IATX25110HR

PCI/104-Express DC/DC Power Supply

User's Manual

BDM-610020126 Rev. A

RTD Embedded Technologies, Inc.
AS9100 and ISO 9001 Certified

RTD Embedded Technologies, Inc.
103 Innovation Boulevard
State College, PA 16803 USA
Telephone: 814-234-8087
Fax: 814-234-5218

www.rtd.com

sales@rtd.com
techsupport@rtd.com

Revision History

Rev A	01/19/2015	Initial Release

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1 Introduction

1.1 Product Overview

The IATX25110HR was designed to meet the power requirements of the PCI/104-Express Specification.

1.2 Board Features

- PCIe pass through bus
- PCI pass through bus
- 10V to 36V DC voltage input range
- 10 Amps of 5V
- 4.17 Amps of 12V
- 3.03 Amps of 3.3V
- 2.0 Amps of 5VSB
- Remote ON/OFF control
- Reverse voltage protection
- Input over voltage protection
- Input over current protection
- ATX functionality

The IATX25110HR is available with the following options:

Table 1: Ordering Options

Part Number	Description
IATX25110HR	Standard Configuration as pictured on cover
IATX35110HR	Standard Configuration as pictured on cover, except without PCI bus connector installed.
IDAN-IATX25110HR	Board Mounted in IDAN frame
IDAN-IATX35110HR	Board Mounted in IDAN frame
ID-IATX25110HR	Board with screw terminals for power connections
ID-IATX35110HR	Board with screw terminals for power connections
IATX25110HR-XNS	Standard Configuration as pictured on cover, except without downward express connector installed.
IATX35110HR-XNS	Standard Configuration as pictured on cover, except without downward express connector installed.
ID-IATX25110HR-XNS	Board with screw terminals for power connections, except without downward express connector installed.
ID-IATX35110HR-XNS	Board with screw terminals for power connections, except without downward express connector installed.

Note: Contact RTD sales if you want a custom configuration.

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 Contact Information

1.3.1 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

1.3.2 Technical Support

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

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_{in}	Supply Voltage		10.00	36.00	V
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

Parameter	Test Condition	Max	Unit
Maximum Power Dissipation	25°C 10.00V Vin four Hour Soak no Airflow no Heat Sink	11.66	W
Combined Efficiency 10Vin	25°C Max load (note 1)	87.83	%
Combined Efficiency 24Vin	25°C Max load (note 1)	90.88	%
Combined Efficiency 36Vin	25°C Max load (note 1)	89.35	%
5V Efficiency with 24Vin	25°C 10.0 Amp load	87.11	%
5VSB Efficiency with 24Vin	25°C 2 Amp load	87.11	%
12V Efficiency with 24Vin	25°C 4.17 Amp load	87.44	%
3.3V Efficiency with 12Vin	25°C 3.03 Amp load	90.67	%
5V DC Load Regulation	25°C	70.0	mV
5VSB DC Load Regulation	25°C	70.0	mV
12V DC Load Regulation	25°C	24	mV
3.3V DC Load Regulation	25°C	10	mV
5VSB P-P voltage ripple	25°C 2.0 Amp load	?	mV
5V P-P voltage ripple	25°C 10.0 Amp load	118.0	mV
12V P-P voltage ripple	25°C 4.17 Amp load	244.0	mV
5V Switching Frequency	25°C	306	KHz+-2%
5V standby Switching Frequency	25°C	306	KHz+-2%
12V Switching Frequency	25°C	308	KHz+-2%
3.3V Switching Frequency	25°C	634	KHz+-2%
Reverse Voltage Protection	25°C	-36	V
Input Overcurrent Trip Level	25°C	14.3	Amps
Galvanic Isolation voltage	25°C	1500	V
Module Thermal Shutdown	Case Temp.	110	C

Note 1: Max Load is defined as 10 Amps on 5V, 3.03 amps on 3.3V, and 3.245 amps on the 12V

2.2.1 DERATING:

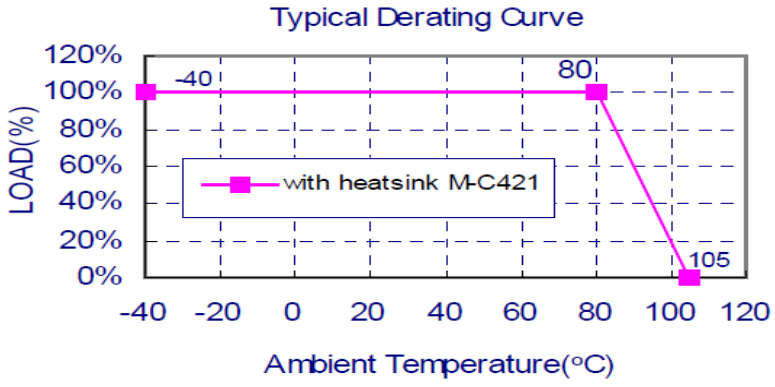
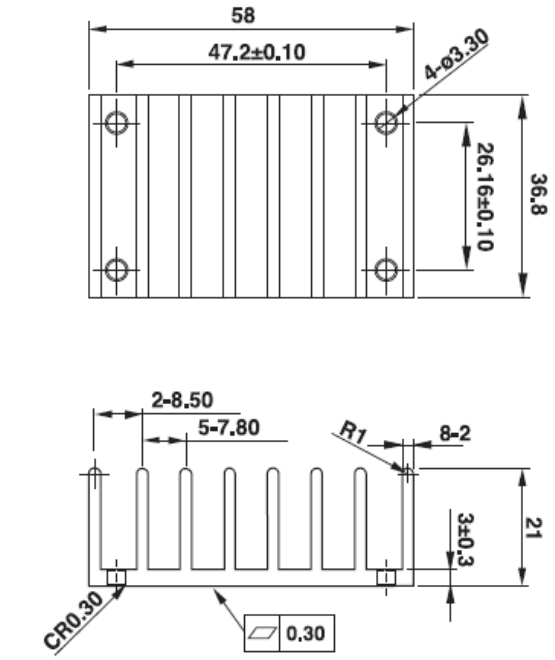


Figure 1 Derating Curve of Modules

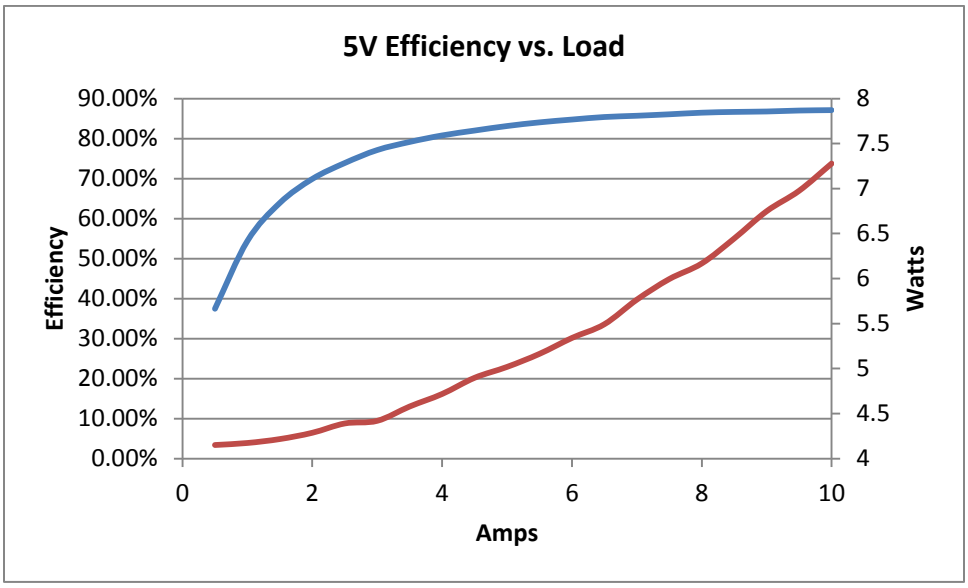
Transverse Fins
Model No. :M-C421
Thermal Pad: SZ56.9x35x0.25mm
Screw: SMP+SW M3x8L

