CAR1248FPBC

1200W
1U High Front-End
Power Supply

DETAIL SPECIFICATION

Marketing Specification
Total Pages: 18

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1. GENERAL

Cherokee's latest addition to the CAR family is a low profile 1U 1200W front-end +48Vdc; ideal for datacom applications (enterprise networking, servers, storage equipment, etc) where space is a premium.

With an unprecedented power density of ~19W/in^3, the CAR1248FPBC is designed for a maximum output power of 1200W (max 25A @ +48Vout, high line operation) in a 1U x 2U package. For scalable architectures, (5) units can be mounted together in a 1U high 19" shelf.

Features of the latest CAR1248FPBC front-end include:
Compact 1U Design
Constant Current Characteristic
High Power Density (~19W/in^3)
Visual LED Indicators (AC Good, DC Good, Fault)
Hot Plug-ability
Redundant Parallel Operation
Active Load Sharing (Single Wire)
Remote On/Off
Remote Sense (up to 0.50V compensation per leg)
No Minimum Load Requirements
Universal Input with PFC
Microcontroller based with I2C Serial Bus
Front to rear air-flow (reverse air flow capability – as an option)
Five CAR1248 Modules per Rack (4.8KW N+1 Capability)

2. INPUT SPECIFICATIONS

Input Voltage

Range:	85*-264Vac
Nominal:	230Vac or 90Vac (single phase)

* Unit derates below 90Vac (input) to 900W

Input Frequency

Range:	47-63Hz (ETSI 300132-1 recommendation)

Under-Voltage

The power supply switches off when mains voltage goes beyond the specified range. When active, the green LED is switched OFF on the front panel to generate a specific alarm. Turn off ≤ 80Vac

Maximum Input Current

7.90A (full load, Vin = 180Vac)
12.75A (full load, Vin = 100Vac)

Power Factor

0.99 typical at nominal line & full load

Efficiency

91% typical, at nominal load and 230Vac (including Oring mosfets).
90% typical at 90Vac.

Input Fuse

Two fuses (line & neutral) – 20A & 250Vac
Type 3AB Axial

Relative Harmonics (of input current)

According to IEC 1000-3-2. Limits for harmonic current emissions for class A equipment

Inrush Current

Max 40A pk (Measured at 25ºC for all line conditions typical duration 10ms)

Input Leakage Current

3mArms (250Vac & 60Hz)

Switching Frequency

200kHz Input (400kHz Output)

Hold-up Time

20ms at 1000W (typical) @ 90 Vac input
16.7ms at 1200W (typical) @ 180Vac input

3. OUTPUT SPECIFICATIONS

Output Voltage

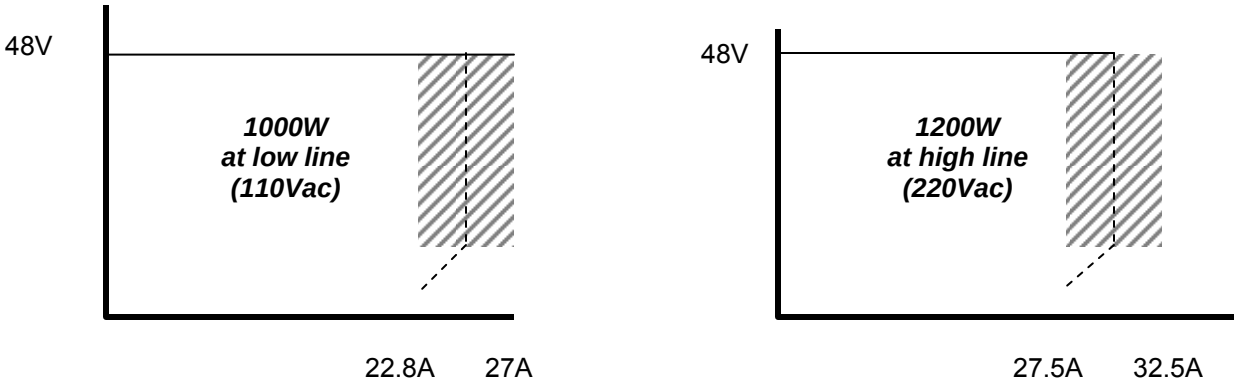
Nominal output:	+48Vout
Set tolerance:	±0.5%
Standby voltage:	5V (@ 0.5A) ± 5%

Output Current (nominal)

20.8A @ +48Vnom for low line operation (90Vac)
25.0A @ +48Vnom for high line operation (230Vac)
Minimum Load: 0A

Current Limit

The unit is self-protected via constant current limit characteristic between the range of 110% - 130% of Iout nominal.



