



# LAN24225 and LAN34225

*PCI Express Dual-Gigabit SFP/Fiber Ethernet*

## User's Manual

BDM-610020100 Rev. B



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# Revision History

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Rev A	Initial Release	
Rev B	Corrected Windows driver info, added IDAN photos, and added MTBF.	6/11/2015

*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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# 1 Introduction

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## 1.1 Product Overview

The LAN24225 and LAN34225 are server grade, dual Gigabit Ethernet Modules. They provide two Small Form-factor Pluggable (SFP) connectors that will accept a pre-installed multi-mode Fiber SFP module, or a customer supplied SFP module. This allows the flexibility to have any combination of multi-mode fiber, single-mode fiber, or twisted pair interfaces. A PCIe x4 interface ensures excellent bandwidth for communication with the CPU.

## 1.2 Board Features

The following sections describe the major features of the LAN24225 server grade dual Gigabit Ethernet communication module.

- General Features
  - PCIe x4 Connection
    - PCIe/104 or PC/104-Express Type 2 connection
  - Two Independent Gigabit Ethernet Connections
    - 1000 Mbps SFP on each channel
    - Does not support 10/100 Mbps
    - Full Duplex support
    - Supports Wake on LAN
  - Chipset
    - Intel 82575EB PCIe Gigabit Ethernet Controller
    - Pre-boot eXecution Environment (PXE) enables system to boot up via the LAN
  - Gigabit MAC/PHY Advanced Features
    - Intel® I/O Acceleration Technology (Intel® I/OAT) accelerates TCP I/O for improved CPU utilization.
    - MSI-X support minimizes the overhead of interrupts and allows load balancing of interrupt handling between cores/CPUs.
    - Mechanism available for reducing interrupts generated from Tx/Rx operations to maximize system performance and throughput.
    - Dual 8 kB configurable Rx and Tx FIFO buffers means no external FIFO memory requirements.
    - Support for transmission and reception of jumbo frames up to 9.5kBytes enables higher and better throughput of data.
    - IEEE 802.3 compliant flow-control support with software-controllable pause times and threshold values to reduce frame loss from receive overruns.
  - Host Offloading Features
    - Direct Cache Access (DCA) enables the I/O device to activate a pre-fetch engine in the CPU that loads the data into the CPU cache before use, eliminating cache misses and reducing CPU load.
    - Checksum offloading, segmentation offloading, and packet filtering capabilities lower processor utilization.
    - IEEE 802.1q virtual local area network (VLAN) support with VLAN tag insertion, stripping and packet filtering for up to 4096 VLAN tags allows creation of multiple VLAN segments.
  - Multi-Mode SFP (with -1 option)
    - Avago AFBR-5715APZ or equivalent
    - 850nm
    - For use with Multi-Mode Fiber Optics
    - LC Connector
    - Bail latch
- Software
  - Supports Windows 7/XP (included on companion CD)
  - Open source Linux drivers included in the kernel
  - Drivers included in most modern operating systems. Check with the OS manufacturer

## 1.3 Ordering Information

The LAN24225 is available with the following options:

**Table 1: Ordering Options**

Part Number	Description
LAN24225ER	PCI/104-Express SFP Ethernet Module (with pass-through PCI)
LAN34225ER	PCIe/104 SFP Ethernet Module (without pass-through PCI)
IDAN-LAN24225ER	PCI/104-Express SFP Ethernet Module in IDAN enclosure
IDAN-LAN34225ER	PCIe/104 SFP Ethernet Module in IDAN enclosure
LAN24225ER-1	PCI/104-Express SFP Ethernet Module (with pass-through PCI) with Multi-Mode SFPs installed
LAN34225ER-1	PCIe/104 SFP Ethernet Module (without pass-through PCI) with Multi-Mode SFPs installed
IDAN-LAN24225ER-1	PCI/104-Express SFP Ethernet Module in IDAN enclosure with Multi-Mode SFPs installed
IDAN-LAN34225ER-1	PCIe/104 SFP Ethernet Module in IDAN enclosure with Multi-Mode SFPs installed

Throughout this document, LAN24225 refers to both the LAN24225 and LAN34225 unless otherwise noted.

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.

## 1.4 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](mailto: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.