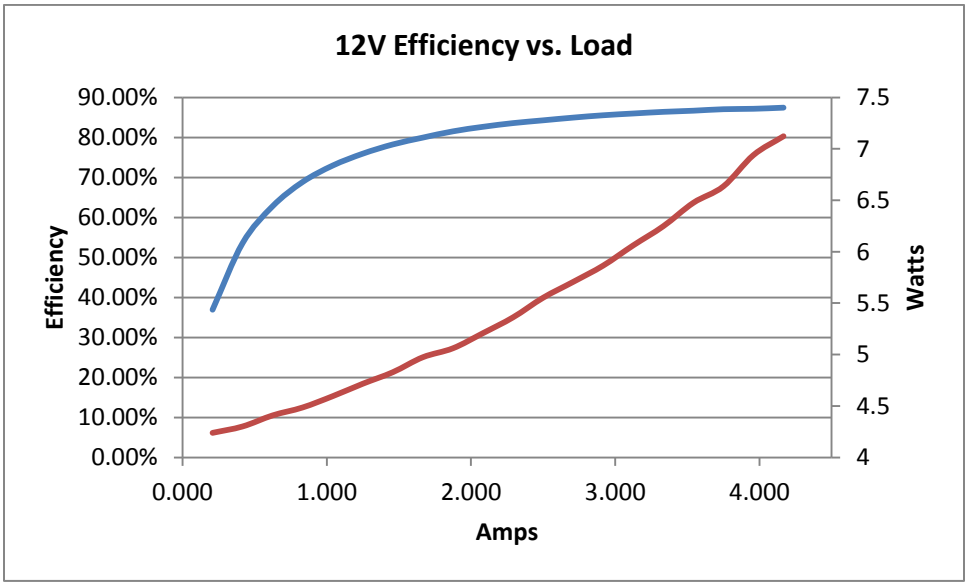


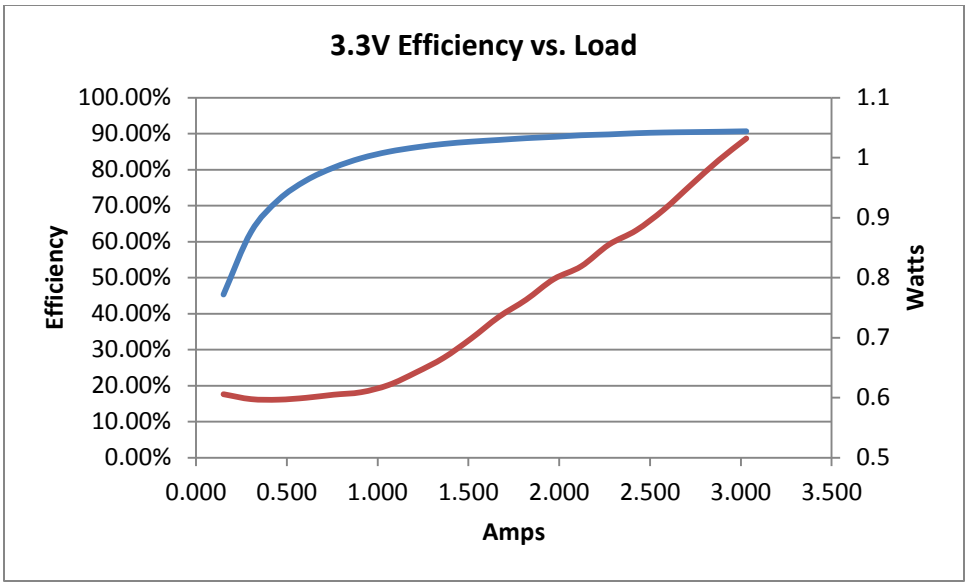
Rca: 4.78˚C/W (typ.), At natural convection
2.44˚C/W (typ.), At 100LFM
2.06˚C/W (typ.), At 200LFM
1.76˚C/W (typ.), At 300LFM
1.58˚C/W (typ.), At 400LFM

