-500 Hz at 2 g x 10 sweeps. EN60068-2-6.                                                                        |

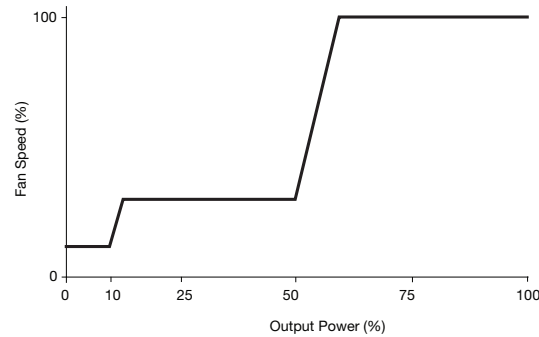
## Temperature Derating Curve

Figure 10



## Fan Speed Control

Figure 11



## Electromagnetic Compatibility - Immunity

| Phenomenon             | Standard     | Test Level           | Criteria | Notes & Conditions |
|------------------------|--------------|----------------------|----------|--------------------|
| Low Voltage PSU EMC    | EN61204-3    | High severity level  | as below |                    |
| 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        |                    |
| Dips and Interruptions | EN61000-4-11 | Dip: 20% 5000 ms     | A        |                    |
|                        |              | Dip: 30% 500 ms      | A        |                    |
|                        |              | Dip: 60% 200 ms      | B        |                    |
|                        |              | Dip: 100% 5000 ms    | B        |                    |
|                        | SEMI F47     |                      |          | Compliant          |

## Electromagnetic Compatibility - Emissions

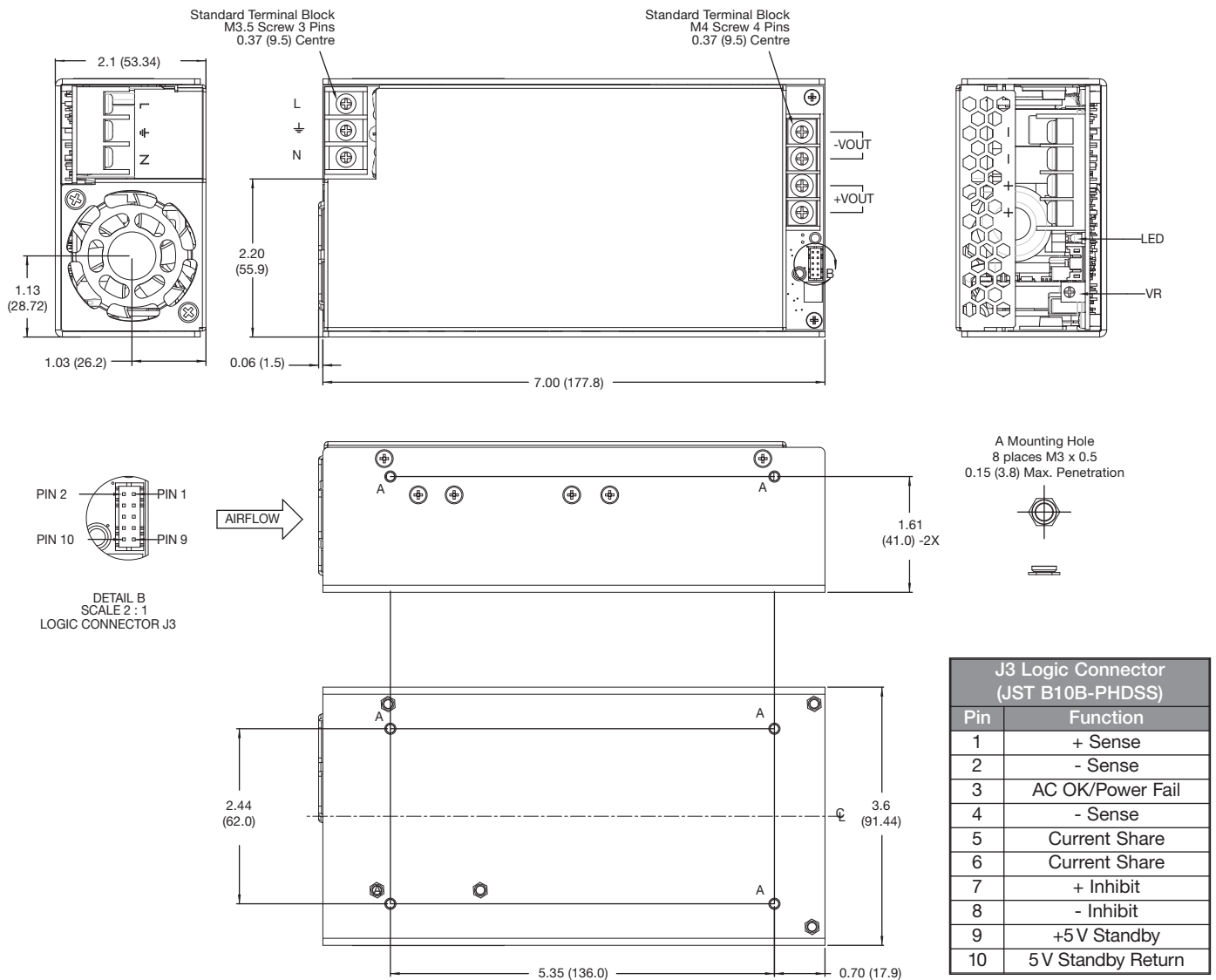
| Phenomenon           | Standard    | Test Level | Criteria | Notes & Conditions |
|----------------------|-------------|------------|----------|--------------------|
| Conducted            | EN55032     | Class B    |          |                    |
| Radiated             | EN55032     | Class A    |          |                    |
| Voltage Fluctuations | EN61000-3-3 |            |          |                    |

## Safety Agency Approvals

| Safety Agency | Safety Standard                           | Category               |
|---------------|-------------------------------------------|------------------------|
| CB Report     | IEC60950-1:2005 Ed 2 / IEC62368-1:2014    | Information Technology |
| UL            | UL 62368-1 & CAN/CSA C22.2 No. 62368-1-14 | Information Technology |
| TUV           | EN62368-1:2014/A11:2017                   | Information Technology |
| CE            | LVD                                       |                        |

| Equipment Protection Class | Safety Standard                        | Notes & Conditions                                        |
|----------------------------|----------------------------------------|-----------------------------------------------------------|
| Class I                    | IEC60950-1:2005 Ed 2 / IEC62368-1:2014 | See safety agency conditions of acceptability for details |

## Mechanical Details



### Notes:

- Dimensions shown in inches (mm).
- Weight: 1.73 lb (0.788 kg).

- Logic connector J3 mates with JST housing PHDR-10VS and SPHD-001T-P0.5 Crimp Terminals

# SHP650 Series



- Rugged Industrial Construction
- End Fan, Top Fan & U'Channel Mechanical Options
- -40 °C to +70 °C Operation
- 5 V Standby
- AC OK, Remote On/Off and Active Current Share
- Load Dependant Variable Fan Speed
- Screw Terminals
- SEMI F47 Compliant
- 3 Year Warranty

The SHP650 AC-DC power supply provides upto 650 W of output power in three mechanical packages to provide installation flexibility in a range of industrial 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 utilised 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 be 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 IEC60950 family safety approvals, the SHP650 has a load dependant variable speed fan which is fully protected with overtemperature shutdown and provides full power from -20 °C to 50 °C and 50% power at +70 °C.