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](mailto:techsupport@rtd.com)



## 2 Specifications

### 2.1 Operating Conditions

Table 2: Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
V <sub>cc5</sub>	5V Supply Voltage		4.75	5.25	V
V <sub>cc3</sub>	3.3V Supply Voltage		n/a	n/a	V
V <sub>cc12</sub>	12V Supply Voltage		n/a	n/a	V
V <sub>cc-12</sub>	-12V Supply Voltage		n/a	n/a	V
T <sub>a</sub>	Operating Temperature		0	70	C
T <sub>s</sub>	Storage Temperature		-40	+85	C
RH	Relative Humidity	Non-Condensing	0	90%	%
MTBF	Mean Time Before Failure	Telcordia Issue 2 30°C, Ground benign, controlled		1,534,607	Hours

### 2.2 Electrical Characteristics

Table 3: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Max	Unit
P <sub>d</sub>	Power Dissipation	V <sub>cc5</sub> = 5.0V		3.0	W
I <sub>cc5</sub>	5V Input Supply Current	Active, Board only		600	mA
<b>CN6 External LED Connector</b>					
V <sub>oh</sub>	Link Signal Output High	I <sub>o</sub> = -8.0mA	3.7	5.0	V
V <sub>ol</sub>	Link Signal Output Low	I <sub>o</sub> = 8.0mA	0.0	0.55	V
V <sub>oh</sub>	Activity Signal Output High	I <sub>o</sub> = -16.0mA	2.4	3.3	V
V <sub>ol</sub>	Activity Signal Output Low	I <sub>o</sub> = 14.0mA	0.0	0.4	V
<b>PCIe Bus</b>					
	Differential Output Voltage		0.8	1.2	V
	DC Differential TX Impedance		95.2	116.9	Ω
	Differential Input Voltage		0.175	3.3	V
	DC Differential RX Impedance		92.7	115.8	Ω
	Electrical Idle Detect Threshold		61	173	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 0.1 kg (0.22 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (3.550 in L x 3.775 in W) (not including SFP sockets)

