

**OPEN**

Compute Project

**Open CloudServer  
OCS Chassis Power Supply  
2.0**

**Author:**

**Shaun Harris**, Director of Mechanical and Power Engineering, Microsoft

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# 1 Summary

This specification, *Open CloudServer Chassis Power Supply Version 2.0*, describes the power supply family requirements for the Windows Cloud Server system. The mechanical interface and electrical interface is identical between power supply options to enable a common slot, universal, modular foundation power supply system to enable the Microsoft Windows Cloud Server systems. The product family encompasses a power supply output power with the option of adding Local Energy Storage (LES) to the parameters offered in the specification:

- Single Phase 1600W 12VDC Power Supply (Version 1)
- Single Phase 1600W 12VDC Power Supply with Local Energy Storage (LES) (Version 2)

The power supply is to be used in a high line only, single phase input, redundant power system design with N=5, N+1=6 configuration. The power supply shall be hot pluggable.

**Note:** Unless otherwise specified, all requirements in this specification shall be met for version 1 and 2 listed above. Where power supplies differ, individual requirements will be listed.

## 2 Reference Documents

This section lists the applicable reference documents and defines the order of preference.

### 2.1 Applicable Documents

Table 1 lists the documents that form a part of this specification to the extent specified herein.

**Table 1: Applicable Documents**

Reference	Description
ANSI C63.4 – 2009	“American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.” American National Standards Institute (ANSI), 2009.
Australian Communications & Media Authority	Electromagnetic Compatibility Framework – Information for Suppliers – Residential, Commercial and Light Industry”(and amendments), July 1995, URL: <a href="http://www.acma.gov.au">http://www.acma.gov.au</a>
C.I.S.P.R. Pub. 22	“Limits and methods of measurement of radio interference characteristics of information technology equipment.” International Special Committee on Radio Interference (C.I.S.P.R.), Fifth Edition, 2005+A1.

Reference	Description
CCC EMC	“Regulations for Compulsory Product Certification,” China Certification Center, URL: <a href="http://www.cemc.org.cn">http://www.cemc.org.cn</a> .
CFR 47, Part 15	“Unintentional Radiators”. Title 47 of the Code of Federal Regulations, Part 15, FCC Rules, Radio Frequency Devices, Subpart B.
CNS14336-1: 2010	“Information technology equipment – Safety – General requirements”, Bureau of Standard, Metrology and Inspection
CNS13438 (2006)	“Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment”, Bureau of Standard, Metrology and Inspection
EN 55022	“Limits and methods of measurement of radio interference characteristics of information technology equipment.” European Committee for Electro technical Standardization (CENELEC), 2006+A1.
EN 55024	“Information technology equipment – Immunity characteristics – Limits and Methods of measurement.” European Committee for Electro technical Standardization (CENELEC) 1998
EN 60320-1	“Appliance Couplers for Household and Similar General Purposes – Part: General Requirements” European Committee for Electro technical Standardization (CENELEC).
EN 60950-1:2005 A1: 2010	“Safety of Information Technology Equipment – Safety – Part 1: General requirements”, Second Edition, International Electrotechnical Commission, 2005, including A1:2010
EN 60950-1:2006 A11: 2008 A1: 2009	“Safety of Information Technology Equipment – Safety – Part 1: General requirements”, Second Edition, European Committee for Electrotechnical Standardization (CENELEC), 2006, including A11: 2008 and A1: 2010
EN 61000-3-2:2006	“Electromagnetic Compatibility (EMC) Part 3-2 Limits – Limits for Harmonics Current Emissions (Equipment input current $\leq 16A$ per phase).” International Electrotechnical Commission, 2006.
EN61000-3-3	“Electromagnetic compatibility (EMC) – Part 3-3 Limits – Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current $\leq 16 A$ ” European Committee for Electrotechnical Standardization (CENELEC), 2008
GB4943-2001	“Safety of Information technology equipment”, Standardization Administration of China
IEC 60950-1: 2005 A1: 2010	“Safety of Information Technology Equipment – Safety – Part 1: General requirements”, Second Edition, International Electrotechnical Commission, 2005 including A1:2010
IEC 61000-4 Sections 2 – 6, 11	“Electromagnetic Compatibility (EMC) – Part 4: Testing and measurement techniques.” International Electro technical Commission (IEC).

Reference	Description
IPC-A-610	“Specification, Acceptability of Electronic Assemblies.”
MIL HDBK 217F	“Reliability Prediction of Electronic Equipment.” U.S. Military Standard.
Taiwan EMC Law	“Commodity EMC Regulation” (Taiwan EMC Law), Bureau of Standards, Metrology, and Inspection under auspices of the Ministry of Economic Affairs, <a href="http://www.bsmi.gov.tw">URL:http://www.bsmi.gov.tw</a> .
UL 60950-1 CSA C22.2 No. 60950-1-07	“Safety of Information Technology Equipment including Electrical Business Equipment, First Edition.” Underwriters Laboratories, Inc., 2007, Canadian Standards Association, 2007.
CSA C22.2 No.107.3- 05,2nded UL 1778, 4th ed	“Uninterruptible Power Systems.”, Underwriters Laboratories, Inc., 2005, Canadian Standards Association, 2005.
UL 60950-1 CSA C22.2 No. 60950-1	"Safety of Information Technology Equipment including Electrical Business Equipment, Second Edition." Underwriters Laboratories, Inc., 2007, Canadian Standards Association, 2007.
CAN/CSA - C22.2 NO. 107.1-01	“General Use Power Supplies Industrial Products, First Edition.” Canadian Standards Association, 2001.
CAN/CSA - C22.2 NO. 107.3-05	“Uninterruptible Power System” (Bi-National standard, with UL 1778), Canadian Standards Association, 2005.

