

PWR-2X-11 Power Supply

PC/104-Plus & PCI/104-Express 50 or 100W MILSTD1275/704
Isolated DC/DC

MNL-0645-01 Rev A2 ECO-4177 Effective: 3 May 13

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Chapter 1 Introduction

The PC/104-Plus and PCI/104-Express 50W or 100W MIL-STD-1275/704 Isolated DC/DC Power Supplies are rugged MIL-STD-1275/704-compliant DC/DC converter power supplies in stackable embedded PC/104-Plus (PWR-21-11) and PCI/104-Express (PWR-22-11) form factors.

About This Document

This manual provides a functional description of the PWR-2X-11 hardware, installation information, connector descriptions and pinouts, and specifications.

Description of Safety Symbols

The following safety symbols are used in this manual and indicate potentially dangerous situations.



Warning! Danger, electrical shock hazard!

Personal injury or death could occur. Also damage to the system, connected peripheral devices, or software could occur if the warnings are not followed carefully.



Caution! Hazard to individuals, environment, devices, or data!

If you do not adhere to the safety advice next to this symbol, there is obvious hazard to individuals, to environment, to materials, or to data.



Note: This symbol highlights important information or instructions that should be observed.

Functional Description

The PWR-21-11 and PWR-22-11 boards are rugged MIL-STD-1275/704 compliant DC/DC converter power supplies in stackable embedded PC/104-Plus (PWR-21-11) and PCI/104-Express (PWR-22-11) form factors designed for demanding power conditions experienced by embedded computing devices used onboard military ground vehicles (MIL-STD-1275D) and aircraft (MILSTD- 704F) installations. These galvanically isolated supplies provide 50 watts (+5V only) or 100 watts of combined power output (+3.3V, +5V, +12V) and come equipped with MIL-STD-461 EMI filtering and transient protections specifically designed for demanding 250V spike and 100V surge requirements under MIL-STD-1275.

These boards provide power over stackable buses (PCI and ISA buses for PWR-21-11, PCI and PCI-Express buses for PWR-22-11) as well as auxiliary power output connectors for non-PC/104 systems. They support an 18-36VDC input range for 24/28VDC applications, and typically eliminate the need for additional in-line power conditioning/EMI filtering devices in military embedded systems.

Featuring a rugged mechanical design, these small-form-factor (3.550" x 3.775") boards are designed to be used as the bottom module in a PC/104, PC/104-Plus, PCI/104, PCIe104, or PCI/104-Express embedded system stack; operate without any active cooling over extended temperature ranges (-40 to +85C per MIL-STD-810G); and provide resistance to high levels of shock and vibration (per MIL-STD-810G fixed wing jet, rotary aircraft, and tracked ground vehicle conditions). They are passively cooled by attaching the bottom of the card to a thermally conductive base or enclosure wall with electrically-isolated gap pad to dissipate heat.

A tribute to their robustness and versatility, the PWR-21-11 and PWR-22-11 power supplies are integrated into various MIL-STD-810/1275/704/461-qualified Parvus DuraCOR mission computers, DuraNET Ethernet switches, and DuraMAR mobile IP router subsystems. These small form-factor power supplies are compatible with Cisco Systems' PCI-104 5915 Series Embedded Services Router (ESR) card as well as many embedded single-board computer modules on the market.

Key aspects are:

- 100 Watt or 50 Watt PC/104+ / PCIe/104 Power Supply
- MIL-STD-704F and MIL-STD-1275D Compliance
- MIL-STD-461F EMI Filter / Power Conditioning
- 18V to 36VDC Input Range
- +3V, +5V, +12VDC Output
- Extended Temperature: -40° to +85C°
- MIL-STD-810G Shock/Vibe/Thermal

Configurations

Each power supply is available in both 100 and 50 Watt configurations. In addition, the PWR-21-11 provides versions with no bus connectors, for use in systems that don't require bus connectors.

Product	Product Number	Description	V _{in} (18-36VDC) for all models V _{out}
Power Supply 21x, PC/104-Plus	PWR-21-11-01	100W PC/104+ MIL-1275/704 DC/DC	+3.3V, 5V, 12V
	PWR-21-11-02	50W PC/104+ MIL-1275/704 DC/DC	+5V only
	PWR-21-11-03	50W MIL-1275/704 DC/DC	+5V only; no bus connectors
	PWR-21-11-04	100W MIL-1275/704 DC/DC	+3.3V, 5V, 12V; no bus connectors
Power Supply 22x, PCI/104-Express	PWR-22-11-01	100W PCI/104-Express MIL-1275/704 DC/DC	3.3V, 5V, 12V
	PWR-22-11-02	50W PCI/104-Express MIL-1275/704 DC/DC	+5V only

Features

Applications

- 24/28V DC-DC conversion for PC/104, PC/104-Plus, PCI-104, PCIe104, PCI/104-Express, and other small form-factor embedded systems
- Compliance with MIL-STD-1275, MIL-STD-704, MIL-STD-461 Surges, Spikes, Conducted Emissions in Aerospace / Avionics / Military / Ground Vehicles

Form Factor

- PWR-21-11: PC/104-Plus (ISA + PCI)
- PWR-22-11: PCI/104-Express (PCI + PCIe)

Compliance

Designed to meet MIL-STD-810G (Environmental), MIL-STD-1275D, MIL-STD-704F (Voltage Input, Surges, Spikes, Transients), and MIL-STD-461F (Conducted Emissions & Susceptibility).

Voltage input

Nominal 28.0 V DC (+18V to +36VDC with protection for 250V spikes and 100V surges per MIL-STD-1275)

Voltage Output

- Up to 100 Watts: +5V @ 10A (50W Max), +3.3V @ 15A (50W Max), +12 V @ 1.5A (18W Max – 12V derived from 3.3V rail)
- Optional 50 Watt 5V only configuration: +5V @ 10A (50W Max)
- 1500V DC Galvanic Isolation input to output

Remote Shutoff

- Remote Power On/Off Shutdown Support

Interface Block Diagram

Figure 1 illustrates the PWR-2X-11 interfaces.