Figure 2 Heat Sink shown for reference only

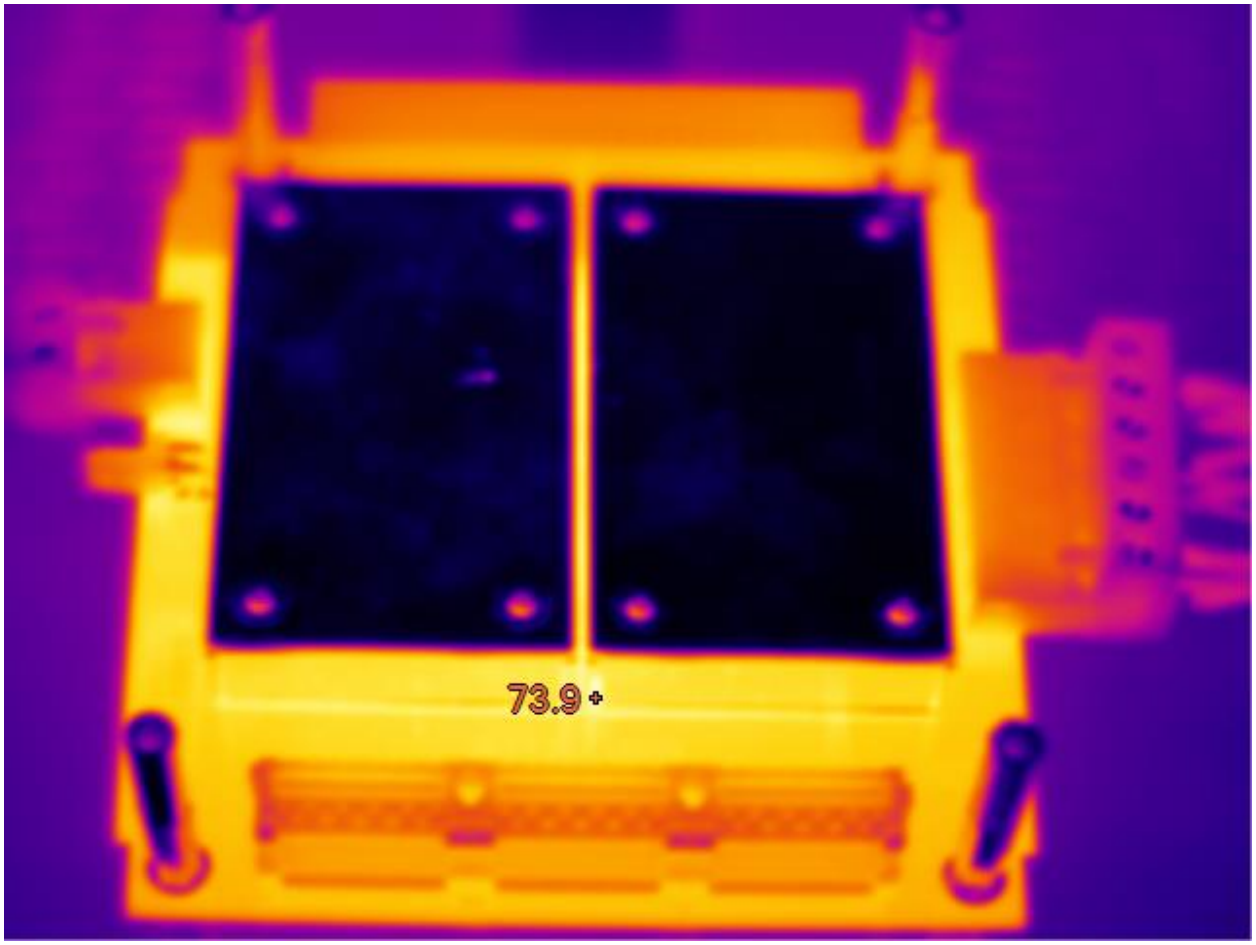
2.3 Efficiency and Dissipation Graphs



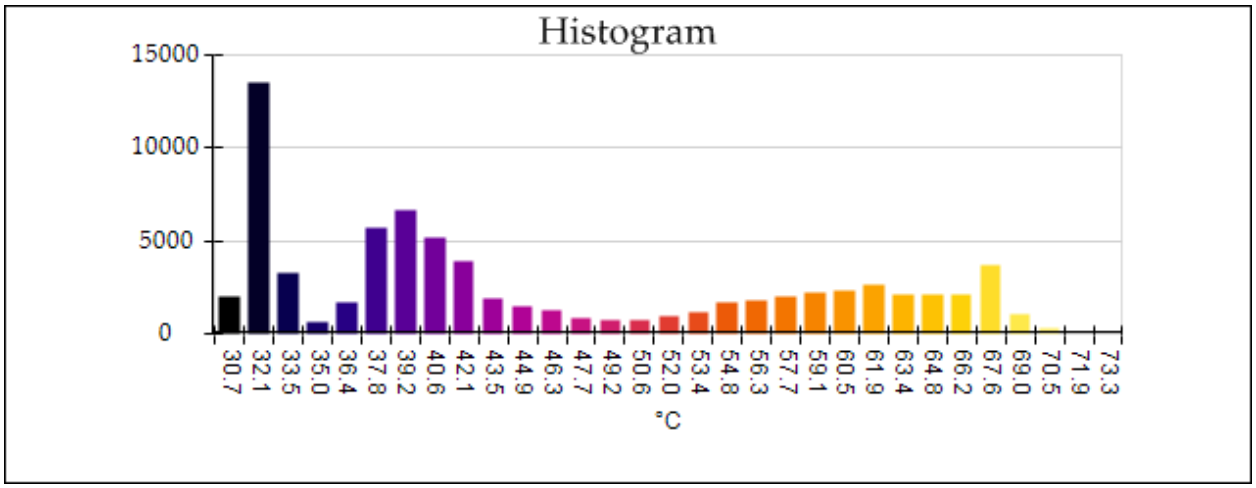


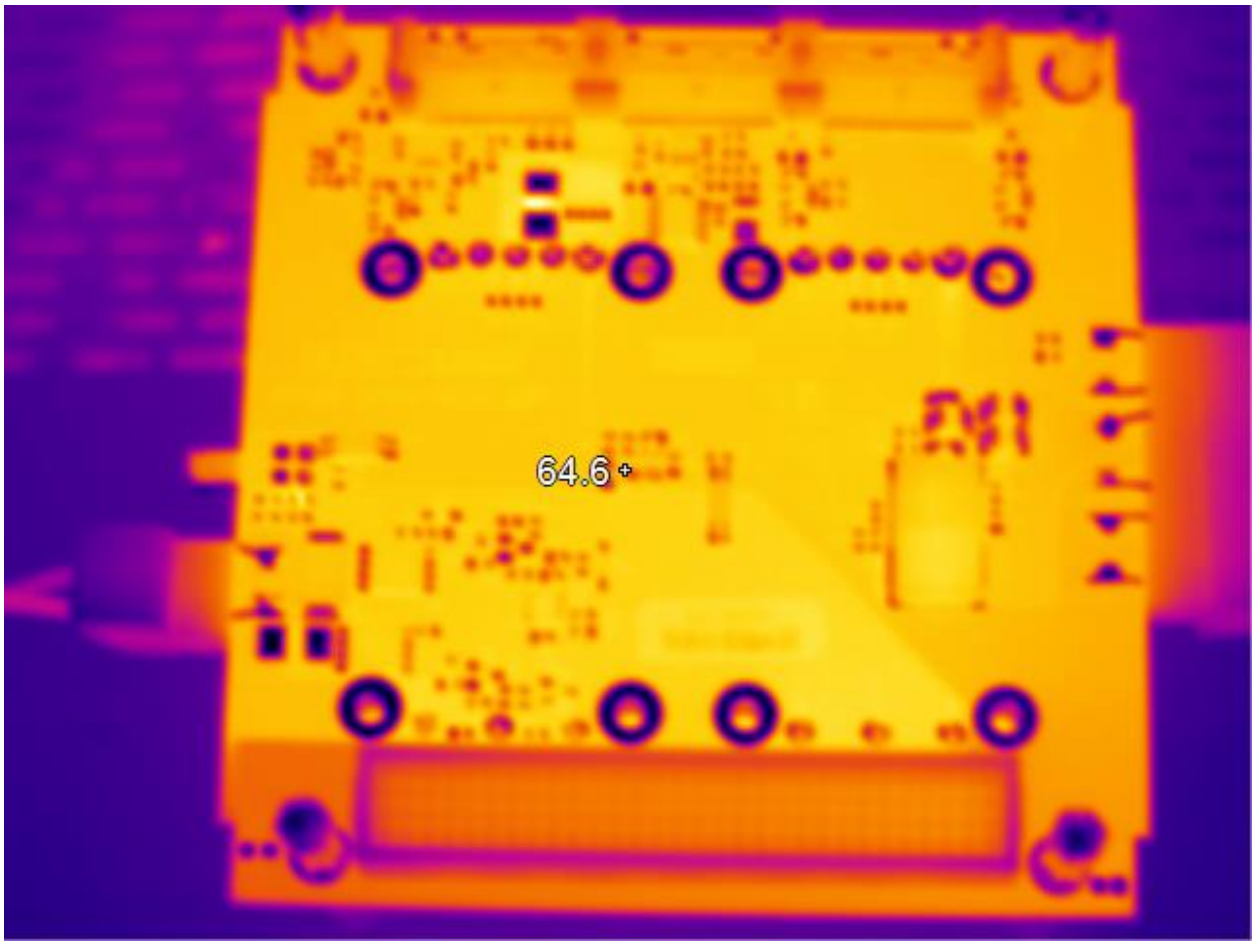

3.3V Efficiency vs. Load
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Efficiency
1.1
1
0.9
0.8
0.7
0.6
0.5
Watts
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
Amps

2.4 Thermal Images

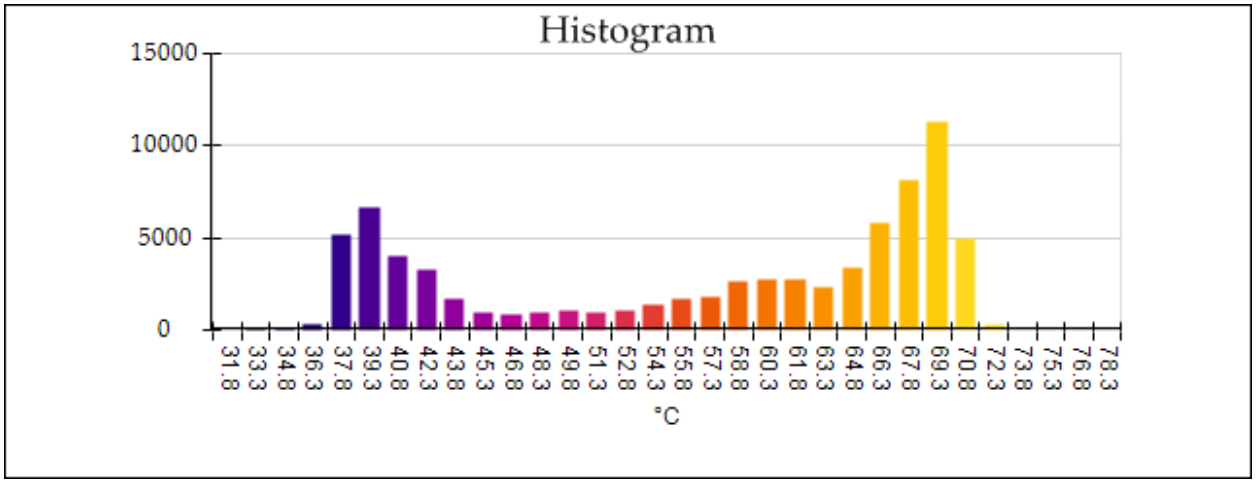


Top; No Heat Sink, 23°C, Max Load, 24Vin, At thermal equilibrium, Max temperature is 81.9C (measured with a thermocouple between the quarter bricks).

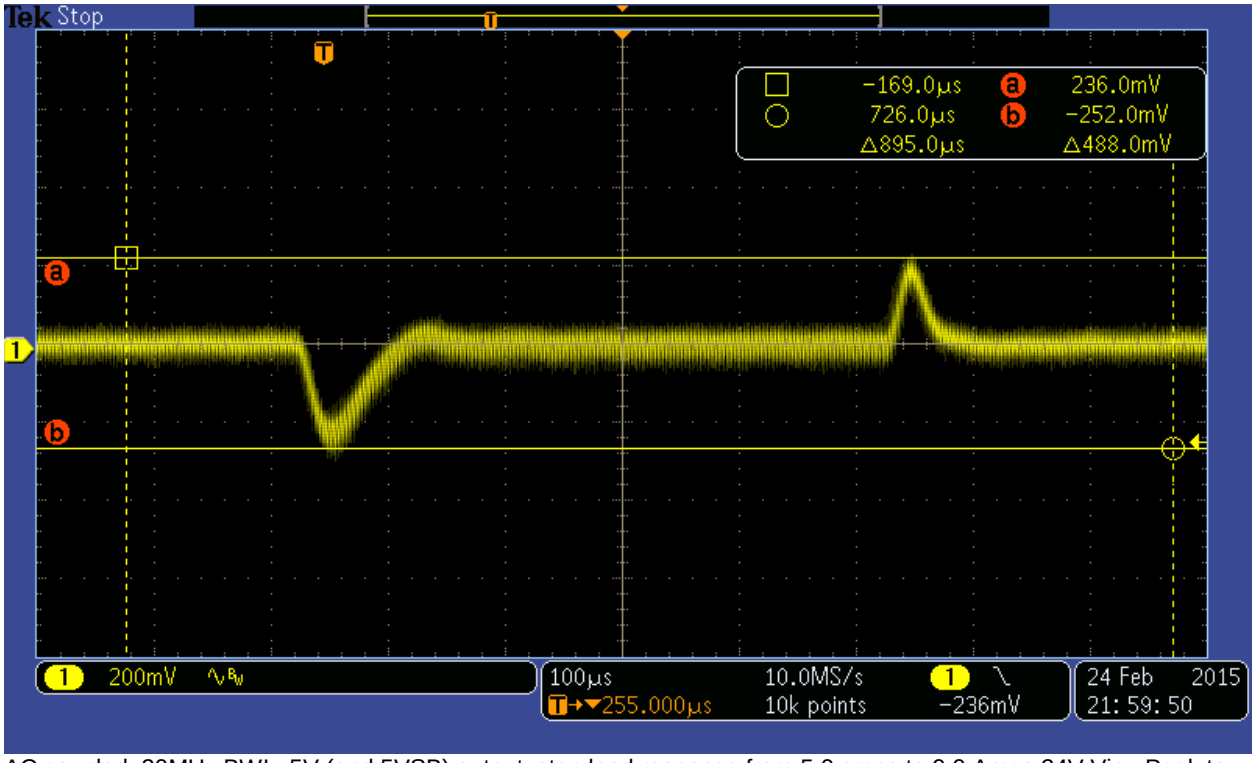




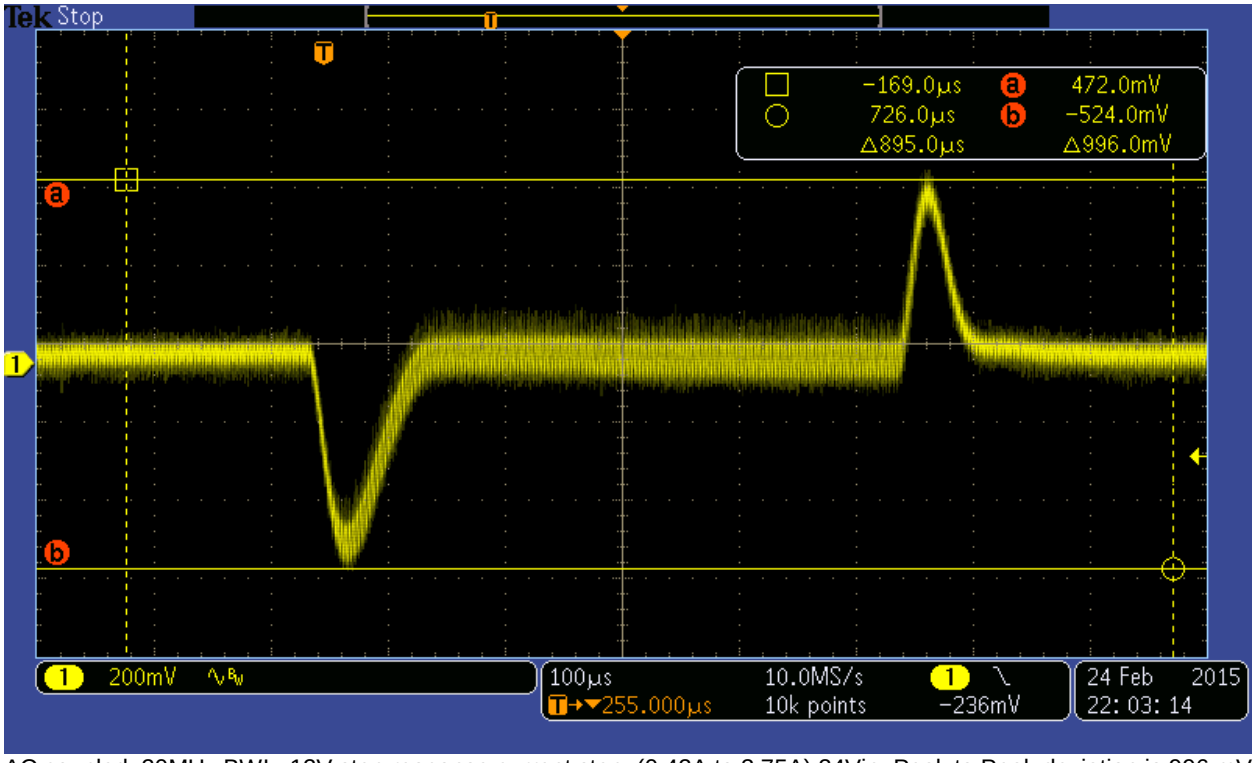
Bottom; No Heat Sink, 23°C, Max Load, 24Vin, At thermal equilibrium, Max temperature is 71.3C