Short Circuit – hiccup mode protection, self resetting upon clearance of the fault condition.

Output Power

1000W at low line* operation (90Vac)
1200W at high line operation (230Vac)
* Unit derates below 90Vac (input) to 900W.

Line/Load/Temperature Regulation

≤ ± 2% of Vnom for any combination of line, load & temperature.

Over-voltage Protection

60Vdc max Latched
Reset condition by recycling the AC input or applying Remote ON/OFF

Dynamic Response

dIout/dt	≤ 1A/µs
Deviation	≤ 5% Vout (for a 50% step load)*
Recovery time	300us

* for system load conditions > 10% Iout max.

Turn on/off Delay Time

Mains on delay time	⩽ 2s
Remote on delay time	⩽ 40ms
Remote off delay time	⩽ 40ms

Turn-on Rise Time

⩽ 50ms

Ripple and Noise

Complies with ETS300 132-2
32 dBrnc (measured without external battery) – TBD
Narrow band noise/Wideband noise (25 Hz - 20 kHz)
± 1% (pk-pk) @ 20MHz with 0.1µF ceramic and 10µF electrolytic caps at the output

Bias Supply

5V @ 0.5A.
Referenced to the -Vout Return.
Ideal source for housekeeping & monitoring circuitry.

4. SIGNALS AND CONTROLS

For specific signal protocol please contact factory.
All analog signals are referenced to the -Vout Return or Chassis Ground.

Output Voltage Programming (Vprog)

Analog input signal - voltage determining the front end output voltage.
Vout = 43.2V + 3.3 x (Vprog – 0.364)V where 0.364V<Vprog<3.27V
The output voltage goes from 43.2Vdc to 52.8Vdc

Output Current Monitoring (I Monitor)

Analog output signal.
Voltage proportional to the power supply output current (0.2V/A) ± 250mV.

Load Share/Paralleling (I Share)

Analog signal. Single wire connection.
Ishare bus voltage at full load
Unit will load share within ±10% of full load on V1 (48V output).

Remote ON/OFF

TTL compatible. Open collector (High) for normal operation.
Sink current: 1mA. Max collector voltage: 12Vdc
Logic 1 (TTL High) or open enables unit (ON); Logic 0 (TTL Low) or short shuts unit down (OFF).
Cycling this signal resets the over-voltage protection memory.

AC OK

TTL compatible. Open collector (High) for normal operation.
Sink current: 20mA. Max collector voltage: 12Vdc
AC OK indicates that AC is applied within the specified input range for the front end.

DC OK

TTL compatible. Open collector (High) for normal operation.
Sink current: 20mA. Max collector voltage: 12Vdc

Over Temperature Warning (Temp OK)

TTL compatible. Open collector (High) for normal operation.
Sink current: 20mA. Max collector voltage: 12Vdc

In the event of an over temperature condition, the unit protects itself by providing a low warning signal for 10 seconds (typical) and then shutting off. Auto restart after the condition is cleared.

Fault Signal

TTL compatible. Open collector (High) for normal operation.
Sink current: 20mA. Max collector voltage: 12Vdc
This alarm is an opto-isolated open collector signal referenced to -Vout Return. The signal indicates that a failure has been detected in the unit due to an over-temperature or over-voltage shutdown condition.

Signal Return

The signal return is the reference for all the signals and is internally connected to the output return.

PS Missing

The signal is connected to the output return to notify the system whether the power supply is present or unplugged.

Module Enable (Short Pin)

Power supply will turn on when pin engages to Output Return. It is required to tie the Mating Connector pin to the Output Return.

Hot Swap

Unit is equipped with internal Or-ring mosfets in the + Vout leg and designed for hot swap operation.

Write Protect

This signal is used for factory EEPROM programming only. When left open, the EEPROM will be write protected. Pulling the signal low (to signal return) will remove the write protection.

Interrupt

The interrupt signal will be issued when signals on the I2C bus have changed state.

