

## DESCRIPTION

Unipower's **AGL3000** is a new generation of high density hot-swap Front-Ends for Networking and DataCom applications that utilize the 12V Bus Architecture. With a power density  $>14W/in^3$  and efficiency of 87%, these "GREEN" power solutions help system designers satisfy increasing demands for reduced energy consumption, smaller size and reduced costs.

These 750 Watt Power Modules feature both Analog and PMBus communication for status and control of each power module. Front panel LED indicator and Audible alarm communicates status or fault conditions for easy identification in any environment. N+N Redundant operation is achieved with active load sharing and ORing protection circuits.

## FEATURES

- ◆ Up to 87% Efficiency
- ◆ 1U High: 1.57"
- ◆ 0°C to +50°C Operation
- ◆ Universal AC Input
- ◆  $>0.95$  Power Factor (minimum)
- ◆ Output Voltages: 12 VDC & 5VSB
- ◆ Power Density to  $>14W/in^3$
- ◆ Hot Swappable
- ◆ Integral Active Output ORing Circuit
- ◆ Class B EMI Filter
- ◆ LED Indicators
- ◆ PMBus Serial Communications
- ◆ Variable Speed Cooling Fans

## TWO-YEAR WARRANTY

## INTERNATIONAL STANDARDS

UL/cUL 60950-1, TUV EN 60950-1  
CB IEC 60950-1, WEEE, CE Mark (LVD)



## 12V FRONT END MODULE

| POWER | +12V <sub>OUT</sub> | 5V <sub>SB</sub> | MODEL NO. |
|-------|---------------------|------------------|-----------|
| 750W  | 62                  | 3A               | AGL3000   |

\* Total power May Not Exceed 750 Watts

## 1. Purpose

This specification defines the performance characteristics and functions of a 750 watts 1U form factor of switch mode power module with Active PFC (Power Factor Correction) and PMBus.

## 2. AC Input Requirements

### 2.1 Input Voltage and Frequency

Voltage (sinusoidal): 100~240 VAC full range, with  $\pm 10\%$  tolerance. Input frequency ranges from 47Hz~63Hz

### 2.2 AC Input Current and Inrush Current

AC line inrush current shall not damage any component nor cause the AC line fuse to blow under any DC conditions and with any specified AC line input voltage and frequency. Repetitive On/Off cycling of the AC input voltage shall not damage the power supply.

**Table 1: AC Input Current and Inrush Current**

| Input Voltage | Maximum Input Current | Maximum Inrush Current             | Output Power |
|---------------|-----------------------|------------------------------------|--------------|
| 100~240VAC    | 10~6A                 | 35A peak@115VAC<br>70A peak@240VAC | 750W         |

### 2.3 Input Power Factor Correction (Active PFC)

The power factor at 100% of rated load shall be  $\geq 0.95$  at nominal input voltage and full load.

### 2.4 AC Line Transient Specification

AC line transient conditions are characterized as “sag” and “surge” conditions. Sag conditions (also referred to as “brownout” conditions) will be defined as the AC line voltage dropping below nominal voltage. Surge conditions will be defined as the AC line voltage rising above nominal voltage. The power supply shall meet the regulation requirements under the following AC line sage and surge conditions.

**Table 2: AC Line Sag Transient Performance**

| Duration     | Sag   | Operating AC Voltage    | Line Frequency | Load | Performance Criteria                          |
|--------------|-------|-------------------------|----------------|------|---|
| Continuous   | 10%   | Nominal AC Input ranges | 50/60 Hz       | 100% | No loss of function or performance            |
| 0-1 AC cycle | 100%  | Nominal AC Input ranges | 50/60 Hz       | 70%  | No loss of function or performance            |
| > 1 AC cycle | > 10% | Nominal AC Input ranges | 50/60 Hz       | 100% | Loss of function Acceptable, Self-recoverable |

**Table 3: AC Line Surge Transient Performance**

| Duration       | Surge | Operating AC Voltage            | Line Frequency | Performance Criteria               |
|----------------|-------|---------------------------------|----------------|------------------------------------|
| Continuous     | 10%   | Nominal AC Voltage              | 50/60 Hz       | No loss of function or performance |
| 0 - ½ AC cycle | 30%   | Mid-point of Nominal AC Voltage | 50/60 Hz       | No loss of function or performance |