## 2.2 Order of Preference

In the event of a conflict between this specification and references cited herein, this specification shall take precedence.

## 3 Electrical Specification

This section details the electrical specification.

### 3.1 AC Input

This section describes the AC input.

#### 3.1.1 Voltage, Current, and Frequency

The power supply shall operate within all specified limits over the following input voltage range as defined in Table 2.

Table 2: AC Input Rating

Parameter	Min	Rated	Max	1600WPSU max input current at min $V_{rms}$
Voltage (240)	180 $V_{rms}$	200-240 $V_{rms}$	264 $V_{rms}$	11.0A $_{rms}$
Frequency	47 Hz		63 Hz	

### 3.1.2 Hold-Up Time

This section defines the hold-up time for version 1 and version 2.

#### 3.1.2.1 Version 1

The power supply shall maintain output voltage at 100% rated load for 20ms after an AC Line drop. An AC Line dropout is defined as input voltage drooping below minimum voltage thresholds as defined in table 1 down to 0VAC for an indefinite amount of time. An AC Line dropout shall not cause an AC line breaker to open. For line drops of less than 20ms the power supply shall operate normally. For line drops greater than 20ms the power supply may shutdown and then shall recover and turn on normally consistent with turn on requirements specified in this document.

#### 3.1.2.2 Version 2

The power supply and LES shall maintain output voltage at 100% rated load for 35 seconds and a no less than 10 second walk in period after an AC Line drop. An AC Line dropout is defined as the input voltage dropping below the minimum voltage thresholds as defined in Table 1 down to 0VAC for a time less than 40 seconds.

For dropouts greater than 35 seconds, if battery capacity is available, the power supply shall continue to operate up to 40 seconds. If AC is returned in this time period, no walk is required. At the 40 second mark, if power has not returned the power supply shall latch off.

An AC Line dropout shall not cause input current to exceed 120% of maximum rated steady state input current. For line drops of 0.00 seconds to 40 seconds, the power supply shall operate normally. For line drops greater than 40 seconds, the power supply shall shutdown and if so shall recover and turn on normally consistent with turn on requirements specified in this document.

This requirement applies to 6 power supplies in parallel (refer to [section 4.3.15](#) for details).

### 3.1.3 AC Turn On Requirement

This section describes the AC turn on requirement for version 1 and version 2 with batteries disabled.

The power supply shall return to normal power up state after a slow recovery condition. The recovery shall be tested in all valid redundant power system configurations. With the test loads configured for 1600W system DC output in resistive mode, the AC line voltage shall be increased from 0VAC to 180VAC/60Hz at a constant rate over 30 minutes. When VAC input is within proper range the PSU shall turn on and assume full load consistent with the soft start requirements. Additional turn on requirements for Version 2 are listed in the LES portion of this specification.

**Note:** Maximum total load for 1-6 power supplies in parallel is 1600W.

### 3.1.4 AC Turn Off Brownout Requirement

This section describes the AC turn off brownout requirement for version 1 and version 2 with batteries disabled.

The power supply shall return to normal power up state after a slow brownout condition. The brownout condition shall be tested with all valid redundant power system configurations using the end use system/s. While the power system is operating at full rated DC load, the AC line voltage shall be reduced from 180VAC/60Hz to 0VAC at a constant rate over a period of 30 minutes. The power shall be then reapplied at 180VAC/60Hz.

When VAC input is within proper range the PSU shall turn on and assume full load consistent with the soft start requirements. This requirement applies to single power supplies only.

### 3.1.5 AC Line Fuse

The AC Line Fuse shall be acceptable for all safety agency requirements. The fuse shall be fast blow type. The fuse shall not blow unless component failure is encountered. The fuse shall not blow under all line and load conditions.

The AC Line Fuse shall be rated at 12.5A and shall be part number (or Microsoft approved equivalent):

CONQUER ELECTRONICS  
HOLLYLAND

UBM-A 12.5  
50CF(P)-125H

### 3.1.6 AC Inlet Connector

The power supply shall contain IEC C14 connector.

### 3.1.7 Input Leakage Current

Maximum input leakage for a single power supply shall be less than 2.0mA at 240VAC.

The typical deployment shall be N+1=6 PSU in parallel per WCS chassis with two WCS per power cord for a total of 12 PSU per power cord.

### 3.1.8 Input Power Rating

The power supply shall be rated for 1900W input power at 200VAC input.

### 3.1.9 Inrush Current

AC line inrush current shall not exceed 40A peak at all line and load conditions for maximum of 5 msec. after application of AC input. Measurement shall be taken 0.1ms after application of AC input. The inrush current shall not exceed the 50% I<sub>2t</sub> derating of any component in series with the inrush current.

The power supply shall meet the inrush requirements for any rated AC voltage, during turn on at any phase of AC voltage, during hot plug, during any AC dropout condition, over the specified temperature

range (Top), and during AC power cycling. The AC power cycling test condition is defined as cycling the AC power off and back on after the power supply has been operating at maximum load and has reached thermal stability.

Version 1: The period between the AC power cycles could be anywhere between 20 ms to 10 seconds. During a line drop out situation the peak inrush current may be violated but no damage or reliability reduction may occur to any components the power supply.

### 3.1.10 Power Factor

The power factor shall be equal to or greater than 0.98 when measured at 240VAC, 47Hz to 63 Hz input. Measurement shall be performed with maximum output load and with source impedance of less than 0.1  $\Omega$ . It is expected that power factor shall be greater than 0.98 at line voltages less than 240VAC at maximum output load condition.