LEDs

AC OK (Green), DC OK (Green), Fault (Red)

CONDITION	LED STATE			MONITORING SIGNAL*		
	AC OK	DC OK	FAULT	FAULT	OVER TEMP.	AC OK
OK	Green	Green	OFF	High	High	High
LOW/NO AC	OFF	OFF	OFF	High	High	Low
OVER-VOLTAGE SHUTDOWN	Green	OFF	Red	Low	High	High
OVER CURRENT	Green	OFF	Red	High	High	High
MISSING MODULE	N/A			**Open**	Open	Open
REMOTE OFF	Green	OFF	OFF	High	High	High
THERMAL ALARM	Green	OFF	Red	High	Low	High

5. I2C Serial Communication

The I2C interface incorporated within the CAR1248 front end includes facilities to monitor various operating parameters within the unit and transmits these on demand over an industry standard I2C Serial bus. I2C operation will over-ride analog signal operation when this option is selected.

Electrical Interface

Address lines (A0, A1 &A2)
These external address lines allow up to 5 CAR1248FPBC modules to be addressed on a single I2C bus.

Serial Clock
This line is clocked by the processor that controls the I2C serial bus. It should be tied to a +5V supply via a pull up resistor.

Serial Data

This line is a bi-directional data line. It should be tied to a +5V supply via a pull up resistor.

Microprocessor (uP) Design Feature

The following information represents a summary of the basic functions provided by the microprocessor (P/N PIC16F873) design feature (refer to CAR1248FPBC detail microprocessor specification No. TBD for further details)

General Fuctions:

Analog Sensing – Output Voltage Sensing (Anode of Oring Device), Current Monitor, and Temperature.

Analog/PWM Control - External Voltage Programming, I2C Voltage Programming, I2C Current Limit Programming, Fan Speed Control, Constant Power Control

Digital Reporting – Line sense, ACOK, DCOK, TEMP_OK, FAULT, Interrupt, OVSD (maybe)

Digital Control – ON/OFF

EEPROM – Internal to IC (1K, 128 bytes)

Communications – SDA, SCL, Addressing (8 unique addresses)

Programming (Factory setting only) – PGC, PGD, MCLR

I2C Iprogram / IPWM (RC1/CCP2) – The user can set the current limit point through the duty cycle at RC1/CCP2 so that its average value (IPWM) is related to ILIMIT by the follow relationship:

ILIMIT = 10 x IPWM = 50 x DCCP2 (CCP2 Duty Cycle)

FANPWM (RC7) – Use a slow sequence (<TBD kHz) of 1's and 0's as a pseudo-PWM output to control the fan speed. The duty cycle should be a function of TS.

Formula to derive D = 0.1 x TS + 0.4

Temp	TS	D (Duty Cycle)	Avg FANPWM	Fan Volt
36C	4V	0.8	4V	12V
86C	2V	0.6	3V	9V

Constant Power Control – Besides the I2C current the uP will also set the current limit point (ILIMIT) basing on the VASENSE reading to create a constant power characteristic on the output from 48 – 58V. The **LOWER** value between this constant power current limit and the I2C current limit will be used to set the DCCP2 and thus the ILIMIT point. Accuracy TBD.

ILIMIT = 10 x IPWM = 50 x DCCP2 (CCP2 Duty Cycle)

Digital Reporting/Control

-LINE_SENSE (RA4) – Input from external hardware

Hi = 90 – 132Vac range
Lo = 180 – 264Vac range.

ACOK (RB4) – Input from external hardware

Hi = AC OK
Lo = AC not OK

DCOK (RC5) – Input from external hardware

Hi = DC OK
Lo = DC not OK

OTEMP (RC6) – Output signal to indicate that there is an over-temperature condition by comparing the voltage from TS against a certain thresholds.

The default values correspond to about 120C of turn off and 110C of recovery.

Hi = TEMP too high
Lo = TEMP OK

Programmable (Internal) DCOK (DCOK_INT) –

This is an optional user programmable DCOK internal to the uP in addition to the hardware DCOK.

Default values: DCOKLO = 307 (1.5V at VASENSE)
DCOKHI = 717 (3V at VASENSE)

FAULT (RB3) – Output signal that indicates whether there is a fault due to over-temperature, over-voltage or internal DCOK conditions.

Hi = FAULT
Lo = No FAULT

INT (RB0/INT) – Output interrupt signal to be triggered by changing state of ACOK, DCOK, TEMP_OK or -OVP going Lo. Interrupt timing from ACOK and DCOK should be minimized per the uP's capability.

