

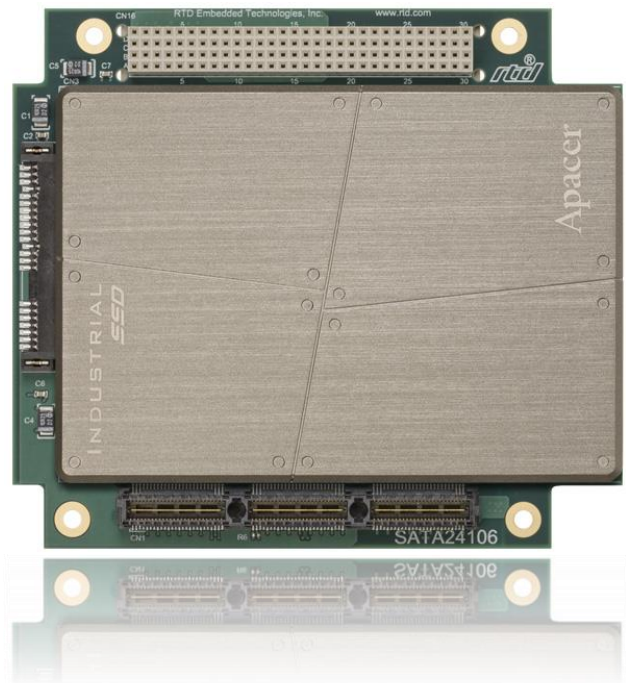


SATA24106HR

PCI/104-Express 2.5" SATA Drive Carrier

User's Manual

BDM-610020125 Rev. A



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Revision History

Rev A Initial Release

Advanced Analog I/O, Advanced Digital I/O, aAIO, aDIO, a2DIO, Autonomous SmartCal, "Catch the Express", cpuModule, dspFramework, dspModule, expressMate, ExpressPlatform, HiDANplus, "ML Value for COTS prices", multiPort, PlatformBus, and PC/104EZ are trademarks, and "Accessing the Analog World", dataModule, iDAN, HiDAN, RTD, and the RTD logo are registered trademarks of RTD Embedded Technologies, Inc (formerly Real Time Devices, Inc.). PS/2 is a trademark of International Business Machines Inc. PCI, PCI Express, and PCIe are trademarks of PCI-SIG. PC/104, PC/104-Plus, PCI-104, PCIe/104, PCI/104-Express and 104 are trademarks of the PC/104 Embedded Consortium. All other trademarks appearing in this document are the property of their respective owners.

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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Table of Contents

1	Introduction	6
1.1	Product Overview.....	6
1.2	Board Features.....	6
1.3	Ordering Information.....	7
1.4	Contact Information.....	7
1.4.1	Sales Support.....	7
1.4.2	Technical Support.....	7
2	Specifications	8
2.1	Board Operating Conditions.....	8
2.2	Board Electrical Characteristics.....	8
2.3	SATA Drive Operating Conditions.....	9
2.4	Physical Characteristics.....	9
3	Board Connection	10
3.1	Board Handling Precautions.....	10
3.2	Stacking Requirements.....	10
3.3	Steps for Installing.....	11
3.4	Connector Locations.....	12
3.5	Functional Diagram.....	13
3.6	Connectors and Functionality.....	14
3.6.1	Bus Connectors.....	14
	PCIe Type 2 Connector (CN1 – Top, CN2 - Bottom)	14
	PCI Connector (CN16)	14
3.6.2	I/O Connectors.....	14
	2.5" SATA Drive Connector (CN3)	14
3.6.3	SATA Link Shifting.....	15
4	IDAN Connections	16
4.1	Module Handling Precautions.....	16
4.2	Physical Characteristics.....	16
4.3	External I/O Connectors.....	16
4.4	Steps for Installing.....	17
5	Troubleshooting	18
6	Additional Information	19
6.1	PC/104 Specifications.....	19
6.2	PCI and PCI Express Specification.....	19
6.3	Serial ATA Specification.....	19
7	Limited Warranty	20

Table of Figures

Figure 1: SATA24106HR	7
Figure 2: SATA24106HR/FSxx	7
Figure 3: Board Dimensions	9
Figure 4: Example 104™ Stack	11
Figure 5: Board Connections	12
Figure 6: SATA24106HR Functional Diagram	13
Figure 7: IDAN Dimensions – L x W x H	16
Figure 8: Example IDAN System	17

Table of Tables

Table 1: Ordering Options	7
Table 2: Operating Environment and Storage Conditions	8
Table 3: Supply Voltage Requirements	8
Table 4: Electrical Characteristics	8
Table 5: SATA Link, Upstream vs. Shifted	13
Table 6: SATA24106HR Bus Connectors	14

1 Introduction

1.1 Product Overview

The SATA24106HR SATA drive carrier modules provide a mechanism to utilize the SATA links on the PCIe/104 Type 2 bus connector on select RTD PCI Express cpuModules. The onboard drive utilizes the first SATA link on the connector, while the other SATA link is lane-shifted up the stack, to permit stacking multiple SATA drive carrier modules within one system.

