COMPUWARE
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Document Name
Product Specification

Release Document

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Component P/N		Page	13

History Record		
Date	Description	Revision
2006-03-11	New Released	1.0
2007-02-02	Modify Output Connector	1.3
2012-03-05	Pin7 change to empty	2

Approved By	**Signing By**	**Prepared By**
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Rev.	ECO No.	Revision Descriptions	Approved by	Date
1.0		Preliminary Specs	Jerry	2006.03.11
1.1		12V nominal output voltage Changed to 12.1V Delete table of contains RoHS full changed to RoHS with server exemption Efficiency 89% OCP delay time 50 ms Power sharing with others	Jerry	2007.01.23
1.2		Output Current Requirements 710W	Jerry	2007.01.29
1.3		Inrush Current up to 60A peak within 1ms Delete Tvout、Tpwok、Tsb holdup time Delete PWOK(Power OK) Modify Output Connector	Jerry	2007.02.02
1.4		- Take off NEBS/ETSI, EN61000-4, -11, NEMKO, EMI class B, for ITE compliant related text, fan vibration, conducted RF Immunity - Revised the spec. of current sharing: +/-20,20,10% share error measured at 25, 50, 100% load.	Jerry	2009.09.22
1.5		Pin7 change to empty	Jack	2012.02.23

Scopes and Definition

This specification defines the performance characteristics of a DC input, and output total 710 watt power supply with wide range input DC capability (-36V/36V to -75V/75V) with operation 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 N. 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.

1 Input Requirement

1.1 DC Input Requirements

The Power supply is with a single DC input and isolated with output voltages

The power supply must be capable of operating with the following Conditions

	min V/A	Nominal V/A	max V/A	Unit
Input Voltage Range(Vdc)	-36	-48	-75	Vdc
Input Current(A)	**25**	**19**	**12**	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.

1.2 Power Factor

N/A

1.3 Inrush Current

When input power is applied to the power supply any initial current surge or spike of 10ms or less will not exceed 25A peak. It is acceptable that DC line inrush current may reach up to 60A peak within 1 ms caused by capacitors of EMI filter.

For any conditions during turn-on the inrush current will not open the primary input fuse or damage any other components.

1.4 Efficiency

Efficiency is up to 89% without fan and with 2A 5Vsb output at 12V/30A loading.

1.5 Input fuse

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

1.6 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 Output Requirements

2.1 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 2.2**

Output	Minimum	Nominal	Maximum	Unit
+12V	11.4	12.1	12.6	Vdc
+5Vsb	4.80	5.0	5.25	Vdc

2.2 Output Current Requirements

All outputs must maintain their regulation as per **section 2.1** when loaded to the following loading combination:

Output	Minimum	Maximum	Unit
+12V	0.5	59	A
+5Vsb	0	4.0	A

The total output power can not exceed 710W continuously. During load changes from minimum to maximum or maximum to minimum the unit must not shut down.

2.3 Output Ripple and Noise

The following output ripple/noise requirements will be met throughout the load ranges specified in Section 2.2 and under all input voltage conditions specified in Section 1.1.

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

2.4 Output Dynamic Loading

The output voltages shall remain within the limits specified in 2.1 for the step loading and within the limits specified in 2.4 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 Δ step load may occur anywhere within the MIN load to the MAX load shown in 2.2

Transient Load Requirements

Output	**Δ Step Load Size**	**Load Slew Rate**	**Capacitive Load**
12V	65% of max load	0.5 A/μs	2200 μF
+5 VSB	25% of max load	0.5 A/μs	1 μF

2.5 Capacitive Loading

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

Capacitive Loading Conditions

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

3 Redundancy Requirements

3.1 Current Sharing Operation

The power supply shall be designed for active current sharing.
1 to 2 power supplies will be paralleled in a system. Each power supply must be able to share load to within +/- 20, 20, 10% share error measured 25, 50, 100% of single power supply full load current. It shall work with SMC PWS-702A-1R, PWS-801-1R, PWS-902-1R, PWS-0064 and with power sharing function.
5Vsb requires an “Oring” Diode/MOSFET to provide protection against internal short circuit fault.

