SPECIFICATION

Industrial Grade
Redundant DC Converter

-36V to -76VDC Wide Input
1000W 12VDC Single Output

P/N: R11000CO-1MD4812

** Specification Approval**

This specification (total 23 pages including cover page) is approved in it's entirety by:

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1. Scopes and Definition

This specification defines the performance characteristics of a DC input, and output total 1010 watt power supply with wide range input DC capability (-36V to -76V) with operating temperature 0 to 50 degree C. The power supply shall be designed for parallel operation with power sharing. In the event of a power supply failure, the redundant power supply continues to power the system even under over voltage fault. The number of power supplies per system will be limited to a maximum of four. The power supply shall be designed for “hot swap” exchange and must contain the OR-ing isolation MOSFETs for all outputs and shall communicate to external devices through Inter-Integrated (I2C) Circuit protocol. The power supply will have an EEPROM for storing powers supply FRU information, and meet PMBus Revision 1.1 requirement.

2. Input Requirement

2.1 DC Input Requirements

The power supply has a single DC input and isolated output voltages.
The power supply must be capable of operating with the following conditions:

	Min Voltage (DC output 850W)	Max Voltage (DC output 850W)	Min Voltage (DC output 1000W)	Nominal Voltage (DC output 1000W)	Max Voltage (DC output 1000W)	Unit
Input Voltage Range(Vdc)	-36	-42	-43	-48	-76	Vdc
Max Input Current(A)	30	30	30	26	17	Amperes

The unit must not go into hiccup mode when in the boundary of Turn on voltage threshold, an input OV/OC protection circuit must have.

2.2 Power Factor

N/A

2.3 Inrush Current

When input power is applied to the power supply any initial current surge or spike of 10ms or less will not exceed 45A peak. Any additional inrush current surges or spikes in the form of DC cycles or multiple DC cycles greater than 10ms, and less than 150ms, must not exceed 45A peak. After 150ms the DC input current must meet the requirements in Section 3.2.
For any conditions during turn-on the inrush current will not open the primary input fuse or damage any other components.

2.4 Efficiency

The Power supply must have a minimum of 85% Efficiency measured at 20% output loading with nominal input DC voltage condition. It shall have minimum 89% peak efficiency for -48Vdc input without fan power.

Load (without fan power @-48Vdc)	Efficiency
20%	85
50%	89
100%	85

2.5 Input fuse

The Input fuse must be slow blow or normal blow high breaking type.

2.6 Input Receptacle

The DC input receptacle must be approved by Product Safety Regulatory Agencies and must be rated properly for current, voltage and temperature.

2.7 Input Under Voltage

The power supply shall contain protection circuitry such that application of an input voltage below the minimum specified in section 2.1 shall not cause damage to the power supply. Input voltage range for DC minimum startup voltage, 32 to 35Vdc, or -32 to -35Vdc, and maximum turn off voltage range 25 to 32Vdc.

3. Output Requirements

3.1 Output regulation Requirements

All outputs must maintain their regulation with the below limits when measured at the output connector point or across the remote sense (if applicable) in any load condition defined in section 3.2

Output	**Minimum**	**Nominal**	**Maximum**	**Unit**
+12V	11.40	12.0	12.60	Vdc
+5Vsb	4.80	5.0	5.25	Vdc

3.2 Output Current Requirements

All outputs must maintain their regulation as per section 3.1 when loaded to the following loading combination:

Output	Minimum	Maximum	Peak	Unit
+12V (-43 to -76Vdc input)	0.5	83		Adc
+12V (-36 to -42Vdc input)	0.5	70		Adc
+5Vsb	0	4.0	6 (at least 500ms)	Adc

The total output power can not exceed 1010W continuously for -43 to -76Vdc input.
The total output power can not exceed 850W continuously for -36 to -42Vdc input.
During load changes from minimum to maximum or maximum to minimum the unit must not shut down.

+5Vsb design should be able to provide peak output current up to 6A for at least 500ms.
However, label should show +5Vsb maximum continuous output 4A only.

3.3 Output Ripple and Noise

The following output ripple/noise requirements will be met throughout the load ranges specified in section 3.2 and under all input voltage conditions specified in section 2.1.
Ripple and noise are defined as periodic or random signals over the frequency band of 10Hz to 20MHz. Measurements will be made with an oscilloscope set to 20MHz bandwidth limit. Measurement is done by using 10uF Tantalum in parallel with a 0.1uf ceramic capacitor, measured directly at the output connector side (Note: care must be taken when doing measurements such as using the smallest grounding wire.).