## 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            | SHP650PS12-EF |
| 15 V              | 40.0 A                | Not Available | 5 V / 0.2 A       | 607 W            | SHP650PS15-EF |
| 24 V              | 27.0 A                | Not Available | 5 V / 0.2 A       | 657 W            | SHP650PS24-EF |
| 28 V              | 23.0 A                | Not Available | 5 V / 0.2 A       | 651 W            | SHP650PS28-EF |
| 36 V              | 18.0 A                | Not Available | 5 V / 0.2 A       | 657 W            | SHP650PS36-EF |
| 48 V              | 13.5 A                | Not Available | 5 V / 0.2 A       | 657 W            | SHP650PS48-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            | SHP650PS12-TF |
| 15 V              | 40.0 A                | Not Available | 5 V / 0.2 A       | 607 W            | SHP650PS15-TF |
| 24 V              | 27.0 A                | Not Available | 5 V / 0.2 A       | 657 W            | SHP650PS24-TF |
| 28 V              | 23.0 A                | Not Available | 5 V / 0.2 A       | 651 W            | SHP650PS28-TF |
| 36 V              | 18.0 A                | Not Available | 5 V / 0.2 A       | 657 W            | SHP650PS36-TF |
| 48 V              | 13.5 A                | Not Available | 5 V / 0.2 A       | 657 W            | SHP650PS48-TF |

### U Channel Models

| Output Voltage V1 | Max Output Current V1 | Fan Supply V2 | Standby Supply V3 | Max Output Power <sup>(1)</sup> | Model Number |
|-------------------|-----------------------|---------------|-------------------|---------------------------------|--------------|
| 12 V              | 50.0 A                | 12 V / 0.5 A  | 5 V / 0.2 A       | 601 W                           | SHP650PS12   |
| 15 V              | 40.0 A                | 12 V / 0.5 A  | 5 V / 0.2 A       | 601 W                           | SHP650PS15   |
| 24 V              | 27.0 A                | 12 V / 0.5 A  | 5 V / 0.2 A       | 651 W                           | SHP650PS24   |
| 28 V              | 23.0 A                | 12 V / 0.5 A  | 5 V / 0.2 A       | 655 W                           | SHP650PS28   |
| 36 V              | 18.0 A                | 12 V / 0.5 A  | 5 V / 0.2 A       | 651 W                           | SHP650PS36   |
| 48 V              | 13.5 A                | 12 V / 0.5 A  | 5 V / 0.2 A       | 651 W                           | SHP650PS48   |

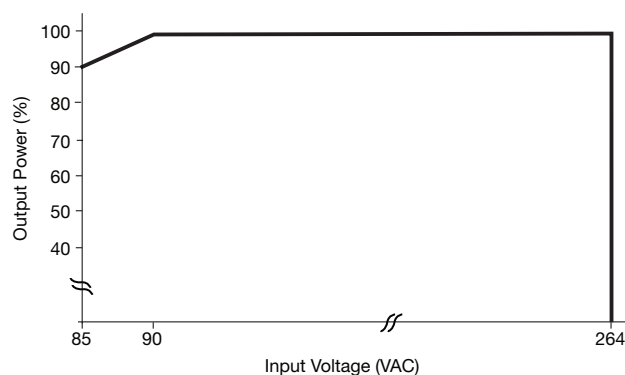
1. U Channel models require a minimum of 5.5 m/s airflow from the system for cooling

## 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    | Agency approval, 47-63 Hz                                           |
| Power Factor              |                                     | >0.9     |         |       | EN61000-3-2 class A compliant<br>EN61000-3-2 class C for loads ≥10% |
| 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     |                                     | 0.3/0.5  | 0.75    | mA    | 115/230 VAC/50 Hz (Typ.), 264 VAC/60 Hz (Max.)                      |
| Input Protection          | T16 A / 250 V internal in-line fuse |          |         |       |                                                                     |

## 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       |         |         | $\pm 1^{(V1)}, \pm 5^{(V3)}$ | %       | 50% load, 115/230 VAC                                                         |
| Output Voltage Adjustment  |         |         | $\pm 10$                     | %       | 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                      |         |         | $\pm 0.2$                    | %       | After 20 min warm up                                                          |
| Line Regulation            |         |         | $\pm 0.5$                    | %       | 90-264 VAC                                                                    |
| Load Regulation            |         |         | $\pm 1^{(V1)}, \pm 5^{(V3)}$ | %       | 0-100% load.                                                                  |
| Transient Response - V1    |         |         | 4                            | %       | Recovery within 1% in less than 500 $\mu$ s 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

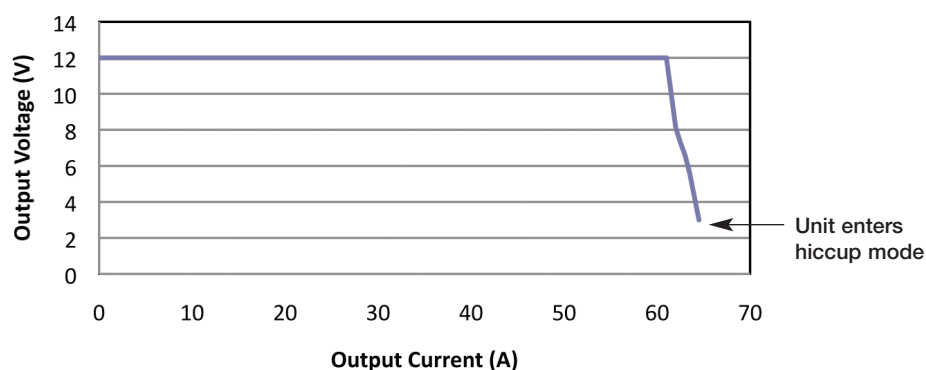


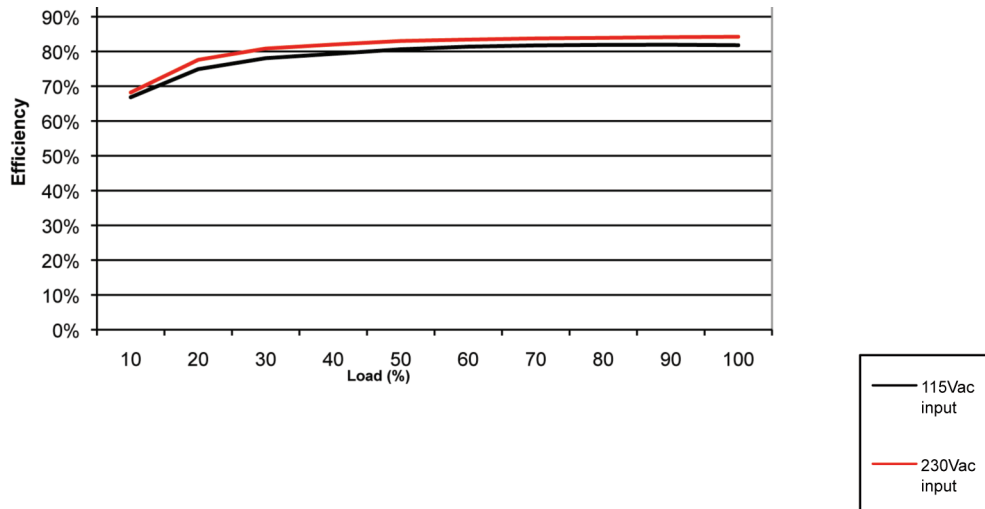
Figure 2  
Typical V1 Overload Characteristic (SHP650PS12 shown)

## General Specifications

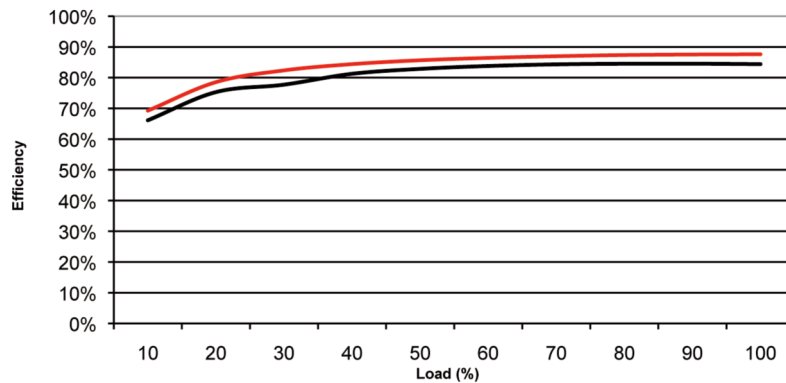
| Characteristic                                                    | Minimum | Typical | Maximum    | Units             | Notes & Conditions             |
|-------------------------------------------------------------------|---------|---------|------------|-------------------|--------------------------------|
| Efficiency                                                        |         | 84      |            | %                 | See fig 3 & 4                  |
| Isolation: Input to Output<br>Input to Ground<br>Output to Ground | 3000    |         |            | VAC               |                                |
|                                                                   | 1500    |         |            | VAC               |                                |
|                                                                   | 500     |         |            | VDC               |                                |
| Switching Frequency                                               |         | 70/200  |            | kHz               | PFC converter / Main converter |
| Power Density                                                     |         |         | 8.2        | W/in <sup>3</sup> |                                |
| 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