The SATA24106HR drive carrier provides power to the SATA drive, sourcing the power from the cpuModule's onboard connector, and thus eliminates the need for external out-of-stack cabling.

This manual provides instructions on how to install a 2.5" SATA drive in the SATA24106HR, and how to install the SATA24106HR module into a PCI/104-Express or PCIe/104 system. It will help you get the SATA drive carrier module up and running quickly, and will also provide enough detail about the board and its functions so you can get maximum use of its features in the most demanding applications.

1.2 Board Features

- Adds one 2.5" SATA (Serial ATA) drive to a system using the PCIe/104 Type 2 bus interface on select RTD cpuModules
 - Useful for RAID configurations
 - Stack up to 2x SATA drive carrier modules per PCIe/104 Type 2 bus interface on the host cpuModule (permitting a maximum of up to 4x SATA drive carriers in one system)
- Benefits of SATA over PATA (Parallel ATA)
 - Transfer rates up to 3.0 Gbits per second is faster and more efficient than PATA
 - Dedicated SATA links for each drive in the system eliminate master/slave addressing jumper
 - Backwards compatibility with PATA permits use of Legacy Mode
- Stackable PCIe/104 Type 2 Expansion Bus
 - Permits system expandability by passing unused SATA links, PCI-Express links, and USB ports from the cpuModule to the next expansion module in the system
- Physical and environmental characteristics
 - Supports 2.5" SATA rotating or flash drives
 - -40 to +85°C operating temperature¹
 - RTD IDAN™ compatible (see chapter 4 on page 16)

¹ Operating temperature range may be limited by the rating of the SATA drive installed in the SATA drive carrier module

1.3 Ordering Information

The SATA24106HR is available with the following options:

Table 1: Ordering Options

Part Number	Description
SATA24106HR	2.5" SATA Drive Carrier
SATA24106HR/FSxx	2.5" SATA Drive Carrier with Apacer Flash Drive Installed
IDAN-SATA24106HRS	2.5" SATA Drive Carrier in IDAN enclosure
IDAN-SATA24106HRS/FSxx	2.5" SATA Drive Carrier in IDAN enclosure with Apacer Flash Drive Installed

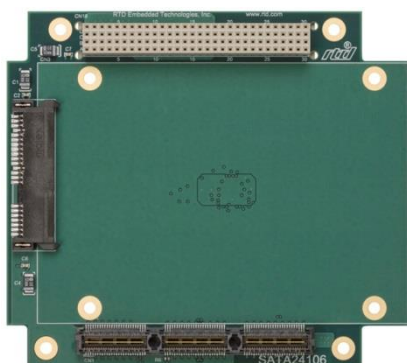


Figure 1: SATA24106HR



Figure 2: SATA24106HR/FSxx

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.

For more information on the Apacer Flash Drives available for the SATA24106HR/FSxx and IDAN-SATA24106HR/FSxx, contact RTD sales.

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 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 Board Operating Conditions

Table 2: Operating Environment and Storage Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
T _a	Operating Temperature		-40	+85	C
T _s	Storage Temperature		-55	+125	C
RH	Relative Humidity	Non-Condensing	0	90%	%



NOTE: The Operating Environment and Storage Conditions listed in Table 2 apply to the SATA24106HR board only. For recommended operating conditions of third party 2.5" SATA drives, refer to documentation from the manufacturer.

2.2 Board Electrical Characteristics

The SATA24106HR requires +5 V, +3.3 V, and +12 V for board operation, all of which are supplied by the PCIe/104 Type 2 connectors (CN1 and CN2) as well as the PCI connector (CN16).

The +5 V power rail is used to generate the voltage requirements for onboard circuitry and all three power rails are used to supply power to the 2.5" SATA drive connector (CN3). All other bus connector supply voltages are pass-through and are unused by the SATA24106HR.