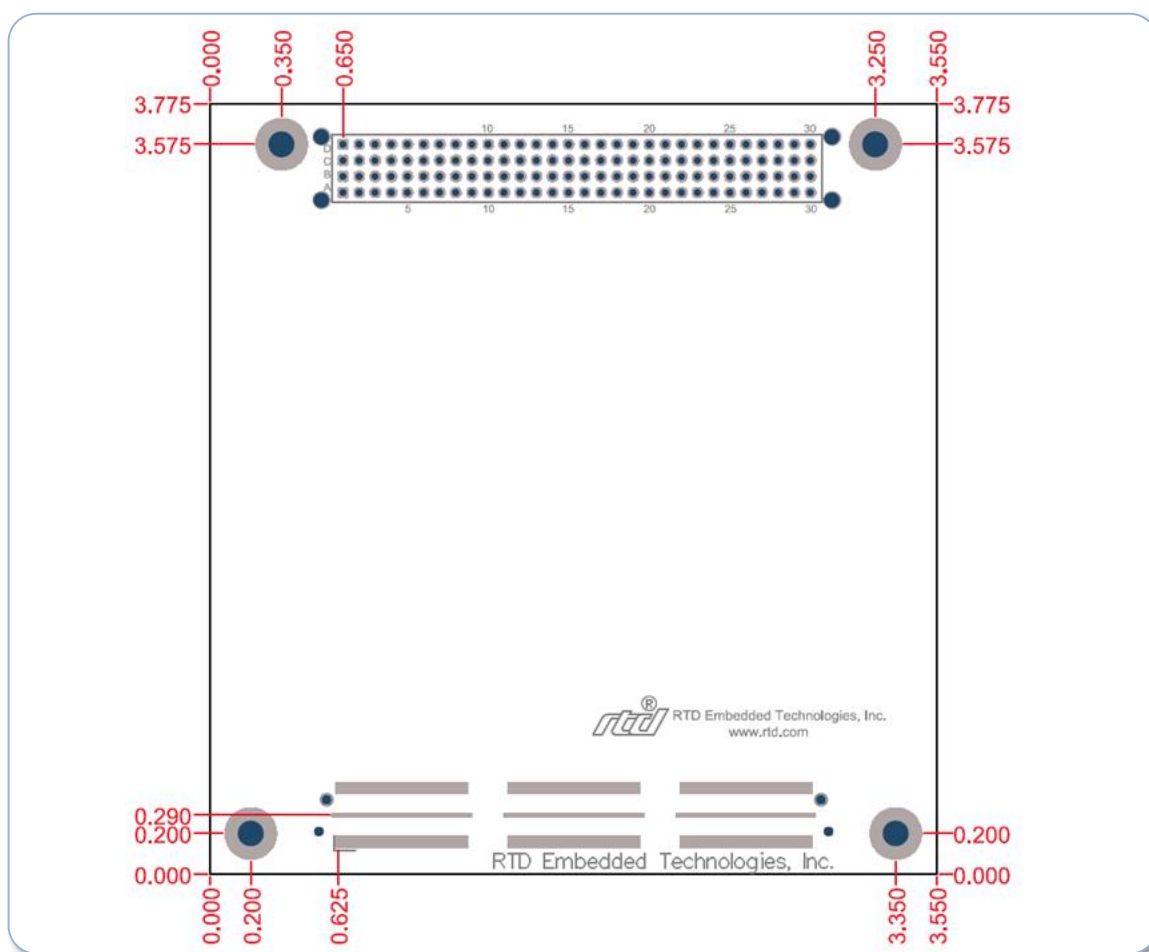