### 3. DC Output Specification

#### 3.1 Output Power / Currents

*Table 4: Load Range 1 (200V Input)*

| Voltage | Minimum Continuous Load | Maximum Continuous Load |
|---------|-------------------------|-------------------------|
| +12V    | 1A                      | 62A                     |
| +5VSB   | 0A                      | 3A                      |

#### 3.2 Voltage Regulation, Ripple and Noise

*Table 5: Regulation, ripple and noise*

| Output Voltage | +12V  | +5VSB |
|----------------|-------|-------|
| Load Reg.      | ±5%   | ±5%   |
| Line Reg.      | ±1%   | ±1%   |
| Ripple & Noise | 120mV | 60mV  |

Ripple and noise shall be measured using the following methods:

- Measurements made differentially to eliminate common-mode noise
- Ground lead length of oscilloscope probe shall be  $\leq 0.25$  inch.
- Measurements made where the cable connectors attach to the load.
- Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with 0.1uF ceramic capacitors.
- Oscilloscope bandwidth of 0 Hz to 20MHz.
- Measurements measured at locations where remote sense wires are connected.
- Regulation tolerance shall include temperature change, warm up drift and dynamic load

#### 3.3 Capacitive Loading

The power supply shall be stable and meet all requirements in the following table, except dynamic loading requirements.

*Table 6: Capacitive Loading Conditions*

| Output | MIN | MAX    | Units |
|--------|-----|--------|-------|
| +12V   | 10  | 11,000 | uF    |
| +5VSB  | 1   | 350    | uF    |

#### 3.4 Dynamic Loading

The output voltages shall remain within the limits specified in **Table-Regulation, ripple and noise** for the step loading and within the limits specified in **Table-Transient Load Requirement** for the capacitive loading. The load transient repetition rate shall be tested between **50Hz and 5kHz** at duty cycle ranging from 10%-90%. The load transient repetition rate is only a test specification. The  $\Delta$  step load may occur anywhere within the MIN load to the MAX load shown in **Table-Load Range**.

**Table 7: Transient Load Requirements**

| Output | $\Delta$ Step Load Size | Load Slew Rate | Capacitive Load |
|--------|-------------------------|----------------|-----------------|
| +12V   | 50% of Max. Load        | 0.5 A/uS       | 2200 uF         |
| +5VSB  | 30% of Max. Load        | 0.5 A/uS       | 1 uF            |

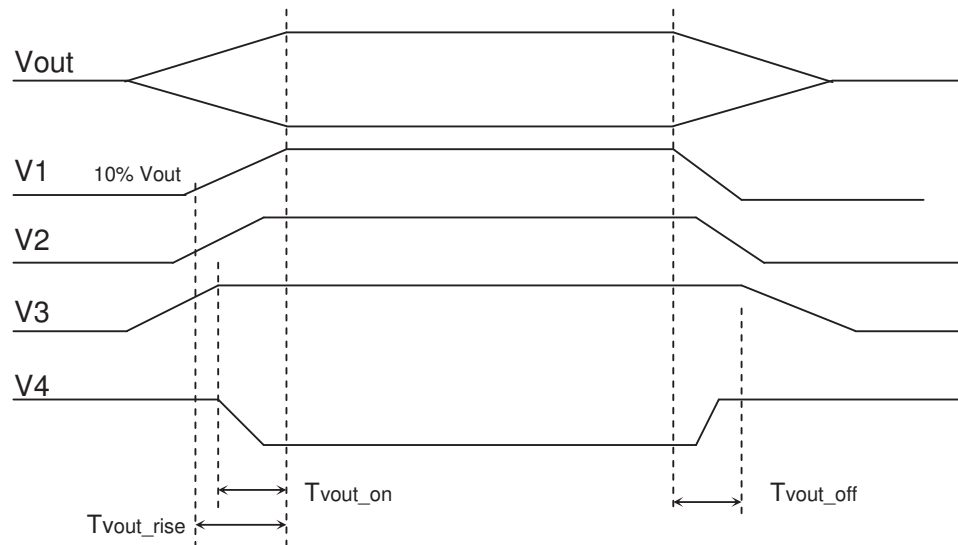
### 3.5 Overshoot at Turn-on/Turn-off

Any output overshoot at turn on shall be less than 10% of the nominal output value. Any overshoot shall recover to be within regulation requirements in less than 10ms.