3.2 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.

3.3 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.

3.4 Parallel Stability

The power supply shall be unconditionally stable under output current range and DC line conditions while operating alone or in parallel mode.

3.5 Hot Swap

The power supply must be designed with “hot swap” function with or without active DC 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.

4 Controls and Signal

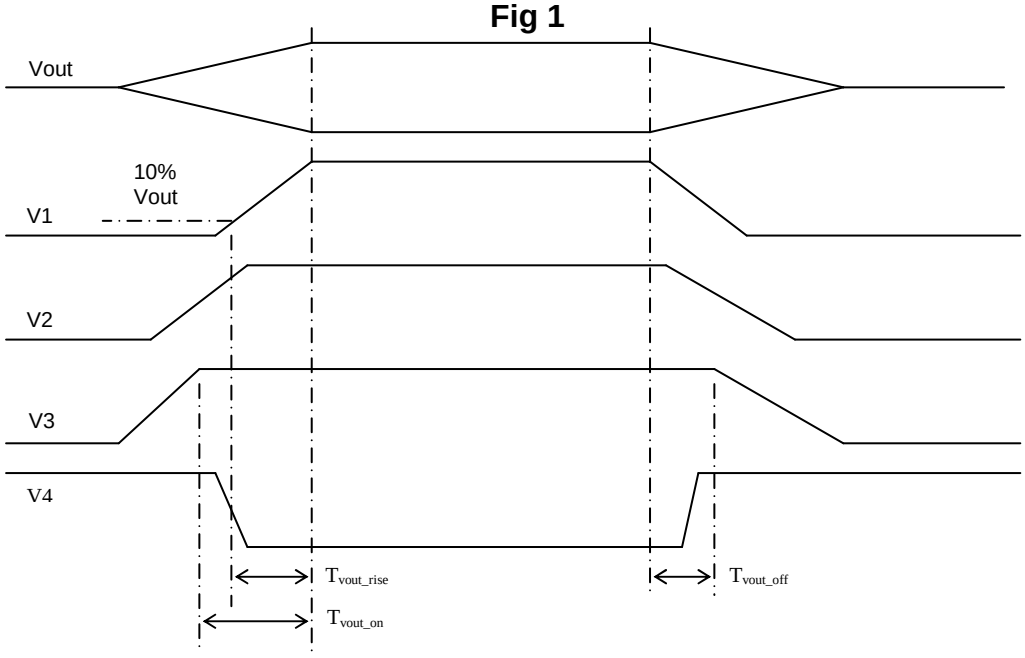
4.1 Timing Requirements

These are the timing requirements for the power supply operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 10 to 120 ms.