### 3.1.11 Harmonic Susceptibility

Harmonic distortion of up to 10% THD must not cause the power supply to go out of specified limits. The power supply shall be capable of start-up (power-on) with full rated power load, at line input as low as 180VAC.

The power supply internal circuitry shall limit maximum input current to 150% max rated at all input and operating ambient conditions and output fault conditions.

### 3.1.12 Modified Sine Waves

The power supply shall operate when the AC input is a variant of a sine wave such as from a UPS. The output shall remain within regulation under all load conditions under modified sine wave. Under conditions below the power supply may disable the output:

- Rise time on the input exceeding 2V/us
- Input voltage zero crossing lasting greater than 4 ms.
- Peak of the modified sine wave voltages consistently exceeding 375V

Under modified sine wave conditions the power supply does not need to meet conducted EMI limits and harmonics.

### 3.1.13 Harmonic Emissions

The power supply shall incorporate universal input with active power factor correction, which shall reduce line harmonics in accordance with IEC EN61000-3-2 and JEIDA MITI standards. It is desired that the power supply also meet the THD requirements across the input voltage range shown in Table 3 below.

**Table 3: THD Requirements**

Output load (% of max output load)	Maximum ITHD (%)
5-20	20
20-30	10
30-100	5

\*\* The Harmonic Content shall be tested at both the single 1xPSU, 5xPSU, 6xPSU, 11xPSU and 12xPSU configurations. The typical deployment shall be N+1=6 PSU in parallel per WCS chassis with two WCS per power cord for a total of 12 PSU per power cord.

### 3.1.14 Line Transient

The power supply shall operate within specifications under the following conditions:

- Transients as defined in IEC 61000-4-4.
- Transients as defined in IEC 61000-4-5.  
(Up to and including  $\pm 2$  kV limits and phases  $0^\circ$ ,  $90^\circ$ ,  $180^\circ$ , and  $270^\circ$ .)

### 3.1.15 Electrostatic Discharge Susceptibility

The power supply shall withstand the following ESD conditions at any point on the power supply enclosure.

- $\pm 15$  kV air discharge with no abnormal operation or damage to power supply
- Transients as defined in IEC 801-2

The storage capacitance shall be 150 pF and the discharge resistance shall be 330 ohms. The power supply shall meet all discharge requirements for the CE Mark designation.

### 3.1.16 Fast Transient Burst

The power supply shall comply with the limits defined in EN55024: 1998/A1: 2001/A2: 2003 using the IEC 61000-4-4: Second edition: 2004-07 test standard and performance criteria B defined in Annex B of CISPR 24.

### 3.1.17 Radiated Immunity

The power supply shall comply with the limits defined in EN55024: 1998/A1: 2001/A2: 2003 using the IEC 61000-4-3: Edition 2.1: 2002-09 test standard and performance criteria A defined in Annex B of CISPR 24.

### 3.1.18 Surge Immunity

The power supply shall be tested with the system for immunity to AC Unidirectional wave; 2kV line to ground and 1kV line to line, per EN 55024: 1998/A1: 2001/A2: 2003, EN 61000-4-5: Edition 1.1:2001-04. The pass criteria include: No unsafe operation is allowed under any condition; all power supply output voltage levels to stay within proper spec levels; No change in operating state or loss of data during and after the test.

### 3.1.19 Efficiency

The power supply shall meet the efficiency requirements given in Table 4.

\*\* Efficiency is important and cost effective efficiency improvements shall be evaluated before the power supply design is finalized. The typical load range will be 50%- 80% PSU loading and 95% under system fault conditions. Special consideration will be given for efficiency improvements in this area of operation. Fan can be powered externally for efficiency test.

Table 4: Efficiency

Input voltage (VAC RMS)	Output load (A)	Minimum efficiency (%)
200	26	92
200	65	92.5
200	131	91
208	26	92
208	65	92.5
208	131	91
230	26	92
230	65	94
230	131	92.5
240	26	92
240	65	94
240	131	92.5

## 3.2 Battery Backup Operation

This section describes the battery backup operation. Figure 1 shows a basic block diagram of the battery backup supply.

Following are the battery backup requirements.

1. The LES shall provide sufficient ride through capacity to maintain proper PSU output for 35 seconds (+/- 500ms) minimum plus walk-in period of no less than 10 seconds (+/- 500ms). The power supply shall meet the reliability and operating life with drop outs at a maximum power of 1600W for 5 seconds then reducing to 1425W for the remainder of the drop out. The power supply shall be capable of operating at greater than 1425W to 1600W continuous drop out but reliability and operating life of the battery are not guaranteed.



The power supply shall switch to battery power upon loss of input AC or PH\_LOSS signal going low.

- a. Walk-in is defined as the action or reloading the AC line incrementally after operating on battery power.
    - i. Walk-in shall occur after being on battery power for more than 500ms up to 35 seconds.
    - ii. The walk-in ramp shall not present input power steps greater than 200W per second on the AC line over the specified walk-in period. The walk-in period shall not be less than 10 seconds. The Walk-in functionality shall be present from LES to line cord transition over the life of the deployment.
  - b. Upon loss of AC or PH\_LOSS going low, the power supply shall switch to internal battery power until AC returns or PH\_LOSS goes high up to 40 seconds. After 35 seconds the power supply is not required to perform a walk in. If AC has not returned by the 40 second mark, the power supply shall latch off.
  - c. PH\_LOSS special condition. If PH\_LOSS is still low after 40 seconds and valid AC is present, the power supply shall return to AC power. The power supply shall ignore PH\_LOSS until PH\_LOSS goes Hi again at which point the power supply shall behave normally. If AC is lost while PH\_LOSS is low the power supply shall go to battery as described in paragraph 5.1.1.1.
2. Partial discharge duty cycle shall be 4 discharges per year at a 5 second discharge with a walk-in period of no less than 10 seconds from LES to line cord transition.
  3. Full discharge duty cycle shall be 1 discharge per 2 years at a 35 second discharge with a walk-in period of no less than 10 seconds from LES to line cord transition.
  4. The LES shall be capable of withstanding multiple outages lasting 35 seconds plus a walk-in period of no less than 10 seconds. The worst case AC fault with minimum recharge period is 4consecutive outages with 60 minute recharge between outages. Figure 1 shows the timing diagram.