### 3.6 Timing Requirements

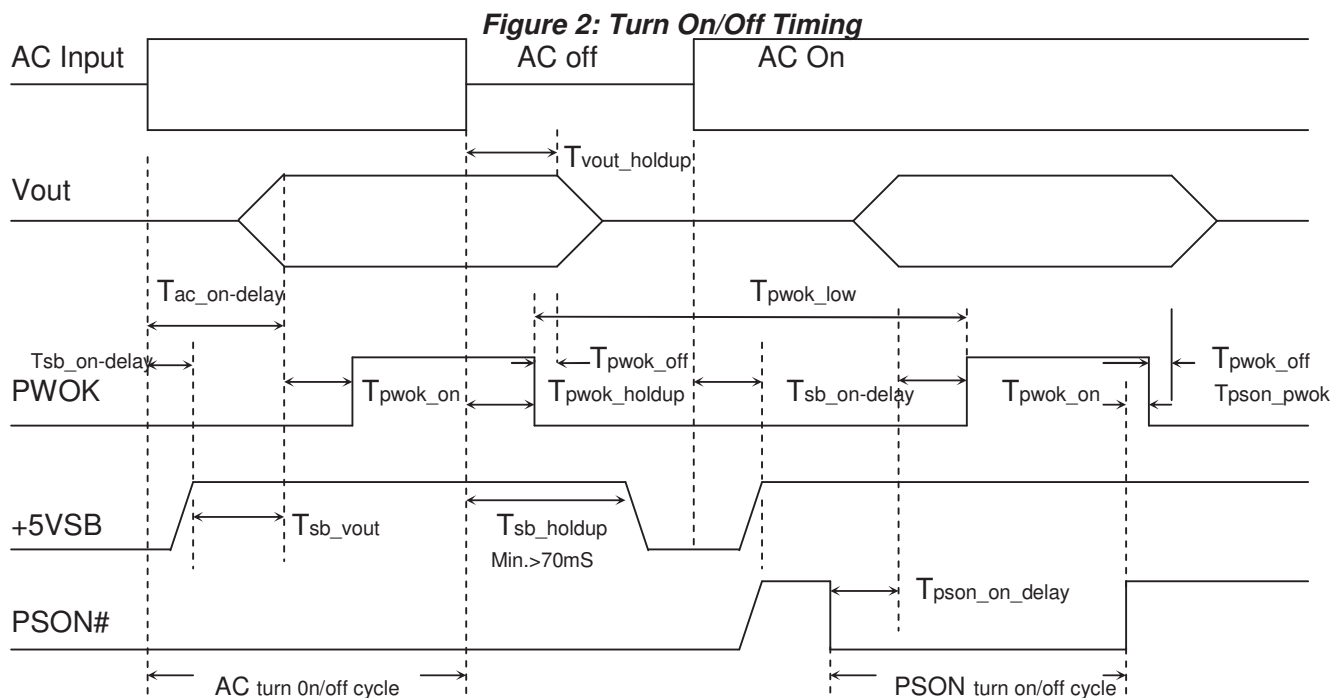
**Table 8: Output Voltage Timing**

| Item       | Description   | MIN | MAX | Units |
|------------|---|-----|-----|-------|
| Tvout_rise | Output voltage rise time from each main output                            | 1   | 20  | mS    |
|            | Output voltage rise time for the 5Vsb out put                             | 1   | 25  | mS    |
| Tvout_on   | All main output must be within regulation of each other within this time. |     | 50  | mS    |
| Tvout_off  | All main output must leave regulation within this time                    |     | 400 | mS    |

**Figure 1: Output Voltage Timing**


**Table 9: Turn On/Off Timing**

| Item           | Description   | MIN | MAX  | Units |
|----------------|---|-----|------|-------|
| Tsb_on-delay   | Delay from AC being applied to +5VSB being within regulation.   |     | 1500 | mS    |
| Tac_on-delay   | Delay from AC being applied to all output voltages being within regulation.                                     |     | 2500 | mS    |
| Tvout_holdup   | Time all output voltage stay within regulation after loss of AC tested at 70% of maximum load.                  | 17  |      | mS    |
| Tpwok_holdup   | Delay from loss of AC deassertion of PWOK tested at 70% of maximum load.  | 16  |      | mS    |
| Tpson_on_delay | Delay from PSON# active to output voltage within regulation limits.   | 5   | 400  | mS    |
| Tpson_pwok     | Delay from PSON# deactive to PWOK being deasserted.   |     | 50   | mS    |
| Tpwok_on       | Delay from output voltage within regulation limits to PWOK asserted at turn on.                                 | 100 | 1000 | mS    |
| Tpwok_off      | Delay from PWOK deasserted to output voltage dropping out of regulation limits measured at 70% of maximum load. | 1   |      | mS    |
| Tpwok_low      | Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .           | 100 |      | mS    |
| Tsb_vout       | Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.                                 | 50  | 1000 | mS    |



