APWR35210HR-80W

PCI Express Avionics Power Supply

User's Manual

BDM-610020140 Rev B

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AS9100 and ISO 9001 Certified

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Revision History

Rev A	Initial Release
Rev B	Updated IDAN drawings

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Failure to follow the instructions found in this manual may result in damage to the product described in this manual, or other components of the system. The procedure set forth in this manual shall only be performed by persons qualified to service electronic equipment. Contents and specifications within this manual are given without warranty, and are subject to change without notice. RTD Embedded Technologies, Inc. shall not be liable for errors or omissions in this manual, or for any loss, damage, or injury in connection with the use of this manual.

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1 Introduction

1.1 Product Overview

The APWR35210HR is a MIL-STD Avionics Isolated power supply. These rugged converters are ideally suited to military applications. Save cost, heat, space, and weight when creating an efficient power system using RTD's isolated DCDC converters.

1.2 Board Features

- 16 VDC to 40 VDC input range
- 8.0 Amps of 5VDC output
- 3.33 amps of 12VDC output
- Power Indicator LEDs
- Remote ON/OFF control
- Reverse Voltage Protection to 50 VDC
- Operational from -40° C to 85° C Ambient
- Full performance over -40° C to 125° C case
- Very low output noise
- No use of Optoisolators
- Input Transient Voltage: 50 Volts for 100 msec
- Under voltage Lockout
- MIL-STD-461 D, E, and F CE102, CS101, CS114, CS115
- Mil-STD-704F Voltage Transients for 28 Volts DC System
- Hermetically Sealed Capacitor

1.3 Ordering Information

The APWR35210HR-80W is available with the following options:

Table 1: Ordering Options

Part Number	Description
APWR35210HR-80W	PCI/104-Express 80 Watt Filtered Avionics Power Supply
IDAN-APWR35210HR-80W	PCI/104-Express 80 Watt Filtered Avionics Power Supply in IDAN enclosure
AC/DC-PS	Recommended 24 V 64.8 Watt AC adapter
IDAN-AC/DC-PS	Recommended 24 V 64.8 Watt AC adapter (for IDAN)
AC/DC-PS-190W	Recommended 24 V 220.8 Watt AC adapter
IDAN-AC/DC-PS-190W	Recommended 24 V 220.8 Watt AC adapter (for IDAN)

The Intelligent Data Acquisition Node (IDAN®) building block can be used in just about any combination with other IDAN building blocks to create a simple but rugged 104™ stack. This module can also be incorporated in a custom-built RTD HiDAN® or HiDANplus® High Reliability Intelligent Data Acquisition Node. Contact RTD sales for more information on our high reliability systems.

1.3.1 RECOMMENDED ADDITIONAL ACCESSORIES

Figure 1: AC/DC PS 64.8 Watts

Figure 2: AC/DC PS-190 190 Watts

1.4 Contact Information

1.4.1 Sales Support

For sales inquiries, you can contact RTD Embedded Technologies sales via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: sales@rtd.com

1.4.2 Technical Support

If you are having problems with your system, please try the steps in the Troubleshooting section of this manual on page 30.

For help with this product, or any other product made by RTD, you can contact RTD Embedded Technologies technical support via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: techsupport@rtd.com

2 Specifications

2.1 Operating Conditions

Table 2: Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{cc}	Input Voltage		16	40	
T_a	Operating Temperature		-40	+85	C
T_s	Storage Temperature		-55	+125	C
RH	Relative Humidity	Non-Condensing	0	90%	%
MTBF	Mean Time Before Failure	Telcordia Issue 2 30°C, ground benign, controlled	TBD		Hours

2.2 Electrical Characteristics

Table 3: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
P_i	Input Power Consumption	V_{cc} = 24 V Full Load		95.57		W
D_{iss5}	5V Power dissipation	V_{cc} = 24 V Full Load		4.694		W
D_{iss12}	12V Power dissipation	V_{cc} = 24 V Full Load		8.544		W
D_{isss}	Support Circuitry Dissipation	V_{cc} = 24 V		2.422		W
D_{issmax}	Total Board Power Dissipation	V_{cc} = 24 V		15.66		W
*$P_{85max12}$	12V Still air max load at 85°C	V_{cc} = 24 V		22.0		W
*P_{85max5}	5V Still air max load at 85°C	V_{cc} = 24 V		22.93		W
I_{cc16}	16V Input Supply Current	Full Load		6.24		A
I_{cc24}	24V Input Supply Current	Full Load		3.98		A
I_{cc28}	28V Input Supply Current	Full Load		3.41		A
I_{cc40}	40V Input Supply Current	Full Load		2.41		A
V_{cc5}	5V Supply Voltage		4.75	5.0	5.25	V
V_{cc12}	12V Supply Voltage		11.4	12.0	12.6	V
E_{ff5}	5V Full Load Efficiency	V_{cc} = 24 V		89.5		%
E_{ff12}	12V Full Load Efficiency	V_{cc} = 24 V		82.4		%
E_{ffc}	Full load Board Efficiency	V_{cc} = 24 V		83.6		%
T_5	5V module surface temp	V_{cc} = 24 V, Full Load, 23°C		90.9		°C
T_{12}	12V module surface temp	V_{cc} = 24 V, Full Load, 23°C		103.4		°C
*T_{max12}	12V Still air max operating temp	V_{cc} = 24 V, Full Load		44.6		°C
*T_{max5}	5V Still air max operating temp	V_{cc} = 24 V, Full Load		57.1		°C
F_{5V}	5V switching frequency		300	350	400	KHz
F_{12V}	12V switching frequency		400	475	550	KHz
	PCIe/104 Bus					
I_{cc5}	5V Output current to PCIe bus			8.0		A
I_{cc12}	12V Output current to PCIe bus			3.33		A
	Output Power Connectors					
I_{cc5}	5V Output current to TB2			8.0		A
I_{cc12}	12V Output current to TB3			3.33		A
	X1 Jumper					
V_{x1}	Enable Signal Clamp Voltage			5.1		V
I_{x1}	Sink current of Zener clamp			10.0		mA