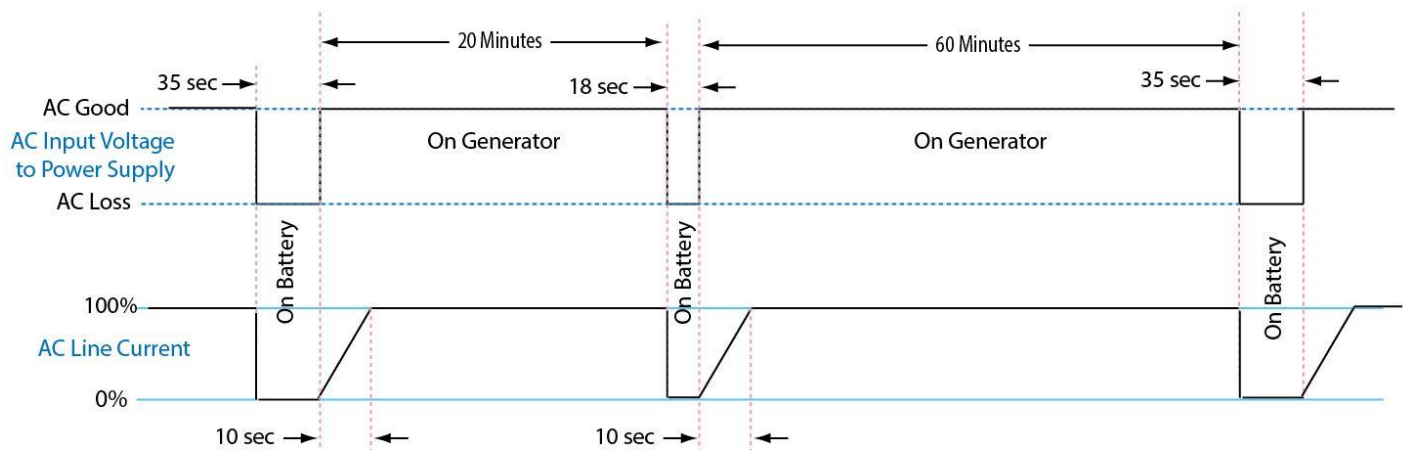


Figure 1: Timing diagram

5. The power supply shall be capable of, when given the command via PMBUS, to go to battery power for one to three seconds then return to AC power. This is to check for weak or bad cells within the battery pack. See firmware section 9 for specific command description and register location.
6. Extended Battery Operation. The power supply shall be capable of running off of battery when set to extended battery operation. When set to extended battery operation, the power supply shall look at output power at 37 +/- 1 seconds after AC loss and if output power is less than 75W, the power supply shall continue to run off of battery for 200 seconds. If power increases above 100W output during that time the 12V output shall be disabled within 1 second. If AC returns during the extended battery operation the power supply shall return to AC mains with no walk in required.

### 3.3 DC Outputs, Signal Outputs, and Control Outputs

This section describes the DC outputs.

#### 3.3.1 Output Power and Current

Across the nominal input voltage range, the PSU output power shall be as specified in Table 5. The power supply shall meet static and dynamic voltage regulations requirements across the load range.

Table 5: Output Power and Current

Power supply unit	Output	Min	Max	Unit
1600W base and LES	12.25VDC	0.1	131	A

#### 3.3.2 Output ORing

For fault tolerance, the power supply shall contain output ORing functionality.

#### 3.3.3 Standby Output

The power shall not provide a standby output.

#### 3.3.4 Setpoint

The voltage setpoint shall be as specified in Table 6.

Table 6: Setpoints

Parameter	Min	Set point nominal	Max	Units	Current (A)
+12V	12.20	12.25	12.30	Vrms	60

### 3.3.5 Static Voltage Regulation

The output voltage regulation output must stay within the following voltage limits when operating at all load and input line voltages across the ambient temperature limits under steady state conditions.

Table 7: Static Voltage

Parameter	Min	Set point nominal	Max	Units
+12V	12.00	12.25	12.50	Vrms

### 3.3.6 Ripple and Noise

The maximum allowed ripple/noise output of the power supply is defined in 120mVp-p. This is measured over a bandwidth of 10Hz to 20MHz at the power supply output connectors. A 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitor is placed at the point of measurement.

### 3.3.7 Dynamic Load Step

The output voltages shall remain within Dynamic voltage limits specified for the step loading and capacitive loading specified below. The load transient repetition rate shall be tested between 50Hz and 5kHz at duty cycles 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 conditions. Dynamic voltage limits are 11.64VDC-12.86VDC.

Table 8: Dynamic Load Step

Output	Delta step load	Transient load rate	Capacitance test load
+12V	60% of maximum rated load 1%-61% and 40% to 100%	0.25A/usec	3500uF +/-5%

### 3.3.8 Capacitive Loading

The power supply shall be stable and meet all requirements with the following capacitive loading ranges.