Table 3: Supply Voltage Requirements

Symbol	Parameter	Test Condition	Min	Max	Unit
V _{cc5}	5 V Supply Voltage		4.750	5.250	V
V _{cc5-STBY}	5 V Stand-by Supply Voltage		n/a	n/a	V
V _{cc3}	3.3 V Supply Voltage		3.135	3.465	V
V _{cc12}	12 V Supply Voltage		11.400	12.600	V
V _{cc-12}	-12 V Supply Voltage		n/a	n/a	V

Supply current and power consumption for the SATA24106HR are listed in the table below.

Table 4: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Max	Unit
P	Power Consumption	V _{cc5} = 5.0V		0.7	W
I _{cc5}	5V Input Supply Current	Active		140	mA
2.5" SATA Drive Connector					
I _{cc3.3}	3.3 V Input Supply Current			1.4	A
I _{cc5}	5 V Input Supply Current			3.5	A
I _{cc12}	12 V Input Supply Current			2.0	A



NOTE: Power measurements were recorded with no device installed in the 2.5" SATA driver connector.

2.3 SATA Drive Operating Conditions

Each 2.5" SATA drive has its own individual operating conditions which will vary from one manufacturer to another. Installing third party 2.5" SATA drives on the SATA24106HR can affect the overall operating temperature of the system. Make sure to verify the operating conditions of third party 2.5" SATA drives before using the SATA24106HR in extreme conditions.

2.4 Physical Characteristics

A STEP model for the SATA24106HR is available upon request. Contact RTD Technical Support for more information.

- Weight: Approximately 55 g (0.12 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (3.550 in L x 3.775 in W)

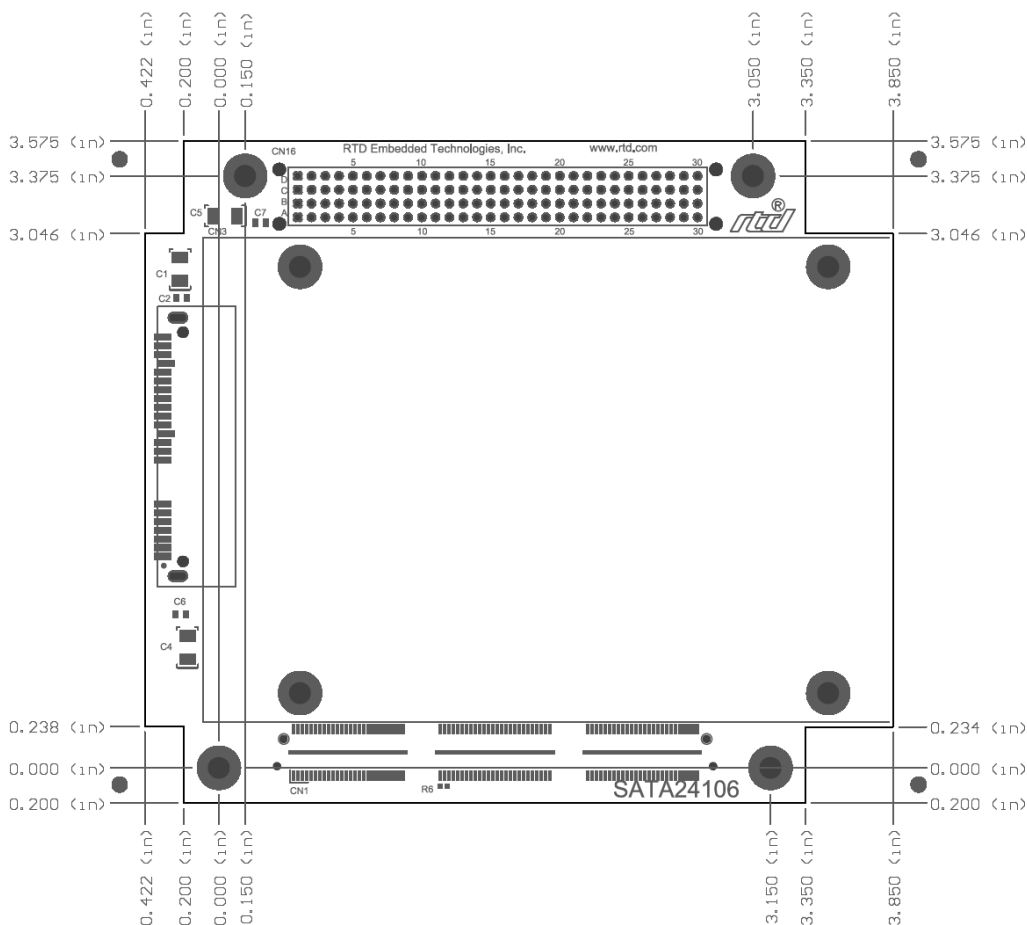


Figure 3: Board Dimensions

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 Stacking Requirements

It is common that the host cpuModule of the system requires that high speed peripherals are installed within six boards of the CPU. With today's wide array of high speed modules (SATA, USB 3.0, PCI Express, etc.), PCI devices connected to PCI/104-Express cpuModules are forced to be stacked farther away from the cpuModule.

