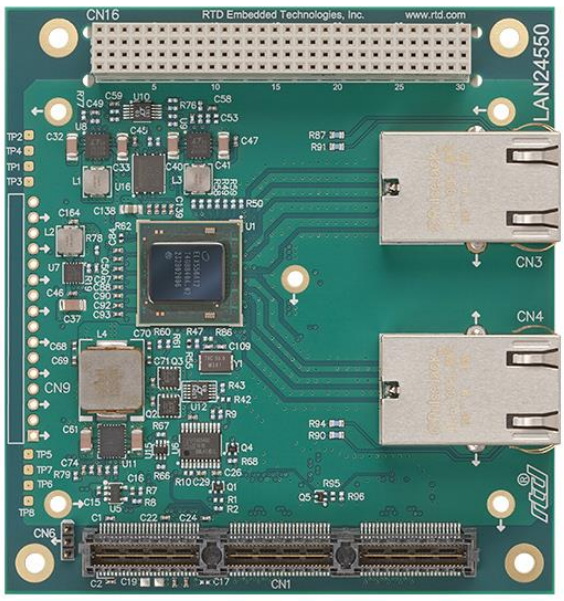
LAN24550/LAN34550

PCI/104-Express Dual 10Gbit/s Twisted Pair Ethernet Controller

User's Manual

BDM-610020156 Rev. A



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AS9100 and ISO 9001 Certified

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Revision History

Rev A	Initial Release

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1 Introduction

1.1 Product Overview

The LAN24550 and LAN34550 are dual 10Gb/s Copper Ethernet Modules. They provide two independent IEEE 10GBASE-T Ethernet connections using a single Ethernet controller chip. This board runs completely off of the PCI-Express bus, utilizing Intel's X550 10 Gigabit Ethernet controller.

The LAN24550 is the PCI/104 Express version that has a pass-through PCI connector.

1.2 Board Features

- Intel X550 10 Gigabit Ethernet Controller
  - 2 Independent 10Gb/s Twisted Pair Ethernet Connections with Integrated MAC and PHY
  - Backward compatible with IEEE 100BASE-TX and 1000BASE-T Ethernet standards
  - NBASE-T (10/5/2.5Gb/s link speed) is also supported (only in Linux)
  - Auto MDI/MDX
  - IEEE 802.3az Energy Efficient Ethernet (EEE)
  - IEEE 802.1q and 802.1ad VLAN support
  - Storage technologies: iSCSI and FCoE over 10GBASE-T.
  - Network virtualization technologies: VXLAN and NVGRE.
  - Integrated IPsec security engines.
  - Secure NVM update support.
  - Jumbo frames of up to 15.5 KB.
- RJ45 connectors with integrated magnetics and Link/Activity indicator LEDs
- PCIe x4 Gen3 Interface
  - Type 2 Board can be used with a PCIe/104 Type 2 host
- PCI Express Bus:
  - Provides up to 32 Gbps in each direction
  - MSI-X support
  - Virtualization technologies:
    - Flexible port partitioning
    - Virtual Machine Device Queues
    - PCI-SIG SR-IOV capability
- PCI Bus is used as a pass through interface.

1.3 Ordering Information

The LAN24550/LAN34550 is available with the following options:

Table 1: Ordering Options

Part Number	Description
LAN24550	PCI/104 Express - Dual 10Gb/s Copper Ethernet Controller
IDAN-LAN24550	Dual 10Gb/s Copper Ethernet Controller in IDAN enclosure
LAN34550	PCIe/104 Dual 10Gb/s Copper Ethernet Controller
IDAN-LAN34550	Dual 10Gb/s Copper Ethernet Controller in IDAN enclosure

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

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 Operating Conditions

Table 2: Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{cc5}	5V Supply Voltage		4.75	5.25	V
V_{cc3}	3.3V Supply Voltage		n/a	n/a	V
V_{cc12}	12V Supply Voltage		n/a	n/a	V
T_a	Operating Temperature		-20	+70	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	Power Consumption	V_{cc5} = 5.0V	3.472	8.47	9.32	W
I_{cc}	5V Input Supply Current	Both ports operating at 10Gb/s	1.680	1.685	1.69	A
PCIe/104 Bus						
	Differential Output Voltage		0.8		1.2	V
	DC Differential TX Impedance		80		120	Ω
	Differential Input Voltage		0.175		1.2	V
	DC Differential RX Impedance		80		120	Ω
	Electrical Idle Detect Threshold		65		175	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 159 g (0.35 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (3.550 in L x 3.775 in W)