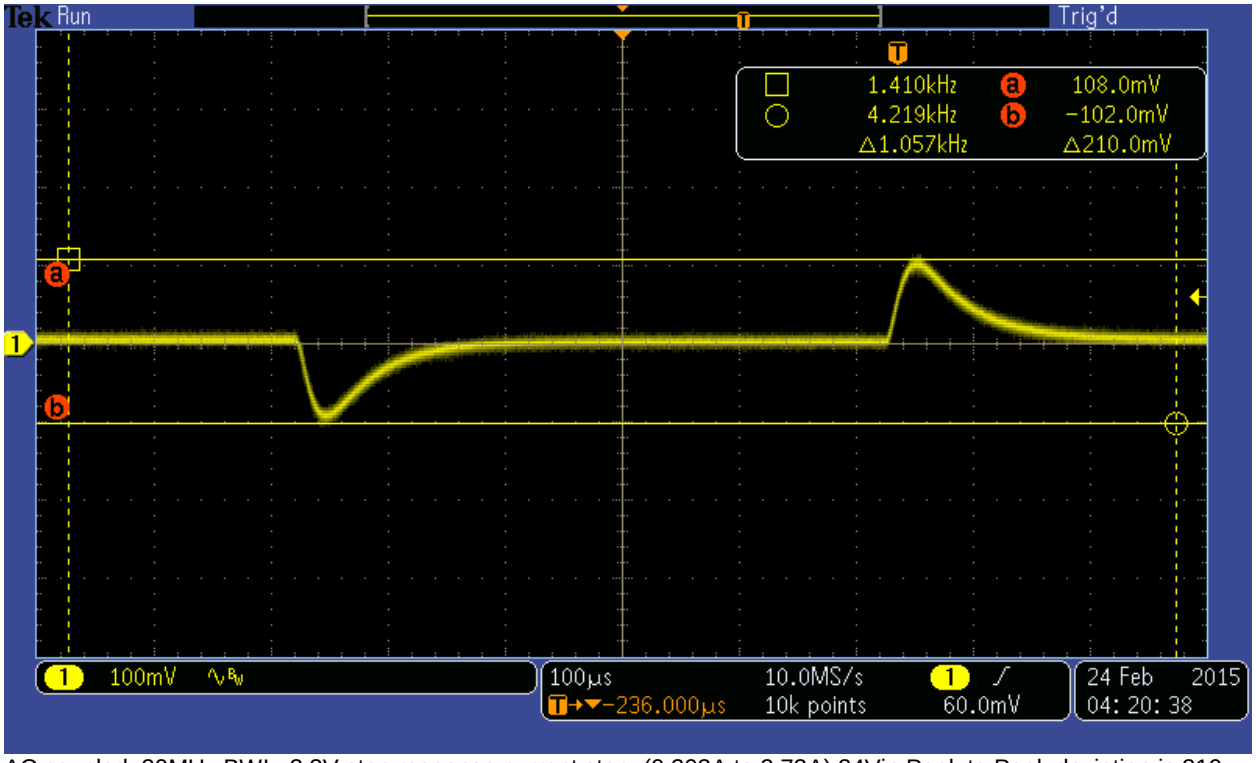
2.5 Step Response



AC coupled, 20MHz BWL, 5V (and 5VSB) output, step load response from 5.0 amps to 9.0 Amps 24V Vin. Peak to Peak deviation is 488 mV

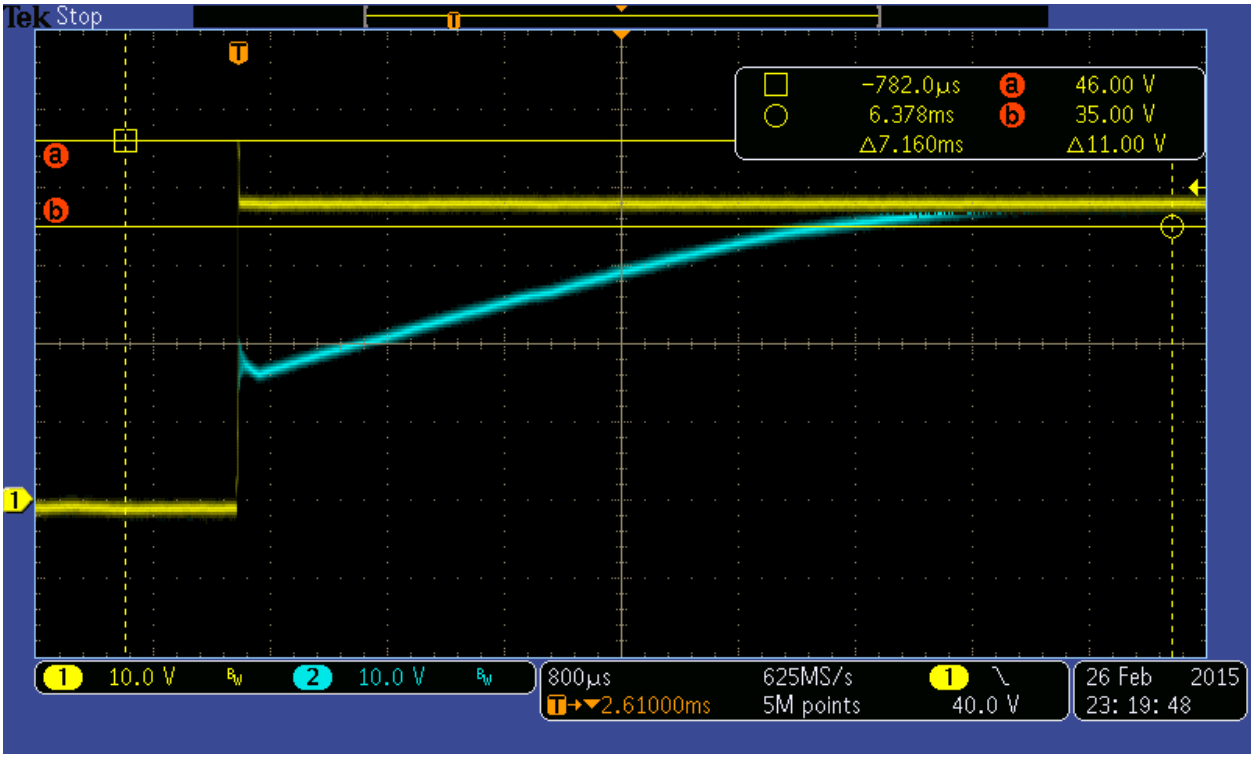


AC coupled, 20MHz BWL, 12V step response current step. (0.42A to 3.75A) 24Vin, Peak to Peak deviation is 996 mV



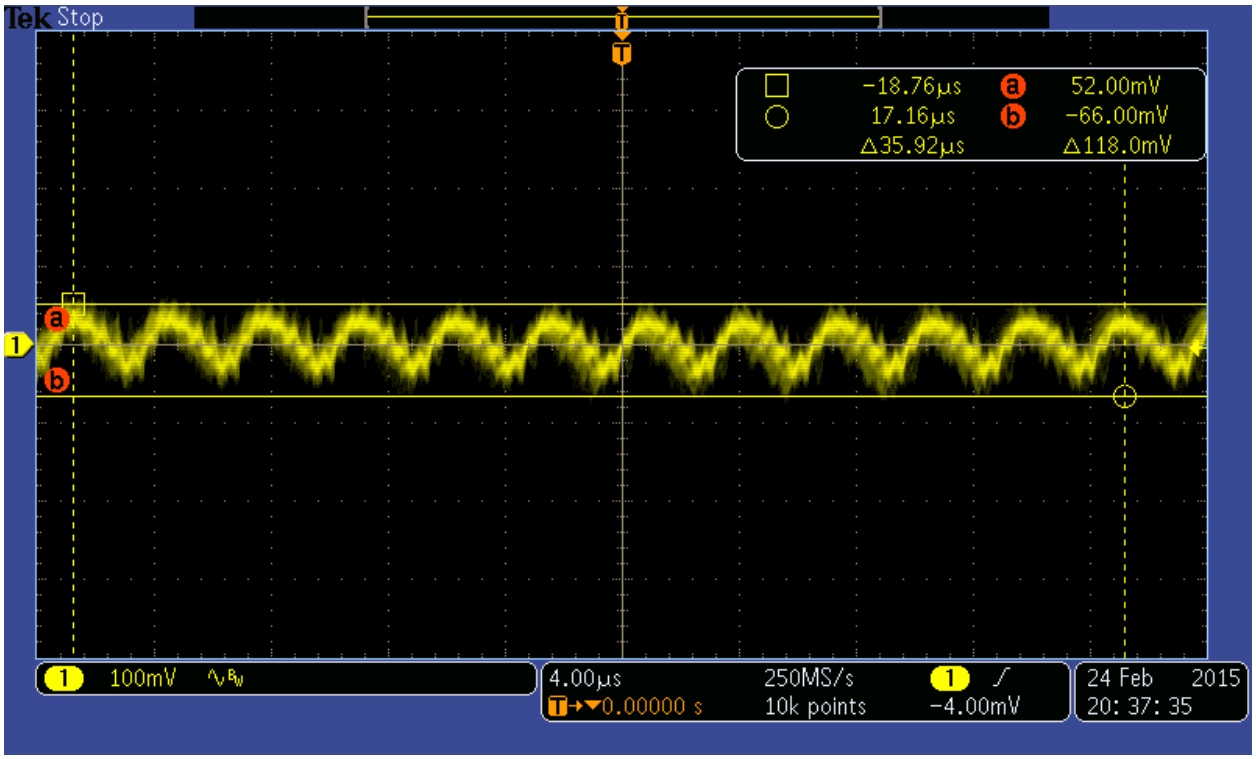
AC coupled, 20MHz BWL, 3.3V step response current step. (0.303A to 2.73A) 24Vin Peak to Peak deviation is 210 mV