Output	Maximum	Unit
+12V	120	mV
+5Vsb	50	mV

3.4 Output Dynamic Loading

The output voltages shall remain within the limits specified in section 3.1 for the step loading and within the limits specified in section 3.5 for the capacitive loading. The load transient repetition rate shall be tested between 50 Hz and 5 kHz at duty cycles ranging from 10%-90%. The load transient repetition rate is only a test specification. The å step load may occur anywhere within the MIN load to the MAX load shown in section 3.2

3.4 Transient Load Requirements

Output	△ Step Load Size	Load Slew Rate	Capacitive Load
+12V	65% of max load	0.5A/uS	2200uF
+5Vsb	25% of max load	0.5A/uS	1uF

3.5 Capacitive Loading

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

3.5 Capacitive Loading Conditions

Output	MIN	MAX	Units
+12 V	10	11,000	µF
+5 VSB	1	350	µF

4. Redundancy Requirements

4.1 Current Sharing Operation

The power supply shall be designed for active current sharing.
Two or more than two power supplies will be paralleled in a system. Each power supply must be able to share load to within +/-10 % share error measured 25, 50, 100% of single power supply full load current.

4.2 Output Isolation Oring MOSFET

The 12V output current must pass through an Oring MOSFET to protect the bus voltage against a power supply internal fault.

4.3 Power Supply Behavior When Faulted

1 The faulted supply shall not sink more than 100 mA current.
2 I2C bus status shall be operational and valid, refer to “I2C Bus/VPD Interface”.
3 The "DC Good" signal and "DC Good Fault" bit status shall be valid.
4 A power supply that fails due to a 12V or 5Vsb Over-Voltage condition will shutdown gracefully and will not cause shutdown of the other power supplies in parallel.

4.4 Parallel Stability

The power supply shall be unconditionally stable under all system load and DC line conditions while operating alone or in parallel mode.

4.5 Hot Swap

The power supply must be designed with “hot swap” function with or without active line cord. After Hot swap I2C address shall be same as host power supply backplane hardware assigned. Host existing working power supply shall not be affected by hot swapping power supply.

5. Controls and Signal

5.1 Timing Requirements

These are the timing requirements for the power supply operation. The output voltages must rise from 10% to within regulation limits (Tvout_rise) within 5 to 20 ms.

Each output voltage shall reach regulation within200 ms (Tvout_on) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 ms (Tvout_off) of each other during turn off. Figure 1 and Figure 2 the turn ON and turn OFF timing requirements. In Figure 2, the timing is shown with both DC and PSON# controlling the ON/OFF of the power supply.

Item	Description	MIN	MAX	Units
Tvout_rise	Output voltage rise time from each main output.	5	20	ms
	Output voltage rise time for 5Vsb output	1	25	ms
Tvout_on	All main outputs must be within regulation of each other within this time.		20	ms
T vout_off	All main outputs must leave regulation within this time.		400	ms