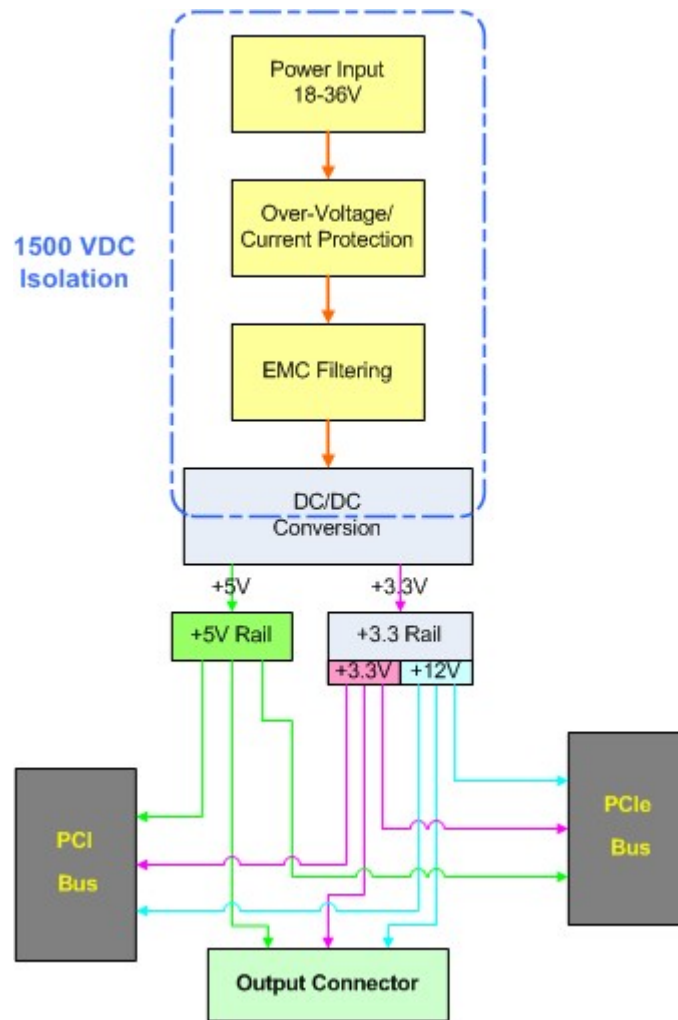


Figure 1. Interface Block Diagram

Chapter 2 Operational Description

This chapter provides the information required for board installation.

Installation

The PWR-2X-11 power supplies are designed to mount in PC/104, PCI-104+, PCI/104, PCIe104, and PCI/104 Express stacks using commercially available hardware. The PWR-2X-11 should be installed at the bottom of the board stack a) for thermal management considerations and b) because the PWR-2X-11 design on the underside of the board is not fully compliant with the heights of the applicable standards. All other sizing elements of the PWR-2X-11 are compliant with each of the applicable standards.

Grounding

For EMC compliance, the front two mounting holes must be connected to chassis ground (see Figures 2, 3, and 4).

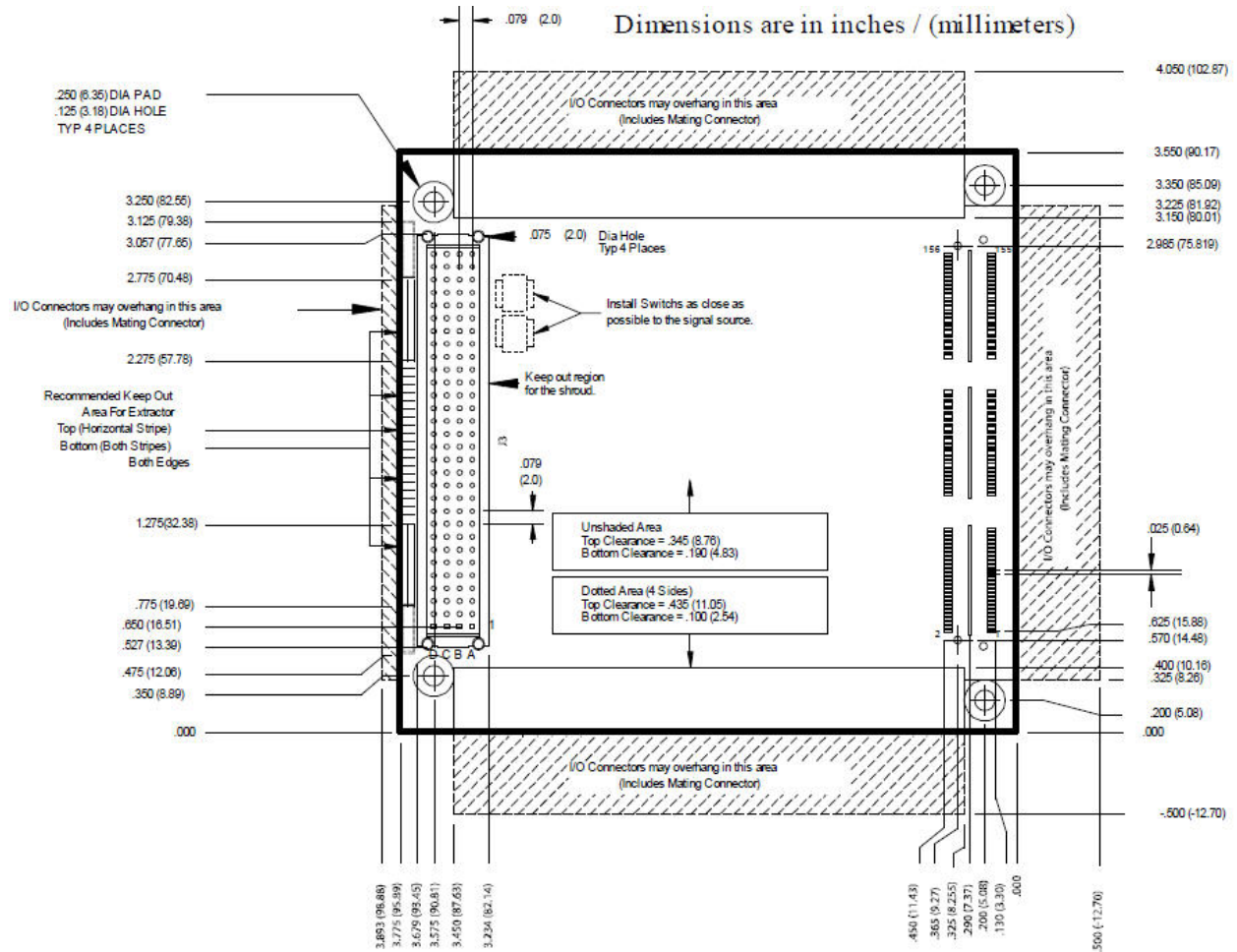


Figure 2. Dimension Drawing

Board Layout

Figures 3 and 4 show the connectors on the power supply.

Connector	Description
Input Connector	Power input interface (18VDC to 36VDC). Molex part# 43045-0802
ISA Bus	ISA bus interface. Refer to the connector pinouts in Chapter 3. Tyco part# 1375796-1
PCI Bus	PCI bus interface. Refer to the connector pinouts in Chapter 3. Tyco part# 1375800-1
PCIeBus	PCIe bus interface. Refer to the connector pinouts in Chapter 3. Samtec part# ASP-129637-03
Output Connector	Power output interface (5VDC, 3.3VDC, 12VDC, and GND). Molex part# 43045-1202
Chassis Ground Holes	Chassis ground holes for EMI filtering