*Additional cooling required above this point or load derating at 0.545 W/°C

2.2.1 EFFICIENCY GRAPHS

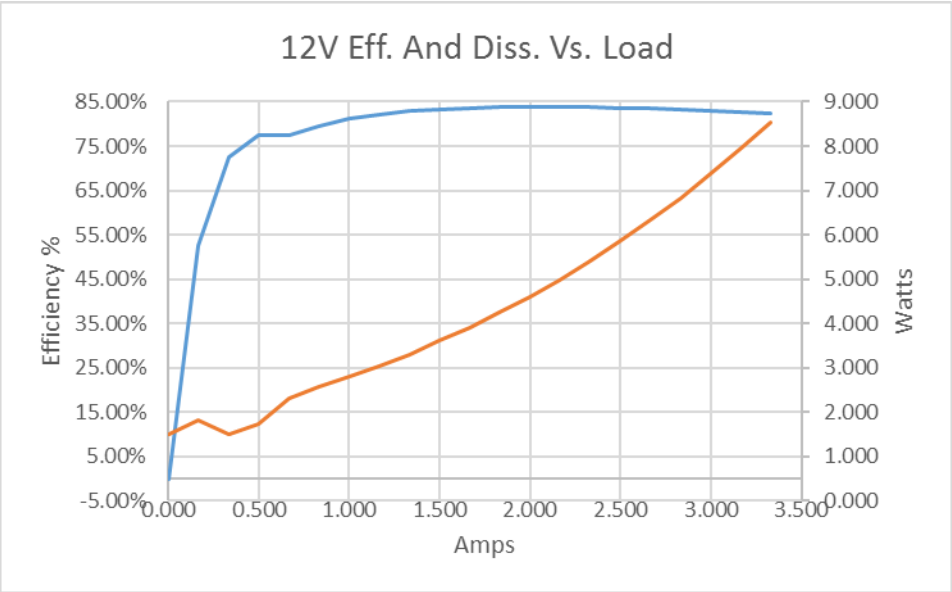


Figure 3: Efficiency Graph 12V at 24V Vin

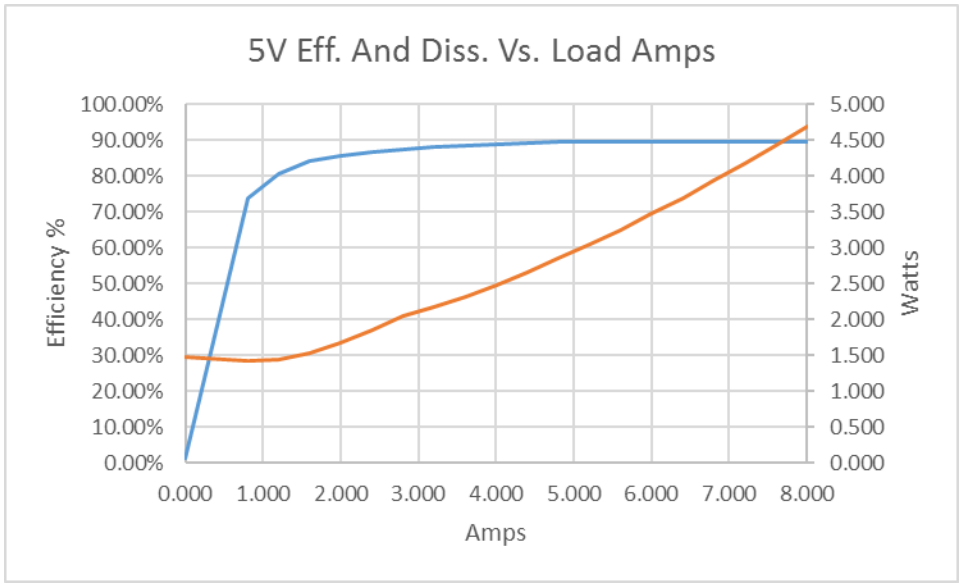


Figure 4: Efficiency Graph 5V at 24V Vin

2.2.2 STEP RESPONSES

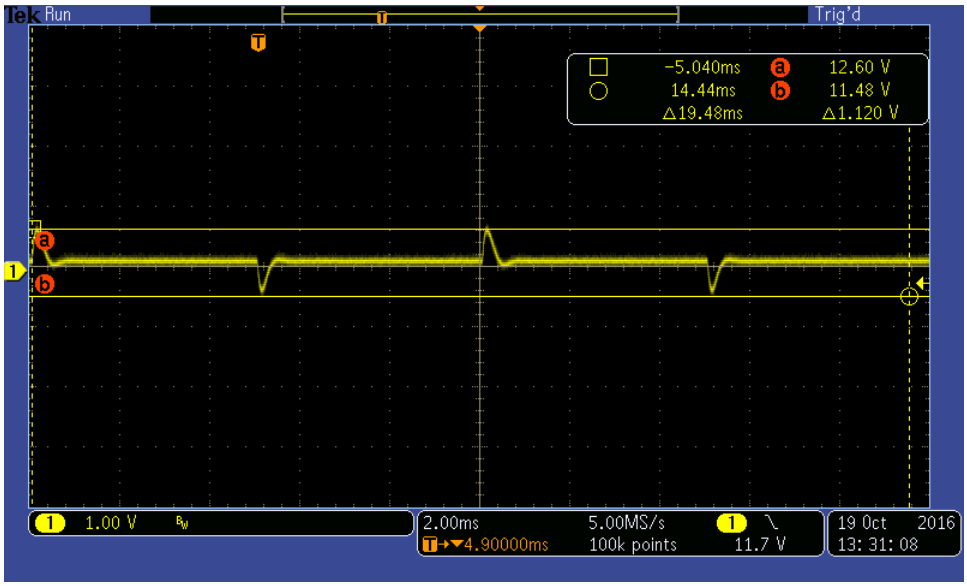


Figure 5: Step Response 12V, from 0.7 Amps to 3.33 Amps

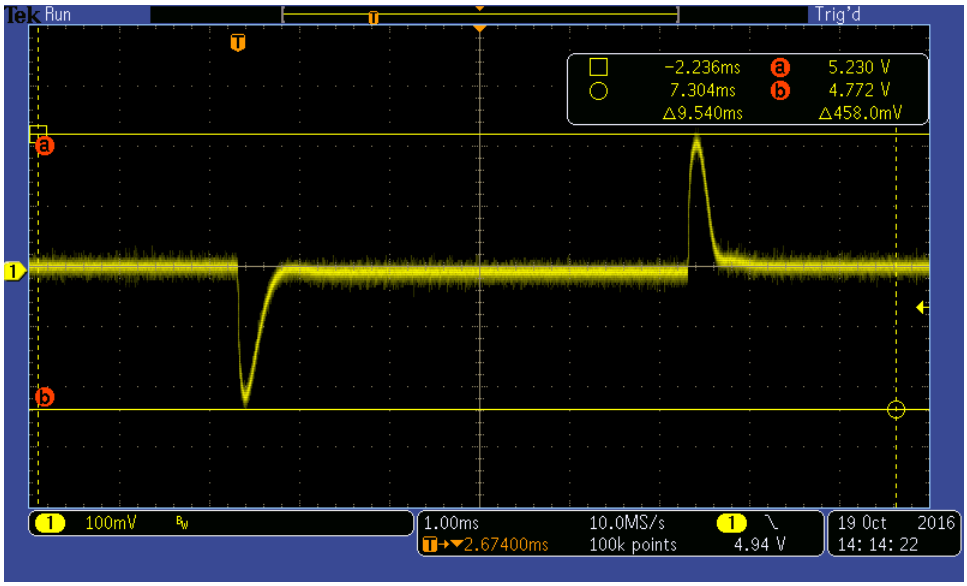


Figure 6: Step Response 5V, from 0.8 Amps to 7.2 Amps

2.2.3 LISN MEASUREMENTS

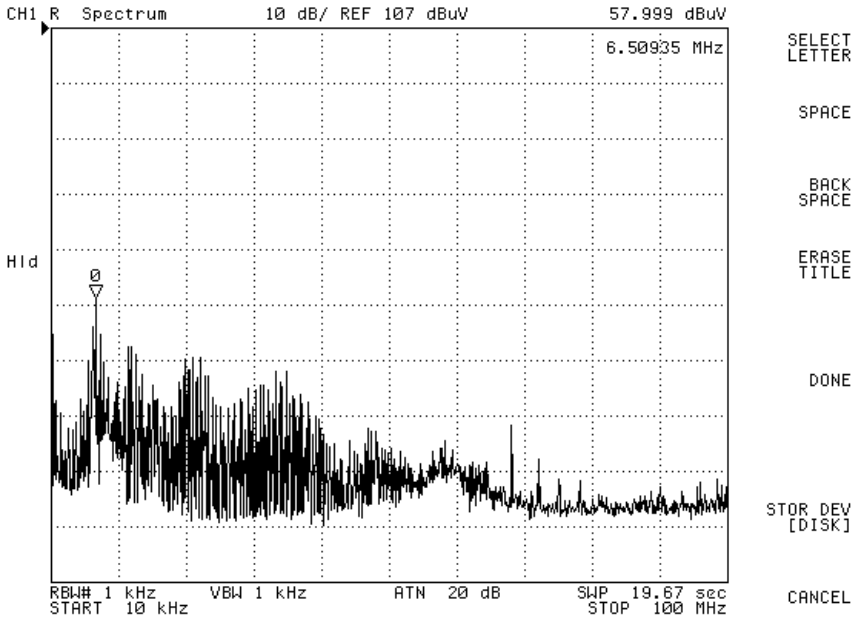


Figure 7: Spectral Sweep Negative Input at Full load

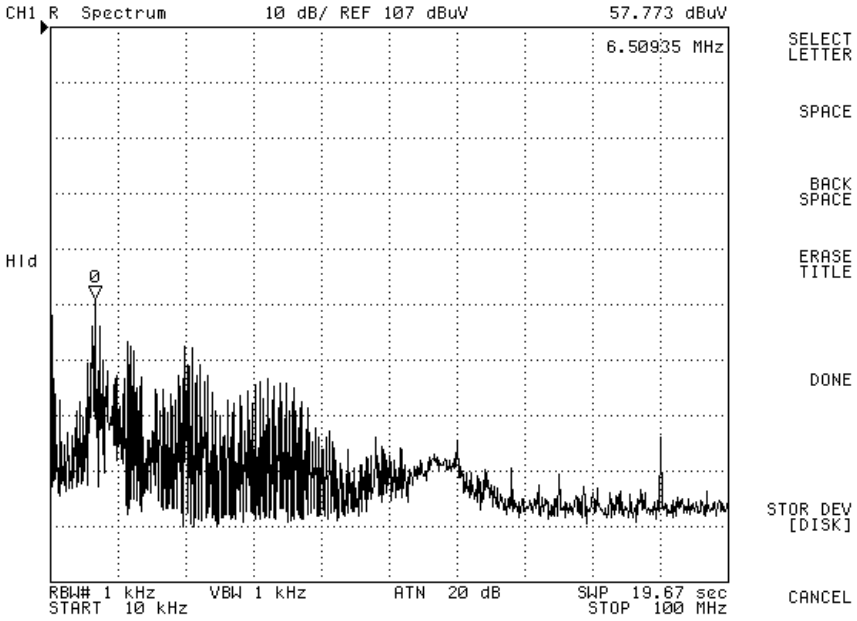


Figure 8: Spectral Sweep Positive Input at Full load

3 Board Connection

3.1 Board Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your board in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the board at the edges, and do not touch the components or connectors. Handle the board in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

3.2 Physical Characteristics

STEP model is available upon request; contact RTD Tech Support for more information.

- Weight: Approximately 0.586 pounds (266 grams)
- Dimensions: 4.55 in. x 3.775 in. (115.57 mm x 95.89 mm)