The PCI-104 connector on the SATA24106HR permits installing the SATA drive carrier near the CPU to meet this requirement, without hindering the PCI bus to pass through to PCI peripherals that are farther away from the CPU in the system.

3.3 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.

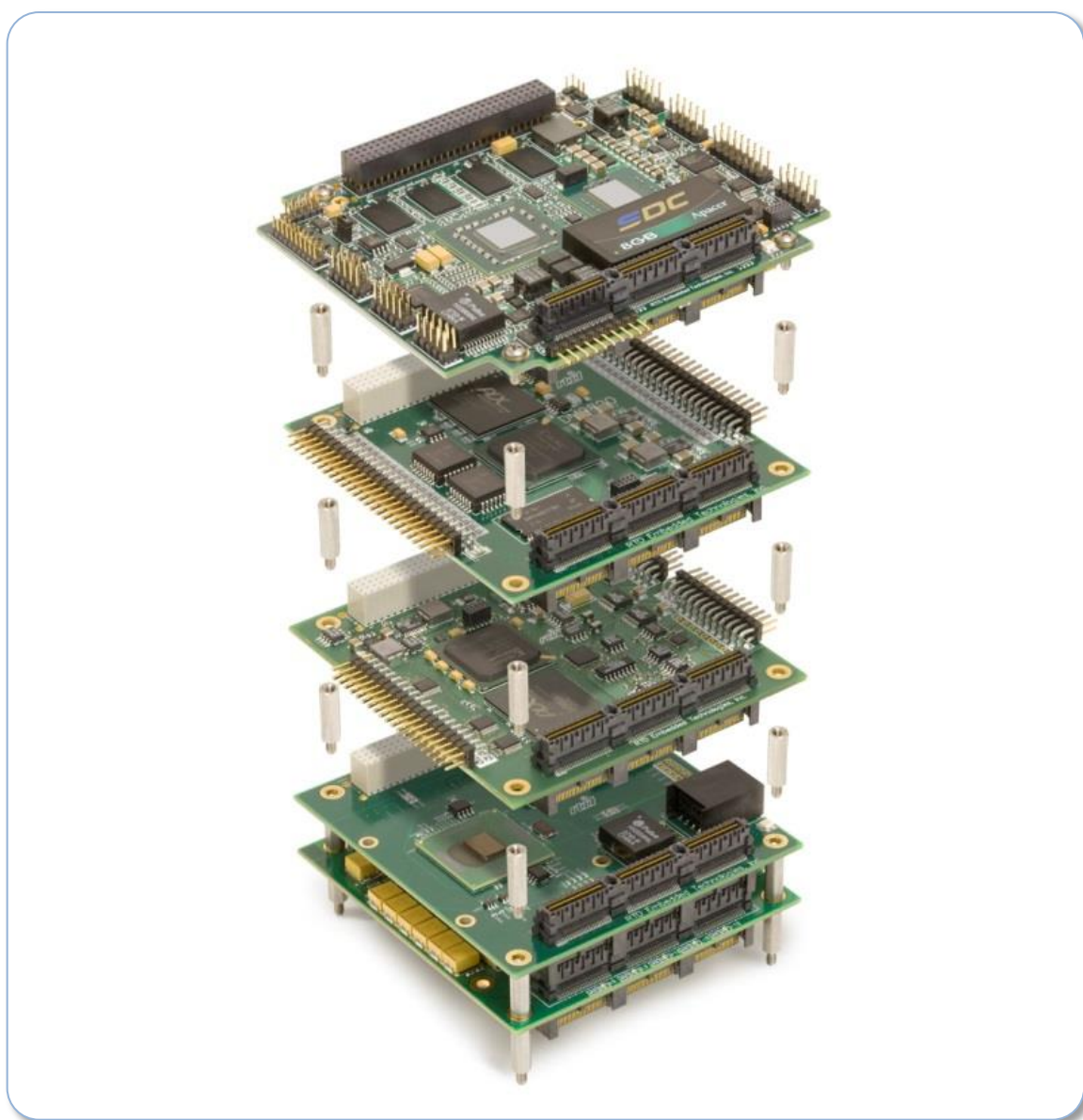


Figure 4: Example 104™ Stack

3.4 Connector Locations

The following top-side photo of the SATA24106HR provides a reference for designators of the bus connectors and the 2.5" SATA drive connector as well as their locations.