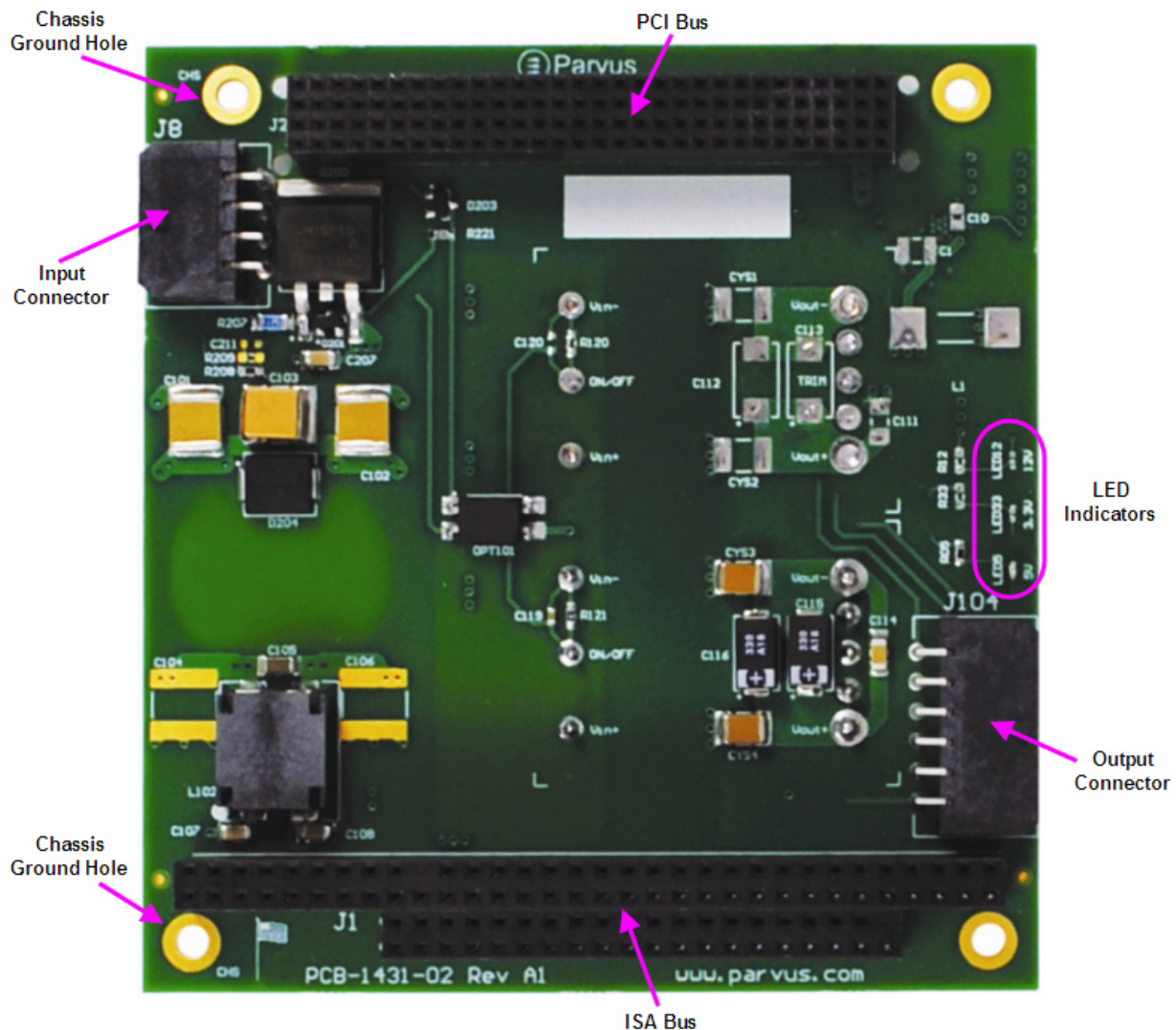


Figure 3. Power Supply Connectors (PWR-21-11)

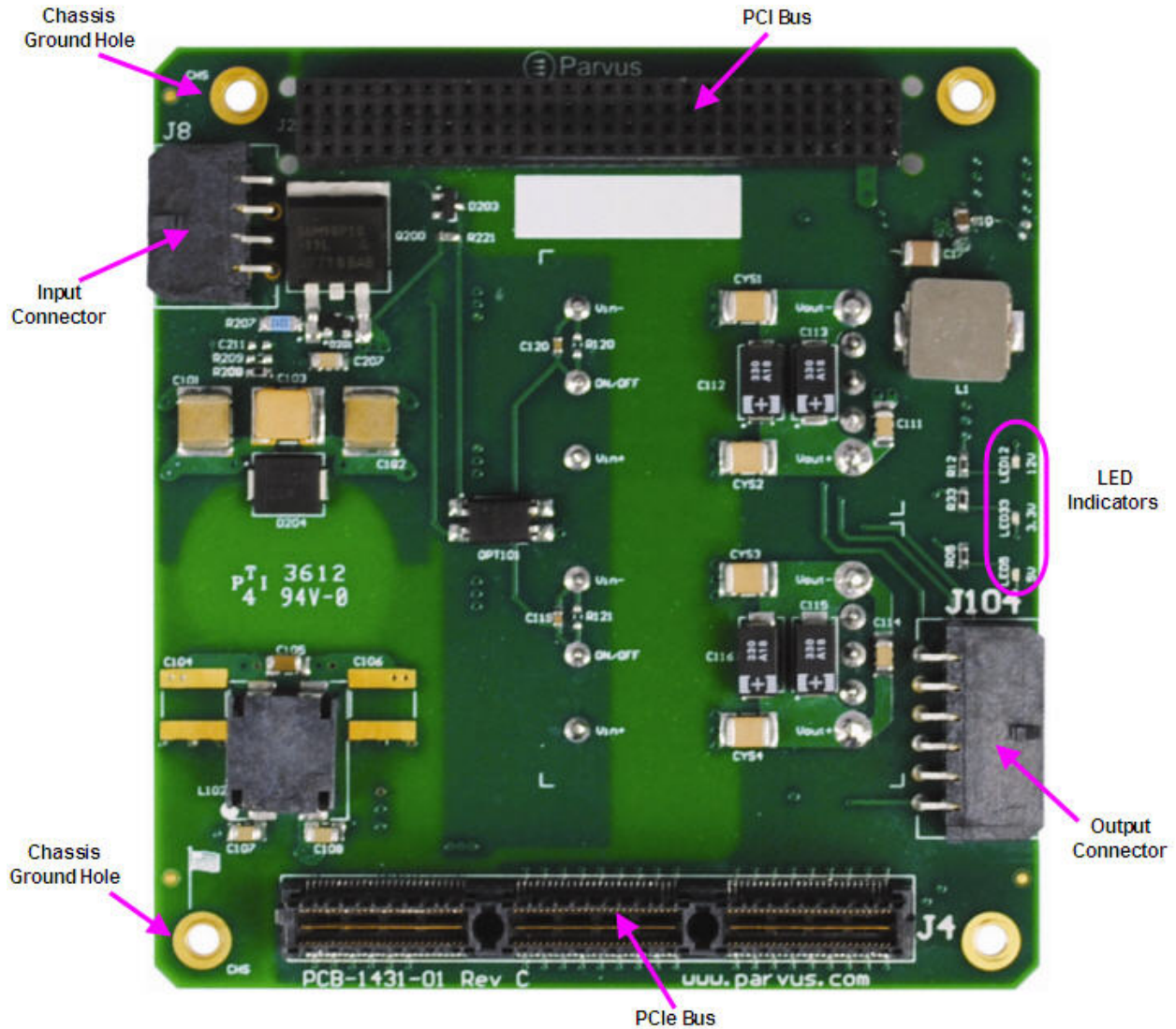


Figure 4. Power Supply Connectors (PWR-22-11)

LED Indicators

The power supply has power-on LEDs for the 3.3VDC, 5VDC, and 12VDC power rails. Figures 3 and 4 show the location of the LED indicators.