2.6 Input Protection

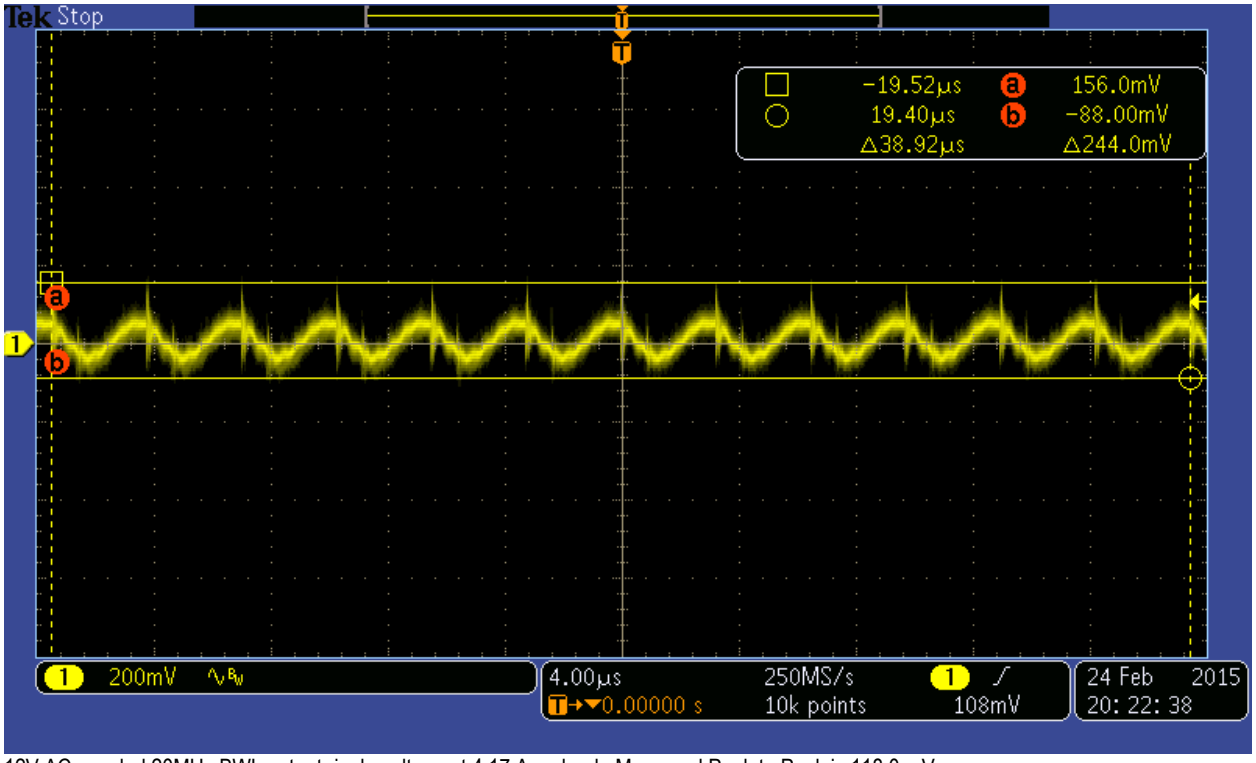


Input surge protection test. 36Vin CH1 is input of 36V. CH2 is after the protection. 46V inductive spike is reduced to 25.6V and rolls up to 36V in 5 mSec.

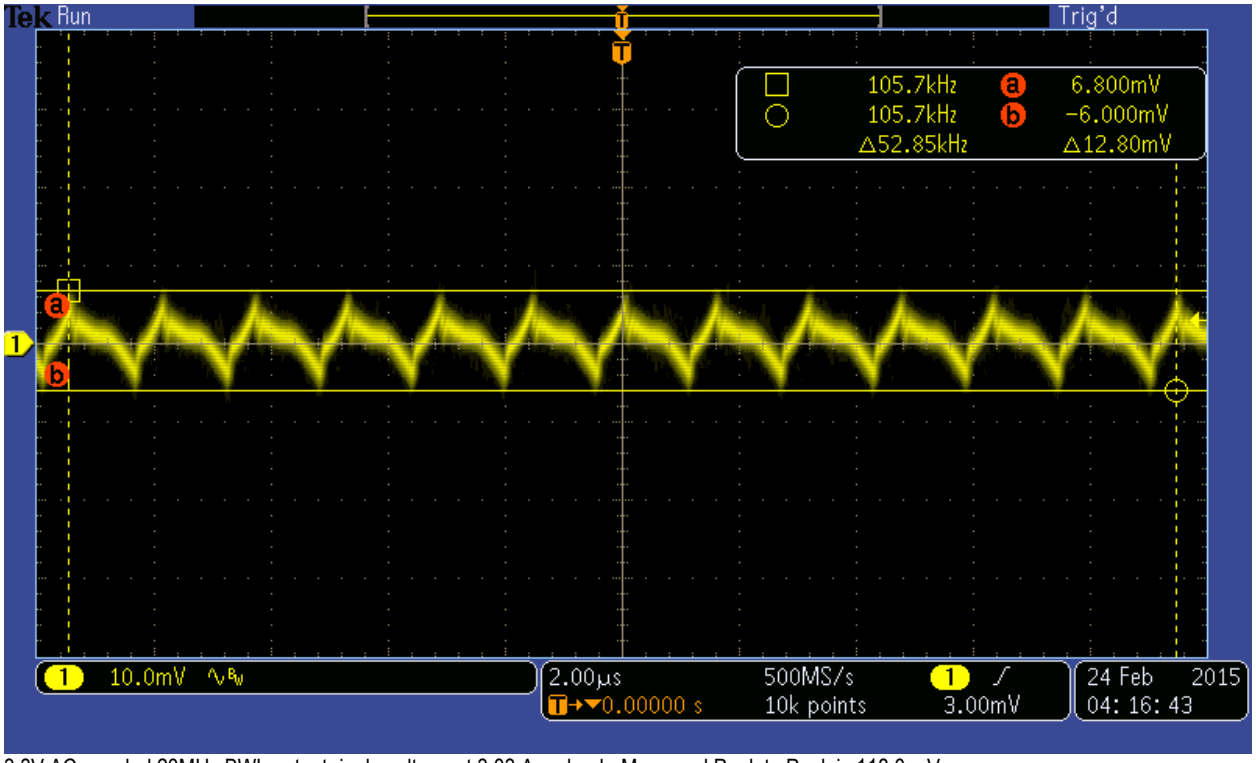
2.7 Ripple Voltage



5V and 5VSB AC coupled 20MHz BWL output ripple voltage at 10.0 Amp load. Measured Peak to Peak is 118.0 mV.



12V AC coupled 20MHz BWL output ripple voltage at 4.17 Amp load. Measured Peak to Peak is 118.0 mV.



3.3V AC coupled 20MHz BWL output ripple voltage at 3.03 Amp load. Measured Peak to Peak is 118.0 mV.

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

- Weight: Approximately 226g (0.498 lbs.) no heat sink
- Board Dimensions: 93.52 mm L x 95.89 mm W (3.682 in L x 3.775 in W)