Table 9: Capacitive Loading

Output	Min	Max	Units
+12V	200	22000	uF

### 3.3.9 Closed Loop Stability

The power supply shall be unconditionally stable under all line/load/transient load conditions including capacitive load ranges specified in Section 4.6. A minimum of: 45 degrees phase margin and -10dB-gain margin is required. The power supply manufacturer shall provide proof of the unit's closed-loop stability with local sensing through the submission of Bode plots. Closed-loop stability must be ensured at the maximum and minimum loads as applicable.

### **3.3.10 Grounding**

The output ground of the pins of the power supply provides the output power return path. The output connector ground pins shall be connected to the safety ground (power supply enclosure). This grounding should be well designed to ensure passing the max allowed Common Mode Noise levels.

The power supply shall be provided with a reliable protective earth ground. All secondary circuits shall be connected to protective earth ground. Resistance from the input receptacle to chassis shall not exceed 100 mΩs. This shall be tested 100%.

### **3.3.11 Common Mode Noise**

The Common Mode noise on any output shall not exceed 350mV pk-pk over the frequency band of 10Hz to 20MHz. The measurement shall be made across a 100Ω resistor between each of DC outputs, including ground at the DC power connector and chassis ground (power subsystem enclosure).

### **3.3.12 Soft Start**

The Power Supply shall contain control circuit which provides monotonic soft start for its outputs without overstress of the AC line or any power supply components at any specified AC line or load conditions.

### **3.3.13 Zero Load Stability**

When the power subsystem operates in a no load condition, it does not need to meet the output regulation specification, but it must operate without any tripping of over-voltage or other fault circuitry. When the power subsystem is subsequently loaded, it must begin to regulate and source current without fault. Continuous operation at no load shall not damage or reduce reliability of the power supply.

### **3.3.14 Hot Swap Requirements**

Hot swapping a power supply is the process of inserting and extracting a power supply from an operating power system. During this process the output voltages shall remain within the limits with the capacitive load specified. The hot swap test must be conducted when the system is operating under static, dynamic, and zero loading conditions. The power supply shall use a latching mechanism to prevent insertion and extraction of the power supply when the AC power cord is inserted into the power supply.

### **3.3.15 Forced Load Sharing**

The +12V output will have active load sharing. The output will share within 5% from 35% load to 75% load and 3% from 75% to 100% full load in a configuration of 4, 5 and 6 power supplies in parallel. Below 35% load the power supplies shall share within 5.0 amps output current of each other. The failure of a power supply should not affect the load sharing or output voltages of the other supplies still operating. The supplies must be able to load share in parallel and operate in a hot-swap / redundant 1+1 configurations.

## 4 PSU System Interconnect

This section describes the PSU system interconnect.

### 4.1 Remote On/Off

The PSU shall be ON when PS\_ON is pulled low below 0.8VDC at 1mA or less source current. The PSU shall be powered off when driven to 2.06VDC or higher.

Table 10: Power On/Off

Signal name	Input/output to PSU	Open collector	3V3 logic	Signal pull up resistor value	Logic low max (V)	Logic high min (V)	Sink/source current max	Rise time max (nsec)	Fall time max (nsec)	Cmax external to PSU	Peak noise (mVpk-pk)
PS_On	In	NO	YES	NA	0.8	2.06	N/A	100	100	no	250

### 4.2 Power Good Signal

The POK signal shall be high when the PSU is operating normally. The POK shall be low when the PSU cannot maintain current for specified proper voltage regulation. POK can be a combination of voltage inside the or'ing diode/FET or detection of loss of switching or other fault indicating that the power supply cannot provide proper output voltage and current. The open collector/drain signal shall be capable of driving the output below 0.4V with a 10mA source current. The POK signal shall go low within 1.5ms of output voltage dropping to 11.6V or below. POK will go HI within 200ms of the 12V output being in regulation.

Table 11: Power Good

Signal name	Input/output to PSU	Open collector	3V3 logic	Signal pull up resistor value	Logic low max (V)	Sink/source current max (mA)	Rise time max (usec)	Fall time max (usec)	Peak noise (mVpk-pk)
POK	Out	YES	YES	1k +/- 5%	0.4	10	200	100	<400

### 4.3 Fan Speed Control

The PSU shall adjust internal fan speed based upon internal temperature sensor(s). The PSU shall adjust fan speed to maintain component temperatures internal to the power supply below derated temperature limits. The fan speed algorithm shall attempt to use as little fan power as possible to keep components within derated limits. The power supply should latch off in the event of a blocked rotor or failed fan.

## 4.4 VIN\_Good Signal

The VIN\_Good Signal shall go low when VAC input falls outside the specified operation range. The signal must have hysteresis to prevent oscillations during AC noise or hash. The output shall be open collector/drain and be capable of driving the output below 0.4V with a load of 4mA. The output shall have an internal input pull up resistor of 1kohm between 3.3VDC.

Table 12: VIN\_Good Signal

Signal name	Input/output to PSU	Open collector	3V3 logic	Signal pull up resistor value	Logic low max (V)	Logic high min (V)	Sink/source current max (mA)	Rise time max (usec)	Fall time max (usec)	Cmax external to PSU (pF)	Peak noise (mVpk-pk)
Vin_Good	Out	YES	YES	1k +/- 5%	0.4		4	2.5	2.5	330	<400

## 4.5 I-Share

I-Share is a common bus used for active current sharing of the power supplies. Refer to section 4.3.15 for sharing requirements.