Remote Power-On Control

By default, remote power-on control is disabled. To enable remote power-on / power-off control:

1. Remove R120 and R121 (see Figure 5 for location).

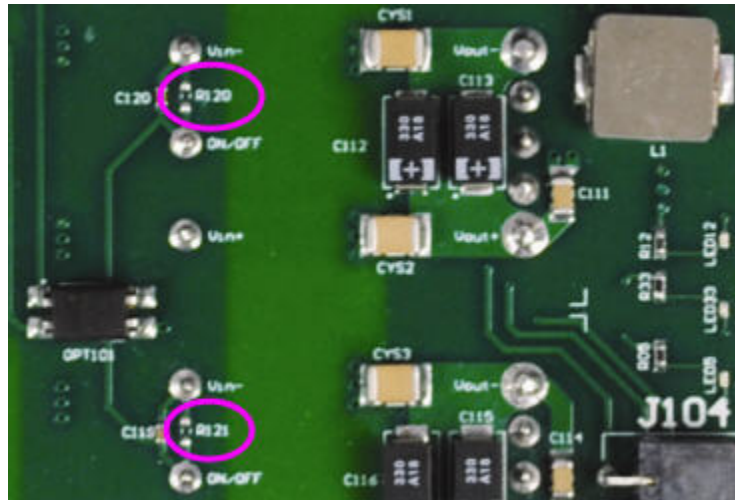


Figure 5. R120 and R121 Enable Remote Power-On Control

2. To turn on the power supply, connect RMT_ON (remote on) to 28V_RTN_IN on the input power connector J8, as shown below. Figure 6 shows J8 looking into the connector.



Figure 6. Connection for Remote Power-On Control

3. To turn off the power supply, remove the connection between RMT_ON and 28V_RTN_IN.

Thermal/Electrical Protection: Design Guidance

The metal cases on the bottom of the board require heat sinking and electrical isolation. Figures 7 and 8 show the locations of the cases that require heat sinking and electrical isolation.

It is recommended that the user design a custom heat sink to adequately disperse thermal energy by conduction through the mechanical enclosure of the user's system. To aid in this effort, Parvus will provide drawings (CAD files) on its website for both the heat sink and thermal pads. These can be leveraged and modified as needed to meet user needs.

The next sections detail this reference design.

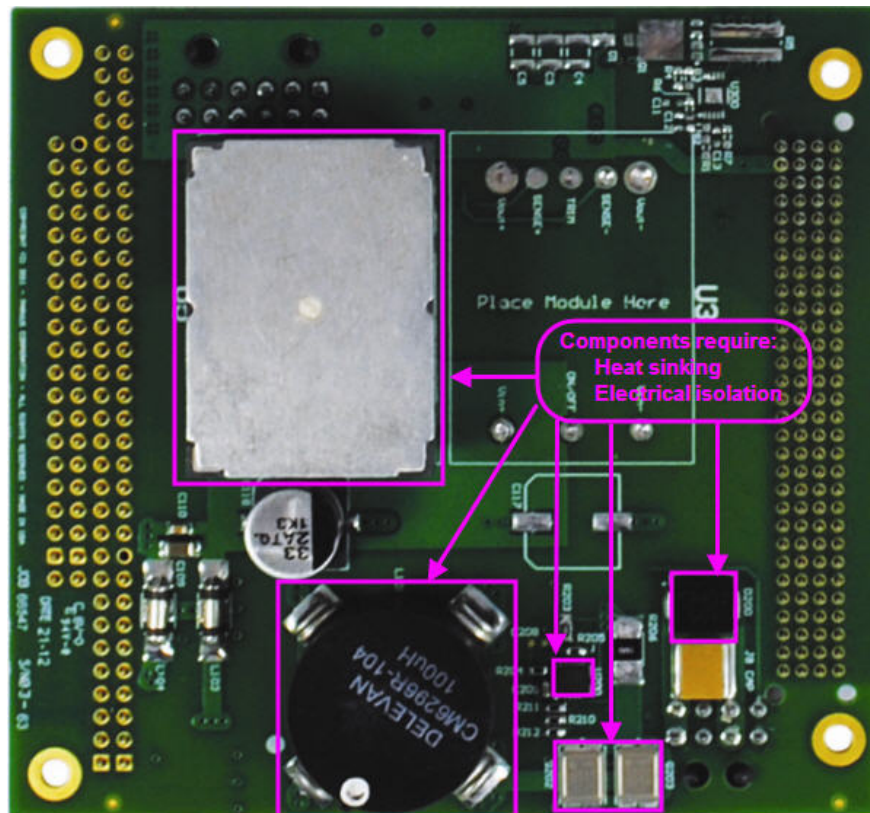


Figure 7. Components on Bottom Side of 50 Watt Board

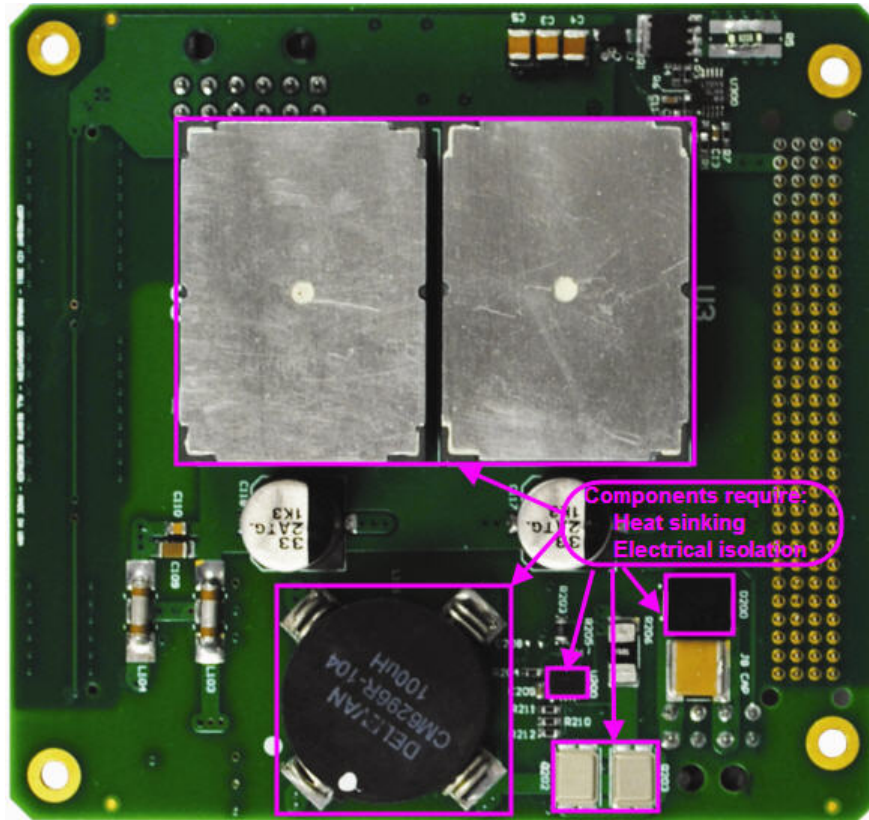


Figure 8. Components on Bottom Side of 100 Watt Board

Reference Thermal Plate Installation

The reference thermal plate (clamshell) design for the PWR-2X-11 provides the heat sinking and electrical isolation required for components on the bottom side of the board.