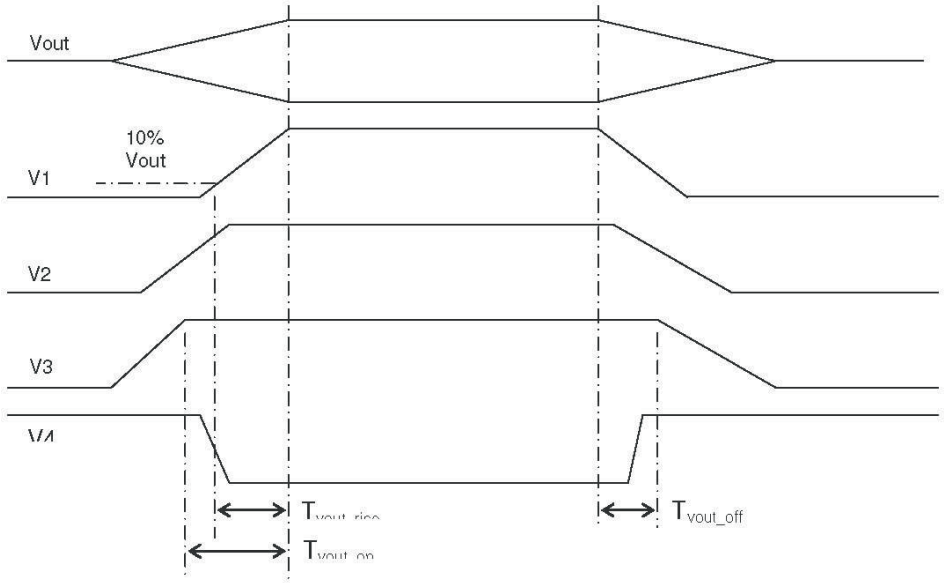


Fig. 1 Output Voltage Timings

DC Input

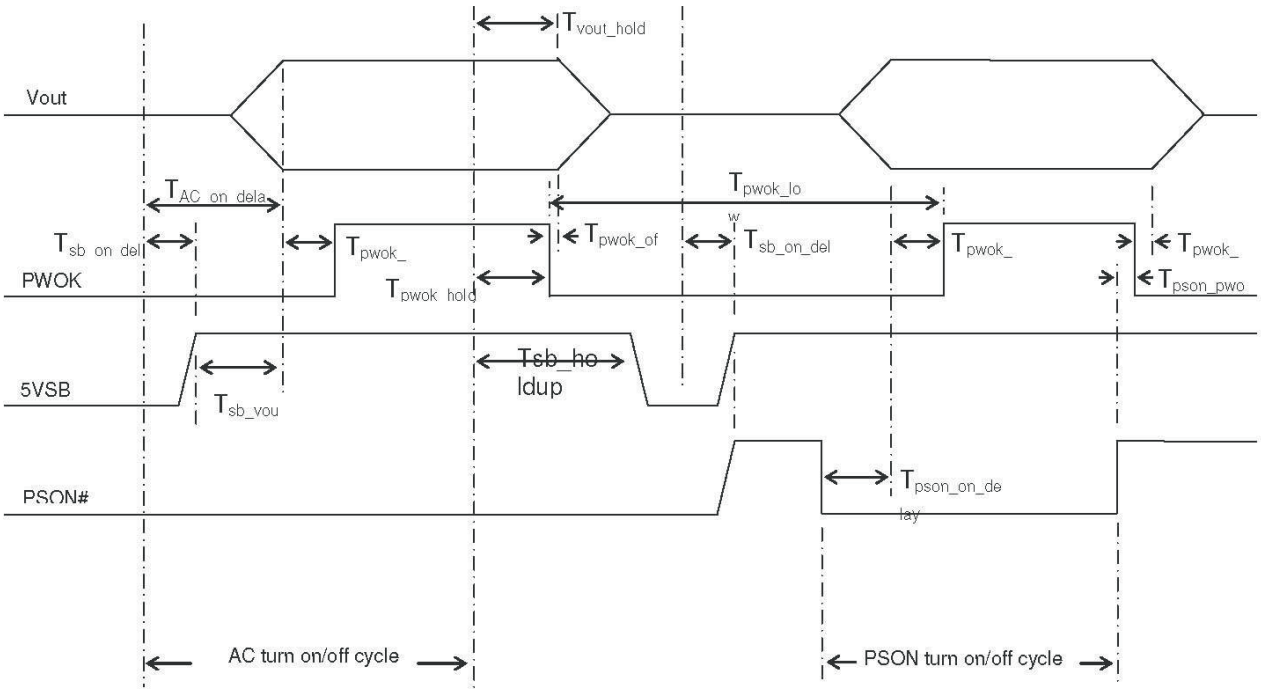


Figure 2 Turn On/Off Timing (Signal Power Supply)

Item	Description	MIN	MAX	Units
Tsb_on_delay	Delay from DC being applied to 5 VSB being within regulation.		1500	ms
Tac_on_delay	Delay from DC being applied to all output voltages being within regulation.		2500	ms
Tvout_holdup	Time all output voltages stay within regulation after loss of DC. Tested at 75% of maximum load and over 36-76Vdc input	50		µs
Tpwok_holdup	Delay from loss of DC to de-assertion of PWOK. Tested at 75% of maximum load and over 36-76Vdc input	50		µs
Tpson_on_delay	Delay from PSON# active to output voltages within regulation limits.	5	400	ms
T pson_pwok	Delay from PSON# deactive to PWOK being de-asserted.		50	ms
Tpwok_on	Delay from output voltages within regulation limits to PWOK asserted at turn on.	100	1000	ms
T pwok_off	Delay from PWOK de-asserted to output voltages (3.3 V, 5 V, 12 V, -12 V) dropping out of regulation limits.	0		ms
Tpwok_low	Duration of PWOK being in the de-asserted state during an off/on cycle using DC or the PSON# signal.	100		ms
Tsb_vout	Delay from 5 VSB being in regulation to O/Ps being in regulation at DC turn on.	50	1000	ms
Tsb_holdup	Time 5VSB output voltage stays within regulation after loss of DC.	2		ms