### 3.7 Efficiency

The power supply system efficiency is designed to meet 80 plus gold criteria.  
 The power efficiency shall be at least 87% at 230V input, 100% load on ATE test.

## 4. Protection Circuits

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, an AC cycle OFF for 15 sec and a PSON# cycle HIGH for 1 sec must be able to restart the power supply.

### 4.1 Over Current Protection (OCP)

The power supply shall have current limit to prevent the +12V output from exceeding the value shown in **Table-Over Current Protection**. The power supply shall latch off if the current exceeds the limit.

**Table 10: Over Current Protection**

| Voltage | Minimum | Maximum | Shutdown Mode |
|---------|---------|---------|---------------|
| +12V    | 68A     | 100A    | Latch Off     |

### 4.2 Over Voltage Protection (OVP)

The power supply is protected against over voltage due to an internal regulator failure. When an over voltage condition is detected, all DC outputs are disabled (except the +5 VSB). The fault must be removed to restore the DC outputs. The limits are given in Table 11.

**Table 11: Over Voltage Protection**

| Voltage | Minimum | Maximum | Shutdown Mode |
|---------|---------|---------|---------------|
| +12V    | +13.3V  | +14.5V  | Latch Off     |

### 4.3 Short Circuit Protection

The power supply shall shut down in latch off mode when the output voltage is short circuit.

### 4.4 No Load Operation

No damage or hazardous condition should occur with all the DC output connectors disconnected from the load. The power supply may latch into the shutdown state.

### 4.5 Over Temperature Protection (OTP)

The power supply will shut down when an over temperature condition occurs; no damage shall occur.

## 5. Environmental Requirements

### 5.1 Temperature

Operating Ambient, normal mode (inlet air): 0°C ~ 50°C (32°F~ 113°F)  
 Non-operating Ambient:: -40°C ~ 70°C (-40°F~ 158°F)

### 5.2 Humidity

Operating: 20% ~ 90%RH non-condensing  
 Non-Operating: 5% ~ 95%RH non-condensing

### 5.3 Altitude

Operating: Sea level to 10,000 ft

Non Operating: Sea level to 40,000 ft

### 5.4 Mechanical Shock

Non-Operating: 50 G Trapezoidal Wave, 11mS half sin wave. The shock is to be applied in each of the orthogonal axes.

### 5.5 Vibration (Non-Operating)

The power supply shall be subjected to a vibration test consisting of a 10 to 300 Hz sweep at a constant acceleration of 2.0g for duration of one (1) hour for each of the perpendicular axes X, Y and Z (0.1 octave/minute). The output voltages shall remain within specification.

### 5.6 Electromagnetic Compatibility

**Table 12: EMC Requirements**

|                                |  |   |                         |  |
|--------------------------------|--|---|-------------------------|--|
| Electromagnetic Interference   | FCC CFR Title 47<br>Part 15<br>Sub Part B<br>EN55022/EN55024 | Conducted B Class<br>Radiated A Class                                 |                         |  |
| Harmonics                      | IEC61000-3-2 Class D   |   |                         |  |
| Flicker                        | IEC61000-3-3   |   |                         |  |
| ESD Susceptibility             | EN-61000-4-2   | ±8KV by Air, ±4KV by Contact<br>Performance Criteria B                |                         |  |
| Radiated Susceptibility        | EN61000-4-3  | 80MHz~1000MHz<br>(3V/m(mns) Amplitude 80% AM 1KHz<br>Criteria A       |                         |  |
| EFT/Burst                      | EN61000-4-4  | 5KHz, AC: 1KV, DC: 0,5 KV, Performance Criteria B                     |                         |  |
| Surge Voltage                  | EN61000-4-5  | Line-to-Line: 1KV<br>Line-to-Ground: 2KV<br>Performance Criteria B    |                         |  |
| Conducted Susceptibility       | EN61000-4-6  | 0.15MHz~80MHz<br>3V/m Amplitude 80% AM 1KHz<br>Performance Criteria A |                         |  |
| RF Conducted                   | EN61000-4-8  | 50 Hz/3A(ms)/m Performance Criteria A                                 |                         |  |
| Voltage Dips and Interruptions | EN61000-4-11   | 30%(Voltage Dips)<br>60%(Voltage Dips)<br>>95%(Voltage Dips)          | 10 ms<br>100ms<br>500ms | Criteria B<br>Criteria C<br>Criteria C |
| Leakage Current                | EN60950-1  | 3.5mA@240VAC  |                         |  |