SHP650PS12  
Figure 3



SHP650PS48  
Figure 4



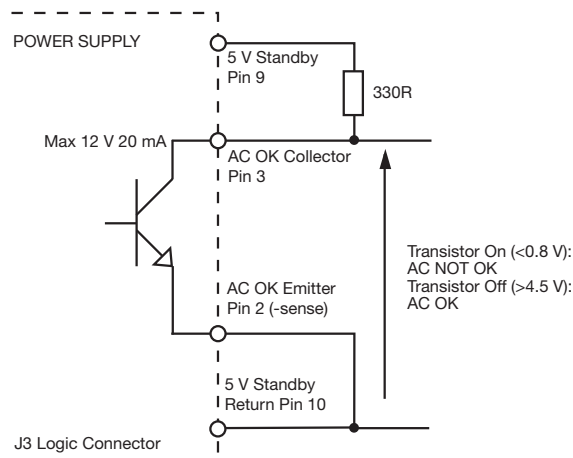
## Signals & Control

| Characteristic                 | Notes & Conditions                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Signals &amp; Control</b>   |                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 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)<br>AC OK: Provides ≥ 5 ms warning of loss of output from AC failure                                                                                                                                                                                                                                           |
| Remote On/Off (Inhibit/Enable) | Uncommitted isolated optocoupler diode, powered diode inhibits both V1 & V2 (fan supply) (see fig.6 & 9)                                                                                                                                                                                                                                                                                                            |
| Current Share                  | When more than one unit (with the same output voltage) is used in parallel to increase output current, the current share pins 5/6 of one unit should be connected to pins 5/6 of the other unit(s). This will force the current to share between the outputs. Similarly pins 2/4 of each unit should also be connected as a ground reference. 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

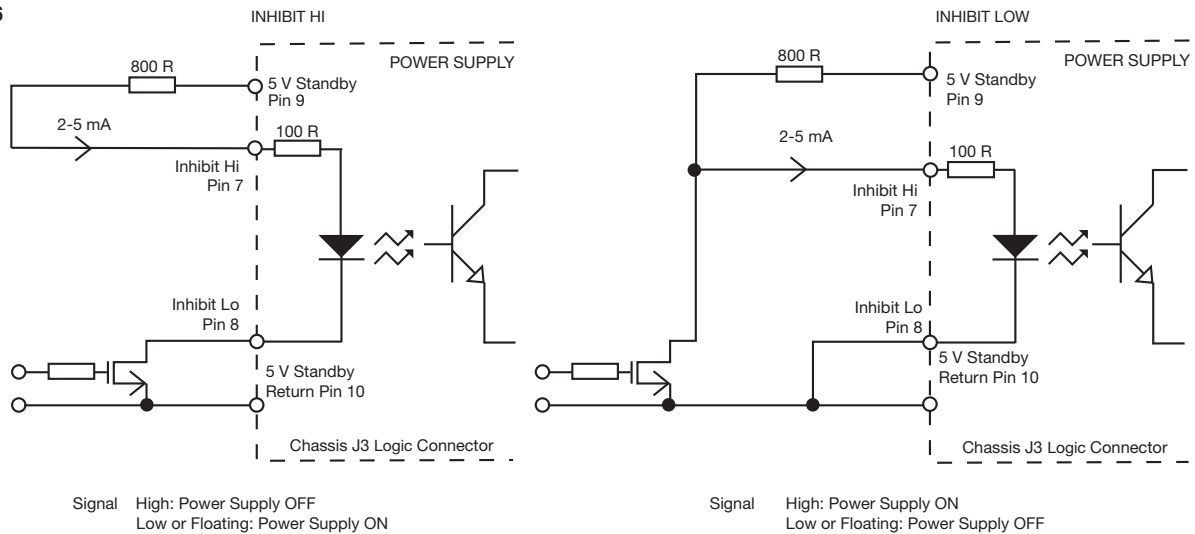
### AC OK/Power Fail

Figure 5



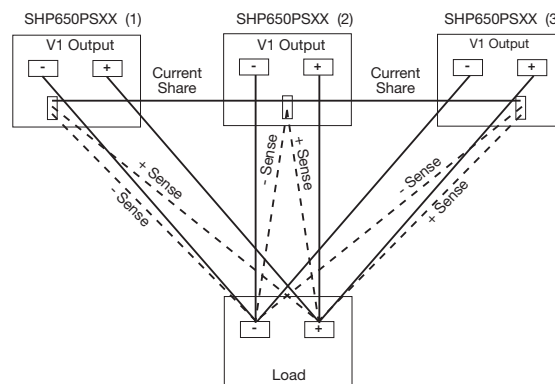
### Remote On/Off (Inhibit)

Figure 6



## Signals - Parallel Load & Current Share Connection Example

Figure 7



## Parallel AC OK Connection

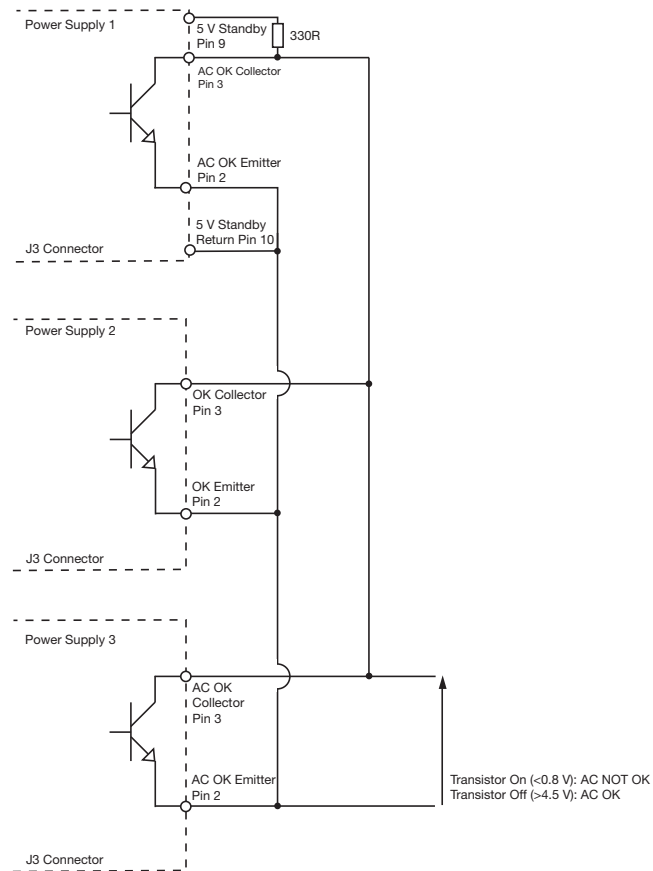


Figure 8

## Parallel Remote Inhibit Connection

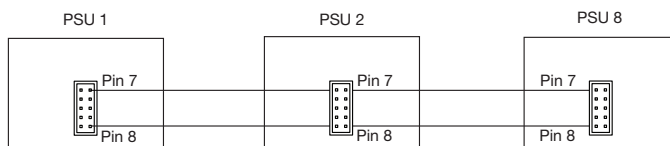


Figure 9

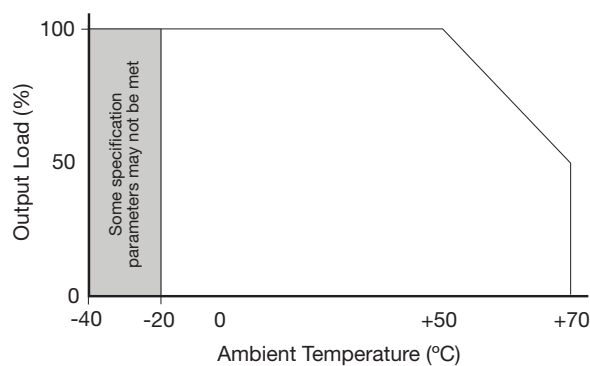
Please see figure 6.