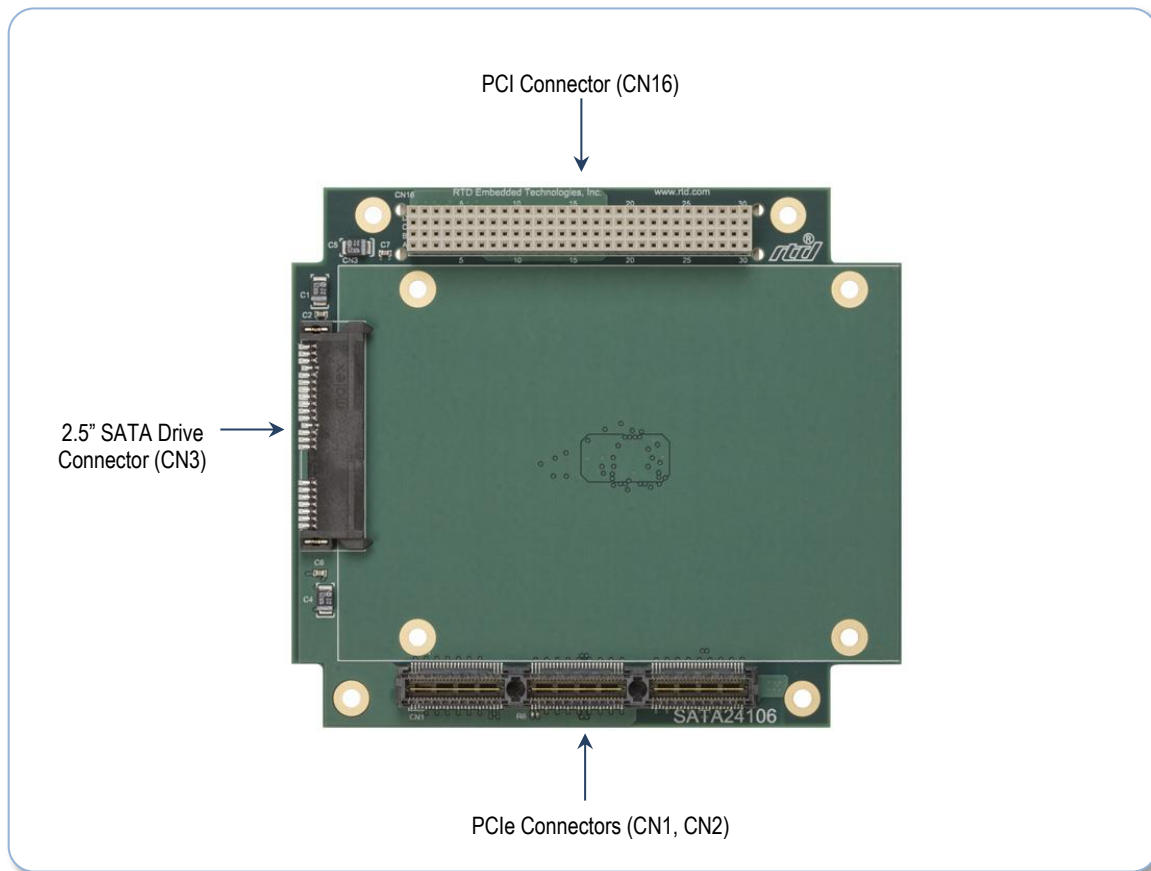


Figure 5: Board Connections

3.5 Functional Diagram

The figure below shows the functional diagram of the SATA24106HR which demonstrates how the upstream SATA link of the 2.5" SATA Drive Connector (CN3) maps to the host cpuModule of the system. It also shows how the unused SATA link on the upstream bus connector is lane-shifted, making the link available to the next SATA device in the system.