Figure 3 Board Pictured without Heat Sink

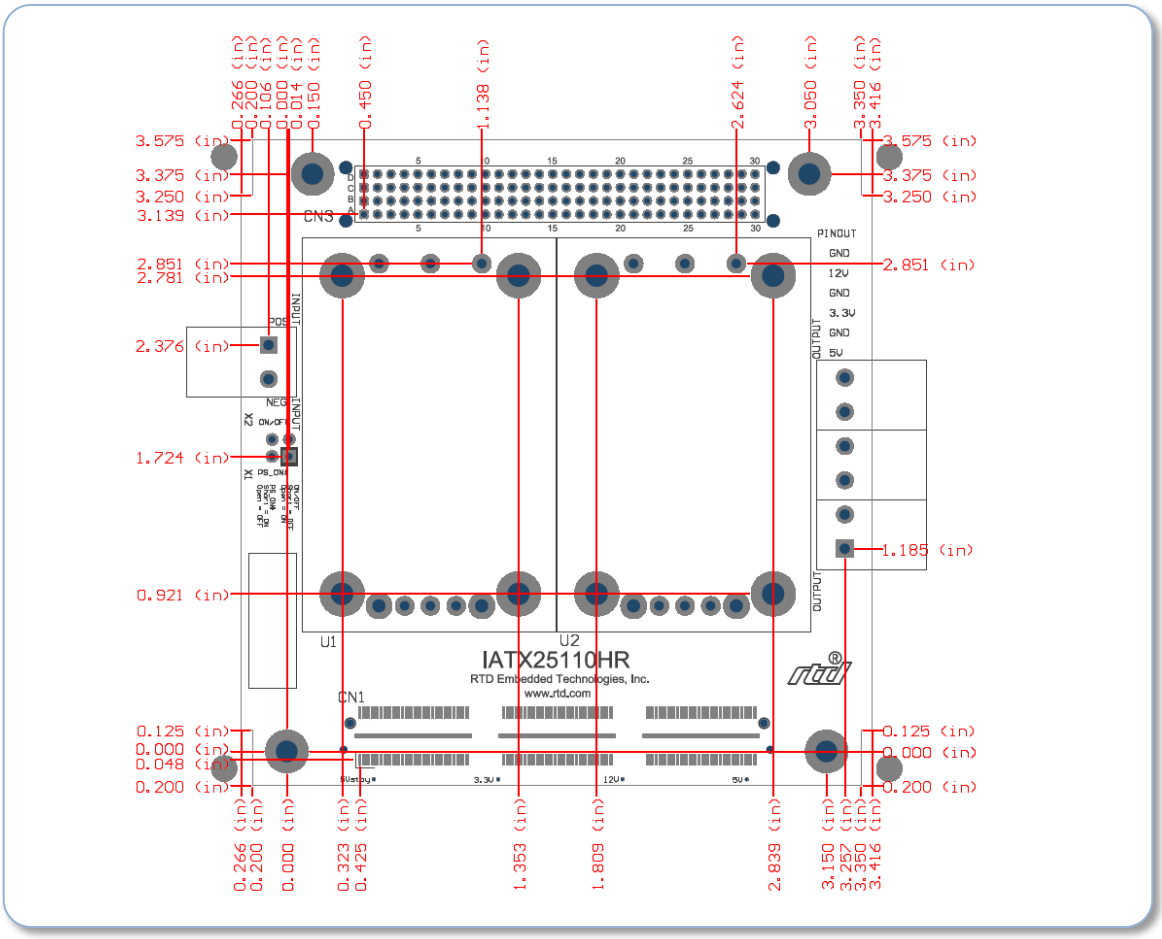


Figure 4: Board Dimensions

3.3 Connectors, Jumpers, and LEDs

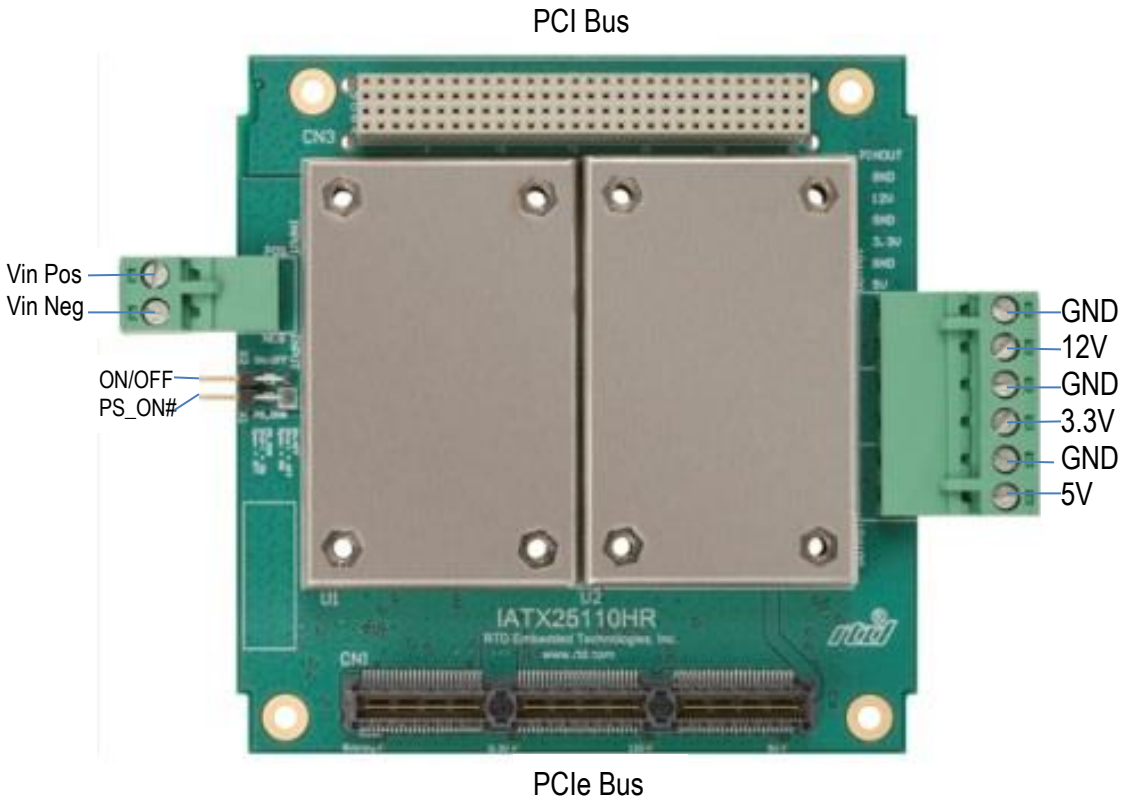


Figure 5: Board Connections, Jumpers

3.3.1 CONNECTORS AND JUMPERS

All I/O connectors have Pin 1 designated by a thick white silkscreen line, and/or a square pad on the PCB.

Power Connectors

TB1 is a two pin input power connector. Each pin is labeled on the PCB. Mating connector is a Pheonix contact 1779987 (www.Pheonixcontact.com)

Facing the connector, from left to right, the pin out is:

Table 3 TB1 Vin Connector

TB1 Pin	Pin Name	Function	IDAN
1	Vin+	9V to 36V input	?
2	Vin-	Input Negative	?

TB2 is a six pin auxiliary power connector. Both +5V pins are sourced from the same 5V supply. Each pin is labeled on the PCB. Mating connector is a Pheonix contact 1781027 (www.Pheonixcontact.com)

Facing the connector, from left to right, the pin out is:

Table 4 TB2 Vout Connector

TB2 Pin	Pin Name	Function	IDAN 9-pin "D"
1	+5V	5V auxiliary output	?
2	GND	Ground connection	?
3	+3.3V	3.3V auxiliary output	?
4	GND	Ground connection	?
5	+12V	12V auxiliary output	?
6	GND	Ground connection	?

CN1 and CN2 PCIe Bus

CN1 and CN2 are the PCIe connectors. All pins stack through with no lane shifting.

Table 5 CN1 and CN2 PCIe Bus

CNX Pin	Signal	Signal	CNX Pin
1	USB_OC#	PE_RST#	2
3	3.3V	3.3V	4
5	USB_1p	USB_0p	6
7	USB_1n	USB_0n	8
9	GND	GND	10
11	PEx1_1Tp	PEx1_0Tp	12
13	PEx1_1Tn	PEx1_0Tn	14
15	GND	GND	16
17	PEx1_2Tp	PEx1_3Tp	18
19	PEx1_2Tn	PEx1_3Tn	20
21	GND	GND	22
23	PEx1_1Rp	PEx1_0Rp	24
25	PEx1_1Rn	PEx1_0Rn	26
27	GND	GND	28
29	PEx1_2Rp	PEx1_3Rp	30
31	PEx1_2Rn	PEx1_3Rn	32
33	GND	GND	34
35	PEx1_1Clkp	PEx1_0Clkp	36
37	PEx1_1Clkn	PEx1_0Clkn	38
39	+5V_SB	+5V_SB	40
41	PEx1_2Clkp	PEx1_3Clkp	42
43	PEx1_2Clkn	PEx1_3Clkn	44
45	DIR	PWRGOOD	46
47	SMB_DAT	PEx_x4_Clkp	48
49	SMB_CLK	PEx_x4_Clkn	50
51	SMB_ALERT	PSON#	52
53	STK0 / WAKE#	STK1 / PEG_ENA#	54
55	GND	GND	56
57	PEx4_1T(0)p	PEx4_0T(0)p	58
59	PEx4_1T(0)n	PEx4_0T(0)n	60
61	GND	GND	62
63	PEx4_1T(1)p	PEx4_0T(1)p	64
65	PEx4_1T(1)n	PEx4_0T(1)n	66
67	GND	GND	68
69	PEx4_1T(2)p	PEx4_0T(2)p	70
71	PEx4_1T(2)n	PEx4_0T(2)n	72
73	GND	GND	74
75	PEx4_1T(3)p	PEx4_0T(3)p	76
77	PEx4_1T(3)n	PEx4_0T(3)n	78
79	GND	GND	80
81	SATA_T1p	SATA_T0p	82
83	SATA_T1n	SATA_T0n	84
85	GND	GND	86
87	SSTX1p	SSTX0p	88
89	SSTX1n	SSTX0n	90
91	GND	GND	92
93	Reserved	Reserved	94
95	Reserved	Reserved	96
97	GND	GND	98
99	SATA_DET#1	SATA_DET#0	100
101	SATA_PWREN#1	SATA_PWREN#0	102
103	GND	GND	104
105	STK2 / SDVO_DAT	LPC_CLK	106
107	GND	GND	108
109	PEx4_1R(0)p	PEx4_0R(0)p	110
111	PEx4_1R(0)n	PEx4_0R(0)n	112
113	GND	GND	114

115	PEx4_1R(1)p	PEx4_0R(1)p	116
117	PEx4_1R(1)n	PEx4_0R(1)n	118
119	GND	GND	120
121	PEx4_1R(2)p	PEx4_0R(2)p	122
123	PEx4_1R(2)n	PEx4_0R(2)n	124
125	GND	GND	126
127	PEx4_1R(3)p	PEx4_0R(3)p	128
129	PEx4_1R(3)n	PEx4_0R(3)n	130
131	GND	GND	132
133	SATA_R1p	SATA_R0p	134
135	SATA_R1n	SATA_R0n	136
137	GND	GND	138
139	SSRX1p	SSRX0p	140
141	SSRX1n	SSRX0n	142
143	GND	GND	144
145	LPC_AD0	LPC_DRQ#	146
147	LPC_AD1	LPC_SERIRQ#	148
149	GND	GND	150
151	LPC_AD2	LPC_FRAME#	152
153	LPC_AD3	RTC_Battery	154
155	GND	GND	156
C1	5V		
C2	5V		
C3	12V		

CN3 PCI Bus

Table 6 CN3 PCI Bus

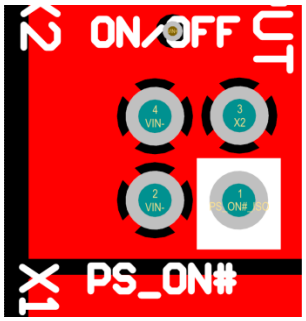
Pin Number	A row	B row	C row	D row
1	GND	5VSB	+5V	N/C
2	N/C	N/C	N/C	+5V
3	N/C	GND	N/C	N/C
4	N/C	N/C	GND	N/C
5	GND	N/C	N/C	GND
6	N/C	N/C	N/C	N/C
7	N/C	N/C	GND	N/C
8	+3.3V	N/C	N/C	+3.3V
9	N/C	GND	PS_ON#	N/C
10	GND	N/C	+3.3V	N/C
11	N/C	+3.3V	N/C	GND
12	+3.3V	N/C	GND	N/C
13	N/C	GND	N/C	+3.3V
14	GND	N/C	+3.3V	N/C
15	N/C	+3.3V	N/C	GND
16	N/C	N/C	GND	N/C
17	+3.3V	N/C	N/C	+3.3V
18	N/C	GND	N/C	N/C
19	N/C	N/C	N/C	N/C
20	GND	N/C	N/C	GND
21	N/C	+5V	N/C	N/C
22	+5V	GND	GND	N/C
23	N/C	N/C	N/C	N/C
24	GND	N/C	+5V	N/C
25	N/C	N/C	N/C	GND
26	+5V	N/C	GND	N/C
27	N/C	+5V	N/C	GND
28	GND	+5V	+5V	N/C
29	+12V	N/C	N/C	N/C
30	-12V	N/C	N/C	GND

X1 Jumper

The X1 jumper is part of a four pin jumper located near the input power connector. Default is open or attached to the power switch in IDAN. The board is labeled with settings. When the jumper is open, all main supplies on the board are controlled via PS_ON# (normal ATX functionality). When the jumper is shorted, the board be powered on when the input is present (assuming X2 is open). The only LEDs that should be on when PS_ON# is not asserted is the input power LED and the 5VSTBY LED.