## Environmental

| Characteristic        | Minimum | Typical | Maximum | Units | Notes & Conditions                                                                               |
|-----------------------|---------|---------|---------|-------|--------------------------------------------------------------------------------------------------|
| Operating Temperature | -40     |         | +70     | °C    | See derating curve, fig 10.                                                                      |
| Storage Temperature   | -40     |         | +85     | °C    | Some specification parameters maybe exceeded until after 20 minutes warm up period.              |
| Cooling               |         |         |         |       | Integral variable speed fan 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                                                         |

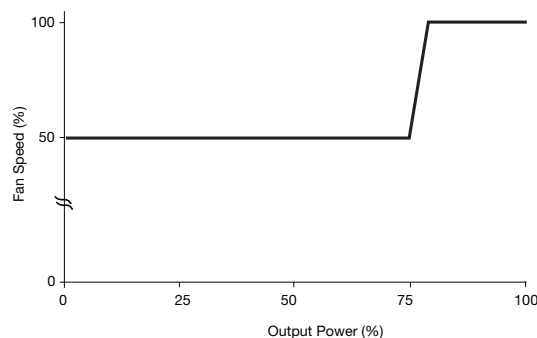
## Temperature Derating Curve

Figure 10



## Fan Speed Control

Figure 11



## Electromagnetic Compatibility - Immunity

| Phenomenon             | Standard     | Test Level           | Criteria | Notes & Conditions |
|------------------------|--------------|----------------------|----------|--------------------|
| Low Voltage PSU EMC    | EN61204-3    | High severity level  | as below |                    |
| Harmonic Current       | EN61000-3-2  | Class A              |          | For loads ≥10%     |
|                        |              | Class C              |          |                    |
| 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        |                    |
| Dips and Interruptions | EN61000-4-11 | Dip: 30% 10 ms       | A        |                    |
|                        |              | Dip: 60% 100 ms      | B        |                    |
|                        |              | Dip: 100% 5000 ms    | B        |                    |
|                        | SEMI F47     |                      |          | Compliant          |

## Electromagnetic Compatibility - Emissions

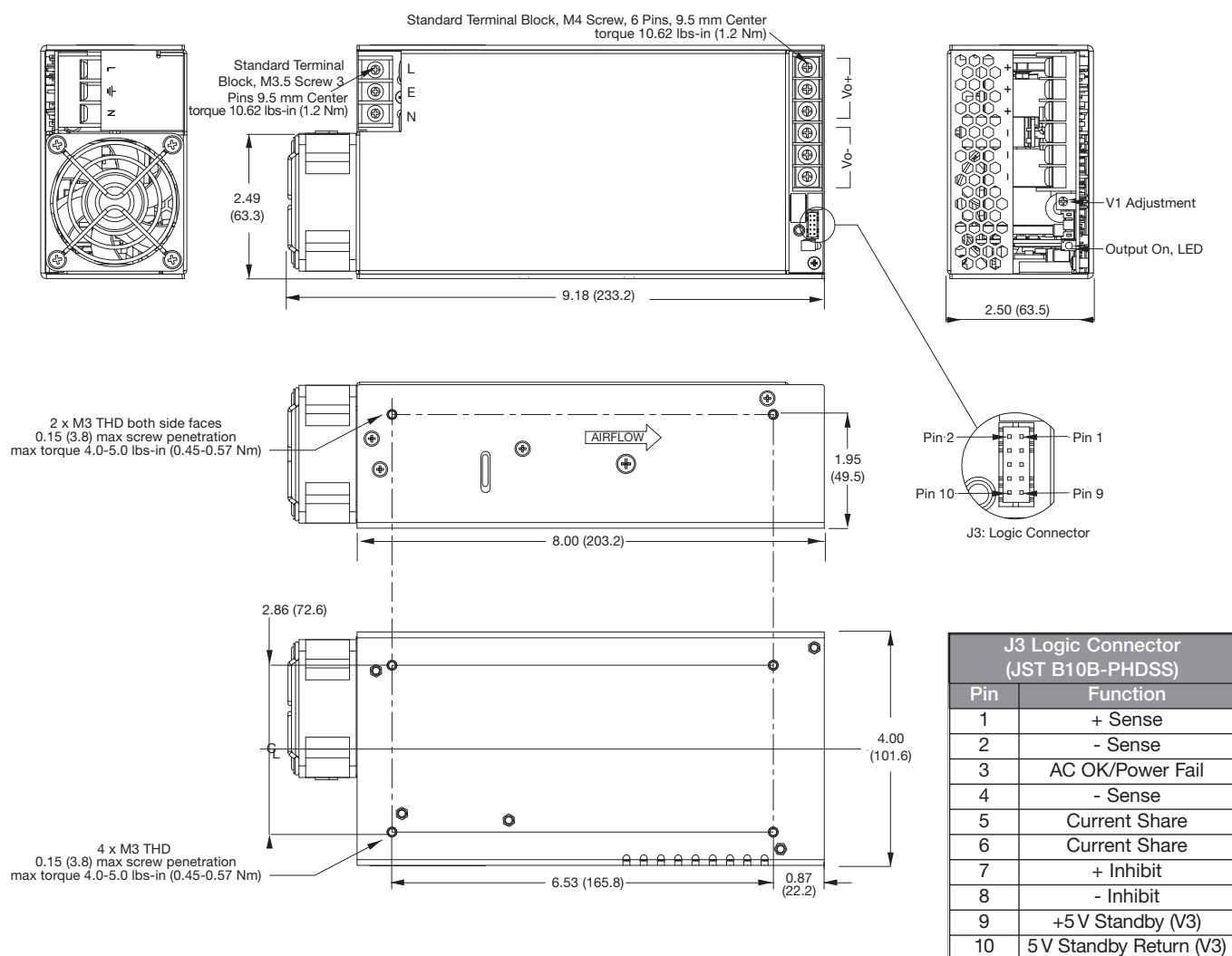
| Phenomenon           | Standard    | Test Level | Criteria | Notes & Conditions |
|----------------------|-------------|------------|----------|--------------------|
| Conducted            | EN55032     | Class B    |          |                    |
| Radiated             | EN55032     | Class A    |          |                    |
| Voltage Fluctuations | EN61000-3-3 |            |          |                    |

## Safety Agency Approvals

| Safety Agency | Safety Standard                           | Category               |
|---------------|-------------------------------------------|------------------------|
| CB Report     | IEC60950-1:2005 Ed 2 / IEC62368-1:2014    | Information Technology |
| UL            | UL 62368-1 & CAN/CSA C22.2 No. 62368-1-14 | Information Technology |
| TUV           | EN62368-1:2014/A11:2017                   | Information Technology |
| CE            | LVD                                       |                        |

| Equipment Protection Class | Safety Standard                        | Notes & Conditions                                        |
|----------------------------|----------------------------------------|-----------------------------------------------------------|
| Class I                    | IEC60950-1:2005 Ed 2 / IEC62368-1:2014 | See safety agency conditions of acceptability for details |