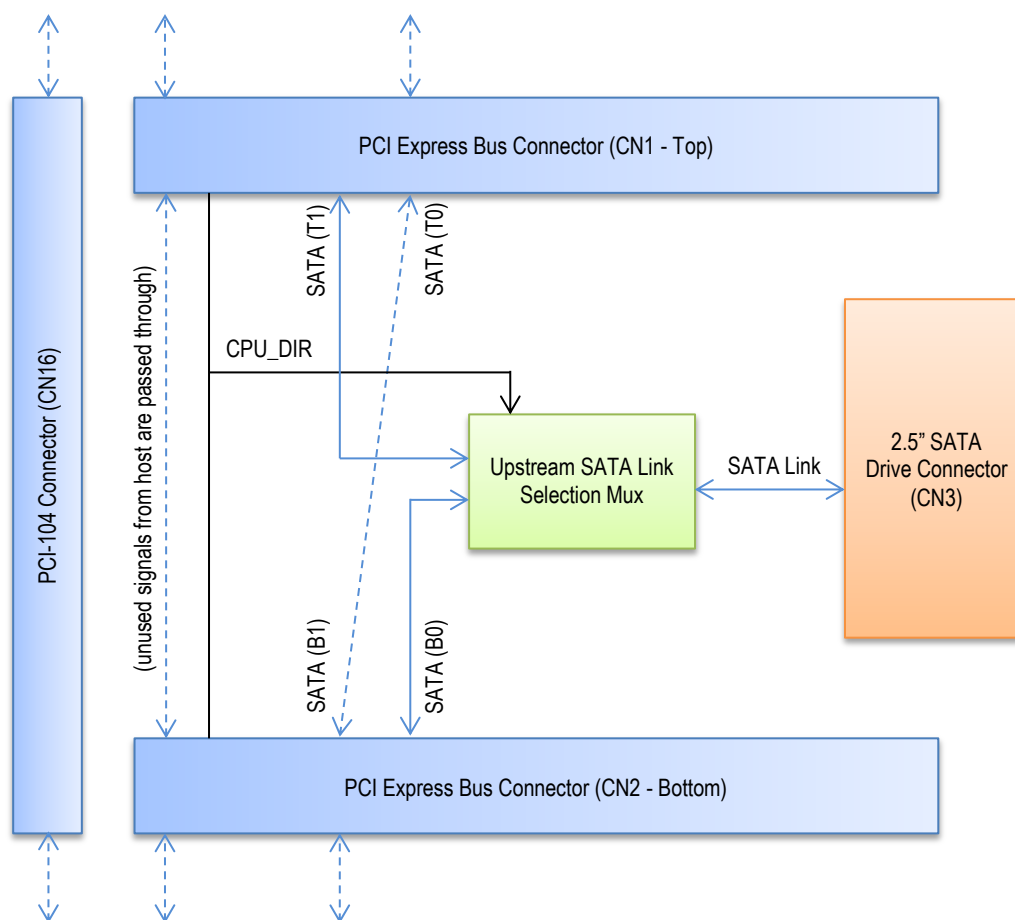


Figure 6: SATA24106HR Functional Diagram

The CPU_DIR signal from the host CPU on the PCI Express bus connectors indicates whether the SATA24106HR is stacked above or below the CPU, and automatically determines if the upstream SATA link for the 2.5" SATA drive connector should connect to the top PCIe connector (CN1) or the bottom PCIe connector (CN2).

Dashed lines in the functional diagram indicate signals which are passed through from the host to the next card in the stack. If the host CPU offers two SATA connections on the PCIe bus connector, the next order SATA link is lane-shifted on the SATA24106HR, making it available to the next SATA24106HR or other SATA drive carrier in the stack.

Table 5: SATA Link, Upstream vs. Shifted

SATA24016HR Position	2.5" SATA Drive Connector Upstream Link	Unused SATA Link Lane-Shifted
Above CPU	SATA (B0)	SATA (B1)
Below CPU	SATA (T1)	SATA (T0)

For more information on the CPU_DIR signal and lane shifting, refer to the *PCI/104-Express Specification*. (See PC/104 Specifications, page 19.)

3.6 Connectors and Functionality

3.6.1 BUS CONNECTORS

Table 6: SATA24106HR Bus Connectors

Connector	Function	Size and Pitch	Mating Connector
CN1	PCIe/104 Type 2 Bus (Top)	156-pin, 0.635mm	Samtec ASP-129646-03
CN2	PCIe/104 Type 2 Bus (Bottom)	156-pin, 0.635mm	Samtec ASP-129637-03
CN16	PCI-104 (PCI) Bus	120-pin, 2mm	Samtec ESQT-130-02-G-Q-368

PCIe Type 2 Connector (CN1 – Top, CN2 - Bottom)

The PCIe connector provides the upstream SATA connection to the system CPU. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 19.)