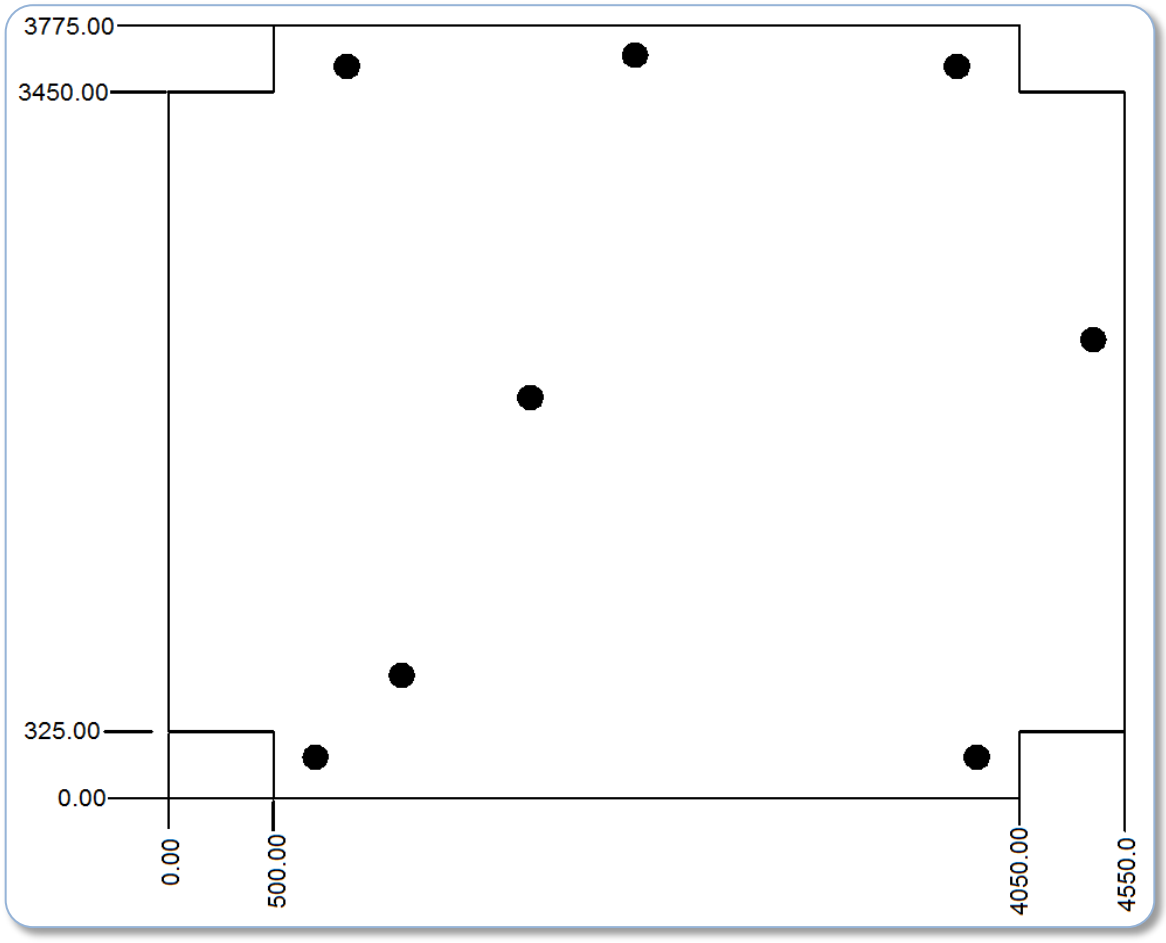


Figure 9: Board Dimensions

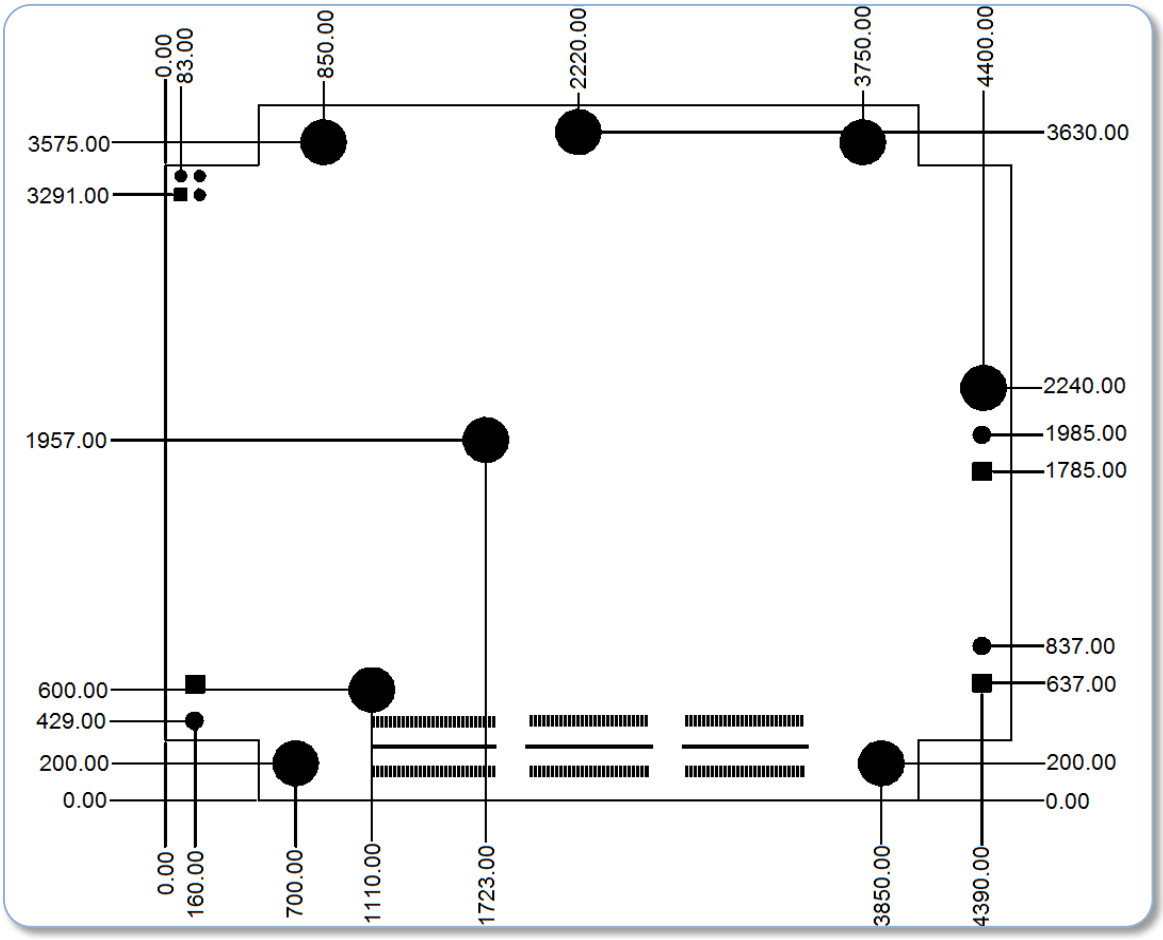


Figure 10: Hole Locations

3.3 Connectors, LEDs, and Jumpers

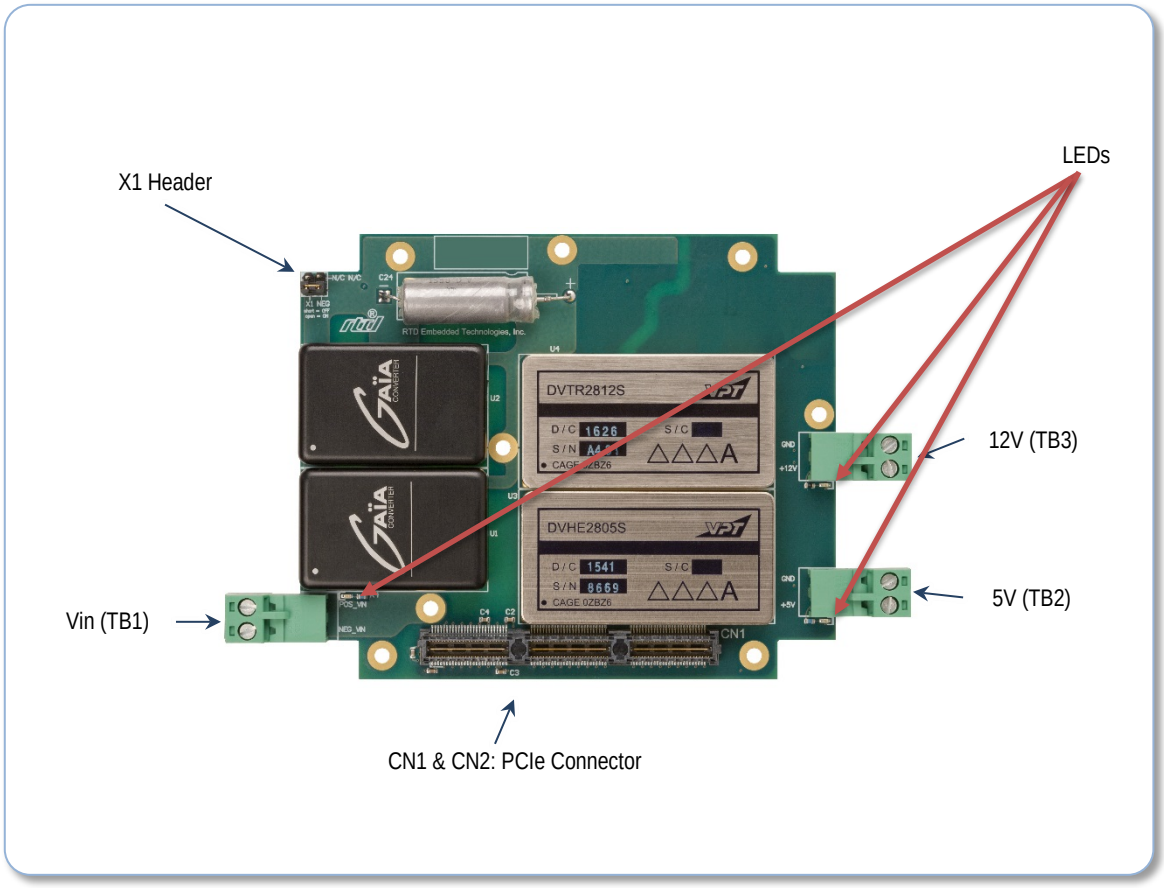


Figure 11: Board Connections and LEDs

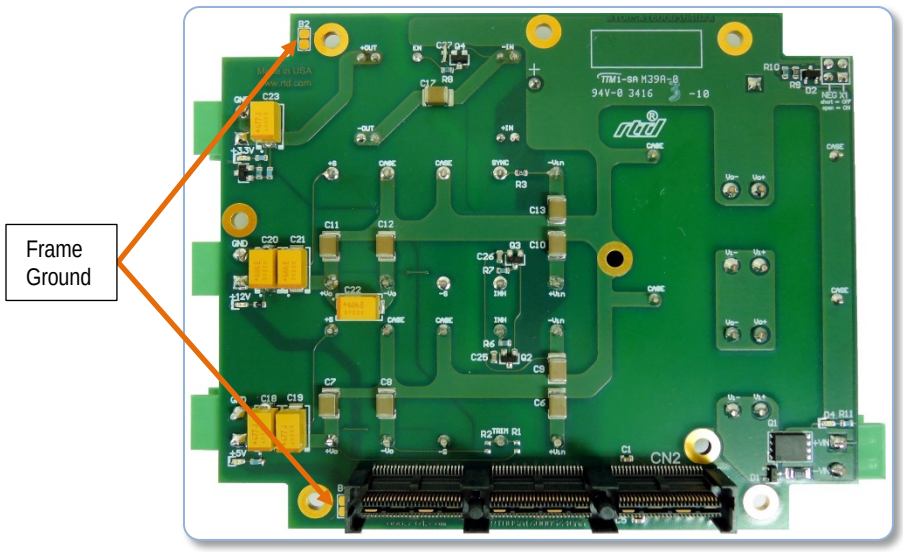


Figure 12: Frame Ground connections to Output Ground B2 and B4

RTD provides B2 and B4, pictured above, for shorting frame ground to output ground, if the customer should wish. Typically, the frame is left floating so noise can be routed away from the system through an external connection to another potential. B2 and B4 are open by default.

3.3.1 ENABLE X1 HEADER 0.1”

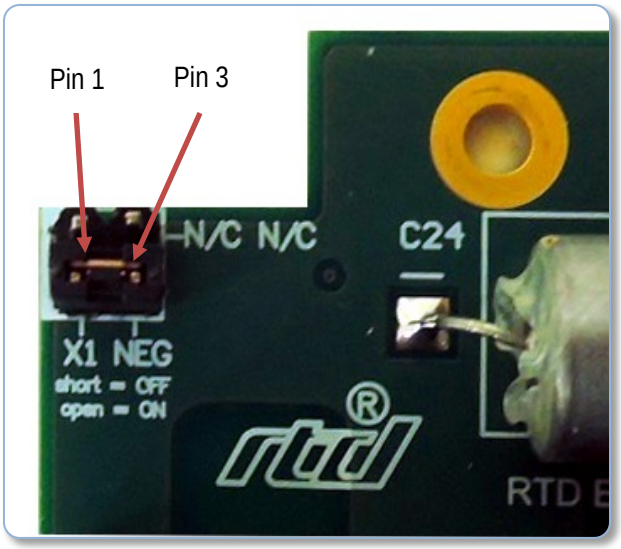


Figure 13: X1 Header Configured in OFF Position

The figure above of the X1 header shows a jumper between pins 1 and 3. Pin 1 is the enable signal pin, labeled X1. Pin 3 is the reference for the signal on pin 1. Pin 3, labeled NEG, is the input ground reference on the DCDC converters. Pins 2 and 4 can be used to store the jumper.

Table 4: X1 Enable Functional Operation

X1 Pin 1 to pin 3	Operation
Short	Power OFF
Open	Power ON

Table 5: X1 Header. Default is open.

X1 Pin	Name	Function
1	X1	DCDC module enable signal
2	N/C	Not connected
3	NEG	DCDC module input ground
4	N/C	Not connected

The X1 signal is intended for a switch connection. Care must be taken when using a method other than a switch to drive the X1 enable signal. Pin 3 is attached to the DCDC modules input ground reference. The reason this detail is important is that reference is connected past the input filter and is a path to allow unwanted noise into the system.