The Ishare voltage shall be 0V at no load and rise linearly to 7V at full load output. The accuracy shall be tight enough to meet the sharing requirements of [paragraph 4.3.15](#)

## 4.6 I2C/PMBus

Table 13: I2C/PMBus

Signal name	Input/output to PSU	Open collector	3V3 logic	Signal pull up resistor value	Logic low max (V)	Logic high min (V)	Sink/source current max (mA)	Rise time max (usec)	Fall time max (nsec)	Cmax external to PSU (pF)
SDA	I/O	NO	YES	6.81K +/-20%	0.8	2.0	6	1	250	120
SCL	I/O	NO	YES	6.81K +/-20%	0.8	2.0	6	1	250	120
Alert	Out	YES	YES	100k +/-20%	0.8	2.0	N/A	1	250	

## 4.7 PS\_KILL/EPO

PS Kill is used to disable the output when the Power Supply is being extracted from the system chassis and to keep the outputs disabled when the power supply is not inserted. When PS\_Kill goes hi (>2.0V),

the output converter shall stop switching within 500us. PS\_Kill is pulled up in the power supply to 3.3V and will be pulled low in the system chassis by a 100 Ohm resistor.

Table 14: PS\_Kill

Signal name	Input/output to PSU	Open collector	3V3 logic	Signal pull up resistor value	Logic low max (V)	Logic high min (V)	Sink/source current max (mA)	Rise time max (usec)	Fall time max (usec)	Cmax external to PSU (pF)	Peak noise (mVpk-pk)
PS_Kill_EPO	In	NO	yes	10KOhm	0.4	2.0V or NC	0.5	250	2.5	0	250mV

## 4.8 PSU Alert

The signal shall be high until status change of the PSU. The signal shall remain low until the port is read or contents of register returns to original state.

Table 15: PSU Alert

Signal name	Input/output to PSU	Open collector	3V3 logic	Signal pull up resistor value	Logic low max (V)	Logic high min (V)	Sink current max (mA)	Rise time max (usec)	Fall time max (usec)	Cmax external to PSU (pF)	Peak noise (mVpk-pk)
Alert	Out	YES	YES	100k +/-20%	0.8V	2.0V	Note 1	1usec	250nsec		250mV

Note 1: Pull up to 3.3V through 100K ohms

## 4.9 Power Supply Present

The PS\_PRESENT signal shall be tied to return via 100ohm resistor in the power supply and be sized for connection to 3.3VDC. This signal is pulled up to 3.3VDC via a WCS system 8.2kohm resistor. The signal shall be tied to ground with a series 100 ohm resistor.

Table 16: PS\_Present

Signal name	Input/output to PSU	Open collector	3V3 logic	Signal pull up resistor value	Logic low max (V)	Logic high min (V)	Sink/source current max (mA)	Rise time max (usec)	Fall time max (usec)	Cmax external to PSU (pF)	Peak noise (mVpk-pk)
PS_Present	Out	No									250mV

## 4.10 Phase Loss Detect

PH-Loss is a common bus used to detect the loss of AC input on two or more power supplies in parallel in a system. The bus is set at 3.32V via resistor divider on the power backplane of 22.1Kohm and 8.2Kohm. When an AC loss is detected the power shall pull down on this bus via 10Kohm resistor to

ground. The power supply shall monitor this bus so that if the signal drops below the trip level of 1.79V the power supply shall immediately go to battery power until the signal rises above 1.84V or 40 seconds have elapsed on battery power in which case the power supply shall return to AC power.

## 4.11 Output Connector Pinout

The mating output connector shall be a 64 pin receptacle, 2 vertical row, 2.54 Pitch, FCI 10046971-001LF or Microsoft approved equivalent.