Hi = No Interrupt
Lo = Interrupt

–OVSD (RA3/AN3, Maybe) – Input from external hardware

Hi = No OV shutdown
Lo = Shutdown due to OV

-ON/OFF (RB5) – Output to control output on and off by user's input from I2C. The off status from either this signal or the analog Remote On/Off will override the on conditions of one another.

Hi = Output Off
Lo = Output On

EEPROM – UP has 1K bytes of memory available. A separate EEPROM IC will provide another 1K bytes of memory with write protect feature. Minimum information to be included in the external EEPROM: model number, revision, date code, serial number and TBD.

I2C Communications – SDA (RC4) and SCL (RC3) lines should have no pull-up resistors and no more than 47pF of filtering capacitor. A0 (RC0), A1 (RB1) & A2 (RB2) are for setting 8 possible addresses by the user.

Device Addresses:

Device	Address	Address Bit Assignments (Most to Least Significant)							
uP	Bx	1	0	1	1	A2	A1	A0	R/W
EEPROM	Ax	1	0	1	0	A2	A1	A0	R/W

Access: R = Read Only; R/W = Read/Write

Source Parameter	Input Source	Register/Bit Location	Access	Comments
VASENSE	**RA0**	**0X00**	**R**	
IMON1	**RA2**	**0X01**	**R**	
TS	**RA5**	**0X02**	**R**	
-ON/OFF	**RB5**	**0X03**	**R/W**	
IPWM	**CCP2**	**0X04**	**R/W**	
VPWM	**CCP1**	**0X05**	**R/W**	
VPROG_EXT	**RA1**	**0X06**	**R**	
OTEMP TRIP THRESHOLD		**0X07**	**R/W**	
OTEMP RECOVERY THRESHOLD		**0X08**	**R/W**	
DCOKHI		**0X09**	**R/W**	
DCOKLO		**0X0A**	**R/W**	
-LINE_SENSE	**RA4**	**0X0B.0**	**R**	**1 = Low Line**
ACOK	**RC5**	**0X0B.1**	**R**	**1 = ACOK**
DCOK	**RC6**	**0X0B.2**	**R**	**1 = DCOK**
OTEMP	**RC6**	**0X0B.3**	**R**	**-OTEMP reported at 0X0B.3 (1 = No OTEMP)**
FAULT	**RB3**	**0X0B.4**	**R**	**-FAULT reported at 0X0B.4 (1 = No FAULT)**
INT	**RB0**	**0X0B.5**	**R**	**1 = No Interrupt**
-OVSD	**RA3**	**0X0B.6**	**R**	**1 = No OVSD**
DCOK_INT		**0X0B.7**	**R**	**1 = Internal DCOK**
EEPROM IN MICRO-P		**0X0D – 0X8C**	**R/W**	
Firmware Revision		**0X0C**	**R**	
EEPROM			**R/W**	

Programming – MCLR, PGC and PGD are for factory programming of uP and not for user's access.

6. SAFETY ASPECTS

Applicable Standards

IEC 950 (per EN 60950)
CSA C22.2-950
UL 1950
CE Mark (LVD)

Input Fuse : 20A

Isolation

Insulation test voltage:

Input – ground:	1500Vac
Output – ground:	500Vdc
Input – Output:	3000Vac

7. EMC SPECIFICATIONS

Immunity

Port	Phenomena	Test	Criteria	Ref Standard
Enclosure	Conducted RF fields Immunity	130dBµV 0.15MHz - 80MHz (80% AM)	A	EN 61000-4-6
	Radiated RF fields Immunity	10V/m 80MHz - 1000MHz (80% AM)	A	EN 61000-4-3
			A	ENV 50140
	ESD	8KV air 4KV contact	B	EN 61000-4-2
AC input	Fast transients Common mode	(5/50ns) 2KV	B	EN 61000-4-4
	Voltage dips Voltage interr.	-30%, 10ms -60%, 100ms -100%, 5000ms > 95% 5 s	A B B	EN 61000-4-11
	Surge common mode differential mode	(1.2 / 50µs) 4KV 2KV	A	EN 61000-4-5

Emission (size dependent – per Engineering)

Port	Frequency-range	Limits	Reference Standard
AC input (conducted)	0.15 – 30MHz	A*	EN 55022 FCC Docket 20780 Part 15, Subpart J Class B.
	0 – 2KHz	-	EN 61000-3-2
Enclosure (radiated)	30 - 230MHz 230 - 1000MHz	A*	EN 55022

- Will meet Class B at rack level or with a specified external filter – System enclosure dependant.