3.3.2 VIN CONNECTOR TB1

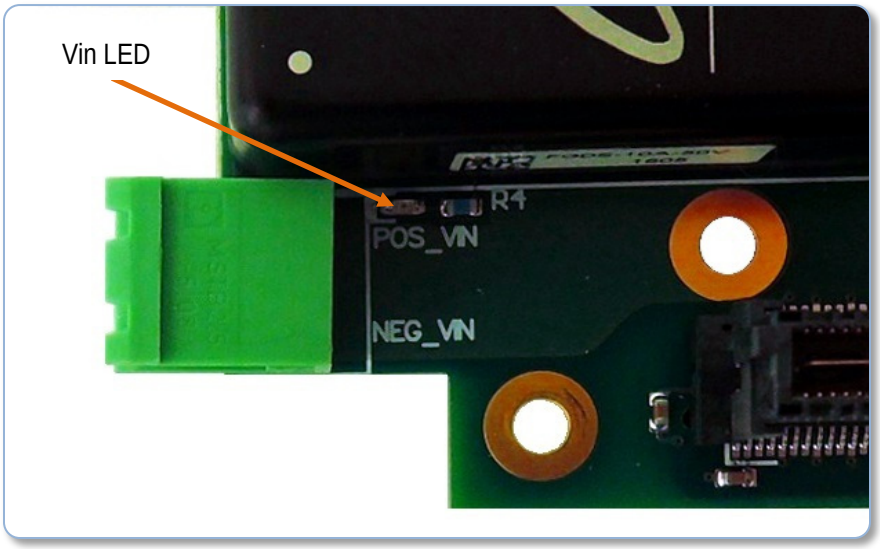


Figure 14: Vin Connector TB1

TB1 Pin 1 is the positive input rail and is labeled POS_VIN. Pin 2 is the negative input rail and is labeled NEG_VIN. The pictured input connector is a Phoenix Contact 1759017. This connector mates with a Phoenix Contact 1779987. The APWR35210HR is shipped with the mating connectors installed.

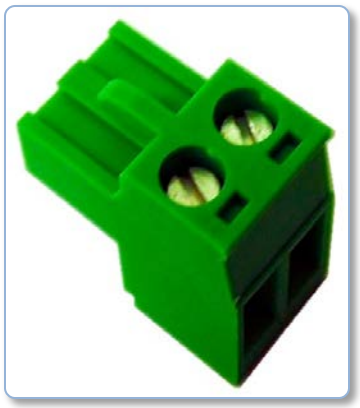


Figure 15: Mating Connector 1779987

3.3.3 5V CONNECTOR TB2

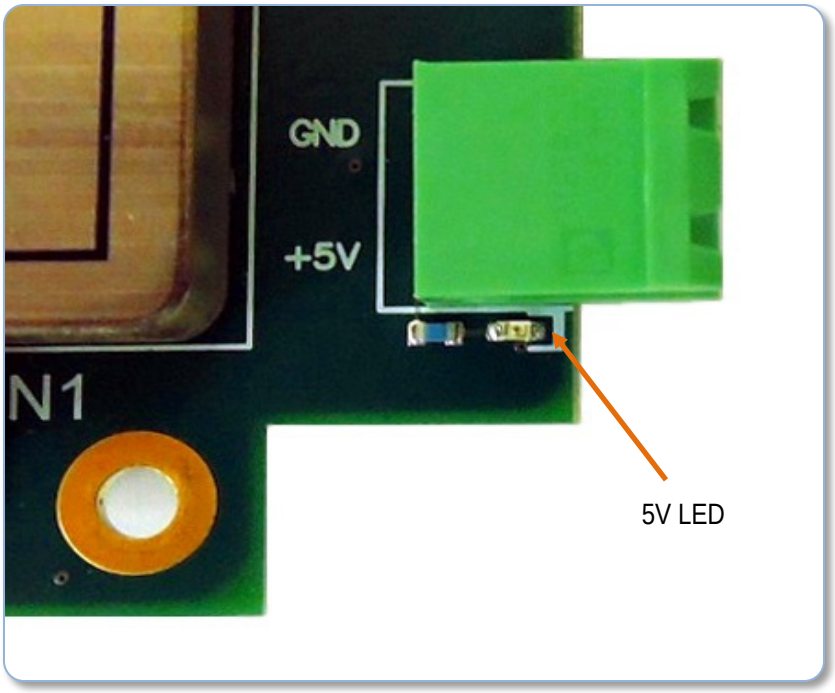


Figure 16: 5V Connector TB2

TB2 Pin 1 is the 5V rail and is labeled +5V. Pin 2 is the output ground and is labeled GND. The pictured input connector is a Phoenix Contact 1759017. This connector mates with a Phoenix Contact 1779987. The APWR35210HR is shipped with the mating connectors installed.

Figure 17: Mating Connector 1779987

3.3.4 12V CONNECTOR TB3

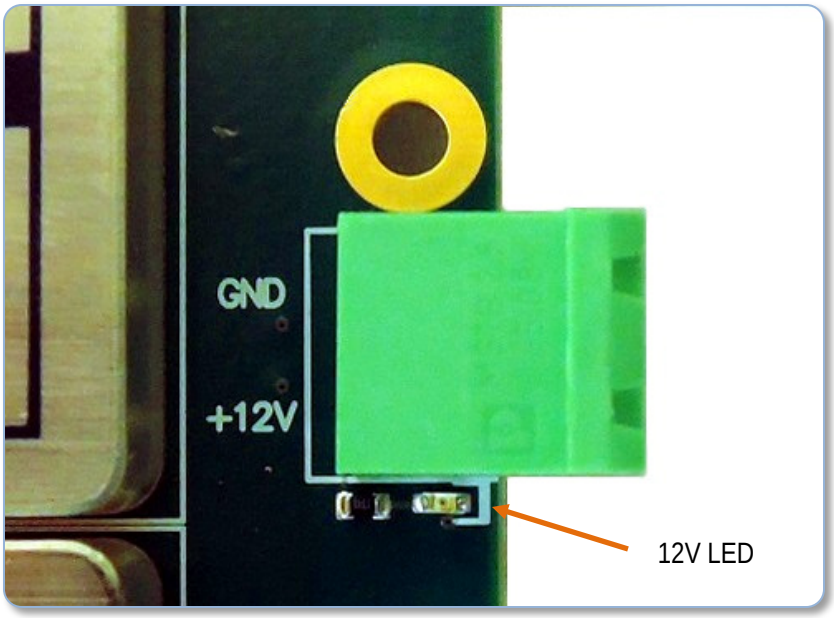


Figure 18: 12V Connector TB3

TB3 Pin 1 is the 12V rail and is labeled +12V. Pin 2 is the output ground and is labeled GND. The pictured input connector is a Phoenix

Figure 19: Mating Connector 1779987

Contact 1759017. This connector mates with a Phoenix Contact 1779987. The APWR35210HR is shipped with the mating connectors installed

3.3.5 PCIe Bus CN1 and CN2

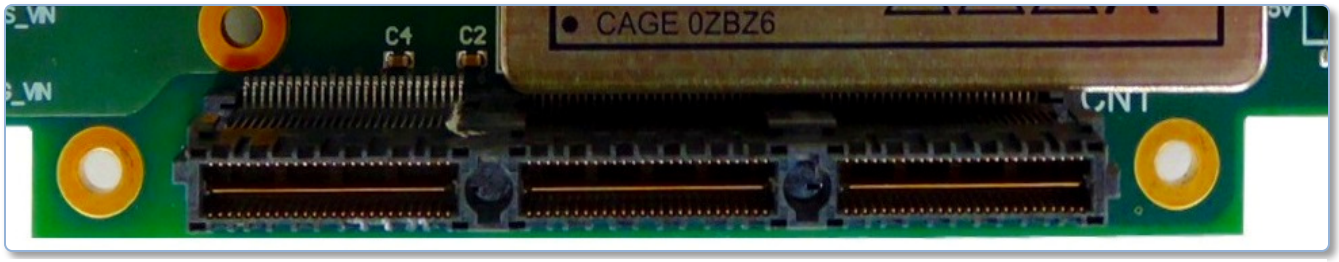


Figure 20: PCIe Connectors CN1 and CN2

The above Figure shows the PCIe connector CN1. CN2 is the bottom PCIe connector. These connectors are pass through only.