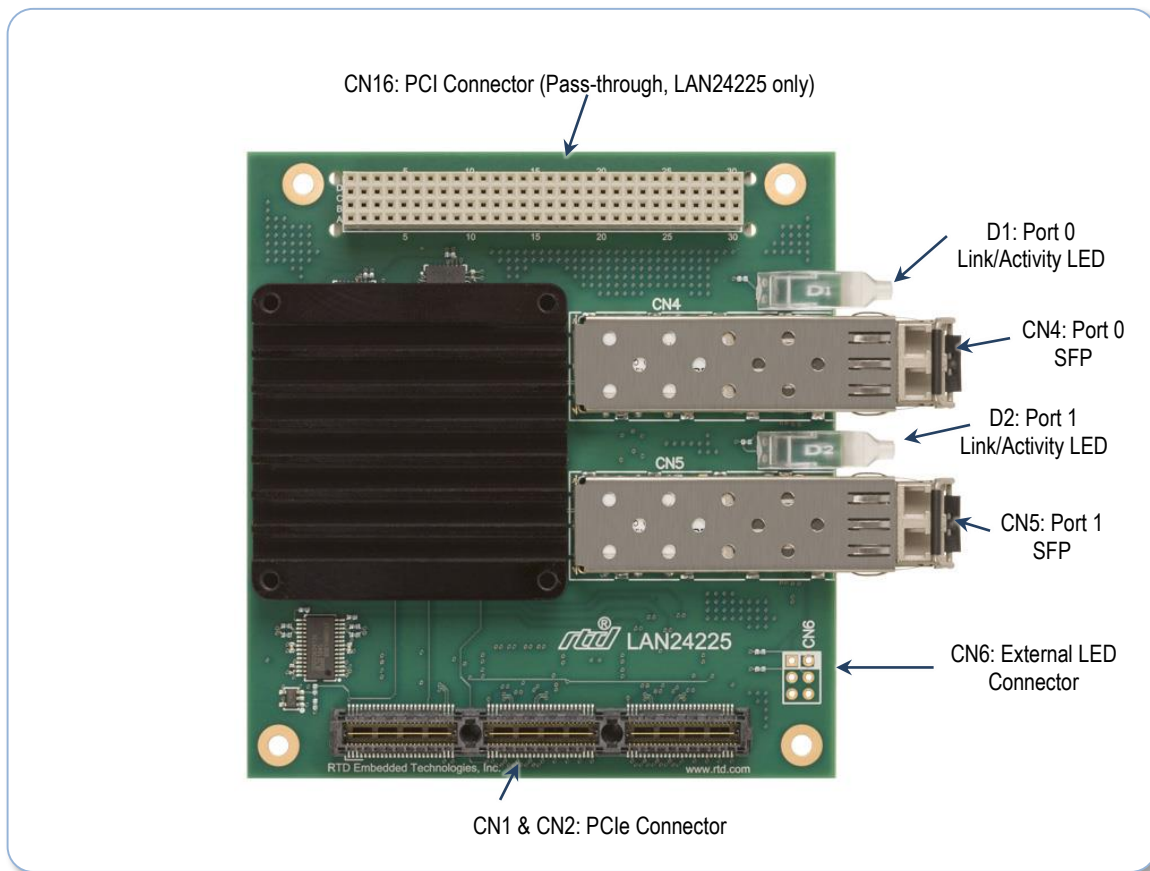