## Mechanical Details - End Fan (Suffix -EF)

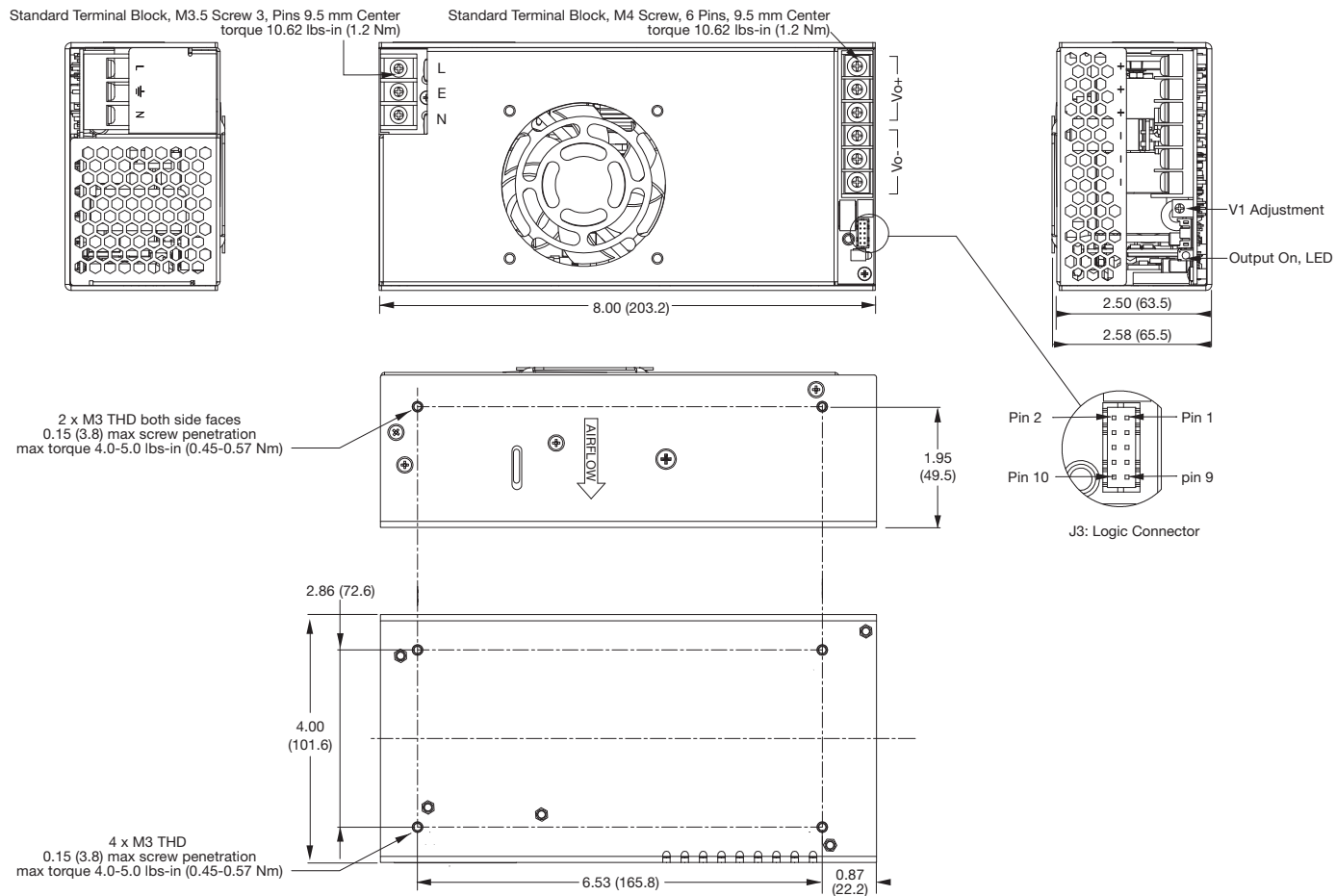


### Notes:

- Dimensions shown in inches (mm).
- Weight: 2.8 lb (1.25 kg).

- J3 Mating plug: JST part no. PHDR-10VS, contact: 26-22 AWG JST part no. SPHD-001T-P0.5.

## Mechanical Details - Top Fan (Suffix -TF)



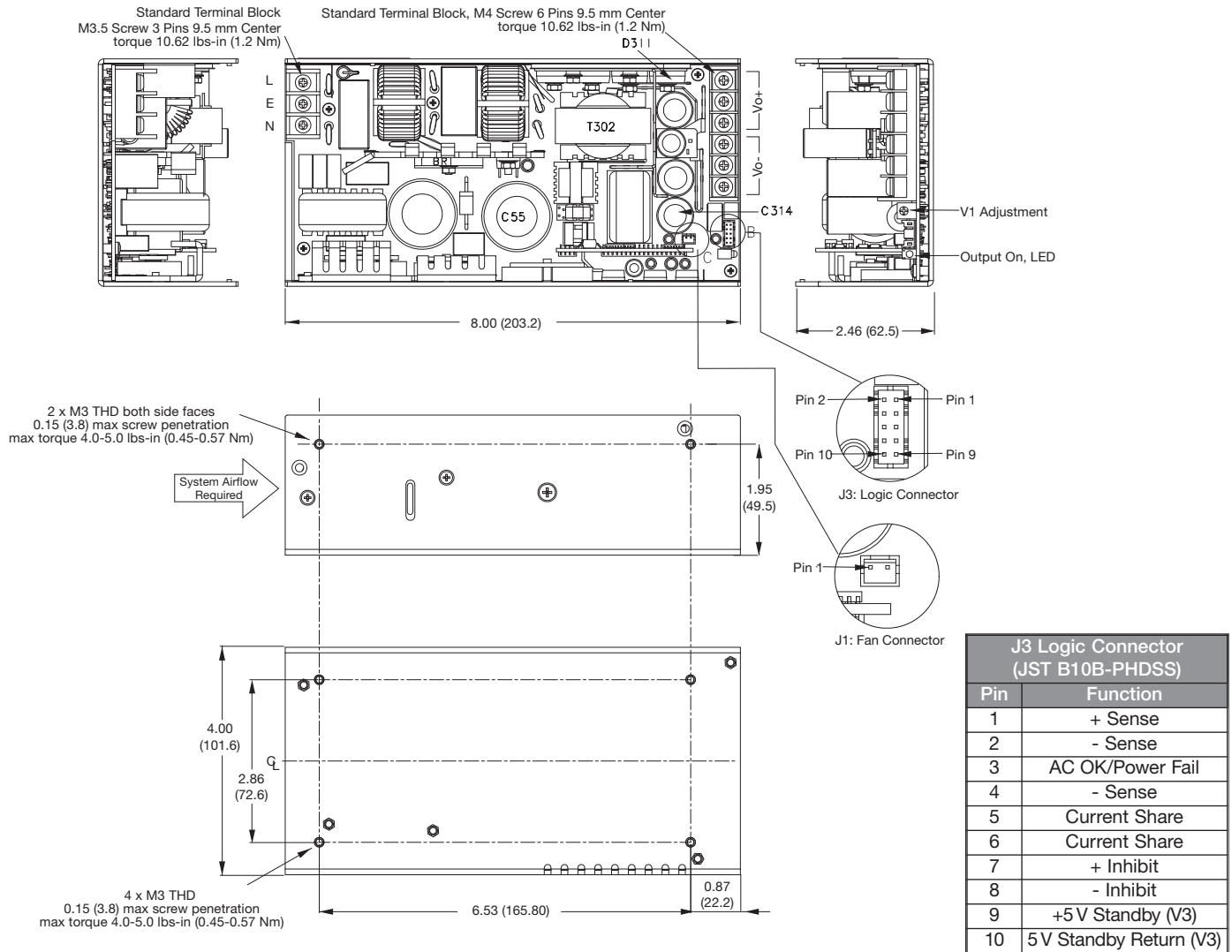
| J3 Logic Connector<br>(JST B10B-PHDSS) |                         |
|----------------------------------------|-------------------------|
| Pin                                    | Function                |
| 1                                      | + Sense                 |
| 2                                      | - 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. J3 Mating plug: JST part no. PHDR-10VS, contact: 26-22 AWG JST part no. SPHD-001T-P0.5.

## Mechanical Details - U Channel (No Suffix)



### Notes:

- Dimensions shown in inches (mm).
- Weight: 2.4 lb (1.1 kg).
- Requires system airflow, see thermal considerations.
- J3 Mating plug: JST part no. PHR-2, contact: JST part no. SPH-002T-P0.5S.
- J3 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 $\leq 50^{\circ}\text{C}$ ) |                                            |                                        |
|---------------------------------------------------------------|--------------------------------------------|----------------------------------------|
| Component                                                     | Recommended Temperature $^{\circ}\text{C}$ | Maximum Temperature $^{\circ}\text{C}$ |
| 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.

# SHP1000 Series



- 1200 W High Line Output Power
- Rugged Industrial Construction
- Variable Speed Fan for Noise Reduction
- -40 °C to +70 °C Operation
- 5 V Standby
- AC OK, Remote On/Off and Active Current Share
- Screw Terminals
- 3 Year Warranty

The SHP1000 AC-DC power supply provides up to 1200 W of output power in a compact rugged mechanical package, suitable for a range of industrial applications.