## 5.7 Safety Agency Requirements

This power supply is designed to meet the following safety

**Table 13: Product Safety**

|                        |        |            |
|------------------------|--------|------------|
| <b>Product Safety:</b> | UL,cUL | UL60950-1  |
|                        | CB     | IEC60950-1 |
|                        | TUV    | EN60950-1  |
|                        | CCC    |            |

## 6. Reliability

### 6.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load; 120V AC input; Ground Benign; 25°C

## 7. PMBus Command Codes (Standard Version)

### 7.1 Command Summary

| Command Code | Command Name       | SMBus Transaction Type | Number of Data Bytes |
|--------------|--------------------|------------------------|----------------------|
| 19h          | CAPABILITY         | Read Byte              | 1                    |
| 1Ah          | QUERY              | Read Byte              | 1                    |
| 88h          | READ_VIN(Note1)    | READ WORD              | 2                    |
| 89h          | READ_IIN           | READ WORD              | 2                    |
| 8Bh          | READ_VOUT          | READ WORD              | 2                    |
| 8Ch          | READ_IOUT          | READ WORD              | 2                    |
| 8Dh          | READ_TEMPERATURE_1 | READ WORD              | 2                    |
| 90h          | READ_FAN_SPEED_1   | READ WORD              | 2                    |
| 91h          | READ_FAN_SPEED_2   | READ WORD              | 2                    |
| 96h          | READ_POUT          | READ WORD              | 2                    |
| 97h          | READ_PIN           | READ WORD              | 2                    |
| 98h          | PMBUS_REVISION     | READ BYTE              | 1                    |
| 99h          | MFR_ID             | R/W Block              | Variable             |
| 9Ah          | MFR_MODEL          | R/W Block              | Variable             |
| 9Bh          | MFR_REVISION       | R/W Block              | Variable             |
| 9Eh          | MFR_SERIAL         | R/W Block              | Variable             |
| A0h          | MFR_VIN_MIN        | READ_WORD              | 2                    |
| A1h          | MFR_VIN_MAX        | READ_WORD              | 2                    |
| A7h          | MFR_POUT_MAX       | READ_WORD              | 2                    |
| B0h          | USER_DATA_00       | READ BYTE              | 1                    |

Note1: If AC Input= 90V ~ 180V PMBus sent the value of 115V  
 If AC Input= 181V ~ 264V PMBus sent the value of 230V

## 7.2 MFR Meaning

| Command Code | Command Name | Meaning   |
|--------------|--------------|-----------|
| 99h          | MFR_ID       | ETASIS    |
| 9Ah          | MFR_MODEL    | EFRP-G753 |
| 9Bh          | MFR_REVISION | A0 ~ Z9   |
| 9Eh          | MFR_SERIAL   | Code = 12 |
| A0h          | MFR_VIN_MIN  | 100VAC    |
| A1h          | MFR_VIN_MAX  | 240VAC    |
| A7h          | MFR_POUT_MAX | 750W      |

## 7.3 Status BYTE Message Contents

Command code = B0h (Command name = USER\_DATA\_00)

| Bit Number | Status Bit Name | Meaning                    |
|------------|-----------------|----------------------------|
| 7          | Reserved        | Default=0                  |
| 6          | Reserved        | Default=0                  |
| 5          | Reserved        | Default=0                  |
| 4          | Reserved        | Default=0                  |
| 3          | Reserved        | Default=0                  |
| 2          | Module Status   | Inserted=0, Not inserted=1 |
| 1          | PS_ON Status    | PS_OFF=0, PS_ON=1          |
| 0          | AC Status       | AC OK=0, AC Fail=1         |