3.3.6 Heat Sink Mounting Holes

RTD provides the user with three 0.250" holes for mounting a heat sink. We recommend the use of #4-40 stainless pan head screws. These Mounting holes are connected to frame ground and are the low impedance path for EMI compliance.

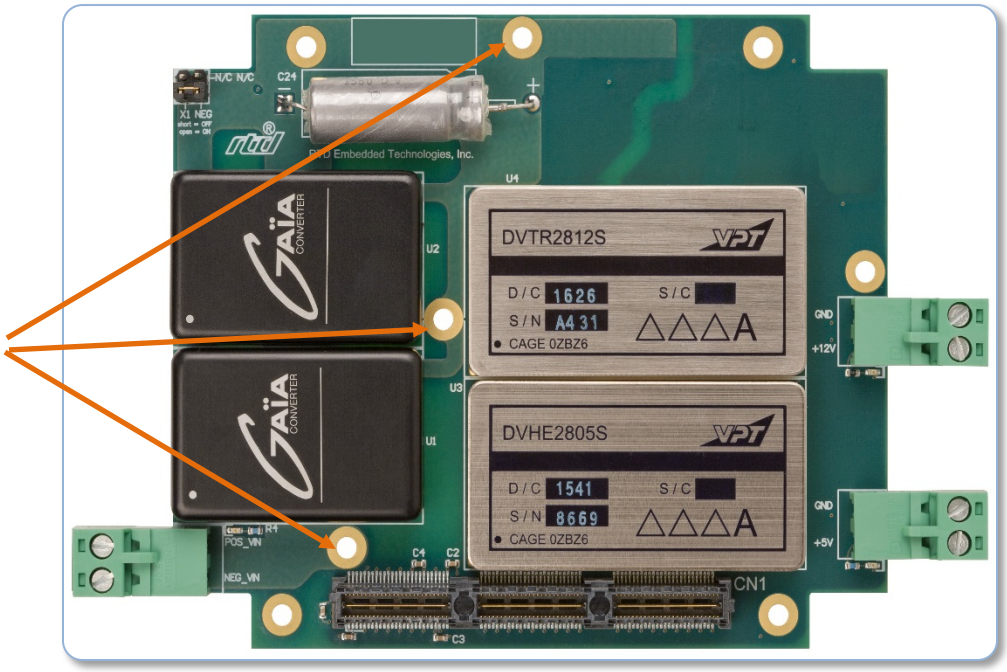


Figure 21: Holes for Mounting a Heat Sink

3.4 Steps for Installing and EMI Concerns

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Wires going to the power should be 20 AWG or larger.
3. Wires should be tightly twisted to reduce input inductance and reduce EMI concerns.
4. Do not route input and output wires together, as this will cause EMI coupling.
5. Keep input and output wiring as short as possible to reduce the chances of coupling.
6. Segregate power wiring from all other wiring or shield it to reduce EMI concerns.
7. Turn off power to the PC/104 system or stack.
8. Select and install stand-offs to properly position the module on the stack.
9. Remove the module from its anti-static bag.
10. Check that pins of the bus connector are properly positioned.
11. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
12. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
13. Gently and evenly press the module onto the PC/104 stack.
14. If any boards are to be stacked above this module, install them.
15. Attach any necessary cables to the PC/104 stack.
16. Re-connect the power cord and apply power to the stack.
17. Boot the system and verify that all of the hardware is working properly.

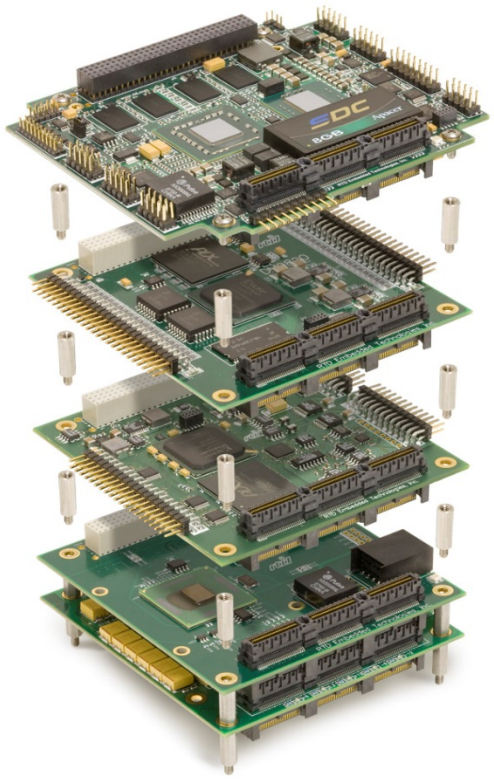


Figure 22: Example 104™ Stack

4 IDAN Connections

4.1 Module Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your module in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the module by the aluminum enclosure, and do not touch the components or connectors. Handle the module in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

4.2 Physical Characteristics

- Weight: Approximately 1.366 pounds (454 grams)
- Dimensions: 152.00 mm L x 130.00 mm W x 34.00 mm H (5.98 in L x 5.12 in W x 1.34 in H)