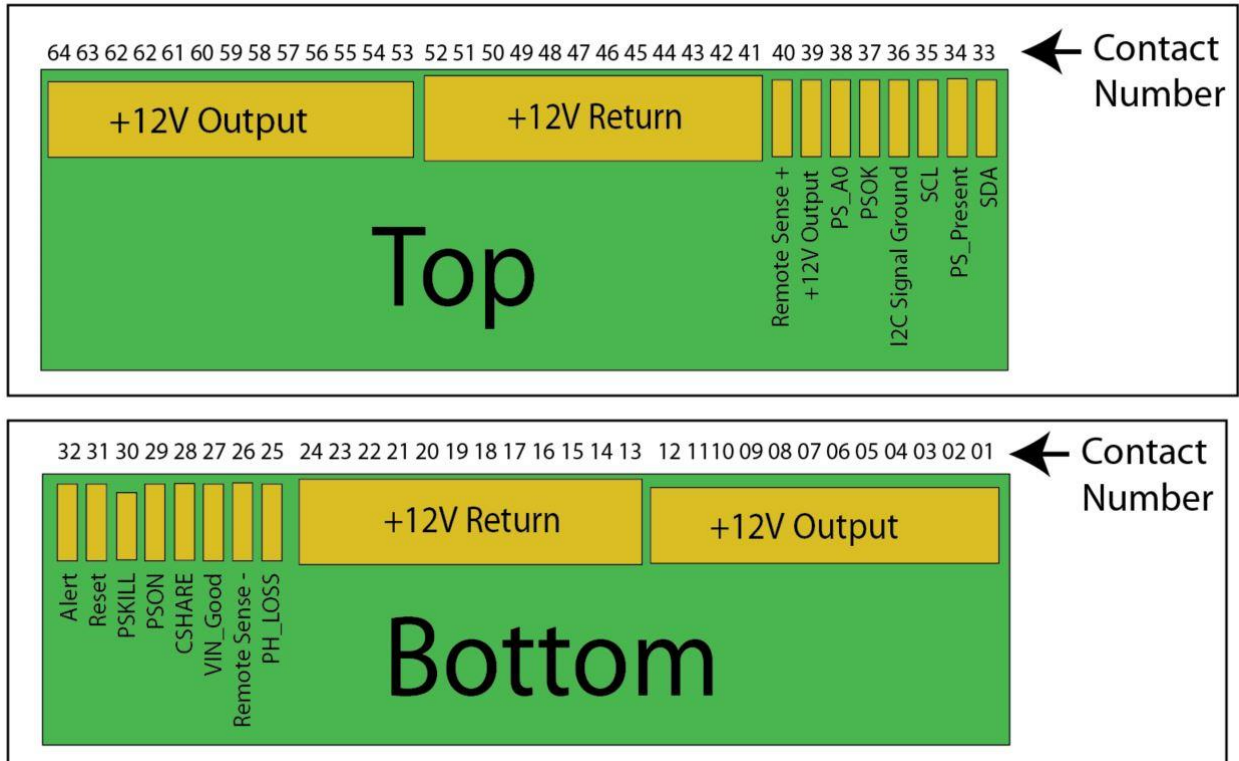


Figure 2: Output connector pinout

## 4.12 Protection Circuits

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. The PSU shall to continue operating under a fault protection condition and provide communication via I2C to the system. Loss of internal communication shall be a condition for latching off the output.

When a protection circuit shuts down the power supply, green LED shall change to solid yellow if able otherwise unlighted status.



### 4.12.1 Over Current Limit (OCL)

The power supply shall provide limited output current to the load for protecting the power supply from damage under indefinite over load conditions. OCL shall be set between 115% and 130% of rated output current. Under an overcurrent condition for over 200ms, the power supply shall employ hiccup mode (20ms on and 2 seconds off) for 5 cycles and if overcurrent isn't cleared after the 5th cycle, the power supply shall latch off (All timing accuracy above is +/- 20%).

### 4.12.2 Over Voltage Protection (OVP)

The power supply over voltage protection shall be shutdown in a latch off mode upon an over voltage condition. Over voltage is range is 13.6VDC to 15VDC.

### 4.12.3 Over Temperature Protection (OTP)

The power supply shall be protected against over temperature conditions caused by loss of fan cooling or excessive ambient temperature which could cause internal part failures. In an over temperature condition the PS shall shutdown protecting itself. When the temperature drops to within safe operating limit for internal parts, the power supply shall restore power automatically. The OTP circuit shall incorporate built in hysteresis such that the power supply does not oscillate on and off due to temperature recovering condition. The OTP event shall be reported as a fault condition.

## 5 LED Indicators

Following are the LED indicators and power supply LED States:

- Power supply LED configuration  
The power supply may have a single bi-color (Green-Yellow) configuration.
- Power supply LED states  
Single bi-colored LED configuration:
  - AC\_OK & DC\_OK (Power Good: Solid Green (Bi-color LED))
  - Fault (fault of any kind): Solid Yellow (Bi-color LED)
  - Internal Battery Charging: Continuous Blinking green
  - Operating off internal battery: Continuous blinking yellow

Following is more detail about the LED indicators:

- **Fault indicator**  
This Bi-Color (Green-Yellow) LED is driven by internal circuitry and will illuminate yellow when a power rail has failed, or -FAN\_FAULT is low. The LED should not be illuminated if the supply turns off due to PS\_KILL. The LED will illuminate even if the power supply is in a latched state.  
3mm Green-Yellow, Bi-color, LED applications: SunLed: XLUGY34M or Kingbright: WP3WGYW or Microsoft approved equivalent.  
**Note:** LED's should be biased with a forward current (If) of 6 mA.

- **Power Good indicator**  
This Bi-Color Green-Yellow LED is driven by internal circuitry and will illuminate whenever POWER GOOD is asserted.
- **AC Good indicator**  
This green LED is driven by internal circuitry and will illuminate whenever VIN\_GOOD is asserted.
- **Operating on internal battery**  
The Yellow LED will turn on and off at a 2 Hz rate whenever the power supply is operating from internal battery power.
- **Internal battery charging**  
The green LED will turn on and off at a 2 Hz rate when the internal battery is charging. This shall not occur during maintenance or top off charge.

## 6 Mechanical Specifications

This section describes the mechanical specifications.

### 6.1 Dimensions

The power supply is held into the chassis using a chassis-mounted latch. The latch hooks on to the power supply using the latching notches detailed in the drawing.

A handle or hook feature is required on the front surface of the supply to allow for removal from the server. The handle may be hinged in order to rotate away when not needed as long as it does not interfere with the power cable location. All features of the power supply, including the handle, fans, connectors and anything else must be within the dimensions shown in the drawing when in use in the server.

The power chord must attach to the plug on the surface shown to allow for power cord connector clearance at the back of the server.

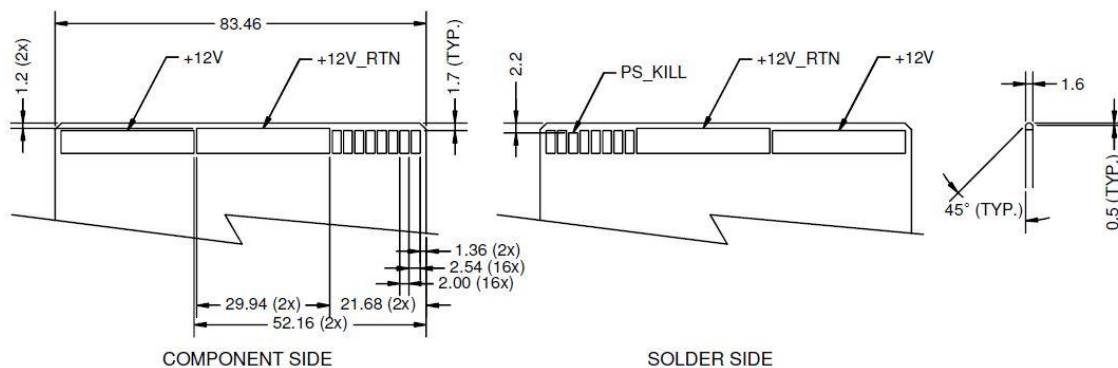


Figure 3: Dimension detail (side)