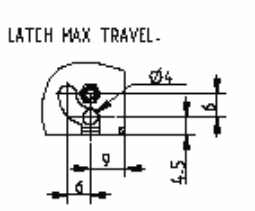
8. Mechanical SPECIFICATIONS

Dimensions

Height: 1.65” - (fits in 1U rack in vertical installation)
Width: 3.44” - (fits in 2U rack in horizontal installation)
Depth: 11.2”

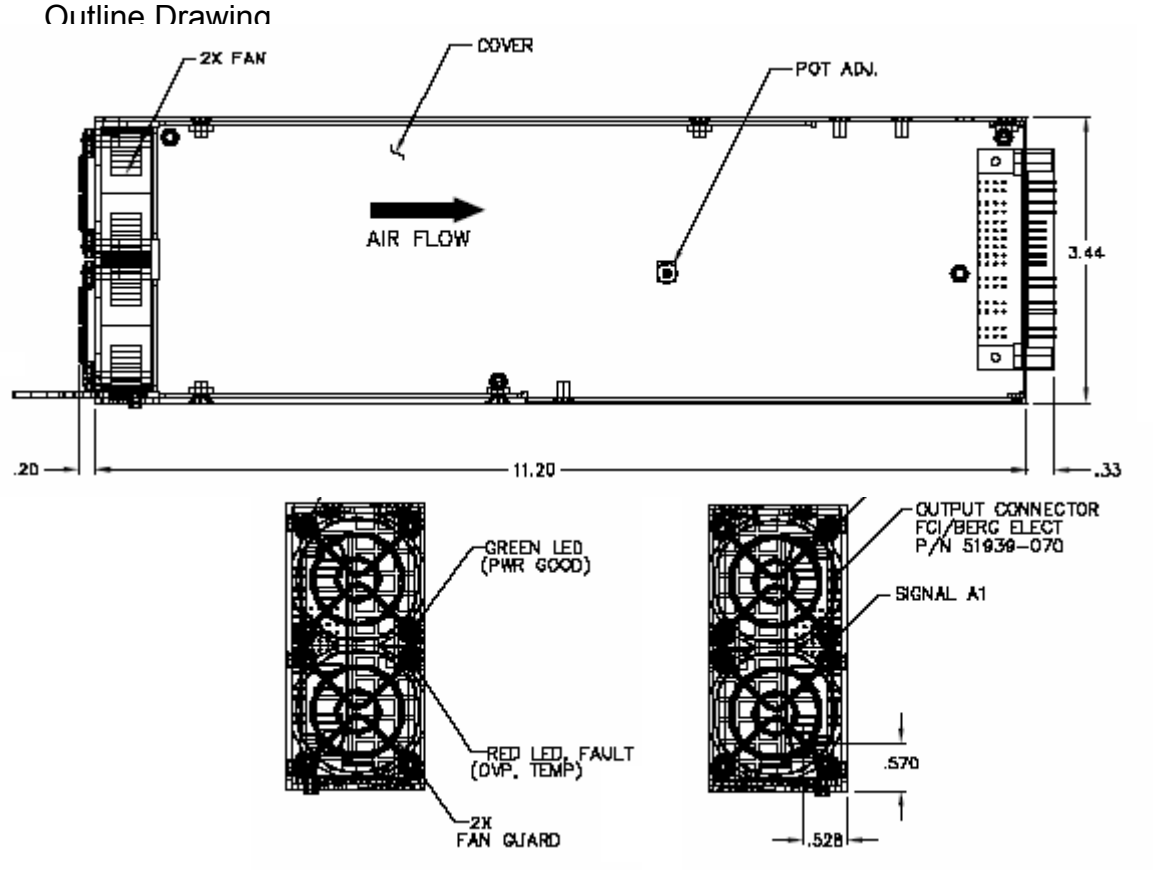
Mounting

Hot plugging allowed. The PS is automatically locked when introduced into the rack. To remove, a small handle enables that user to unlock the unit and easily extract the unit.