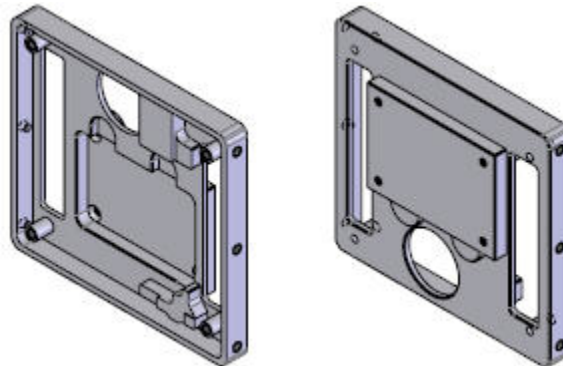


Figure 9. Clamshell Isometric View

Installing such a clamshell involves connecting the clamshell to the board using four screws 4-40x5/16 combined with a flat washer and lock washer, or with a flat washer and some Loctite. (Refer to Figures 10 and 11 for the hole locations.) A set of thermal pads is necessary between the board components and the heat sink. Parvus recommends the use of Bergquist Gap Pad 5000S35 .060 thick or equivalent for the thermal pads.

Reference Thermal Plate Features

Figures 10 and 11 show the heat sinking and electrical isolation features of the reference clamshell.