## 7.4 Device Address Location

|                   |     |     |     |     |
|-------------------|-----|-----|-----|-----|
| PDB address A0/A1 | 0/0 | 0/1 | 1/0 | 1/1 |
| PSU PMBUS Device  | B0h | B2h | B4h | B6h |

## 8. LED Indicators

There will be a LED on each power module to indicate power status

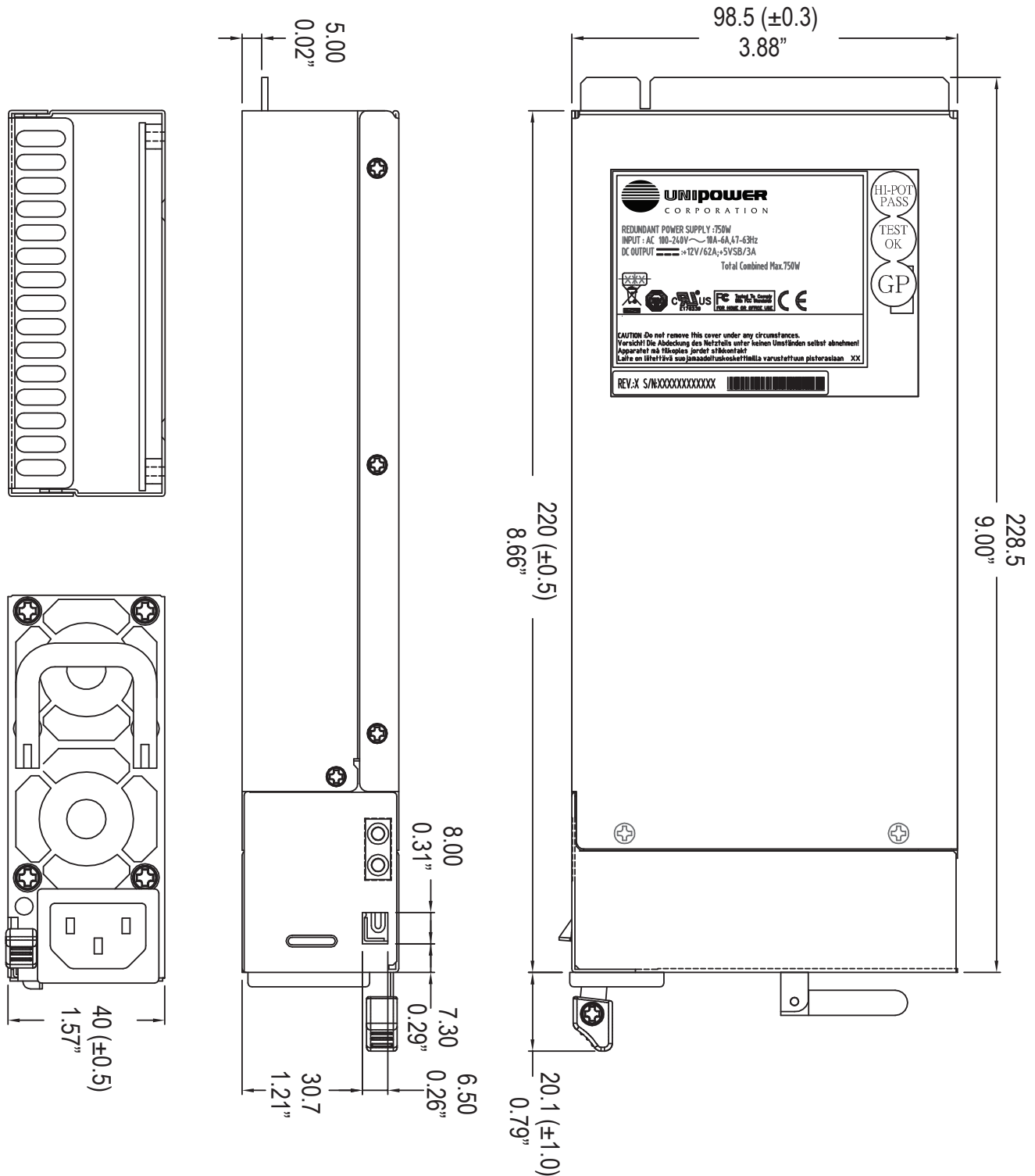
| Power Supply Status         | Color          |
|-----------------------------|----------------|
| Works Normally              | Green          |
| Standby (Only +5VSB output) | Blinking Green |
| Power Fail                  | Red            |
| Fan Fail                    | Blinking Red   |