Figure 1: Board Dimensions

### 3.3 Connectors and Jumpers



**Figure 2: Board Connections(LAN24225ER-1 shown)**

#### 3.3.1 EXTERNAL I/O CONNECTORS

##### CN4 and CN5: SFP Connectors

CN4 and CN5 are Small Form-factor Pluggable (SFP) connectors. They accept standard SFP modules, which can be used to connect to Gigabit Fiber or Twisted Pair Ethernet. These modules are hot-pluggable, so they can be changed without shutting down the system.



**NOTE: The SFP interface will only link at 1000 Mbps. It cannot be used at 10/100 Mbps for any media type**

##### D1 and D2: Link/Activity LEDs

The LEDs provide link status information. Each is a green LED that will illuminate when a link is established. The LED will also blink momentarily when there is any activity on that port.

### CN6: External LED Connector

The External LED connector is provided to allow external Link and/or Activity LEDs to be attached to the board. This connector is typically not populated – contact the RTD Sales department for additional ordering options.

**Table 4: CN6 External LED Header**

Pin	Signal	Function
1	Port0_Link	Port 0 Link H = Link L = No Link
2	Port0_Act	Port 0 Activity (with 200Ω series resistor) H = Link and Active (blinks) L = No Link or Not Active
3	Port1_Link	Port 1 Link H = Link L = No Link
4	Port1_Act	Port 1 Activity (with 200Ω series resistor) H = Link and Active (blinks) L = No Link or Not Active
5	GND	Ground
6	GND	Ground

## 3.3.2 BUS CONNECTORS

### CN1(Top) & CN2(Bottom): PCIe Connector

The PCIe connector is the 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)

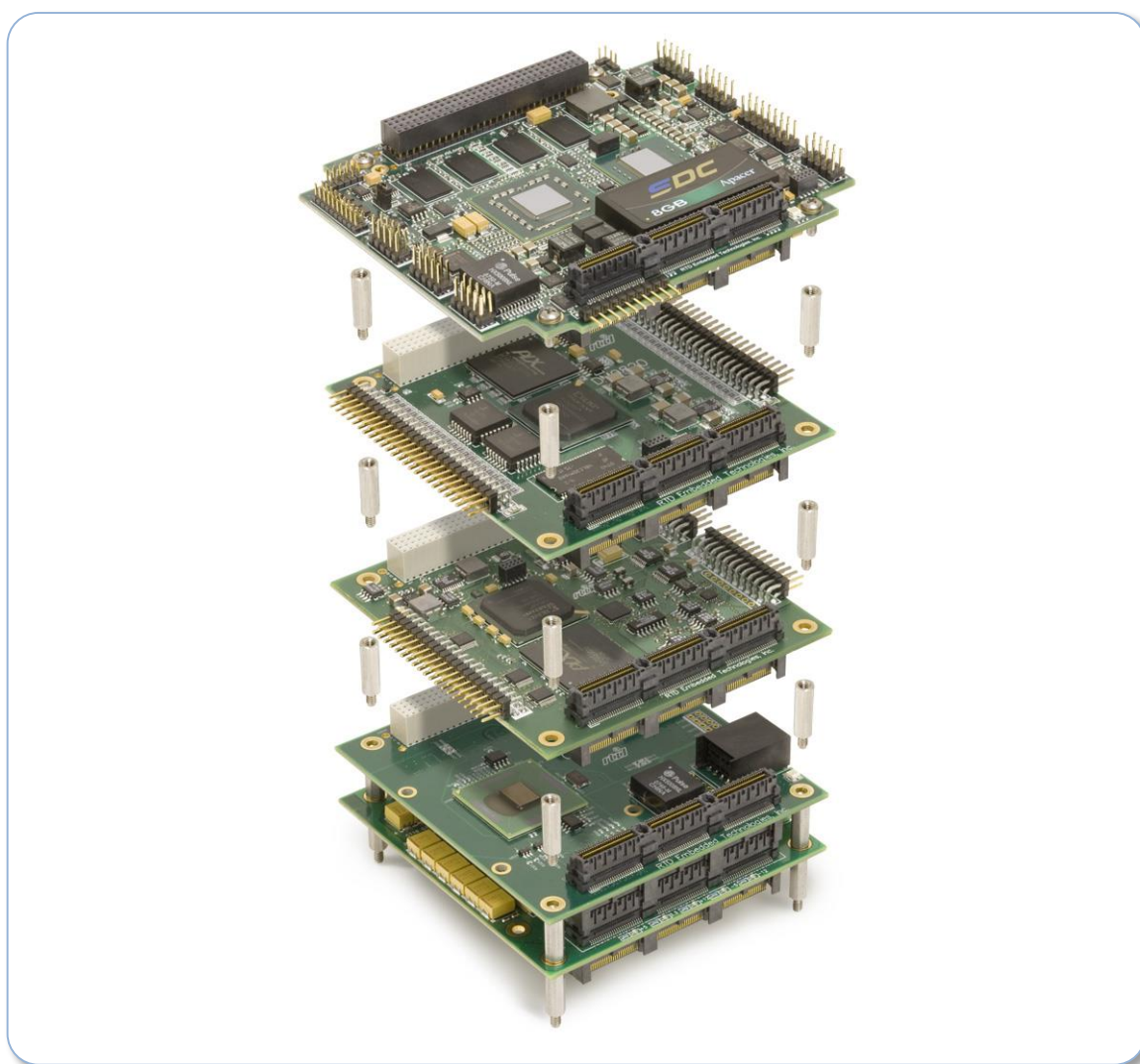
The LAN24225 is a Type 2 board, and can connect to a Type 2 PCIe/104 connector. For an adapter to convert the x16 link on a Type 1 connector to a single x4 link on a Type 2 connector, contact the RTD Sales department (ADP055).