The unit comprises of a main output with voltages from 12-48 VDC and a 5 VDC standby supply which can be utilised 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 be 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 9.5" (241 mm) x 5.9" (150 mm) x 2.4" (61 mm) and carrying IEC60950 family safety approvals, the SHP1000 has a load dependant variable speed fan is fully protected with overtemperature shutdown and provides -40 °C start up with full power from -20 °C to 50 °C and 50% power at +70 °C.

## Models and Ratings

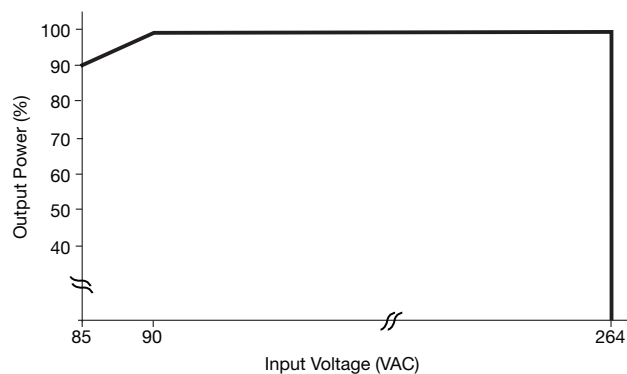
| Output Voltage V1 | Max Output Current V1 |          | Standby Supply V2 | Max Output Power |          | Model Number |
|-------------------|-----------------------|----------|-------------------|------------------|----------|--------------|
|                   | <180 VAC              | >180 VAC |                   | <180 VAC         | >180 VAC |              |
| 12 V              | 83.0 A                |          | 5 V / 1.0 A       | 1001 W           |          | SHP1000PS12  |
| 15 V              | 67.0 A                |          | 5 V / 1.0 A       | 1010 W           |          | SHP1000PS15  |
| 24 V              | 42.0 A                | 50.0 A   | 5 V / 1.0 A       | 1013 W           | 1205 W   | SHP1000PS24  |
| 28 V              | 36.0 A                | 42.9 A   | 5 V / 1.0 A       | 1013 W           | 1206 W   | SHP1000PS28  |
| 36 V              | 28.0 A                | 33.3 A   | 5 V / 1.0 A       | 1013 W           | 1204 W   | SHP1000PS36  |
| 48 V              | 21.0 A                | 25.0 A   | 5 V / 1.0 A       | 1013 W           | 1205 W   | SHP1000PS48  |

## 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            |                                         | 0.35/0.5 |         | A     | 115/230 VAC                                    |
| Input Current - Full Load (1000 W) |                                         | 10.9/5.3 |         | A     | 115/230 VAC                                    |
| Inrush Current                     |                                         |          | 60      | A     | 230 VAC cold start, 25 °C                      |
| Earth Leakage Current              |                                         | 75/140   | 250     | μA    | 115/230 VAC/50 Hz (Typ.), 264 VAC/60 Hz (Max.) |
| Input Protection                   | T20 A/250 V internal fuse in both lines |          |         |       |                                                |

## 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       |         |         | $\pm 1^{(V1)}$ , $\pm 5^{(V2)}$ | %       | 50% load, 115/230 VAC                                                         |
| Output Voltage Adjustment  |         |         | $\pm 10$                        | %       | 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                      |         |         | $\pm 0.2$                       | %       | After 20 min warm up                                                          |
| Line Regulation            |         |         | $\pm 0.5$                       | %       | 90-264 VAC                                                                    |
| Load Regulation            |         |         | $\pm 1^{(V1)}$ , $\pm 5^{(V2)}$ | %       | 0-100% load.                                                                  |
| Transient Response - V1    |         |         | 4                               | %       | Recovery within 1% in less than 500 $\mu$ s for a 50-75% and 75-50% load step |
| Ripple & Noise             |         |         | 1                               | % pk-pk | V1: 20 MHz bandwidth                                                          |
| Overvoltage Protection     | 115     |         | 145                             | %       | Vnom DC. Output 1 only, recycle input to reset                                |
| Overload Protection        | 110     |         | 140                             | % 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

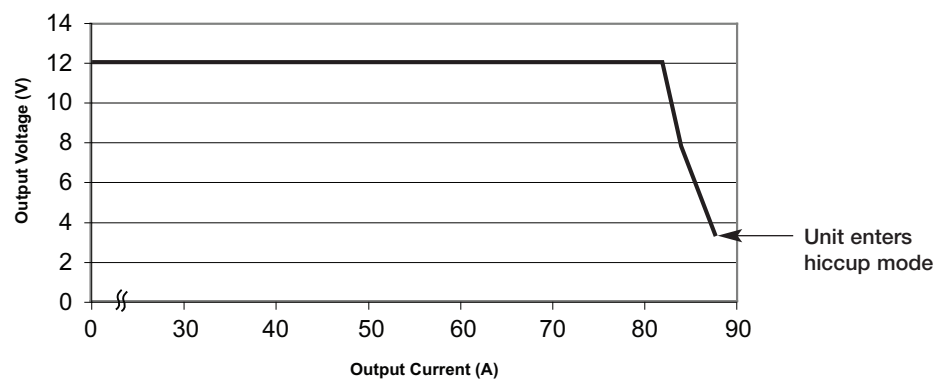


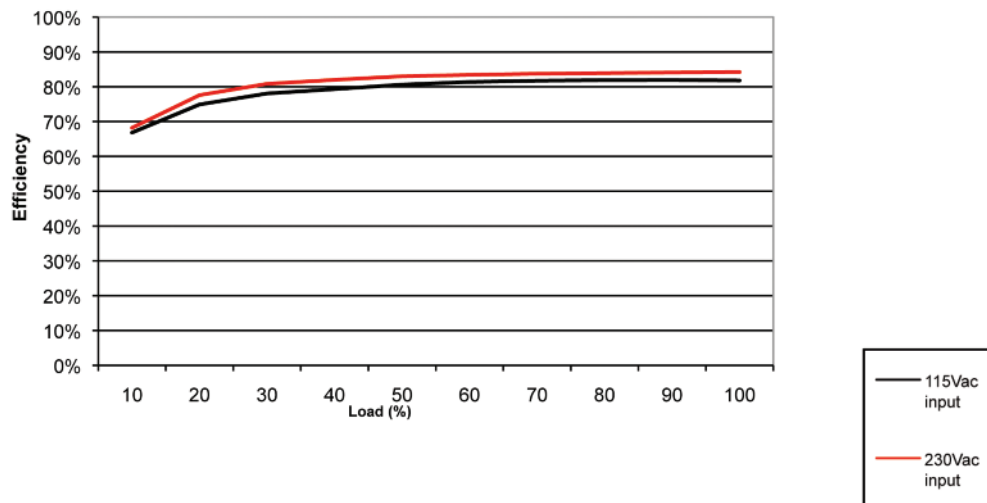
Figure 2  
Typical V1 Overload Characteristic (SHP1000PS12 shown)

## General Specifications

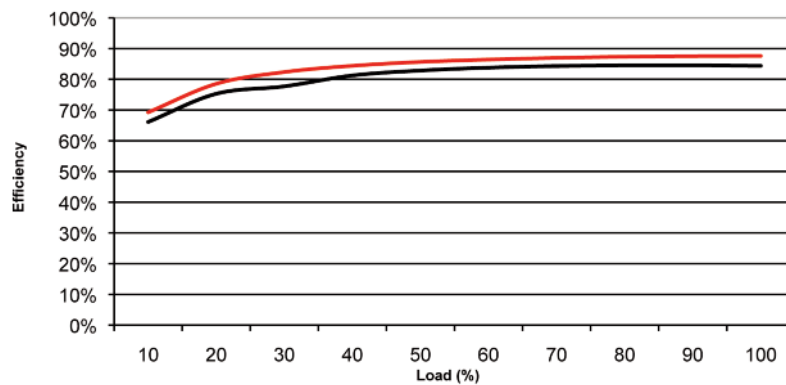
| Characteristic                                                    | Minimum | Typical    | Maximum | Units             | Notes & Conditions                       |
|-------------------------------------------------------------------|---------|------------|---------|-------------------|------------------------------------------|
| Efficiency                                                        |         | 84         |         | %                 | See fig 3 & 4                            |
| Isolation: Input to Output<br>Input to Ground<br>Output to Ground | 3000    |            |         | VAC               |                                          |
|                                                                   | 1500    |            |         | VAC               |                                          |
|                                                                   | 500     |            |         | VDC               |                                          |
| Switching Frequency                                               |         | 70/200/130 |         | kHz               | PFC converter / Main converter / Standby |
| Power Density                                                     |         |            | 8.9     | W/in <sup>3</sup> |                                          |
| Mean Time Between Failure                                         |         | 275        |         | kHrs              | MIL-HDBK-217F at 25 °C GB                |
| Weight                                                            |         | 2.1 (940)  |         | lb (g)            | See mechanical details                   |