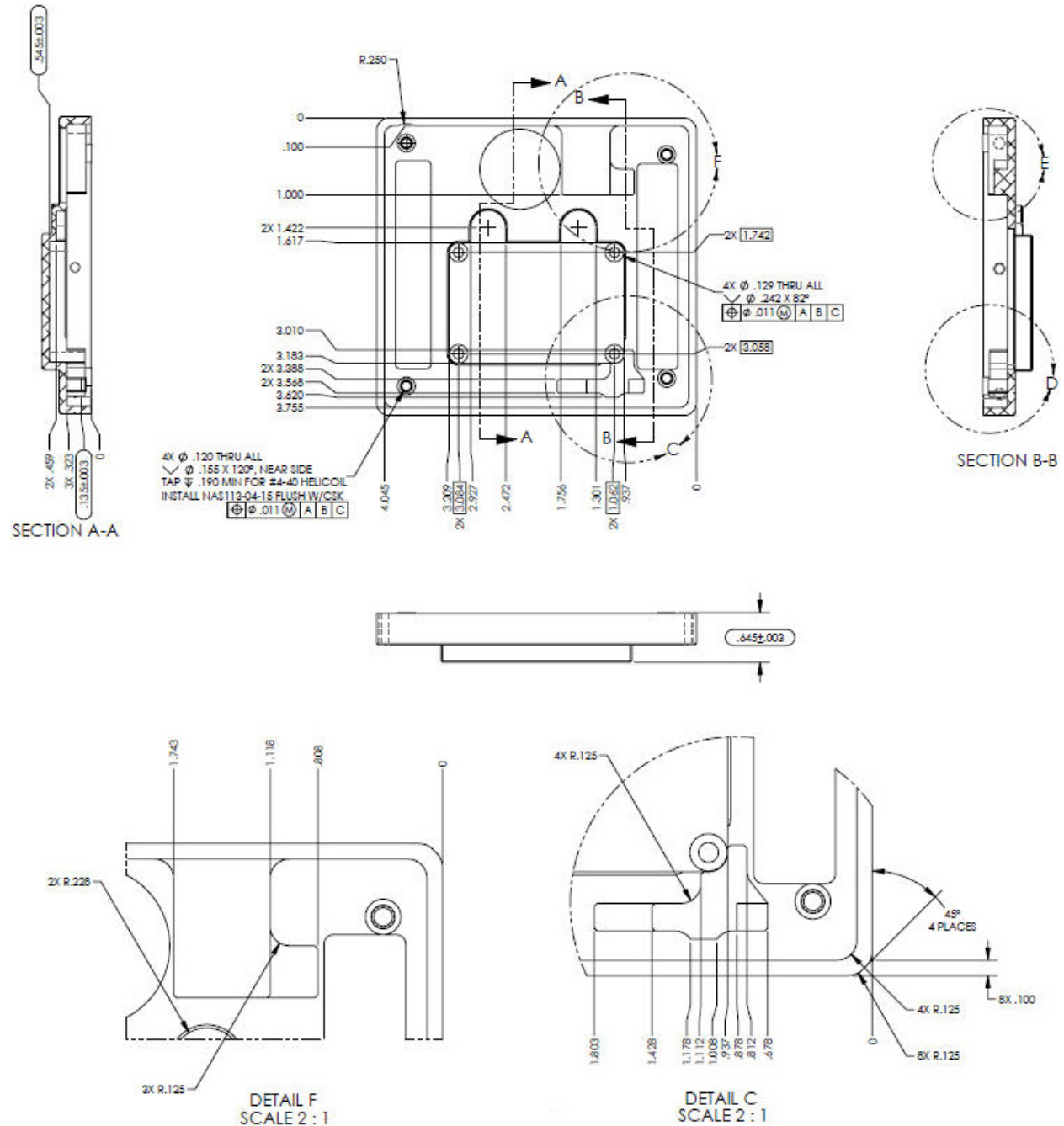


Figure 10. Clamshell Bottom View

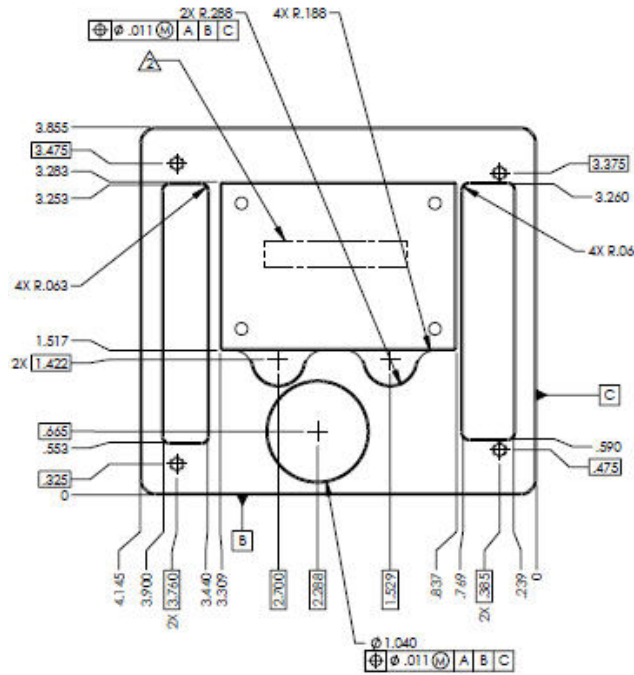


Figure 11. Clamshell Top View

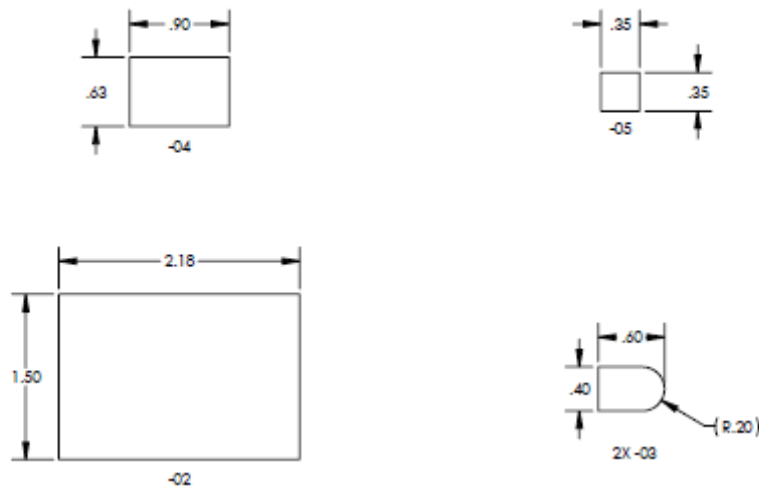


Figure 12. Thermal Pads Top View

Power Output

When determining how much current can be drawn from the PWR 2X-11, make sure that the supply delivers less than or equal to 100 (or 50) watts, while accounting for the 3.3 Volt and 12 Volt shared power rail.



Warning!

The absolute maximum currents for each of the three supply outputs (5.0V, 12V, and 3.3V) should NOT exceed their maximum rated values.

Use the information in the table to determine the projected current draw for your configuration. Make sure that the total power output (Pout) is less than or equal to 100 (or 50) watts.

Output Voltage	Maximum Rated Output Current
5.0 Volt	10 Amps
3.3 Volt	15.2 Amps. (3.3VDC only available on 100W versions)
12 Volt (shared with 3.3V)	1.5 Amps. (12VDC only available on 100W versions) Reduces the output power available on the 3.3V rail. $P_{out}(3.3\&12V) = 50Watts = 3.3 \text{ Volts} \times I_{out3.3} + 12 \text{ Volts} \times I_{out12}$



Note: This amount of power is available up to ~70°C ambient, and then is subject to thermal derating to 70% of full load at 85°C.

Chapter 3 Connector Descriptions

This chapter identifies the pinouts and signal descriptions for the PWR-2X-11. It also provides connector part numbers along with suggested mating connector details as necessary.

Connector Part Numbers

Refer to Figures 3 and 4 for the location of each connector.

Input Power Connector

- Connector: Molex R/A Header, Molex part # 43045-0802
- Suggested mating connector: Receptacle Housing Molex part # 43025-0800, with crimp pins Molex part# 43030-0009

Output Power Connector

- Molex R/A Header, Molex part # 43045-1202 – rated for full output capabilities of 5V, 3.3V, 12V Rails
- Suggested mating connector: Receptacle Housing Molex part# 43025-1200, with crimp pins Molex part# 43030-0009

Bus Connectors

- Stacking PCI and ISA Bus Connectors, top of board only (PWR-21-11)
 - Suggested mating connector for PCI: TE Connectivity / Amp 1375799-1.
 - Suggested mating connector for ISA: TE Connectivity / Amp 1375795-1
- Stacking PCI and PCI-Express Bus Connectors, top of board only (PWR-22-11)
 - Suggested mating connector for PCI: TE Connectivity / Amp 1375799-1.
 - Suggested mating connector for PCI-Express: Samtec ASP-129646-03

Connector Pinouts

Input Power Connector (J8)

8	RMT_ON	7	28VIN	6	Chassis	5	28V_RTN_IN
4	28V_RTN_IN	3	28VIN	2	Chassis	1	28V_RTN_IN

Figure 12. Input Power Connector Pinout

J8 Pin	Signal
1	28V_RTN_IN
2	CHASSIS
3	28VIN
4	28V_RTN_IN
5	28V_RTN_IN
6	CHASSIS
7	28VIN
8	#RMT_ON

Output Power Connector (J104)

12	5V	11	5V	10	12V	9	3.3V	8	3.3V	7	3.3V
6	GND	5	GND	4	GND	3	GND	2	GND	1	GND

Figure 13. Output Power Connector Pinout

J104 Pin	Signal
1	GND
2	GND
3	GND
4	GND
5	GND
6	GND
7	3.3V
8	3.3V
9	3.3V
10	12V
11	5V
12	5V

ISA Bus Pin Matrix (PC/104 Plus Standard) (J1)

Only ground and power pins are connected.

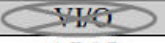



Pin	Row D	Row C
0	GND	GND
1	MEMCS16*	SBHE*
2	IOCS16*	LA23
3	IRQ10	LA22
4	IRQ11	LA21
5	IRQ12	LA20
6	IRQ15	LA19
7	IRQ14	LA18
8	DACK0*	LA17
9	DRQ0	MEMR*
10	DACK5*	MEMW*
11	DRQ5	SD8
12	DACK6*	SD9
13	DRQ6	SD10
14	DACK7*	SD11
15	DRQ7	SD12
16	+5V	SD13
17	MASTER16*	SD14
18	GND	SD15
19	GND	KEY

Pin	Row A	Row B
1	IOCHK*	GND
2	SD7	RESET
3	SD6	+5V
4	SD5	IRQ9
5	SD4	-5V
6	SD3	DRQ2
7	SD2	-12V
8	SD1	SRDY*
9	SD0	+12V
10	IOCHRDY	KEY
11	AEN	SMEMW*
12	SA19	SMEMR*
13	SA18	IOW*
14	SA17	IOR*
15	SA16	DACK3*
16	SA15	DRQ3
17	SA14	DACK1*
18	SA13	DRQ1
19	SA12	REFRESH*
20	SA11	BCLK
21	SA10	IRQ7
22	SA9	IRQ6
23	SA8	IRQ5
24	SA7	IRQ4
25	SA6	IRQ3
26	SA5	DACK2*
27	SA4	TC
28	SA3	BALE
29	SA2	+5V
30	SA1	OSC
31	SA0	GND
32	GND	GND

PCI Bus Pin Matrix (PC/104 Plus Standard) (J2)

Only ground and power pins are connected.