## 9. Mechanical Overview

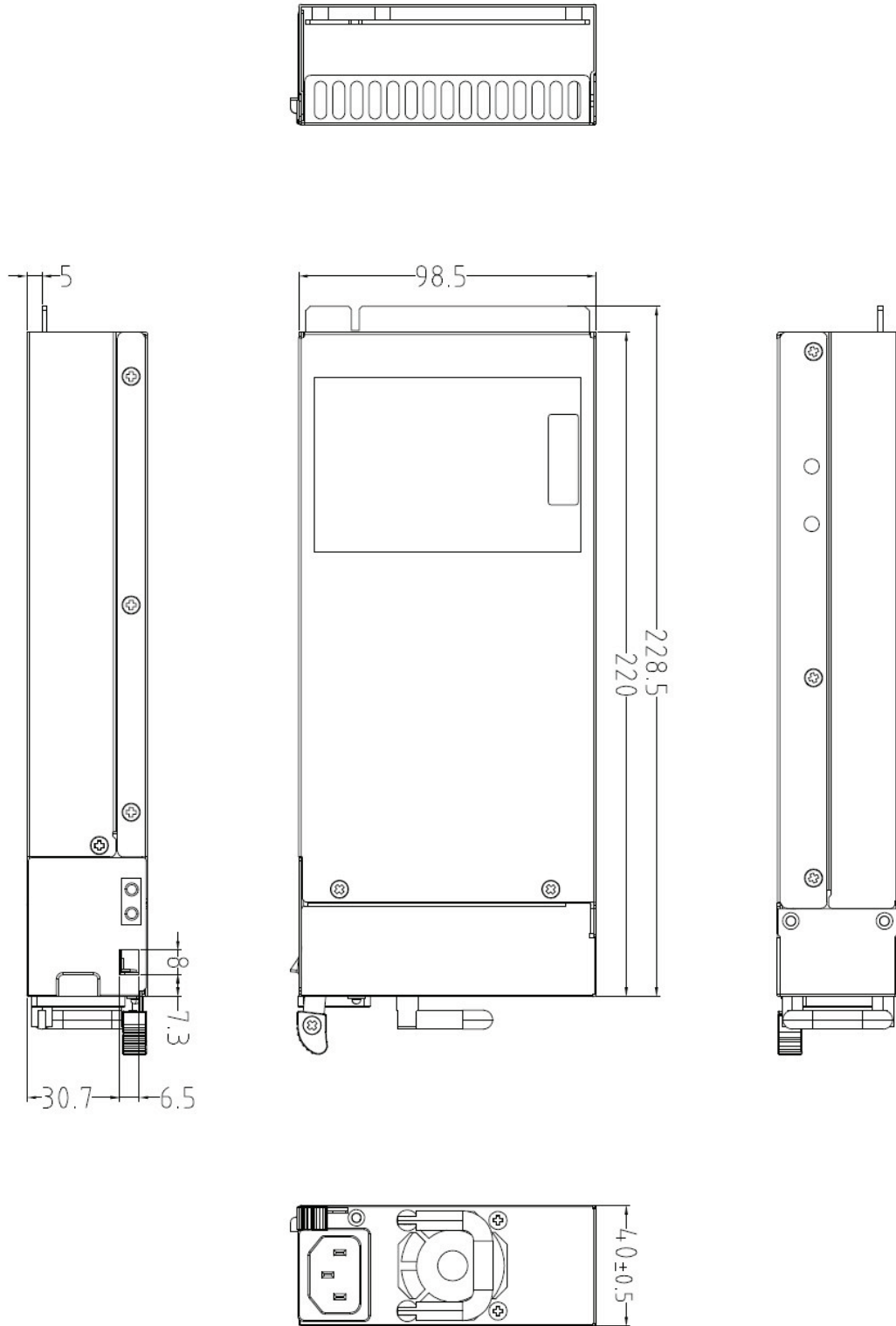
Dimension: 98.5mm(W) x 40mm(H) x 220mm(D)