The SATA24106HR only uses one SATA link from the PCIe connector. All other signals present on the bus connector (PCIe, USB, LPC bus, etc.) are passed through the SATA24106HR to the next card in the system.



NOTE: The SATA24106HR is not a "Universal" PCIe peripheral card. The PCIe connectors are only compatible with Type 2 PCIe/104 connectors.

PCI Connector (CN16)

The PCI connector is not used on the SATA24106HR. It exists to permit stacking the SATA24106HR near the CPU, while passing through the host CPU's PCI bus to PCI peripheral modules in the stack. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 19)

3.6.2 I/O CONNECTORS

2.5" SATA Drive Connector (CN3)

The 2.5" SATA drive connector on the SATA24106HR provides a convenient interface to the first SATA link on the PCIe/104 Type 2 bus on select RTD PCIe/104 and PCI/104-Express cpuModules.

The data segment of the 2.5" SATA drive connector is connected to the first available SATA link on the host cpuModule's PCIe/104 Type 2 connector. A full SATA power segment is provided on the 2.5" SATA drive connector. Voltage rails on the power segment include +5 V, +3.3 V, and +12 V, all of which are supplied by the PCIe/104 Type 2 connectors (CN1 and CN2) as well as the PCI connector (CN16).



NOTE: When installing a 2.5" drive, be certain to install all four mounting screws in the underside of the board. Failure to do so may introduce intermittent SATA connection issues, which can lead to drive errors and data corruption!

NOTE: Screw threading for 2.5" drives may vary from vendor to vendor.

3.6.3 SATA LINK SHIFTING

The SATA24106HR's 2.5" SATA Drive Connector (CN3) utilizes the first SATA link on the PCIe/104 Type 2 bus. As a result, when the SATA24106HR is the first SATA device stacked above a CPU, the unused SATA link on the bus is shifted from the bottom-side PCIe/104 Type 2 connector (CN2) to the top-side (CN1). Shifting the remaining link allows a second SATA24106HR (or other SATA drive carrier) to be installed upwards in the stack.

Similarly, when the SATA24106HR is the first SATA device stacked below a CPU, the unused SATA link on the bus is shifted from the top-side PCIe/104 Type 2 connector (CN1) to the bottom-side (CN2), permitting a second SATA drive carrier to be installed downwards in the stack. This bidirectional stacking is possible due to an onboard switch, which uses the CPU's CPU_DIR pin to determine whether the SATA24106HR is stacked above or below the host cpuModule.

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 0.21 Kg (0.46 lbs.)
- Dimensions: 151.972 mm L x 129.972 mm W x 16.993 mm H (5.983 in L x 5.117 in W x 0.669 in H)