### CN16: PCI Connector (LAN24225 only)

The PCI connector is pass-through. The only electrical connections to the board are power and ground. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 19)

## 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.



**Figure 3: 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 0.21 Kg (0.46 lbs.)
- Dimensions: 151.972 mm L x 129.978 mm W x 16.993 mm H (5.983 in L x 5.117 in W x 0.669 in H)

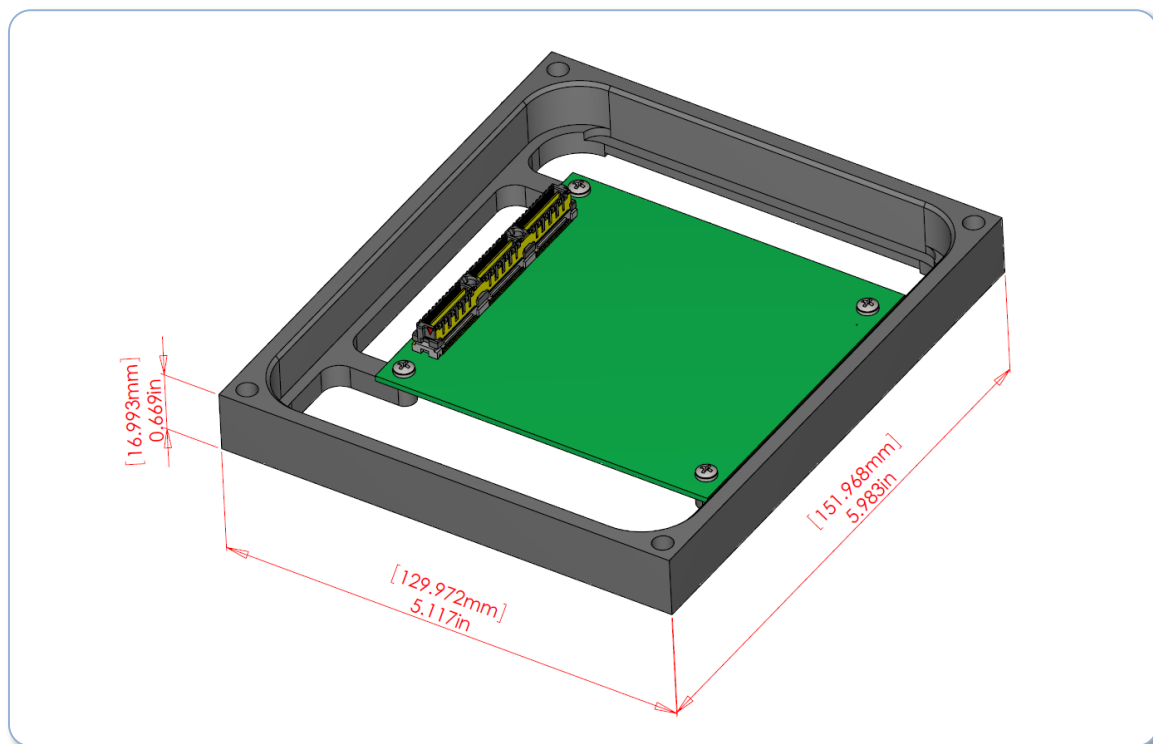


Figure 4: IDAN Dimensions

## 4.3 Connectors

### 4.3.1 EXTERNAL I/O CONNECTORS

#### CN4 and CN5: SFP Connectors

CN4 and CN5 are Small Form-factor Pluggable (SFP) connectors. They accept standard SFP modules, which can be used to connect to Gigabit Fiber or Twisted Pair Ethernet. These modules are hot-pluggable, so they can be changed without shutting down the system.




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**NOTE: The SFP interface will only link at 1000 Mbps. It cannot be used at 10/100 Mbps for any media type**

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#### D1 and D2: Link/Activity LEDs

The LEDs provide link status information. Each is a green LED that will illuminate when a link is established. The LED will also blink momentarily when there is any activity on that port.

### 4.3.2 BUS CONNECTORS

#### CN1(Top) & CN2(Bottom): PCIe Connector

The PCIe connector is the 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 LAN24225 is a Type 2 board, and can connect to a Type 2 PCIe/104 connector. For an adapter to convert the x16 link on a Type 1 connector to a single x4 link on a Type 2 connector, contact the RTD Sales department (ADP055).

#### CN16: PCI Connector(LAN24225 only)

The PCI connector is pass-through. The only electrical connections to the board are power and ground. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See *PC/104 Specifications* on page 19)