## Efficiency vs Load

SHP1000PS12  
Figure 3



SHP1000PS48  
Figure 4



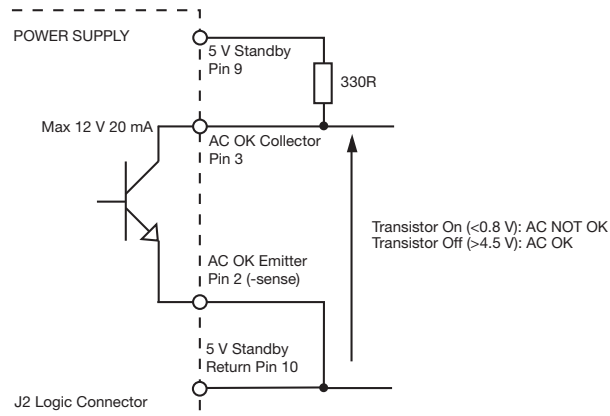
## Signals & Control

| Characteristic                 | Notes & Conditions                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Signals &amp; Control</b>   |                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 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)<br>AC OK: Provides ≥ 5 ms warning of loss of output from AC failure                                                                                                                                                                                                                                           |
| Remote On/Off (Inhibit/Enable) | Uncommitted isolated optocoupler diode, powered diode inhibits both V1 & V2 (fan supply) (see fig.6 & 9)                                                                                                                                                                                                                                                                                                            |
| Current Share                  | When more than one unit (with the same output voltage) is used in parallel to increase output current, the current share pins 5/6 of one unit should be connected to pins 5/6 of the other unit(s). This will force the current to share between the outputs. Similarly pins 2/4 of each unit should also be connected as a ground reference. Units share current within 10% of each other at full load. See fig 7. |
| Standby Supply V2              | Isolated 5 V/1.0 A supply, always present when AC supplied.                                                                                                                                                                                                                                                                                                                                                         |

## Signals & Control

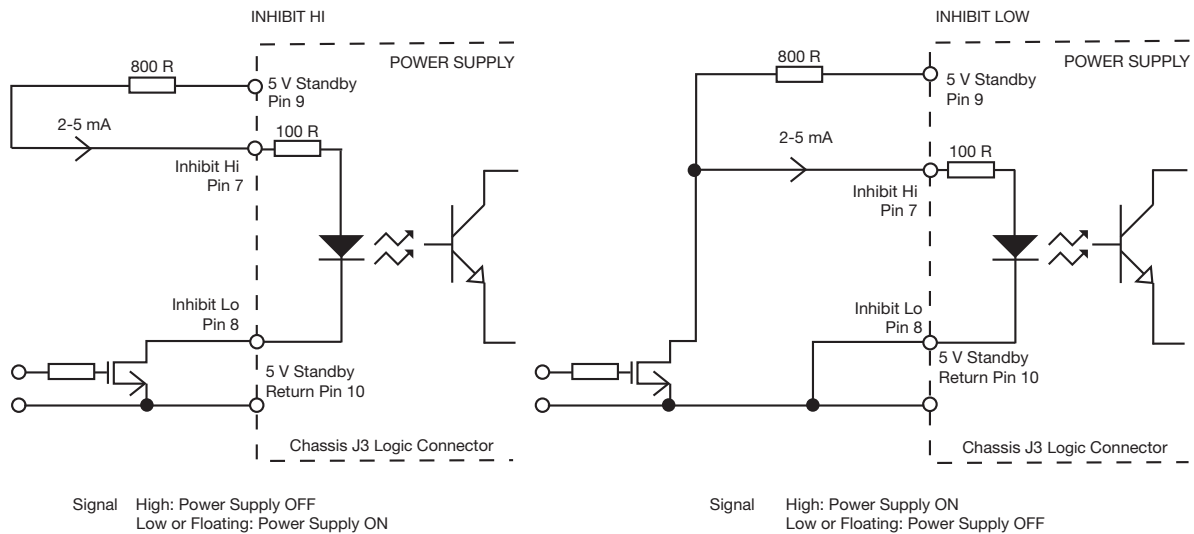
### AC OK/Power Fail

Figure 5



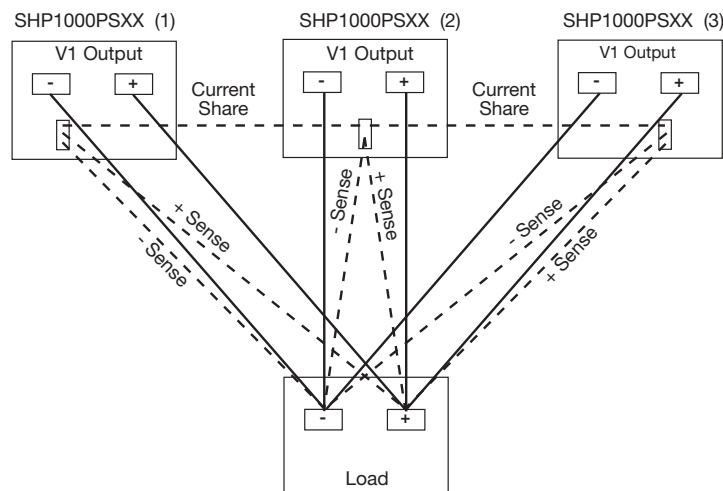
### Remote On/Off (Inhibit)

Figure 6



### Signals - Parallel Load & Current Share Connection Example

Figure 7



## Parallel AC OK Connection

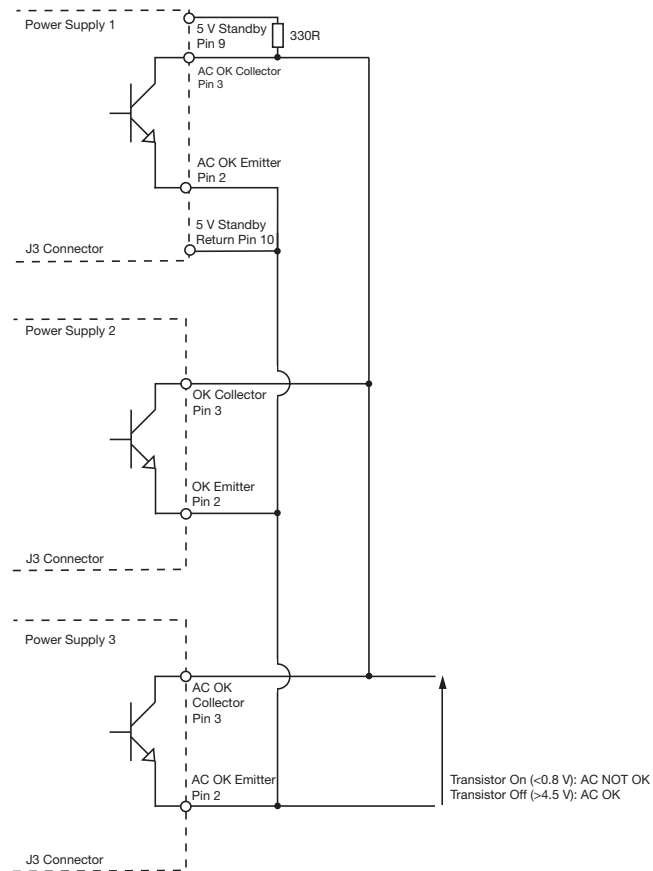


Figure 8

## Parallel Remote Inhibit Connection

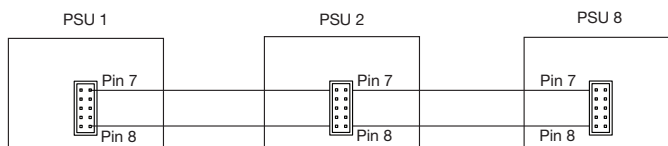


Figure 9

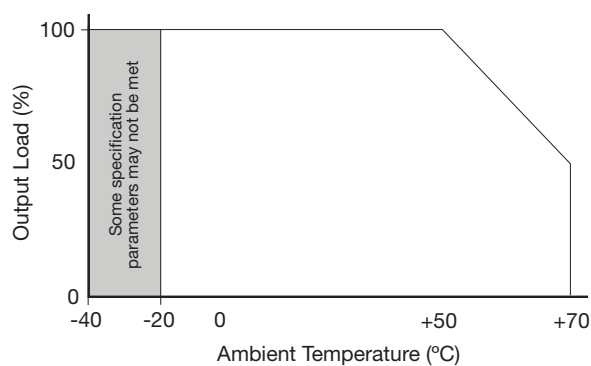
Please see figure 6.