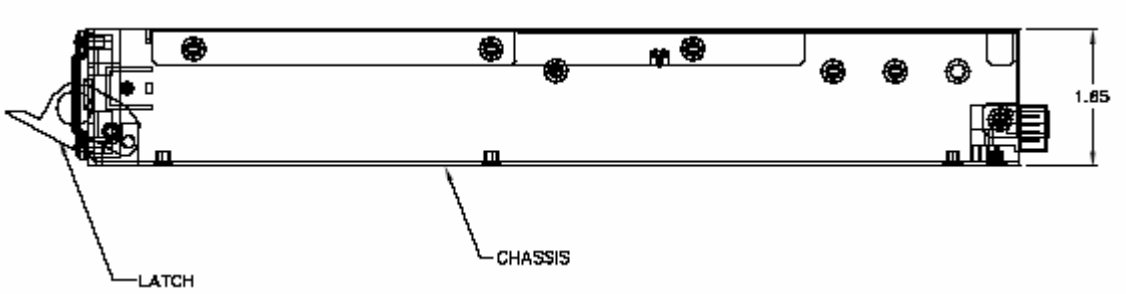


Typical locking devise

Outline Drawing



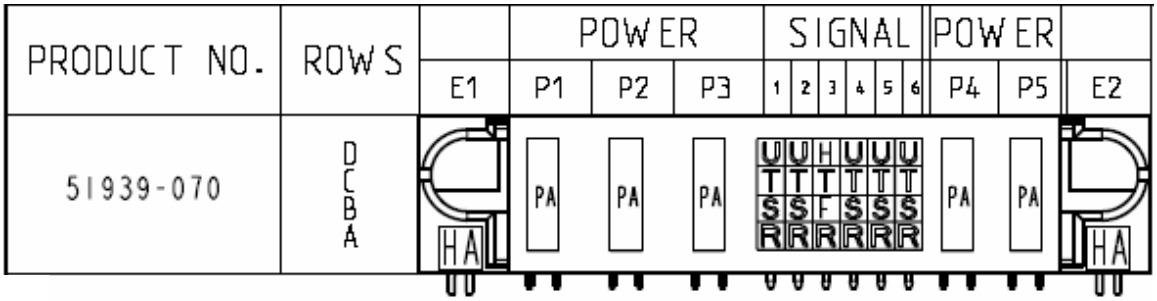
FRONT VIEW **BACK VIEW**



Power supply length without optional face-plate is 11.2”.

9. Connections

A1	NC	C1	I Share	P1	Line
A2	NC	C2	N/C	P2	Neutral
A3	Output Return	C3	Temperature OK	P3	Chassis
A4	Write protect	C4	I2C Address (A0)	P4	Return
A5	Remote Sense (+)	C5	I2C Address (A1)	P5	-V1 Output
A6	Remote Sense (-)	C6	I2C Address (A2)		
B1	Fault	D1	V Prog		
B2	I Monitor	D2	OVP Test point		
B3	Module Enable	D3	Remote ON/OFF		
B4	PS Missing Return	D4	DC-OK		
B5	Serial Data Line	D5	AC OK		
B6	Serial Clock Line	D6	INTERRUPT		



FCI Berg P/N: 51939-070

Mating connector – FCI Berg P/N: 51915-050

10. ENVIRONMENTAL SPECIFICATIONS

Temperature

Operating ambient: -10°C to +70°C (-40°C startup)
Active derating between: 51°C to +70°C (2.5% above 50°C)
Storage: -40°C to +85°C

Cooling: Horizontal airflow front to back with built in fan

Humidity

Operating relative humidity 30 to 95 % non-condensing
Storage:10 to 95 % non condensing

Altitude – Pressure Drop

Operating (up to 2250m): 700 – 1100mbar
Non-operating: 300 – 1100mbar

Vibration/Shock

Shock & Vibration: NEBS GR-63-CORE Level 3
Frequency Range: 20 – 2000Hz
Time duration: Minimum of 30 minutes
Acceleration: 6Grms

Telcordia GR-63-CORE, GR-487-CORE (NEBS shock and vibration, Seismic Zone 4)
Designed and tested to meet NEBS specifications.

MTBF

100,000 hrs at full load and 50°C per Bellcore RPP
200,000 hrs at full load and 50°C – demonstrated
Lifetime fans: 40,000 hrs at 40°C

11. PART NUMBER SELECTION

PRODUCT	DESCRIPTION	PART NUMBER
1200W Front-End	+48Vout Front-End	CAR1248FP-1A
1200W Front-End	+48Vout Front-End – w/ Microcontroller	CAR1248FPC-1A
1200W Front-End	+48Vout Front-End with Face Plate & Microcontroller	CAR1248FPBC-1A
6000W Rack	Universal Rack for CAR1248 – 5 Units	ACE125RUW-1A