**Figure 5: IDAN Photo**

## 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.

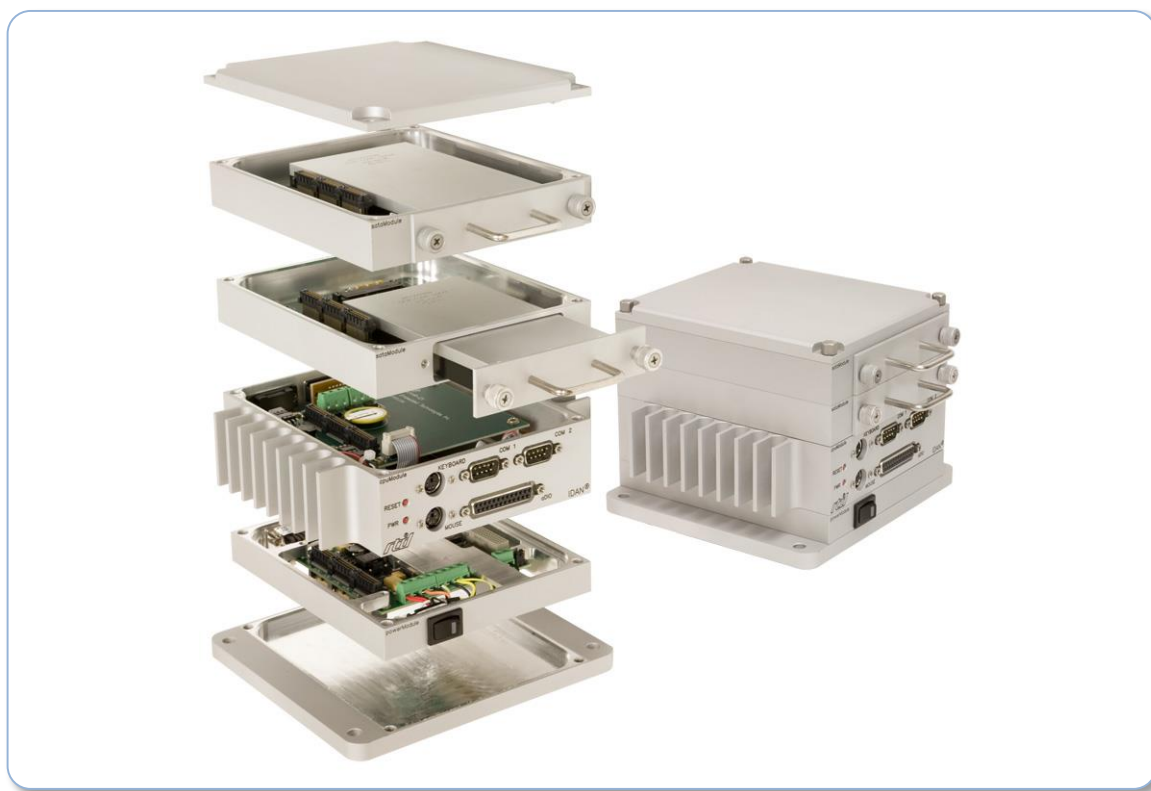


Figure 6: Example IDAN System



# 5 Functional Description

## 5.1 Block Diagram

The Figure below shows the functional block diagram of the LAN24225.

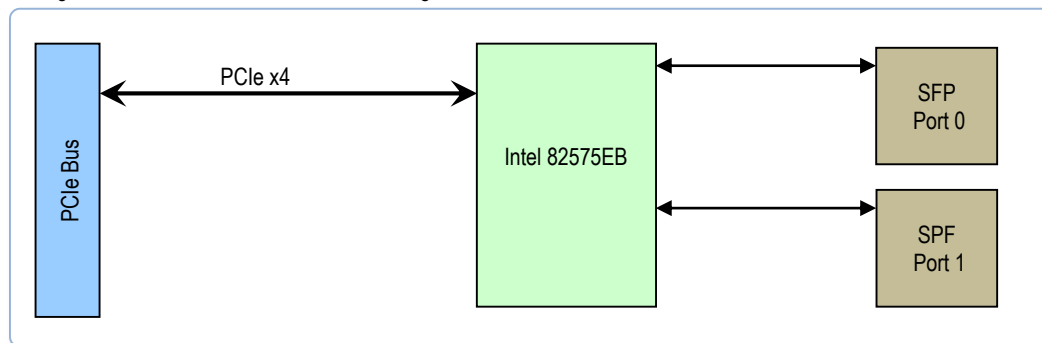


Figure 7: LAN24225 Block Diagram

## 5.2 Ethernet Boot

The LAN24225 support Ethernet boot. This allows the CPU to request a boot image from a server, negating the need to have any bootable media directly attached to the system. The ability to use Ethernet Boot is dependent on the BIOS of the CPU, and the boot order is controlled by the BIOS on the CPU. The LAN24225 comes with a PXE boot agent installed. Other boot agents, including iSCSI, and the programming utilities are available from Intel's website, [www.intel.com](http://www.intel.com). Contact RTD technical support for more information.

## 5.3 Driver Support

For Windows XP and Windows 7, the LAN24225 is supported by an Ethernet driver provided by Intel. A copy of this driver is provided on the companion CD that is shipped with the board, and may also be downloaded from the RTD web site ([www.rtd.com](http://www.rtd.com)) or the Intel web site ([www.intel.com](http://www.intel.com)). It is recommended that you frequently check the RTD web site for updated documentation and drivers.

Under Linux, the Ethernet controller is supported via the *igb* kernel module that is included in Linux kernels 2.6.25 or later. Most modern desktop Linux distributions will automatically detect the Ethernet controller and load the necessary drivers. Contact the vendor of your Linux distribution for more information.

For other operating systems, the LAN24225 may be natively supported. Many operating systems include support for the Intel 82575EB PCI Ethernet controller, which the LAN24225 is based on. Your operating system vendor should be able to provide the necessary information.

## 6 Troubleshooting

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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](mailto: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

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### 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](http://www.pc104.org)

### 7.2 PCI Express Specification

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

[www.pcisig.com](http://www.pcisig.com)

### 7.3 Ethernet Controller

For more information on the Ethernet Controller used on the LAN24225, refer to the Intel 82575EB Datasheet:

[www.intel.com](http://www.intel.com)

## 8 Limited Warranty

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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.**

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