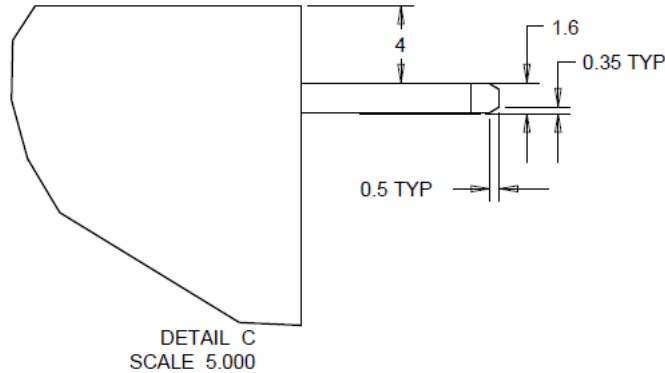


Figure 4: Additional detail

## 6.2 Core Handle Retention

A latch or Microsoft approved equivalent on the power supply is required to provide retention of the AC power cord.

## 6.3 Electrostatic Discharge

The power supply shall withstand the following ESD conditions at any point on the power supply enclosure.

- $\pm 8$  kV with no abnormal operation, air discharge.
- $\pm 8$  kV with no damage to the power supply, air discharge.
- Transients as defined in IEC 801-2, Level 4

The storage capacitance shall be 150 pF and the discharge resistance shall be 330  $\Omega$ s. The supply shall meet all discharge requirements for the CE Mark designation.

# 7 Agency Approvals and Product Regulatory Requirements

This product was evaluated as Information Technology Equipment (ITE), which may be installed in offices, schools, computer rooms, and similar commercial type locations. The suitability of this product for other product categories and environments (such as: medical, industrial, telecommunications, NEBS, residential, alarm systems, test equipment, etc.), other than an ITE application, may require further evaluation.

## 7.1 Safety Requirements and Approvals

The following are the product safety compliance regulations that must be met:

- UL60950-1/CSA 60950-1 (USA / Canada)
- EN60950-1 (Europe)
- IEC60950-1 (International)
- CB Certificate & Report, IEC60950-1 (report to include all country national deviations)
- Nordics – EMKO-TSE (74-SEC) 207/94
- CE - Low Voltage Directive 2006/95/EC (Europe)
- GB4943- CNCA Certification (China)

## 7.2 EMC Requirements and Approvals

The power supply and LES shall be approved/licensed/certified as specified below. Copies of ALL approval licenses/certifications for the system shall be provided upon request.

- Certifications / Registrations / Declarations
- UL Certification (US/Canada)
- CB Certificate & Report
- CE Declaration of Conformity (CENELEC Europe)
- FCC/ICES-003 Class A Attestation (USA/Canada)
- C-Tick/MED Declaration of Conformity (Australia/New Zealand)
- CNCA Certification (China)
- Ecology Declaration (International)

**Note:** Certification shall be done to the most recent standard editions

## 7.3 Component Regulation Requirements

Following are the component regulation requirements:

- All Fans shall have the minimum certifications: UL and TUV or VDE.
- All current limiting devices shall have UL and TUV or VDE certifications and shall be suitable rated for the application where the device in its application complies with IEC60950.
- All printed wiring boards shall be rated UL94V-0 and be sourced from a UL approved printed wiring board manufacturer.
- All connectors shall be UL recognized and have a UL flame rating of UL94V-0.
- All wiring harnesses shall be sourced from a UL approved wiring harness manufacturer. SELV Cable to be rated minimum 80V, 130C.
- Product safety label must be printed on UL approved label stock and printer ribbon. Alternatively labels can be purchased from a UL approved label manufacturer.

- The product must be marked with the correct regulatory markings to support the certifications that are specified in this document.

## 7.4 Product EMC Compliance

The product is required to comply with Class A emission requirements as the end system that it is configured into is intended for a commercial environment and market place. The power supply is to have minimum of 6db margin to Class A.

- FCC /ICES-003 - Emissions (USA/Canada) Verification
- CISPR 22 – Emissions (International)
- EN55022 - Emissions (Europe)
- EN55024 - Immunity (Europe)
  - EN61000-4-2 Electrostatic Discharge
  - EN61000-4-3 Radiated RFI Immunity
  - EN61000-4-4 Electrical Fast Transients
  - EN61000-4-5 Electrical Surge
  - EN61000-4-6 RF Conducted
  - EN61000-4-8 Power Frequency Magnetic Fields
  - EN61000-4-11 Voltage Dips and Interruptions
- \*EN61000-3-2 - Harmonics (Europe)
- \*EN61000-3-3 - Voltage Flicker (Europe)
- CE – EMC Directive 89/336/EEC (Europe)
- JEIDA (Japan)

## 7.5 Markings and Identification

The power supply module nameplate label(s) shall have the following markings at a minimum.

- Supplier's Company
- Regulatory Model Number (RMN)
- supplier's Generic Part Number:
- supplier's Part Number:
- supplier's Spares Part Number:
- Supplier Revision level
- Supplier Date Code of manufacture
- Commodity Tracking Label, OEM Sub-Assemblies
- Assembly Codes for this supply Country of Manufacture
- All Required AGENCY MARKINGS
- Multi-Lingual Hazardous Cautionary marking
- Electrical Rating: Output rating, Input rating in Volts, Amps, Hertz.
- Hipot marking



- Electric shock warning (lightning bolt marking)
- Crossed out screw driver marking
- All required environmental markings