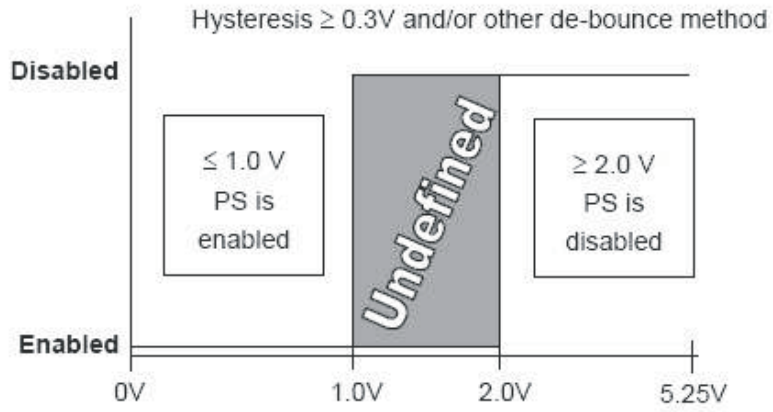
5.2 PS_ON

The PSON signal is required to remotely turn on/off the power supply. PSON is an active low signal that turns on the +12V power rail. When this signal is not pulled low by the system, or left open, the outputs (except the +5 VSB and Vbias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Table 3: PSONSignal Characteristic

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.	
PSON# = Low	ON	
PSON# = Open or High	OFF	
	MIN	MAX
Logic level low (power supply ON)	0 V	1.0 V
Logic level high (power supply OFF)	2.0 V	5.25 V
Source current, Vpson = low		4 mA
Power up delay: Tpson_on_delay	5 ms	400 ms
PWOK delay: Tpson_pwok		50 ms

Fig.3 Logic level definition | Hysteresis ≥ 0.3V and/or other de-bounce



5.3 PWOK(Power OK)

PWOK is a power OK signal and will be pulled HIGH by the power supply to indicate that all the outputs are within the regulation limits of the power supply. When any output voltage falls below regulation limits or when DC power has been removed for a time sufficiently long so that power supply operation is no longer guaranteed, PWOK will be de-asserted to a LOW state. For a representation of the timing characteristics of PWOK, The start of the PWOK delay time shall be inhibited as long as any power supply output is in current limit.

Table 4: PWOK Signal Characteristics

Signal Type	+5V TTL Compatible output signal	
PWOK = High	Power OK	
PWOK = Low	Power not OK	
	MIN	MAX
Logic level low, Isink = 4mA		0.4 V

Logic level high, Isource = 200μA	2.4 V	5.25 V
PWOK delay: T pwok_on	100 ms	1000 ms
PWOK rise and fall time		100 μs
Power down delay: T pwok_off	0 ms	

5.4 DC Warning

Noted on PMBus standard.

5.5 LED Indicator

A green/amber double color Light Emitting Diode (LED) shall be mounted as indicated in mechanical drawing and shall indicate the status of the DC GOOD signal with green color. The LED shall continue to glow under normal operation of the power supply. If this LED is blinking or not lit or in amber color, the power supply is not operating properly.

6. I²C and PMBus™ 1.1 standard.

6.1 I2C

Slave address will be 0x70 (default), 0x72, 0x74, 0x76

The power supply can be read and written to as if it's an 2k bit (256 byte) I2C EEPROM. The power supply must support: Byte write and Random read. Read and write must work at speeds up to 100 kHz. This bus shall operate at 3.3V but be tolerant of 5V signaling.

All the data stored in the power supply follows FRU spec, IPMI, Platform Management FRU information Storage Definition v1.0.
FRU spec attached below:

The "Chassis Info" and "Board Info" are not to be implemented. The "Common Header" and "Product Area" are required.

For the "Multiple Record" area, the power supply should implement the "Power Supply Information"(section 18.1), and multiple "DC Output" section as needed.

For the "Product Info" area must began from offset location 0x18 (offset 0x04 product information offset must contains value of 0x03).