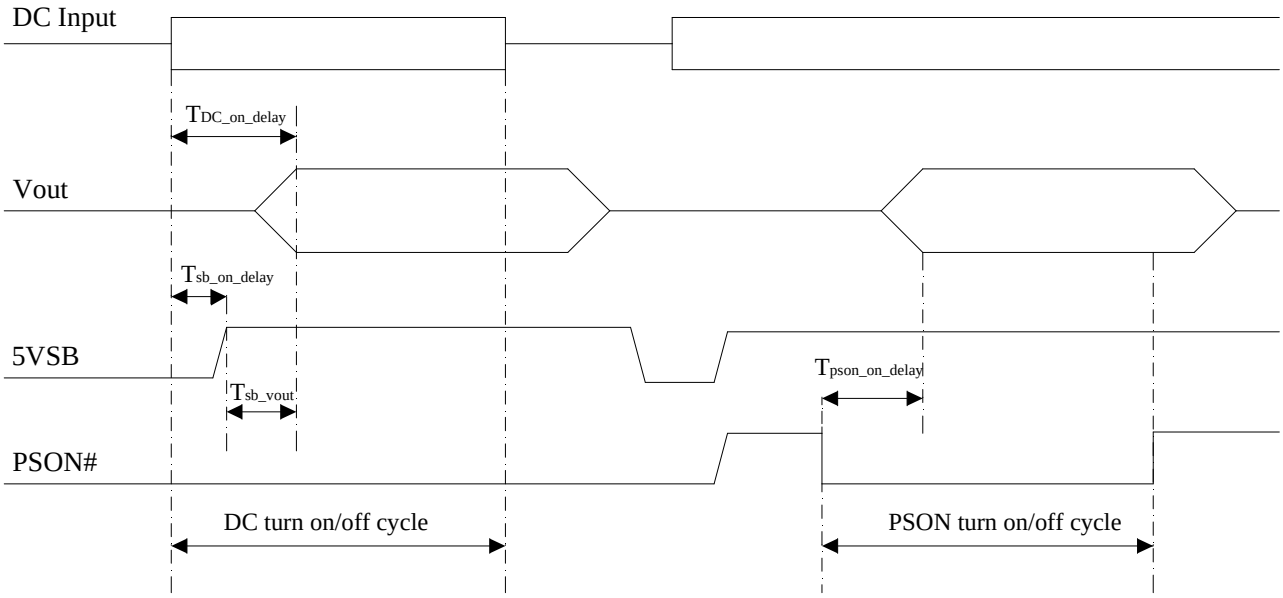
Each output voltage shall reach regulation within 50 ms (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 ms (T_{vout_off}) of each other during turn off. Figure 1 and Figure 2 the turn ON and turn OFF timing requirements. In Figure 2, the timing is shown with both DC and PSON# controlling the ON/OFF of the power supply.

Item	Description	MIN	MAX	Units
T_{vout_rise}	Output voltage rise time from each main output.	10	120	ms
T_{vout_on}	All main outputs must be within regulation of each other within this time.		50	ms
T_{vout_off}	All main outputs must leave regulation within this time.		400	ms

Output Voltage Timings
Fig 1



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



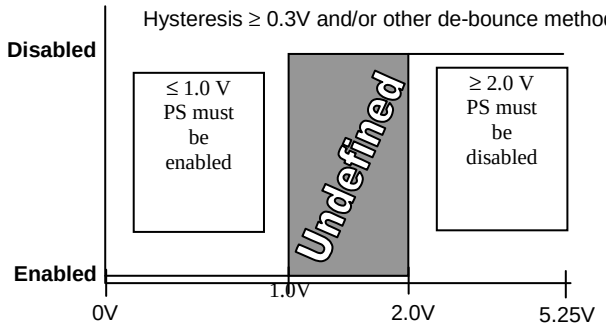
Item	Description	MIN	MAX	Units
Tsb_on_delay	Delay from DC being applied to 5 VSB being within regulation.		1500	ms
T dc_on_delay	Delay from DC being applied to all output voltages being within regulation.		2500	ms
Tpson_on_delay	Delay from PSON# active to output voltages within regulation limits.	5	400	ms
Tsb_vout	Delay from 5 VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	ms

4.2 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 +12 V power rail. When this signal is not pulled low by the system, or left open, the outputs (except the +5 VSB) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Table 1: PSON# Signal 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: $T_{pson\_on\_delay}$	5 ms	400 ms



Logic level definition

4.3 DC Warning

Not applicable

4.4 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.

4.5 I^2C to meet Super Micro standard.

Salve address will be 0x70 (default), 0x72, 0x74, 0x76
All the data follows FRU spec.

There is an Internal Area in FRU that is used and defined by vendor (us). Therefore,
We use it for health monitoring. It is located in second block (offset 0x08),
Offset 0x09: Temperature,
Offset 0x0A: Fan 1 speed,
Offset 0x0B: Fan 2 speed,
Offset 0x0C: Power Status,
Offset 0x0D: Temperature High Limit,
Offset 0x0E: Fan 1 speed Low Limit,
Offset 0x0F: Fan 2 speed Low Limit.
Offset 0x16: Firmware Version (for example, revision 2.1 would be 0x21).
Offset 0x10-0x15 and 0x17: reserved for future use.

Power Status: bit0 =1 -> GOOD, bit0 = 0 -> Failed
Fan Speed formula: RPM = (1/0.262) *(Fan Pulse Count * 60 /2)

User want to retrieve the FRU data, must follow FRU spec.