 =Not Used

Pin	A	B	C	D
1	GND	Reserved	+5	AD00
2	 VI/O	AD02	AD01	+5V
3	AD05	GND	AD04	AD03
4	C/BE0#	AD07	GND	AD06
5	GND	AD09	AD08	GND
6	AD11	VI/O	AD10	M66EN
7	AD14	AD13	GND	AD12
8	+3.3V	C/BE1#	AD15	+3.3V
9	SERR#	GND	Reserved	PAR
10	GND	PERR#	+3.3V	Reserved
11	STOP#	+3.3V	LOCK#	GND
12	+3.3V	TRDY#	GND	DEVSEL#
13	FRAME#	GND	IRDY#	+3.3V
14	GND	AD16	+3.3V	C/BE2#
15	AD18	+3.3V	AD17	GND
16	AD21	AD20	GND	AD19
17	+3.3V	AD23	AD22	+3.3V
18	IDSEL0	GND	IDSEL1	IDSEL2
19	AD24	C/BE3#	 VI/O	IDSEL3
20	GND	AD26	AD25	GND
21	AD29	+5V	AD28	AD27
22	+5V	AD30	GND	AD31
23	REQ0#	GND	REQ1#	 VI/O
24	GND	REQ2#	+5V	GNT0#
25	GNT1#	 VI/O	GNT2#	GND
26	+5V	CLK0	GND	CLK1
27	CLK2	+5V	CLK3	GND
28	GND	INTD#	+5V	RST#
29	+12V	INTA#	INTB#	INTC#
30	-12V	REQ3#	GNT3#	GND

PCIe Bus Pin Matrix (PCI/104 Express Standard) (J4)

Only power and ground pins are connected (5VSTDBY not connected).

1	USB_OC#	PE_RST#	2	105	STK2 / SDVO_DAT	LPC_CLK	106
3	3.3V	3.3V	4	107	GND	GND	108
5	USB_1p	USB_Dp	6	109	PEx4_1R(0)p	PEx4_0R(0)p	110
7	USB_1n	USB_Dn	8	111	PEx4_1R(0)n	PEx4_0R(0)n	112
9	GND	GND	10	113	GND	GND	114
11	PEx1_1Tp	PEx1_0Tp	12	115	PEx4_1R(1)p	PEx4_0R(1)p	116
13	PEx1_1Tn	PEx1_0Tn	14	117	PEx4_1R(1)n	PEx4_0R(1)n	118
15	GND	GND	16	119	GND	GND	120
17	PEx1_2Tp	PEx1_3Tp	18	121	PEx4_1R(2)p	PEx4_0R(2)p	122
19	PEx1_2Tn	PEx1_3Tn	20	123	PEx4_1R(2)n	PEx4_0R(2)n	124
21	GND	GND	22	125	GND	GND	126
23	PEx1_1Rp	PEx1_0Rp	24	127	PEx4_1R(3)p	PEx4_0R(3)p	128
25	PEx1_1Rn	PEx1_0Rn	26	129	PEx4_1R(3)n	PEx4_0R(3)n	130
27	GND	GND	28	131	GND	GND	132
29	PEx1_2Rp	PEx1_3Rp	30	133	SATA_R1p	SATA_RDp	134
31	PEx1_2Rn	PEx1_3Rn	32	135	SATA_R1n	SATA_RDn	136
33	GND	GND	34	137	GND	GND	138
35	PEx1_1C1kp	PEx1_0C1kp	36	139	SSRX1p	SSRXDp	140
37	PEx1_1C1kn	PEx1_0C1kn	38	141	SSRX1n	SSRXDn	142
39	+5V_SB	+5V_SB	40	143	GND	GND	144
41	PEx1_2C1kp	PEx1_3C1kp	42	145	LPC_AD0	LPC_DRQ#	146
43	PEx1_2C1kn	PEx1_3C1kn	44	147	LPC_AD1	LPC_SERIRQ#	148
45	DIR	PWRGOOD	46	149	GND	GND	150
47	SMB_DAT	PEx_x4_C1kp	48	151	LPC_AD2	LPC_FRAME#	152
49	SMB_CLK	PEx_x4_C1kn	50	153	LPC_AD3	RTC_Battery	154
51	SMB_ALERT	PSON#	52	155	GND	GND	156

53	STK0 / WAKE#	STK1 / PEG_BNA#	54	53	STK0 / WAKE#	STK1 / PEG_BNA#	54
55	GND	GND	56	55	GND	GND	56
57	PEx4_1T(0)p	PEx4_0T(0)p	58	57	PEx4_1T(0)p	PEx4_0T(0)p	58
59	PEx4_1T(0)n	PEx4_0T(0)n	60	59	PEx4_1T(0)n	PEx4_0T(0)n	60
61	GND	GND	62	61	GND	GND	62
63	PEx4_1T(1)p	PEx4_0T(1)p	64	63	PEx4_1T(1)p	PEx4_0T(1)p	64
65	PEx4_1T(1)n	PEx4_0T(1)n	66	65	PEx4_1T(1)n	PEx4_0T(1)n	66
67	GND	GND	68	67	GND	GND	68
69	PEx4_1T(2)p	PEx4_0T(2)p	70	69	PEx4_1T(2)p	PEx4_0T(2)p	70
71	PEx4_1T(2)n	PEx4_0T(2)n	72	71	PEx4_1T(2)n	PEx4_0T(2)n	72
73	GND	GND	74	73	GND	GND	74
75	PEx4_1T(3)p	PEx4_0T(3)p	76	75	PEx4_1T(3)p	PEx4_0T(3)p	76
77	PEx4_1T(3)n	PEx4_0T(3)n	78	77	PEx4_1T(3)n	PEx4_0T(3)n	78
79	GND	GND	80	79	GND	GND	80
81	SATA_T1p	SATA_T0p	82	81	SATA_T1p	SATA_T0p	82
83	SATA_T1n	SATA_T0n	84	83	SATA_T1n	SATA_T0n	84
85	GND	GND	86	85	GND	GND	86
87	SSTX1p	SSTXDp	88	87	SSTX1p	SSTXDp	88
89	SSTX1n	SSTXDn	90	89	SSTX1n	SSTXDn	90
91	GND	GND	92	91	GND	GND	92
93	Reserved	Reserved	94	93	Reserved	Reserved	94
95	Reserved	Reserved	96	95	Reserved	Reserved	96
97	GND	GND	98	97	GND	GND	98
99	SATA_DET#1	SATA_DET#0	100	99	SATA_DET#1	SATA_DET#0	100
101	SATA_PWREN#1	SATA_PWREN#0	102	101	SATA_PWREN#1	SATA_PWREN#0	102
103	GND	GND	104	103	GND	GND	104

Chapter 4 Specifications

Technical Specifications

This section describes the technical specifications of the PWR-2X-11 power supplies.

Function

- MIL-STD Compliant Isolated DC/DC Converter Board
- Converts DC input from vehicle battery / aircraft generator to provide clean, filtered output to Size, Weight & Power (SWaP) Sensitive Embedded Systems in mobile, airborne, and vehicle applications.