The "Internal Use" section, defined by TOP as follows:

Offset		Result of a read
0x09	Temperature	Value to represent the current temperature of the hottest spot

		inside the power supply This is an unsigned integer value in Celsius.
0x0A	Fan 1 speed (main fan)	Value to represent the RPM of the power supply fan #1 This should be the fan pulse count in 262 ms. We are assuming that two fan pulses equal one rotation. The system software will convert this value, to fan RPM, using: RPM=(1/0.262) *(Fan Pulse Count * 60 /2)
0x0B	Reserved	
0x0C	Power Status	Value to represent DC GOOD status byte = hex 01 means DC GOOD byte = 00 means no DC output
0x0D	Temperature High Limit	Value is fixed and should be the highest acceptable temperature that the power supply can sustain based on offset 09.
0x0E	Fan 1 speed Low Limit	Value is fixed and should be the lowest fan #1 RPM acceptable
0x14	DC current	This byte, divided by 16, is the DC input current.
0x15	Reserved	
0x16	Firmware version	Example: version 2.0 is encoded as 0x20 The smallest version number allowed is 2.0 Anything less than 2.0 (0x20) found at this location will be reported as version 1.0 by Supermicro health monitoring software
0x17	FRU file revision	Integer only
0xF0	DC current limit	DC current upper limit; same scale factor as 0x14
0xF1	+12V DC current limit	+12V DC current upper limit; scale factor: this byte, divided by 2, is the DC (+12V) output current.
0xF2	Power supply wattage	Power supply wattage; lower byte
0xF3		Power supply wattage; higher byte
0xF4	Input voltage	36 to 76 or -36 to -76Vdc input voltage reading
0xF5	Input power	Input power in watt (lower byte) (0x0864=360W)
0xF6	Input power	Input power in watt (higher byte)
0xFF	Write protection Control	This byte controls whether the FRU is writeable or read only. When this byte content is 0x88, the FRU is writeable. Otherwise, only byte 0xFF can be modified. value= 0x88 is FRU writeable mode Any other value, FRU is read only except address 0xFF can be modified. Default value for this byte is read only, 0x00.

The power supply will support the “byte write” procedure defined in the I2C EEPROM spec.

Read only bytes --- writes to the following bytes should be ignored:

Offset	
0x09	Temperature
0x0A	Fan 1 speed (main fan)
0x0B	Fan 2 speed (secondary fan if available)
0x0C	Power Status
0x14	DC RMS current
0xF4	Input voltage
0xF5	Input power (lower byte)
0xF6	Input power (higher byte)

I2C auto-recovery feature:
In a normal I2C transaction, there will be 8 bytes of transmission plus an ACK (acknowledge) byte, for a total of 9 clock cycles. ACK is done by pulling down the SDA line. If there is a missing clock cycle, the chip doing the ACK will hold down the SDA line indefinitely and hanging the I2C bus. The power supply needs to prevent the above scenario from happening. If the I2C bus SDA or SCL is stuck low for more than 40 ms, the power supply should reset either its I2C communication module, or itself.

The power supply I2C microcontroller should not latch the system I2C bus by pulling SDA or SCL line low for more than 40 ms.

The power supply needs to have 2k Ohm internal pull up on the SDA or SCL lines and operate at 3.3V voltage.

6.2 PMBus

The PMbus firmware version of the power supply shall follow the

1. PMBus Power System Management Specification Part I – General Requirements, Transport and Electrical Interface.
2. PMBus Power System Management Specification Part II – Command Language

The device in the power supply shall be compatible with both SMBus 2.0 ‘high power’ specification for I^2C V_{dd} based power and drive (for Vdd = 3.3V). This bus shall operate at 3.3V but be tolerant of 5V signaling.

One pin is the Serial Clock [SCL] (PSM Clock). The second pin is used for Serial Data [SDA] (PSM Data). Both pins are bi-directional, open drain signals, and are used to form a serial bus. The circuits inside the power supply shall derive their power from the standby output.

The device shall support SMBus clock-low timeout (Ttimeout). This capability requires the device to abort any transaction and drop off the bus if it detects the clock being held low for >40ms, and be able to respond to new transactions 10ms later.

The device must recognize SMBus START and STOP conditions on ANY clock interval. (These are requirements of the SMBus specifications, but are often missed in first-time hardware designs.) The device must not hang due to 'runt clocks', 'runt data', or other out-of-spec bus timing. This is defined as signals, logic-level glitches, setup, or hold times that are shorter than the minimums specified by the SMBus specification. The device is not required to operate normally, but must return to normal operation once 'in spec' clock and data timing is again received. Note if the device 'misses' a clock from the master due to noise or other bus errors, the device must continue to accept 'in spec' clocks and re-synch with the master on the next START or STOP condition.

6.3 Addressing

System addressing Address2/Address1/Address0	0/0/0	0/0/1	0/1/0	0/1/1
Power supply PMBus™ device	78h	7Ah	7Ch	7Eh

Note: Non-redundant power supplies will use the 0/0/0 address location.