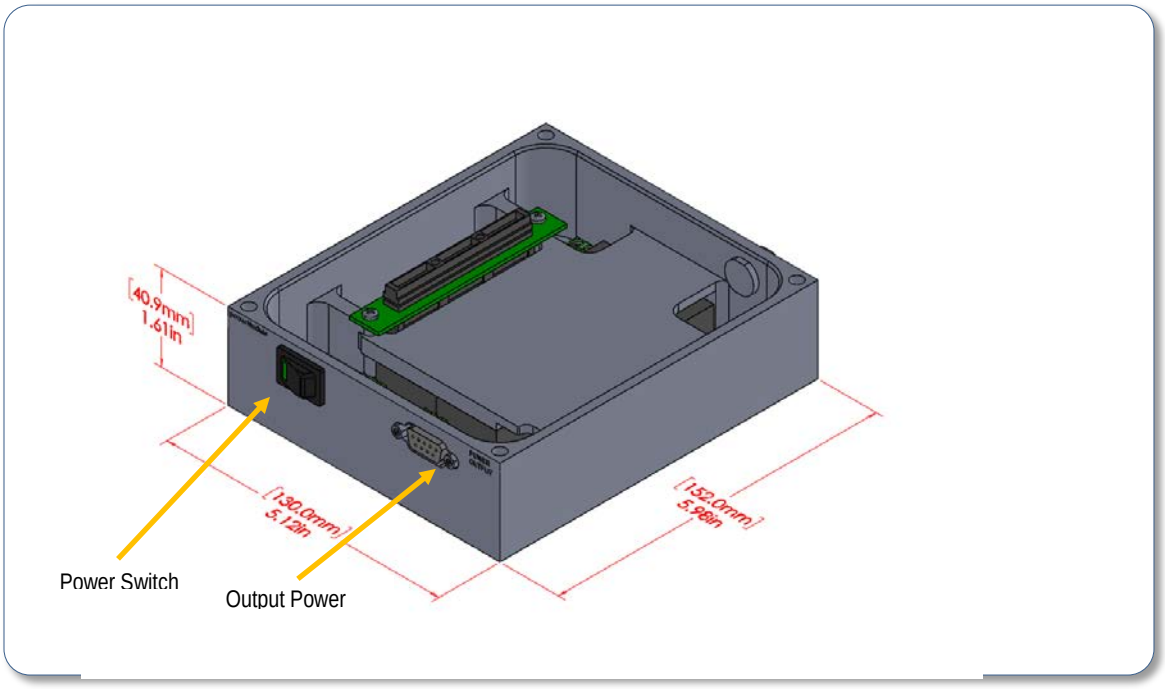


Figure 23: IDAN Dimensions

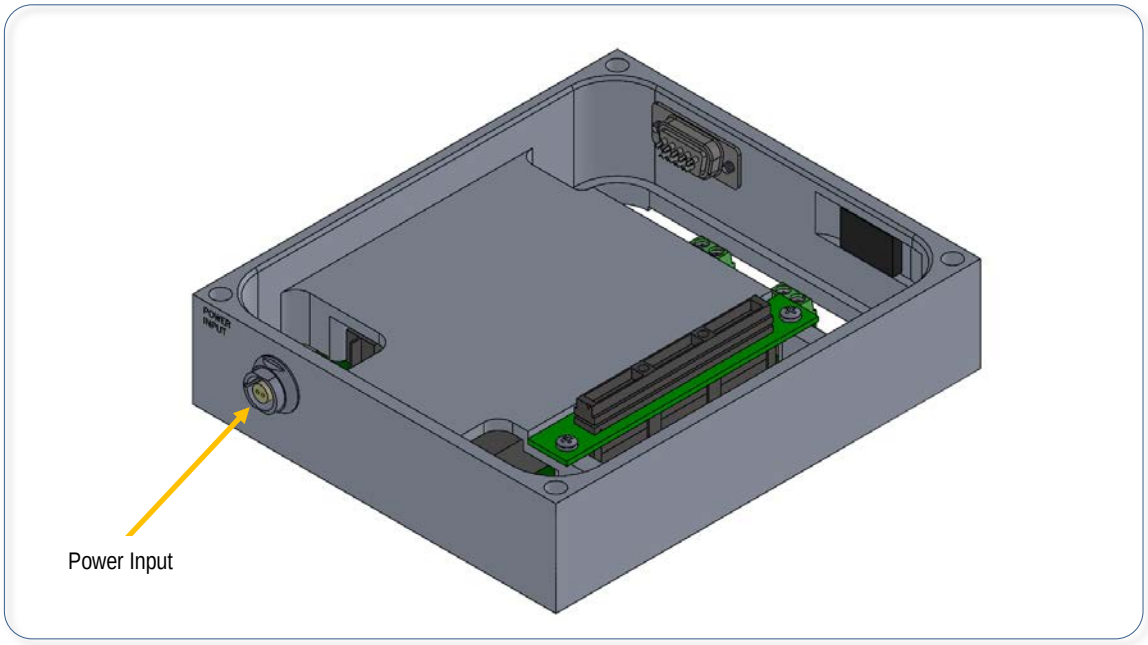


Figure 24: IDAN Power Input Connector

4.3 Connector locations

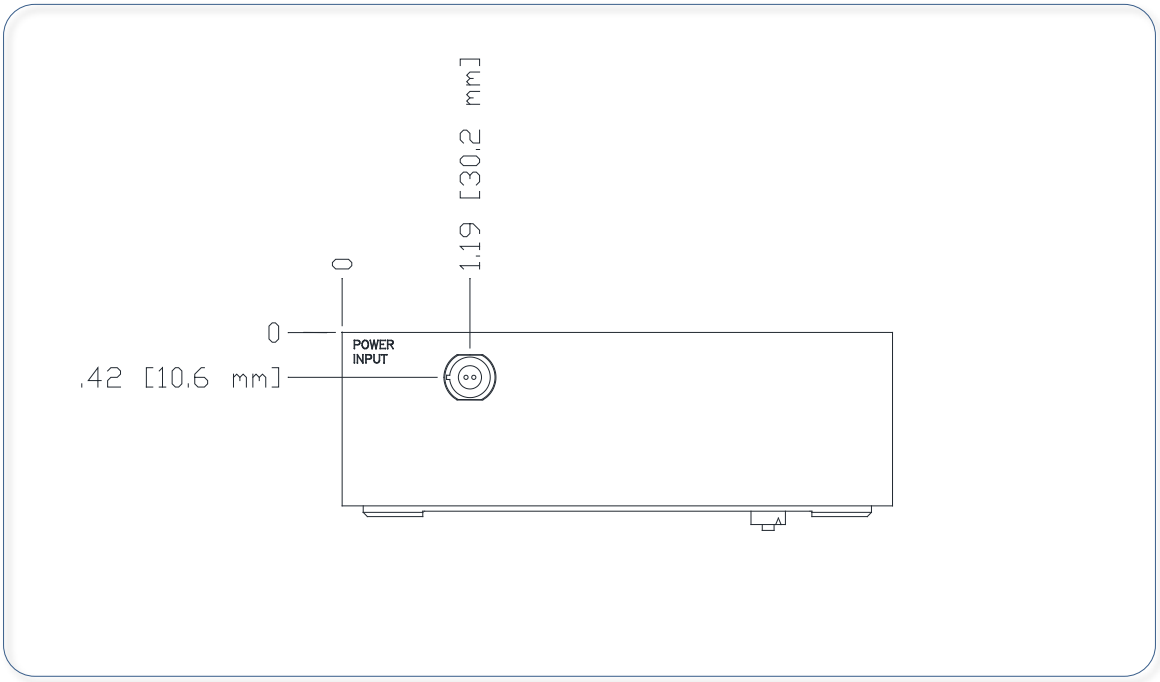


Figure 25 Power input

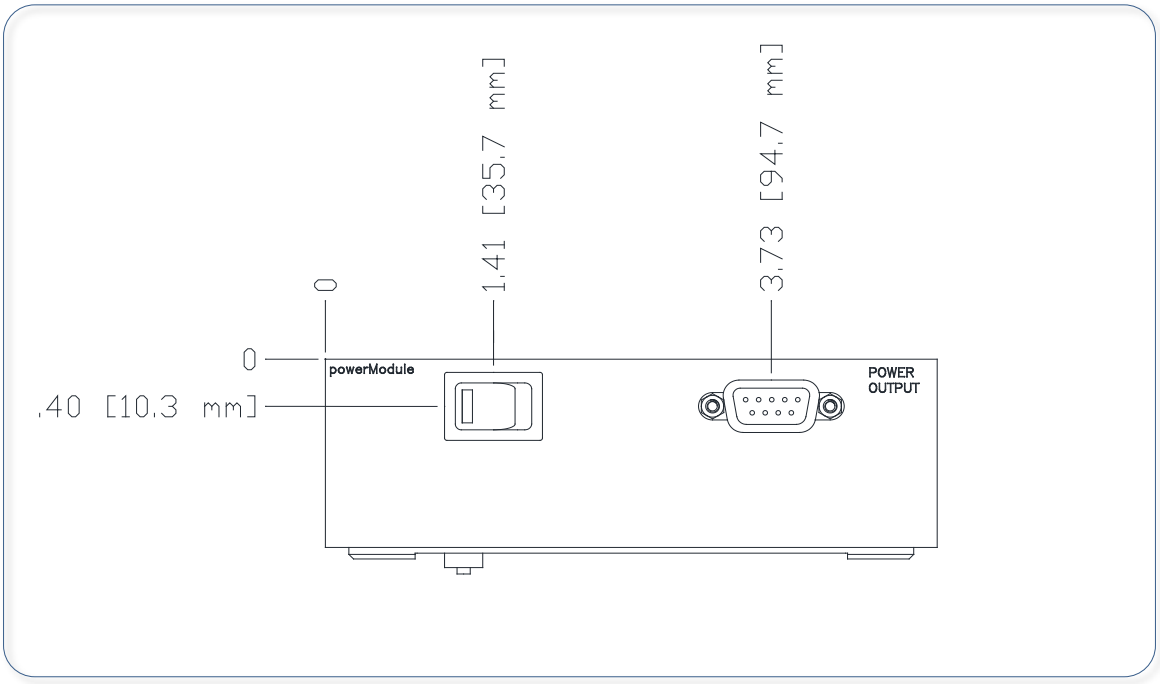


Figure 26 Power Switch and Output Power

4.4 IDAN Vin Connector

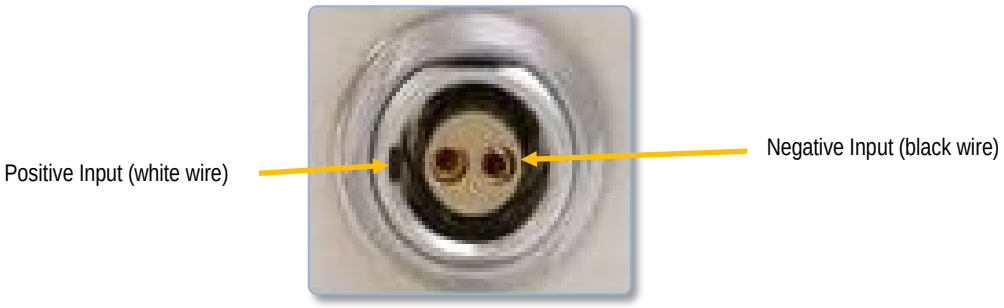


Figure 27: Vin Connector

The Vin connector is a Souriau JBXEP1G02FSSDS and mates with a JBXFD1G02MSSDSMR. The IDAN-APWR35210HR-80W is shipped with a IDAN-XKCM18 cable kit.