Power supply I2C operation shall not latch system I2C bus for over certain time period needed for normal operation. Power supply I2C shall have auto reset function in case of waiting for clock pulse over a reasonable time period.

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

4.6 Over Current Protection

The power supply shall have current limit to prevent +12 V outputs from exceeding the values shown in Table 2. If the current limits are exceeded, the power supply shall shutdown and latch off. The latch will be cleared by toggling the PSON# signal or by an input DC power interruption. The power supply shall not be damaged from repeated power cycling in this condition. All outputs shall be protected so that no damage occurs to the power supply under a shorted output condition. Over current protection trigger delay time is 50 ms.

Table 2: Over Current Protection

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

4.7 240VA Protection

Not applicable

4.8 Over Voltage Protection

The power supply over voltage protection shall be locally sensed. The power supply shall shutdown and latch off after an over voltage condition occurs. This latch shall be cleared by toggling the PSON# signal or by an DC power interruption. Table 3 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 3: Over Voltage Limits

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

4.9 Over Thermal Protection

The power supply over thermal protection shall be locally sensed. The power supply shall shutdown when over temperature condition occurs. The power supply shall recover when the temperature returns normal. 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.

5 Environmental Requirements

5.1 Temperature

5.1.1 Normal Operating Ambient(at sea level):

minimum 0 degrees Celsius ; maximum 50 degrees Celsius

5.1.2 Abnormal Operating Ambient(at sea level):

N/A degrees Celsius
N/A survival time

5.1.3 HUMIDITY

Operating: 10% to 90% RH
Storage: 5% to 95% RH

5.1.4 ALTITUDE

Operating: to 10,000 feet (3,023 meters)

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

5.2 SHOCK AND VIBRATION

5.2.1 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

.

5.2.2 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.

5.3 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**.**

6 MTBF and Quality Data

6.1 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.

7 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. Typically this includes:

- cUL
- UL
- CCC
- TUV
- CE
- FCC

The power supply itself meets class A with 4 dB margin of EMI limits for CE, FCC 15, CISPR22 and certificated with CE compliance.
The power supply, when installed in the system, shall also meet immunity requirements specified in EN55024, and EN61000-4-2, -3, -4, -5, -6, -8. The power supply must maintain normal performance within specified limits. This testing must be completed by the system EMI engineer. Conformance must be designated with the European Union CE Marking. Specific immunity level requirements are left to customer requirements.

7.1 Leakage Current

Meets the latest EN60950 safety standard.

7.2 Flammability

The following is a list of the minimum acceptable flammability ratings for parts used within the power supply:

Printed circuit boards, including all daughter cards: 94V-0

Magnetic assemblies must be constructed of materials with a UL flame class of VW-1, V-1 or better, or meet the flammability requirements of V-1 or better when tested per the procedures as specified in Appendix A6 of IEC 60950. The test is to be applied to the magnetic assembly (not a material sample) without the assembly being preconditioned prior to the test.

Power connectors on the Motherboards: 94V-0

All other connectors, other than Motherboard power connectors: V-2 or better

Plastic fabricated parts must be made of a material with a UL recognized flame class of V-1 or better. However, small mechanical parts such as cable ties, washers, and PC board mounts may be made with a UL recognized flame class of V-2.

7.3 ROHS

This power supply is compliant to ROHS requirements with server exemption.