6.4 Command

The following PMBus commands shall be supported for the purpose of monitoring currents, voltages, and power. All data should use the linear data format as documented in PMbus spec.

PMBus command	Command Offset location	Description
READ_IIN	0x89	RMS input current in amps (note; not used on power distribution boards)
READ_VIN	0x88	RMS input voltage in volts(note; not used on power distribution boards)
READ PIN	0x97	DC input power in watts (note; not used on power distribution boards)
STATUS_BYTE	0x78	command to report the On/off status of the power supply. Please refer to page 74 of PMbus spec part 2
READ_TEMPERATURE	0x8D	Read airflow inlet temperature
MFR_VIN_MIN	0xA0	Retrieves the minimum rated value, in volts, of input voltage (ex. 36Vdc). This value remains a constant value.

MFR_VIN_MAX	0xA1	Retrieves the maximum rated value, in volts, of input voltage (ex. 76Vdc). This value is a constant value.
MFR_PIN_MAX	0xA3	Retrieves the maximum rated value, in watts, of input power. If there is a high line or low line input power difference, the suitable input max power should be displayed properly. (ex. Power supply with rating 1000W, During 100-140Vac, MFR_PIN_MAX=(1000W+10W fan DC power)/0.88 efficiency= 1148W.
MFR_POUT_MAX	0xA6	Retrieves the maximum rated value, in watts, of output power. If there is a high line or low line input power difference, the suitable input max power should be displayed properly. (ex. Power supply with rating 1000W)
MFR_TAMBIENT_MAX	0xA7	Retrieves the maximum rated ambient temperature, in degree C, in which the unit might be operated. This value is a constant value.
MFR_TAMBIENT_MIN	0xA8	Retrieves the minimum rated ambient temperature, in degree C, in which the unit might be operated. This value is a constant value.
PMBUS_REVISION	0x98	Reads the revision of the PMBus to which the device is compliant
CAPABILITY	0x19	Provides a way for a host system to determine some key capabilities of a PMBus device

STATUS_BYTE: Please refer to PMbus.

Offset 0x78		
Bit #	7	Not used, default=0
	6	Device is off due to PSON or for any reason (ex. Protection)=1, else 0
	5	Output OVP=1, else 0
	4	Output OCP=1, else 0
	3	Vin under voltage=1, else 0
	2	OTP=1; else 0
	1	Not used, default=0
	0	none of the above (Power is good and turned on)=1, else=0

PMBUS_REVISION Value:

Bits 7:5	Part I Revision	Bits 4:0	Part II Revision
0001	1.1	0001	1.1

6.5 Manufacturer Specific Commands:

Offset 0xD0-0xDE is used to represent the unit model serial number. Data represented in byte format. These bytes are read/write capable through I2C

Below serial number is for example only:

	Serial number	
Offset	**character**	**Hex**
D0	P	
D1	1	
D2	0	
D3	2	
D4	1	
D5	M	
D6	Y	
D7	W	
D8	W	
D9	R	
DA	M	
DB	S	
DC	S	
DD	S	
DE	S	

Offset 0xE0 – 0xEA is used to represent the model number, data represented in byte format. These bytes are read/write capable through I2C.

	Item number	
Offset	**character**	**Hex**
E0	C	
E1	P	
E2	R	
E3	1	
E4	0	
E5	2	
E6	1	
E7	-	
E8	1	
E9	M	
EA	1	
EB	1	

Additional information bytes for FRU backward compatibility. These bytes are read/write capable.

Offset	Function	Description
ED	Temperature upper limit	Internal temperature upper limit in degree Celsius. Direct data format, data length is one byte.
EE	Fan 1 pulse count lower limit	Value to represent the lower limit RPM of the power supply fan #1 The system software will convert this value, to fan RPM, using: RPM limit=(1/0.262) *(Fan Pulse Count limit * 60 /2)
EF	Fan 2 pulse count lower limit	Same calculation as fan 1. If fan 2 is not available, default value is 0x00.

Offset 0xF0-0xF5 is used to represent the unit revision number. Revision begins with Rev 1.0. Data is represented in byte format. These bytes are read/write capable using I2C.

	Revision	
Offset	**character**	**Hex**
F0	R	
F1	E	
F2 V		
F3	1	
F4	.	
F5	0	

6.6 Sensor Sampling

The sensor registers inside the power supply for monitoring input/output power, current, and voltage shall meet the following minimum requirements. Register refresh rate is the frequency the sensor register gets updated with a new measurement value.
Register refresh rate ⩾10Hz

6.7 Sensor Averaging

The sensor registers for monitoring input/output power, current, and voltage shall contained averaged data, not instantaneous peak data. This may be achieved in two ways; an arithmetic average or a low pass filter. An exponential moving average shall not be used. The power supply shall refresh the sensor data at a rate no slower than the averaging duration.