Power Input

- Normal Steady State Operation: 18V DC to 36V DC (28V DC Nominal)
- Protection against 100V Surge / 250V Spike Conditions (per MIL-STD-1275)

Power Output

- Refer to the Power Output section in Chapter 2 for a description of power calculations.
- Connectors
 - Molex PCB Header – rated for full output capabilities of 5V, 3.3V, 12V rails
 - Stacking PCI and ISA Bus Connectors on top of board only (PWR-21-11)
 - Stacking PCI and PCI-Express Bus Connectors on top of board only (PWR-22-11)

Voltage / Load Protection and Conditioning

- Input Protection per MIL-STD-1275D and MIL-STD-704F: Reverse Polarity, Voltage Transient, Surge (100V), Spike (250V), Reverse Polarity, EMI/RFI Filter
- Electrical (Galvanic) Isolation: 1500VDC Input to Output, 1500VDC Output to Chassis
- Output Protection: Short Circuit Protection, Overcurrent Protection, Overvoltage Protection
- In-Rush Current limited to <10A@3ms max

Efficiency

- DC/DC Conversion Efficiency: Approximately 84% at full load

Switching Frequency

- Synchronized Switching at 350kHz for reduced noise and system stress

PARD (Noise, Ripple)

- <50 mV p-p max (20MHz)

Remote On/Off

- Remote Shutdown Support (Onboard Molex Connector)

Status Indicators

- Onboard Voltage Rail Status LED Indicators

Reliability

- Workmanship: Assembled to IPC-A-610 Class III Workmanship
- No moving parts. No active cooling required. Over-temperature shutdown @ 100°C.
- MTBF: Calculated per MIL-HDBK-217F

Test Standard	MTBF (Hours)
Ground Benign @ 71°C	805,854
Ground Mobile @ 71°C	117,333
Airborne Inhabit Fighter @ 71°C	44,461
Airborne Rotary Winged @ 71°C	38,511

Mechanical Specifications

Physical

- Form Factor:
 - PC/104-Plus (ISA and PCI Buses) – PWR-21-11-XX, Stack-thru Buses on top only
 - PCI/104-Express (PCIe and PCI Buses) – PWR-22-11-XX, Stack-thru Buses on top only
- Weight: Approx. 0.35 lbs (0.16 kg)
- Cooling: Passive Conductive
 - Baseplate Cooling: Bottom-mounted DC/DC Converter Module should be mated with thermally conductive, electrically-isolated Gap Pad against system enclosure wall to dissipate heat. Base plate temperature must stay below 100°C (Max).

Dimensions

The dimensions of the PWR-2X-11 are:

- 3.550" x 3.775" (90x96 mm) L x W
- PC/104-Plus / PCI/104-Express Compliant, except component height on bottom

Refer to the dimension drawing (Figure 2) in Chapter 2.

Options

Conformal Coating special ordered; integrated into PC/104+ or PCI/104-Express chassis/system

Standards Compliance

- PC/104-Plus (PWR-21-11)
- PCI/104-Express (PWR-22-11)
- MIL-STD-704F (Aircraft Power Transients)
- MIL-STD-1275D (Vehicle Power Transients)
- MIL-STD-461F (Conducted Emissions & Susceptibility)
- MIL-STD-810G (Environmental)

Environmental

Designed and tested in Parvus-designed systems to MIL-STD-810G:

- Operating Temp: -40° to +85°C / -40° to +185°F at thermal interface (MIL-STD-810G, Methods 501,502)
- Storage Temp: -55° to +100°C / -67° to 212°F at thermal interface (MIL-STD-810G, Methods 501,502)
- Operating Shock: 40g, 11ms, 3 pos/neg per axis (MIL-STD-810G, Meth 516)
- Random Vibration: Jet-Helo-Tracked Vehicle Profile, 3 Axes, 1 Hour/Axis (MIL-STD-810G, Method 514)
- Humidity: Up to 95% RH @ 40C, Non-Condensing (qualification by analysis)

EMI/EMC

Designed and tested in Parvus-designed systems to MIL-STD-461F:

- CE102, Conducted Emissions, Power Leads, 10 KHz to 10MHz, basic curve
- CS101, Conducted Susceptibility, Power Leads, 30 Hz to 150 KHz, curve 2 (28V and below)

Chapter 5 Troubleshooting

Product Identification

The product is labeled with the Parvus P/N and serial number. Please refer to this information when communicating with Parvus.

Technical Assistance

If you have a technical question or if you cannot isolate a problem with your product, please call or e-mail the Parvus Technical Support team:

Email	tsupport@parvus.com
Phone	1 (801) 433-6322
Fax	1 (801) 483-1523

Returning for Service

Before returning any Parvus product, please fill out a Return Material Authorization (RMA) request form available for download from the following website under the support section:

www.parvus.com

Email this form to the Technical Support email address (tsupport@parvus.com) to receive authorization for shipment. An RMA number will be emailed back to you as soon as possible.



Note: You must have the RMA number in order to return any product for any reason.



Warning!

Any product returned to Parvus improperly packed will immediately void the warranty for that particular product.

Chapter 6 Contact Info

Company contact info:

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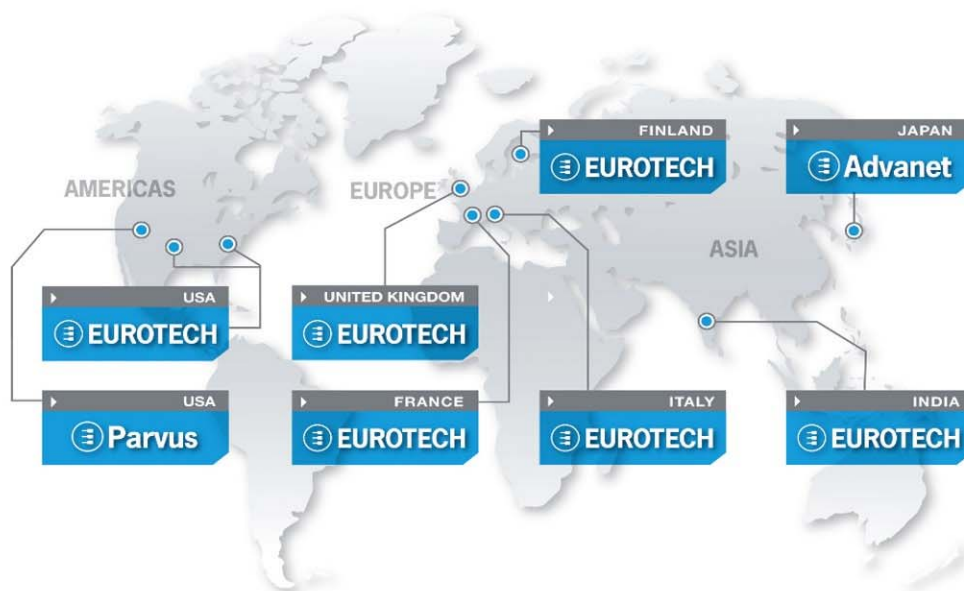
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