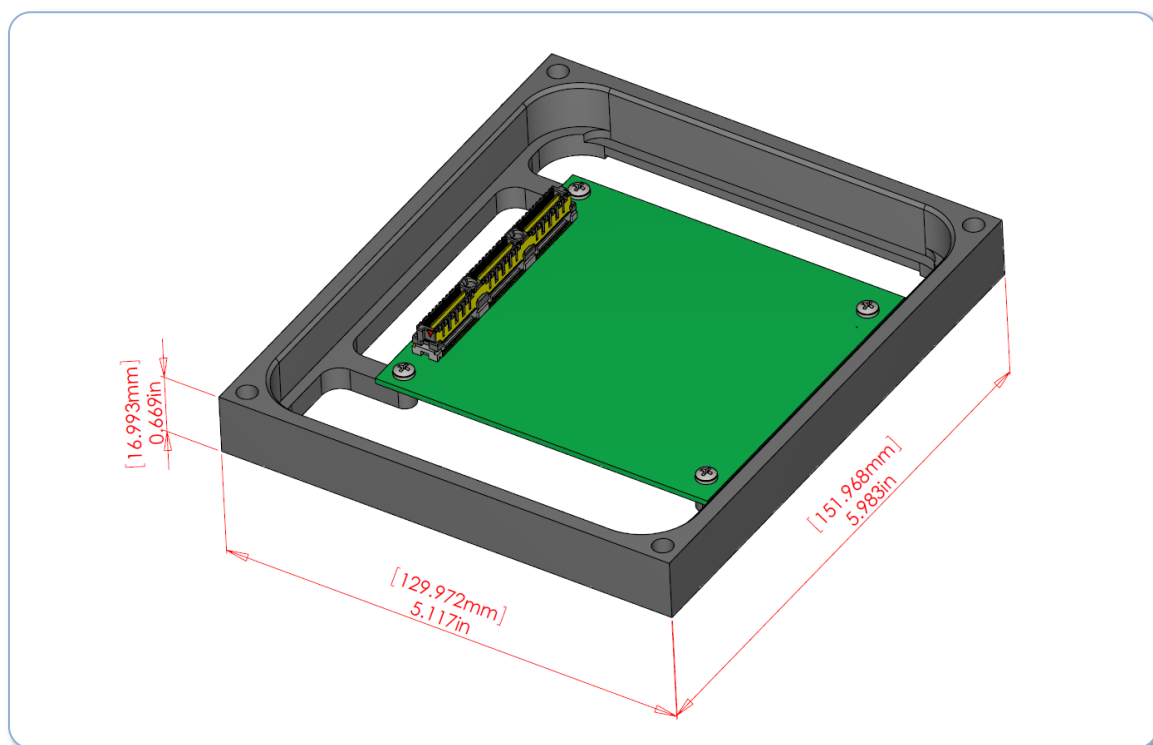


Figure 7: IDAN Dimensions – L x W x H

4.3 External I/O Connectors

There are no external I/O connectors on the IDAN-SATA24106HRS.

4.4 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.

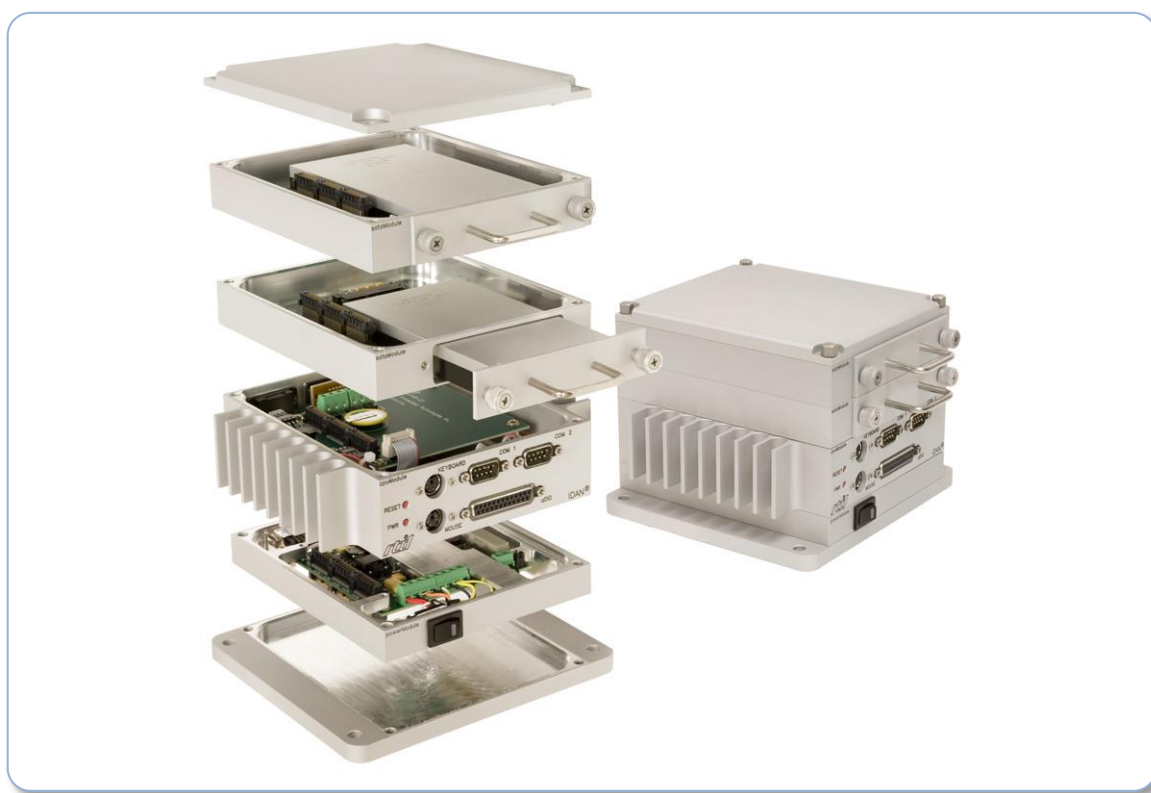


Figure 8: Example IDAN System

5 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 your 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.

6 Additional Information

6.1 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

6.2 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

6.3 Serial ATA Specification

A copy of the latest Serial ATA specification can be found on the webpage for the Serial ATA International Organization:

www.sata-io.org

7 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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