READ_PIN, shall be an average value over a 1 second interval.
READ_IIN and READ_VIN shall be an RMS value over a 1 second interval.

6.8 Accuracy

The sensor commands shall meet the following accuracy requirements.

		20% of max load	**50% of max load**	**100% of max load**
READ_IIN		+/-5%	+/-5%	+/-5%
READ_PIN		+/-5%	+/-5%	+/-5%
READ_VIN		+/- 5% over full range		
READ_TEMPERATURE		+/-3 ºC		

7. 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, a DC OFF for 10 seconds and a PSON cycle HIGH for 1 second shall be able to reset the power supply.

7.1 Over Current Protection

The power supply shall have current limit to prevent +12 V outputs from exceeding the values shown in Table 5. If the current limits are exceeded, the power supply shall shutdown and latch off in timing as long as good (about 200ms) with no damage occur to PDB self and power supply. The latch will be cleared by
toggling the PSONsignal or by an DC power interruption. The power supply shall not be damaged from repeated power cycling in this condition. 5 VSB shall be protected under over current or shorted conditions so that no damage can occur to the power supply. All outputs shall be protected so that no damage occurs to the power supply under a shorted output condition.

Table 5: Over Current Protection

Voltage	**Over Current Limit (Iout limit)**
+12 V	110% minimum; 130% maximum
+5Vsb	110% minimum; 180% maximum

7.2 240VA Protection

Not applicable

7.3 Over Voltage Protection

The power supply over voltage protection shall be locally sensed. The power supply shall and latch off after an over voltage condition occurs. This latch shall be cleared by toggling the PSONsignal or by a DC power interruption. Table 6 contains the over voltage limits. The values are measured at the output of the power supply's connectors. The voltage shall never exceed the maximum levels when measured at the power pins of the power supply connector during any single point of fail. The voltage shall never trip any lower than the minimum levels when measured at the power pins of the power supply connector.

Table 6: Over Voltage Limits

Output Voltage	MIN (V)	MAX (V)
+12 V	13.3	14.5
+5 VSB	5.7	6.5

7.4 Over Thermal Protection

The power supply over thermal protection shall be locally sensed. The power supply shall shutdown and latch off after an over required temperature condition occurs. This latch shall be cleared by toggling the PSON signal or by a DC power interruption. The over thermal limits that power supply which components contain required maximum temperature. The temperature shall never exceed the maximum levels when measured at the individual component.

7.5 Short Circuit Protection

All outputs shall be protected and into latch off mode so that no damage occurs to the power supply under a shorted output condition. This latch shall be cleared by toggling the PSON signal or by a DC power interruption. 5Vsb should be protected and into hiccup mode. No damage occurs to the power supply under a shorted output condition, and should be output normally after shorted output released.

8. Environmental Requirements

8.1 Temperature

8.1.1 Normal Operating Ambient(at sea level):

0 degrees Celsius minimum (operating and in standby) 50 degrees Celsius maximum (operating – power supply on)
maximum rate of change is 30 degrees Celsius/hour

8.1.2 Abnormal Operating Ambient(at sea level):

N/A degrees Celsius
N/A survival time

8.2 Humidity

Operating : 20% to 95% RH
Storage : 5% to 95% RH

8.3 Altitude

Operating: to 10,000 feet (3,023 meters)
Non-operating: to 35,000 feet (10,580 meters)

8.4 SHOCK AND VIBRATION

8.4.1 Mechanical Shock

The device will withstand the following imposed conditions without electrical or mechanical failure: Non-operating Square Wave Shock: 40G, Square wave at 200in/sec (508cm/sec); on all six sides Non-operating Half Sine Shock: Half Sine pulse for 70in/sec (178cm/sec) for 2ms; on all sides except top Operating Half Sine Shock: Half Sine pulse for 40in/sec (102cm/sec) for 2ms; on all sides except top

8.4.2 Vibration

Operating: Sinusoidal vibration, 0.5G (0-peak) acceleration. 3-500Hz, sweep at 1/2 octave/min from low to high frequency, and then from high to low. Thirty minute dwell at all resonant points, where resonance is defined as those exciting frequencies at which the device under test experiences excursions two times larger than non-resonant excursions. Plane of vibration to be along three mutually perpendicular axis.