## Environmental

| Characteristic        | Minimum | Typical | Maximum | Units | Notes & Conditions                                                                               |
|-----------------------|---------|---------|---------|-------|--------------------------------------------------------------------------------------------------|
| Operating Temperature | -40     |         | +70     | °C    | See derating curve, fig 10.                                                                      |
| 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                                                         |

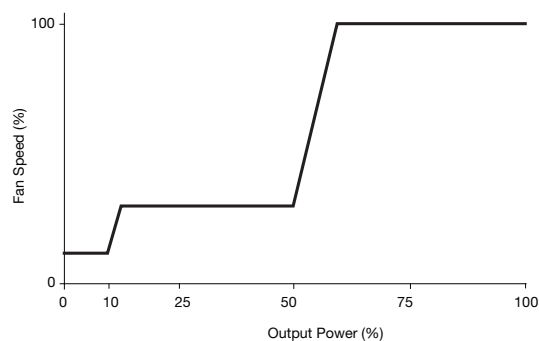
## Temperature Derating Curve

Figure 10



## Fan Speed Control

Figure 11



## Electromagnetic Compatibility - Immunity

| Phenomenon             | Standard     | Test Level           | Criteria | Notes & Conditions |
|------------------------|--------------|----------------------|----------|--------------------|
| Low Voltage PSU EMC    | EN61204-3    | High severity level  | as below |                    |
| 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        |                    |
| Dips and Interruptions | EN61000-4-11 | Dip: 20% 5000 ms     | A        |                    |
|                        |              | Dip: 30% 500 ms      | A        |                    |
|                        |              | Dip: 60% 200 ms      | B        |                    |
|                        |              | Dip: 100% 5000 ms    | B        |                    |
|                        | SEMI F47     |                      |          | Compliant          |

## Electromagnetic Compatibility - Emissions

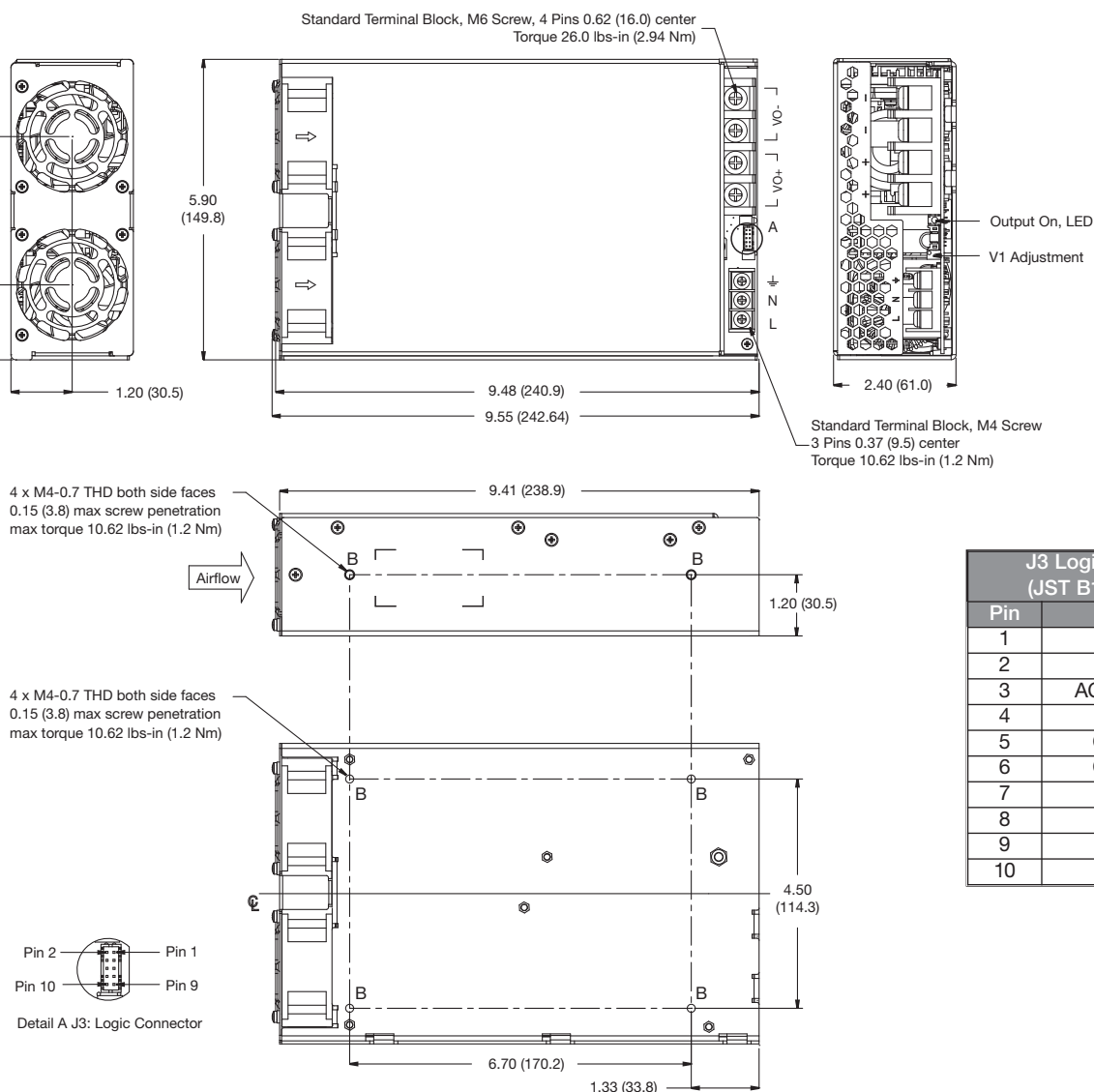
| Phenomenon           | Standard    | Test Level | Criteria | Notes & Conditions |
|----------------------|-------------|------------|----------|--------------------|
| Conducted            | EN55032     | Class B    |          |                    |
| Radiated             | EN55032     | Class A    |          |                    |
| Voltage Fluctuations | EN61000-3-3 |            |          |                    |

## Safety Agency Approvals

| Safety Agency | Safety Standard                           | Category               |
|---------------|-------------------------------------------|------------------------|
| CB Report     | IEC60950-1:2005 Ed 2 / IEC62368-1:2014    | Information Technology |
| UL            | UL 62368-1 & CAN/CSA C22.2 No. 62368-1-14 | Information Technology |
| TUV           | EN62368-1:2014/A11:2017                   | Information Technology |
| CE            | LVD                                       |                        |

| Equipment Protection Class | Safety Standard      | Notes & Conditions                                        |
|----------------------------|----------------------|-----------------------------------------------------------|
| Class I                    | IEC60950-1:2005 Ed 2 | See safety agency conditions of acceptability for details |

## Mechanical Details



| J3 Logic Connector<br>(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     |
| 10                                     | -5 V Standby     |

### Notes:

- Dimensions shown in inches (mm).
- Weight: 2.8 lb (1.25 kg).

- J3 Mating plug: JST part no. PHDR-10VS, contact: 26-22 AWG JST part no. SPHD-001T-P0.5.