Table 7 X1 Board PS_ON# Jumper

X1 Pin	Signal	Function	IDAN	note
1	PS_ON#	Short to Pin 2 = Override PS_ON# Open = CPU controls PS_ON# (Default)	Power Switch	Pin 1 is indicated By a square pad
2	Vin-	Reference	Power Switch	

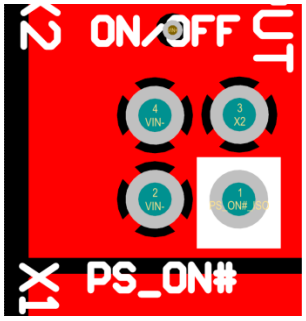


X2 Jumper

The X2 jumper is the ON/OFF signal. Default is open. When set to ON, all board supplies can be enabled. When the ON/OFF jumper is set to OFF, all supplies, including 5VSTBY, are disabled. The X2 pin is pulled to Vin+ through a 100K resistor. The only indication of power on the board will be the input power LED should still be on.

Table 8 X2 ON/OFF Jumper

X2 Pin	Signal	Function	IDAN
3	X2	Short to Pin 2=ON Open = OFF (Default)	N/C
4	Vin-	Reference	N/C



Solder Jumpers B2 and B3

B2 and B3 are on the bottom of the board located in the corners to either side of the PCI connector. Both of the solder jumpers are open by default and are used for setting the potential of the frame. B2 is labeled “Frame Input GND” and B3 is labeled “Frame Output GND”. B2 shorts the Vin- rail to the frame when populated and B3 shorts the GND rail to the frame when populated. If both solder jumpers are populated, input and output ground will be shorted together.

3.3.2 LEDs

Voltage indicator LEDs

There are six LEDs on the board. Four are labeled by CN1 (PCIe bus) by their voltage. If one of these four LEDs is on, the respective voltage is good. The remaining two LEDs, of the six, are input power indicators. They are located on the bottom of the board by the input power connector. The green one is labeled "Vin is On" and the red one is labeled "Reversed". When the green LED is on, there is a voltage present at the input connector. When the red LED is on, the input leads have been reversed.

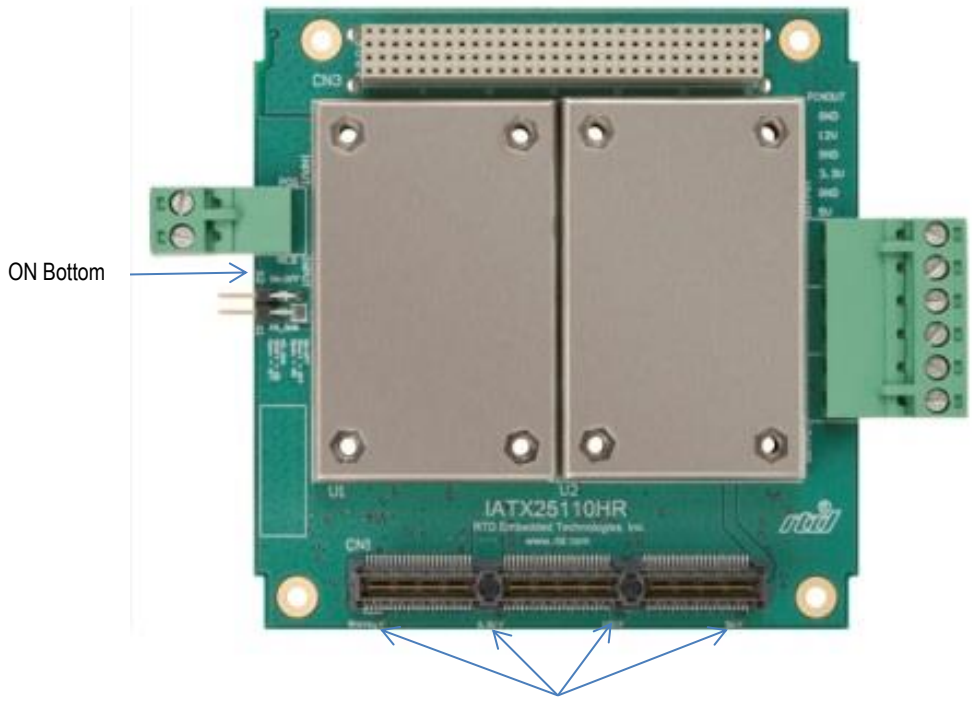


Figure 6 LED Locations

3.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the PC/104 system or stack.
3. Select and install stand-offs to properly position the module on the stack.
4. Remove the module from its anti-static bag.
5. Check that pins of the bus connector are properly positioned.
6. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
7. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
8. Gently and evenly press the module onto the PC/104 stack.
9. If any boards are to be stacked above this module, install them.
10. Attach any necessary cables to the PC/104 stack.
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.
13. Any wires into or out of the board should be twisted to reduce inductance.
14. Wires are to be kept as short as possible to reduce unnecessary voltage drops.
15. Power wires should be able to carry at least 10 Amps of current.

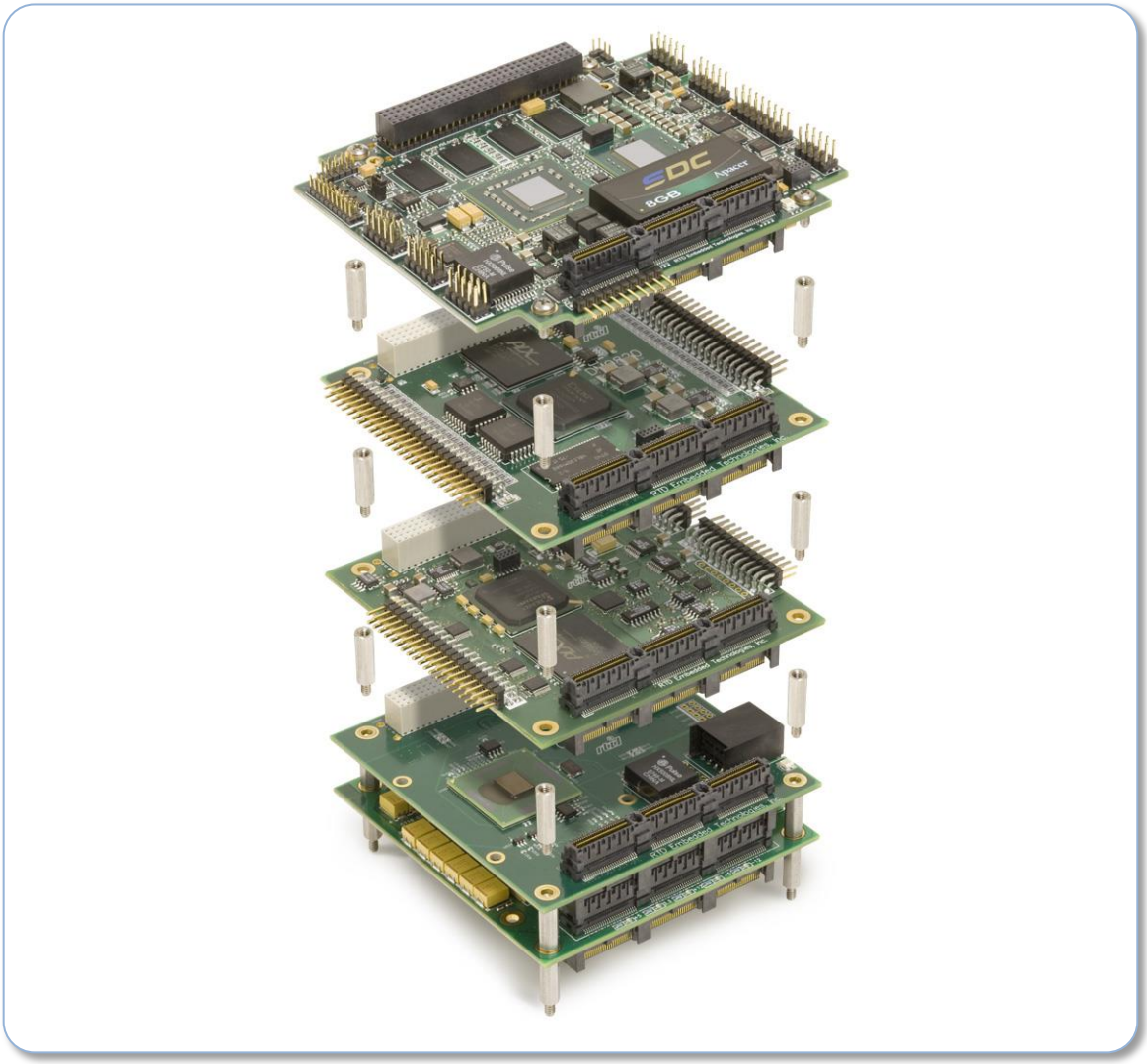


Figure 7: Example 104™ Stack

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 Connectors

4.2.1 External I/O Connectors

The power ON/OFF switch with LED is located on the front of the frame. The 2-pin push-pull power input connector and the 9-pin "D" power output connector are brought out of the back of the frame.