Non-operating: Sinusoidal vibration, 1.0G (0-peak) acceleration. 3-500Hz, sweep at 1/2 octave/min from low to high frequency, and then from high to low. Thirty minute dwell at all resonant points, where resonance is defined as those exciting frequencies at which the device under test experiences excursions two times larger than non-resonant excursions.

8.4.3 THERMAL SHOCK

Non-operating: -40 (+/-5) to +70 (+/-5) degrees Celsius, transition time not to exceed 5 minutes. Duration of exposure to temperature extremes will be 20 minutes**.**

8.5 MTBF and Quality Data

8.5.1 MTBF

The life requirement shall be met the following condition. And the environmental temperature is assumed to be 25 degrees Celsius.Normal operation (at the rated input/output): 150,000h.

9. Regulatory Agency Requirements

The power supply must comply with all regulatory requirements for its intended geographical market as computer server of Information Technology Equipment.

The power supply must meet all regulatory requirements for the intended market at the time of manufacturing. This power supply shall have below certificates for ITE category:

- cUL
- UL
- CCC
- TUV
- CB
- CE
- RoHS 6/6
- FCC class A

The power supply, when installed in the system, shall meet immunity requirements specified in En55024. Specific tests are to be EN61000-4-2, -3, -4, -5, -6, -8, and -11. The power supply must maintain normal performance within specified limits. Conformance must be designated with the European Union CE Marking. Specific immunity level requirements are left to customer requirements.

10. Fan Speed Control

When power cord plug in, Fans will be on and have minimum speed to cooling power supply to keep normal operating temperature. The power supply will have internally controlled

PWM fans. The PWM fans will be thermal controlled by microcontroller. Note that speed transition should be non-linear to reduce perceived noise from fan.

Pin 17 implement a function for system control power fan speed into normal or quiet mode go through power PDB same pin to empty pin (was for -5V) output on 24pin or 20pin connector.

5V TTL Low @ pin 17 – Fan operate in quiet mode
5V TTL High or no connection @ pin 17 – Fan operate in normal (default setting)

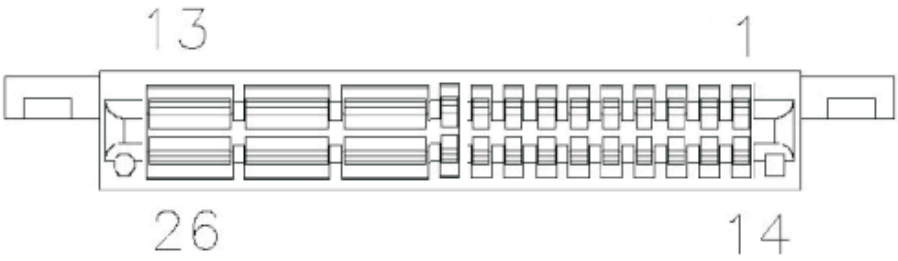
11. Output Connector and Dimension

The power supply will provide a card edge connector compatible with the backplane. See power supply mechanical drawing for dimensions. The power supply connector is a 6 blade (3 pair) and 20 pins (10 pair) edge connection type from Tyco Electronics, Mfr P/N 1489958-1 or FCI P/N 10034908 connector.

Power and Signal Connection

Description	Pin Number	I/O	Active	Pin Length
Ishare	1		Analog	Standard
A1 (address)	2	I/O	High/Low	Standard
A2(address)	3	I/O	High/Low	Standard
I2C SCL	4	I/O	High/Low	Standard
I2C SDA	5	I/O	High/Low	Standard

PS ON/OFF	6	I	Low	Short (by 1mm)
Spare	7			
DC GOOD	8	O	High	Standard
+12V	9		Power Pin	Standard
+12V	10		Power Pin	Standard
+12V	11		PowerPin	Standard
+12V	12		PowerPin	Standard
+12V	13		PowerPin	Standard
RS GND	14		Analog	Standard
Spare	15			
12V RS GND	16		Analog	Standard
Fan Control	17	I	High	Standard
DC Return	18		Power Pin	Standard
5Vsb CO	19		Power Pin	Standard
5VsbCO	20		PowerPin	Standard
DC Return	21		Power Pin	Standard
DCReturn	22		PowerPin	Standard
DCReturn	23		PowerPin	Standard
DCReturn	24		PowerPin	Standard
DCReturn	25		PowerPin	Standard
DCReturn	26		PowerPin	Standard



12. Mechanical Drawing