7.4 DC Line immunity compliance

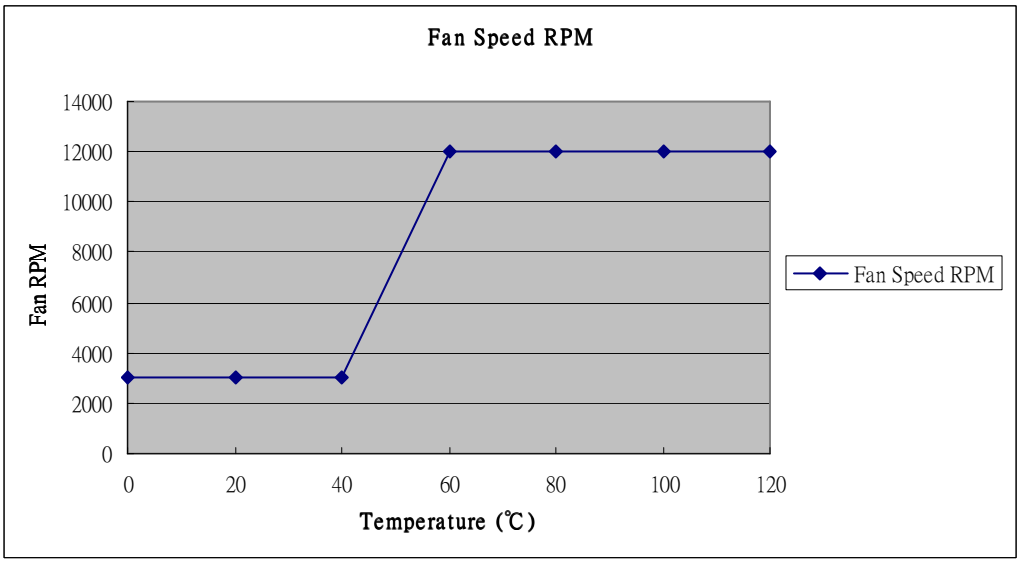
Test Type or Specification	**Applies to**	**Class / Level / Criteria**
Electrostatic Discharge EN61000-4-2:1995	System/enclosure	Level 4/8 KV contact ,15KV air/B
Radiated Immunity IEC61000-4-3:1995 ENV50140:1993	System/enclosure	Level 3/10V/m/A 1KHz 80% AM (80MHz – 1GHz)
Surge Immunity EN61000-4-5:1995	DC Power line (live-earth) DC Power line (return-earth) Signal lines 2 ohms	Class 4/500 V/B Class 4/500 V/B Indoor:500V Outdoor: 4KV/R
Conducted RF Immunity EN61000-4-6:1996+ ENV50141:1993	DC Power line Signal lines	Level 3/10 V/A (150KHz to 80MHz)

8 Mechanical and Drawing

8.1 Fan Speed Control

8.1.1 When DC plug in, Fans will be on and have minimum speed to cooling power supply to keep normal operating temperature.

8.1.2 The power supply will have internally controlled fans. The fans will be thermal controlled by internal temperature and will have a profile as indicated below, with 35 degree C environment temperature.



Note that speed transition should be non-linear to reduce perceived noise from fan.

8.1.3 Fan Vibration.

Fan vibration should be well controlled to avoid large vibration. Accelerate velocity can't over 1.0m/s^2 on any place on the surface of power supply case.

8.2 Output Connector

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 equivalent connector**.

Power and Signal Connection

Description	Pin Number	I/O	Active	Pin length
Ishare	1	I/O	Analog	Standard
A1 (address)	2	I/O	High/Low	Standard
A0 (address)	3	I/O	High/Low	Standard
I2C SCL	4	I/O	Digital	Standard
I2C SDA	5	I/O	Digital	Standard
PS ON/OFF	6	I/O	Low	Short (by 1mm)
	7	O	High/Low	Standard
DC GOOD	8	I/O	High/Low	Standard
+12V	9		Power Pin	Standard
+12V	10		Power Pin	Standard
+12V	11		Power Pin	Standard

+12V	12		Power Pin	Standard
+12V	13		Power Pin	Standard
RS GND	14		Analog	Standard
	15			
12V RS GND	16			
Present	17			
DC Return	18		Power Pin	Standard
5V CO	19		Power Pin	Standard
5V CO	20		Power Pin	Standard
DC Return	21		Power Pin	Standard
DC Return	22		Power Pin	Standard
DC Return	23		Power Pin	Standard
DC Return	24		Power Pin	Standard
DC Return	25		Power Pin	Standard
DC Return	26		Power Pin	Standard

.**Note:** The signal pins on the power supply connector will be gold plated to 30 microns.