Weight: 1kg

### 9.1 Mechanical Drawing for Dual Cooling FAN (For 100~240VAC Input)



## 9.2 Mechanical Drawing for Single Cooling FAN (For 200~240VAC Input)



## 10. Pin Assignment

|                |       |             |       |
|----------------|-------|-------------|-------|
| PDB-FAULT      | 36    | PS-KILL     | 72    |
| PGO            | 35    | PSON        | 71    |
| 12VRS+         | 34    | 12VSHR      | 70    |
| A1             | 33    | SCL         | 69    |
| A0             | 32    | SDA         | 68    |
| AC-OK          | 31    | 12VRS-(GND) | 67    |
| PDB-ALERT      | 30    | SMB-ALERT   | 66    |
| Vsense         | 29    | PRESENT     | 65    |
| GND            | 28    | GND         | 64    |
| GND            | 27    | GND         | 63    |
| GND            | 26    | GND         | 62    |
| GND            | 25    | GND         | 61    |
| GND            | 24    | GND         | 60    |
| GND            | 23    | GND         | 59    |
| GND            | 22    | GND         | 58    |
| GND            | 21    | GND         | 57    |
| GND            | 20    | GND         | 56    |
| +12V           | 19    | +12V        | 55    |
| +12V           | 18    | +12V        | 54    |
| +12V           | 17    | +12V        | 53    |
| +12V           | 16    | +12V        | 52    |
| +12V           | 15    | +12V        | 51    |
| +12V           | 14    | +12V        | 50    |
| +12V           | 13    | +12V        | 49    |
| +12V           | 12    | +12V        | 48    |
| +12V           | 11    | +12V        | 47    |
| 5VSB           | 10    | 5VSB        | 46    |
| 5VSB           | 9     | 5VSB        | 45    |
| X              | 8     | X           | 44    |
| X              | 7     | X           | 43    |
| X              | 6     | X           | 42    |
| AC-L           | 5     | AC-L        | 41    |
| AC-L           | 4     | AC-L        | 40    |
| X              | 3     | X           | 39    |
| AC-N           | 2     | AC-N        | 38    |
| AC-N           | 1     | AC-N        | 37    |
| Signal         | Pin # | Signal      | Pin # |
| Component Side |       | Solder Side |       |

| <b>Pin NO.</b> | <b>Pin Name</b> | <b>Function</b>   | <b>Description</b>  |
|----------------|-----------------|---|---|
| 1,2,37,38      | AC-N            | AC input (Neutral)  | For front AC access   |
| 4,5,40,41      | AC-L            | AC input (Line)   | For front AC access   |
| 9,10,45,46     | 5VSB            | +5V standby output  | To system 5VSB bus  |
| 11~18,47~55    | +12V            | +12V output   | To system 12V bus   |
| 20~28,56~64    | GND             | Ground  | GND   |
| 29             | Vsense          | +5VSB negative return   | To system GND   |
| 30             | PDB-ALERT       | To receive alert signal from system backplane, if the pin is pulled LOW, FAN will be forced to run at full speed.   | It can be floating or controlled by system.                         |
| 31             | AC-OK           | The pin will be pulled HIGH if 5VSB is ready  | It can be floating  |
| 32             | A0              | I2C address (LSB)   | B0 = 0/0 ; B2 = 1/0 ; B4 = 0/1 ; B6 = 1/1                           |
| 33             | A1              | I2C address (MSB)   |   |
| 34             | 12VRS+          | +12V Remote sense   | To system 12V bus   |
| 35             | PGO             | POWER GOOD signal will be pulled HIGH to indicate all output voltage rails are within the regulation limits         | To system power good  |
| 36             | PDB-FAULT       | To receive alert signal from system backplane, if the pin is pulled HIGH, power supply will be forced to shut down. | It can be floating  |
| 65             | Present         | The pin is grounded with a 47R resistor for system detection  | To system to detect if power module is inserted.                    |
| 66             | SMB-ALERT       | The pin is pulled HIGH if power is working, while pulled LOW means power fail                                       | To system to detect if power module is ok or failed.                |
| 67             | 12VRS-          | +12V negative return  | To system GND   |
| 68             | SDA             | I2C DATA  | To system I <sup>2</sup> C bus                                      |
| 69             | SCL             | I2C CLOCK   | To system I <sup>2</sup> C bus                                      |
| 70             | 12SHR           | 12V current share   | Connect this pin with each other among modules via system backplane |
| 71             | PSON            | Module PSON   | Pulled LOW by system to enable power outputs                        |
| 72             | PS_KILL         | Moudle PS_KILL  | For Hot-plug use, grounded at system backplane                      |