Figure 28: IDAN-XKCM18 36" Power Input cable

4.5 IDAN Vout Connector

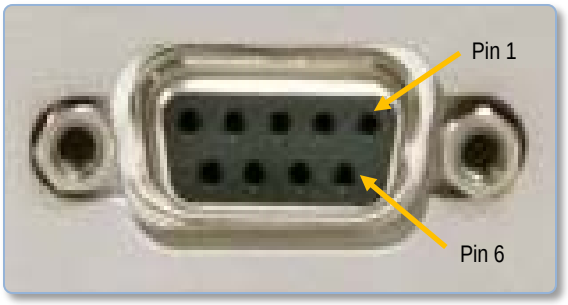


Figure 29: IDAN Output Connectors

Table 6: IDAN Power Output Connector

X1 Pin	Name
1	5V
2	GND
3	12V
4	GND
5	N/C
6	5V
7	GND
8	N/C
9	N/C

The IDAN Output Connector is a DB9 Female Connector.

4.6 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the IDAN system.
3. Remove the module from its anti-static bag.
4. Check that pins of the bus connector are properly positioned.
5. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
6. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
7. Gently and evenly press the module onto the IDAN system.
8. If any boards are to be stacked above this module, install them.
9. Finish assembling the IDAN stack by installing screws of an appropriate length.
10. Attach any necessary cables to the IDAN system.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

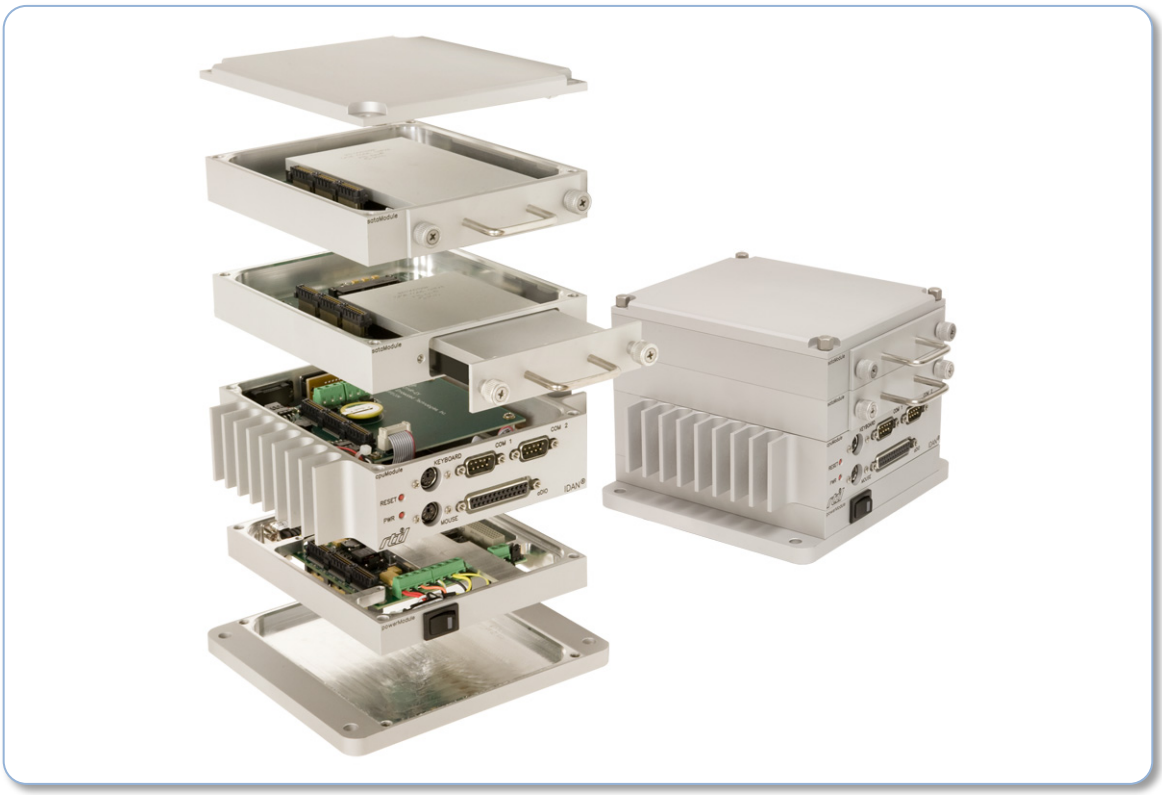
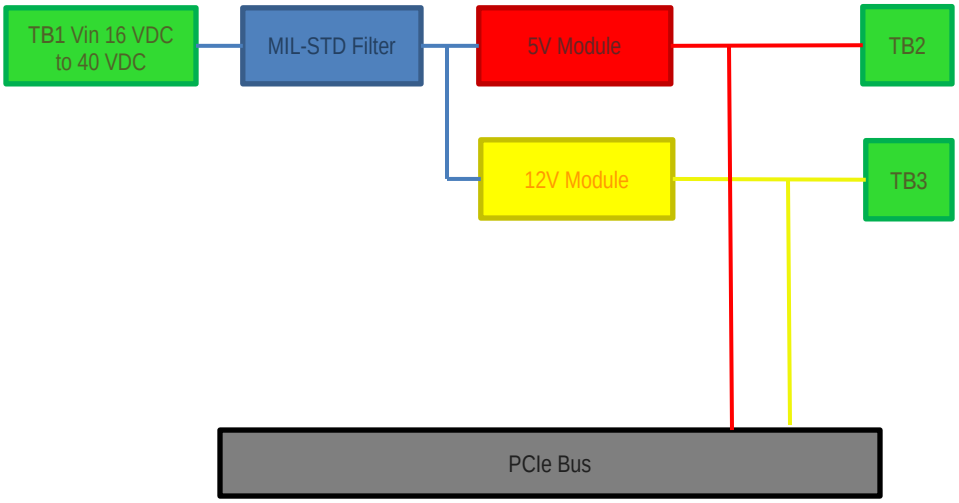


Figure 30: Example IDAN System

5 Functional Description

5.1 Avionics Isolated DCDC Power Supply

5.1.1 Block Diagram



6 Troubleshooting

If you are having problems with your system, please try the following initial steps:

- Simplify the System – Remove modules one at a time from your system to see if there is a specific module that is causing a problem. Perform you troubleshooting with the least number of modules in the system possible.

- Swap Components – Try replacing parts in the system one at a time with similar parts to determine if a part is faulty or if a type of part is configured incorrectly.

If problems persist, or you have questions about configuring this product, contact RTD Embedded Technologies via the following methods:

Phone: +1-814-234-8087
E-Mail: techsupport@rtd.com

Be sure to check the RTD web site (http://www.rtd.com) frequently for product updates, including newer versions of the board manual and application software.

7 Additional Information

7.1 PC/104 Specifications

A copy of the latest PC/104 specifications can be found on the webpage for the PC/104 Embedded Consortium:

www.pc104.org

7.2 PCI and PCI Express Specification

A copy of the latest PCI and PCI Express specifications can be found on the webpage for the PCI Special Interest Group:

www.pcisig.com

8 Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one-year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization (RMA) number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, “acts of God” or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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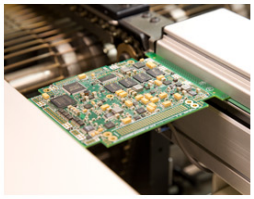
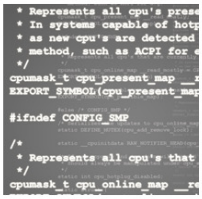

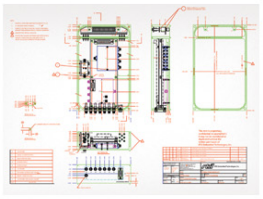
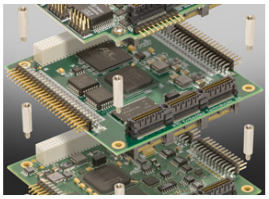

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