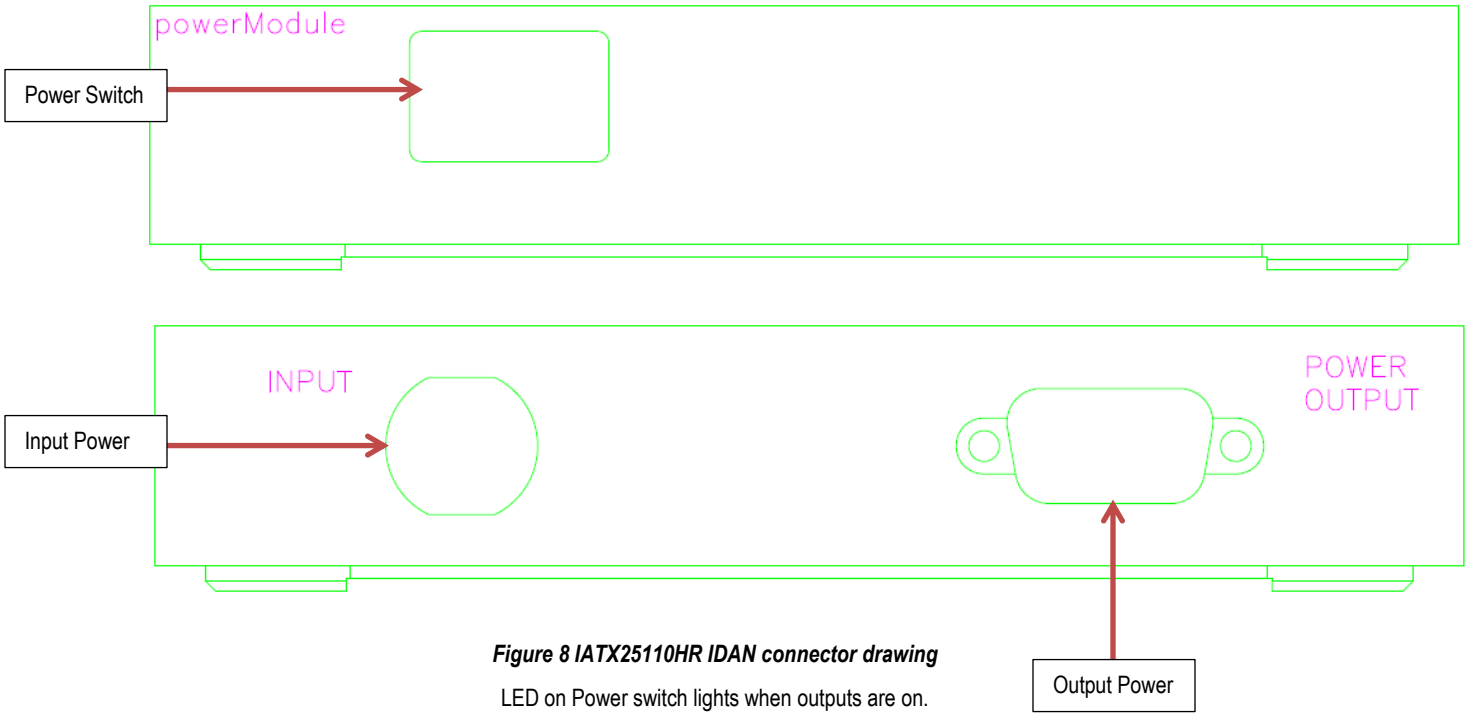


Figure 8 IATX25110HR IDAN connector drawing

LED on Power switch lights when outputs are on.

To be added later

Figure 9 IDAN frame rear view

To be added later

Figure 10 IDAN frame front view

Figure 11 Power Output Connector DB9

Table 9: IDAN Power Output Connector Pin-out

Pin Number	Description
1	5V
2	GND
3	12V
4	GND
5	N/C
6	5V
7	GND
8	3.3V
9	GND

Three Amp current rating per pin.

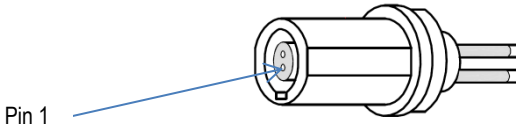


Figure 12 IDAN Input Power Connector

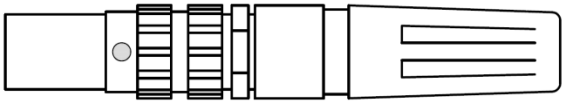


Figure 13 IDAN Power Mating Connector

The mating connector is a Souriau JBXFD1G02MSSDSMR

Table 10: IDAN Power Input Connector Pin-out

Pin Number	Description
1	Vin+
2	Vin-

Ten Amp current rating per pin.

Figure 14 IDAN Power Mating Cable

Mating cable IDAN-XKCM18 is shipped with IDAN configuration.

4.3 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.

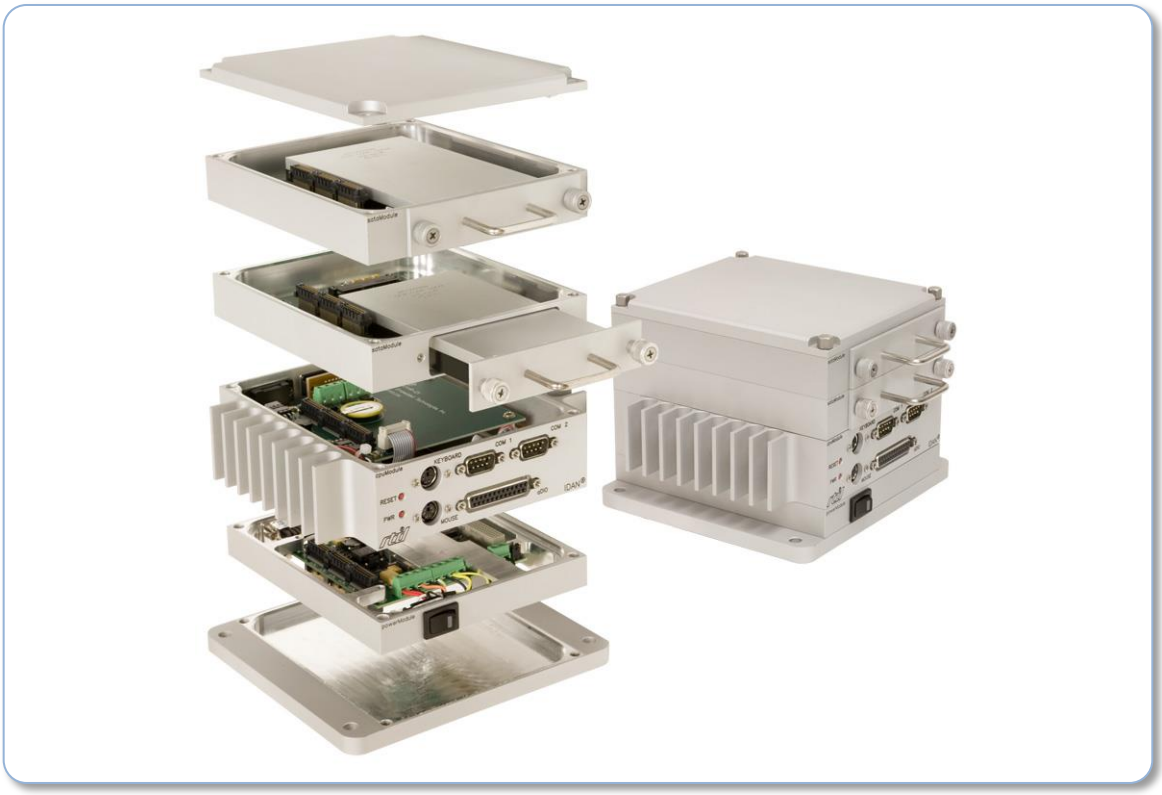


Figure 15: Example IDAN System

5 Functional Description

5.1 Block Diagram

The Figure below shows the functional block diagram of the ATX35110HR-190W. The various parts of the block diagram are discussed in the following sections.

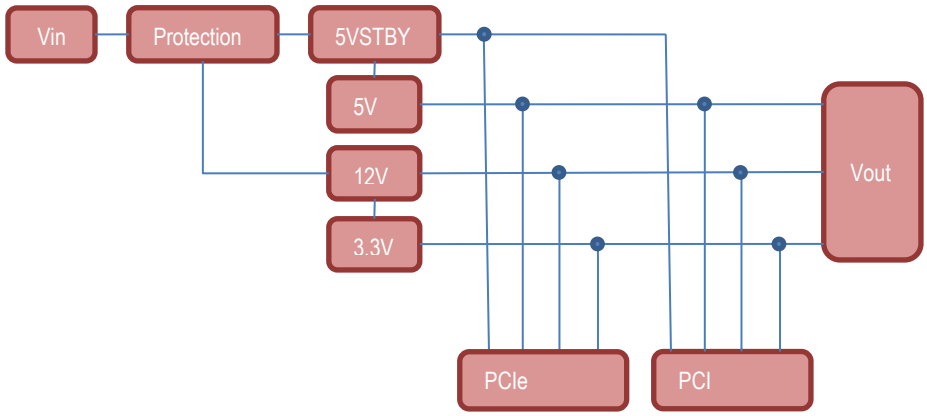


Figure 16: IATX25110HR Block Diagram

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.

RTD Embedded Technologies, Inc.
103 Innovation Boulevard
State College, PA 16803 USA
Telephone: 814-234-8087
Fax: 814-234-5218

www.rtd.com

sales@rtd.com
techsupport@rtd.com