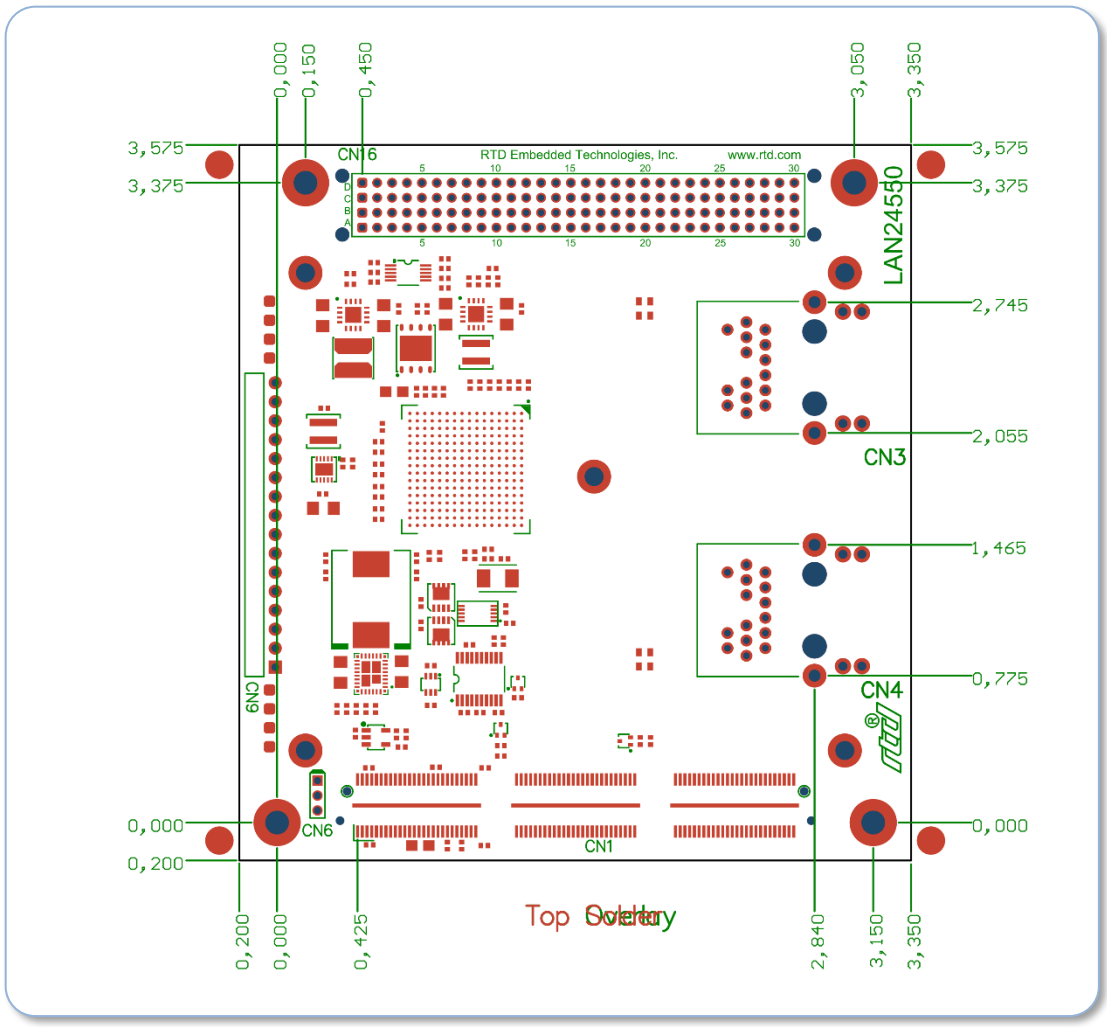
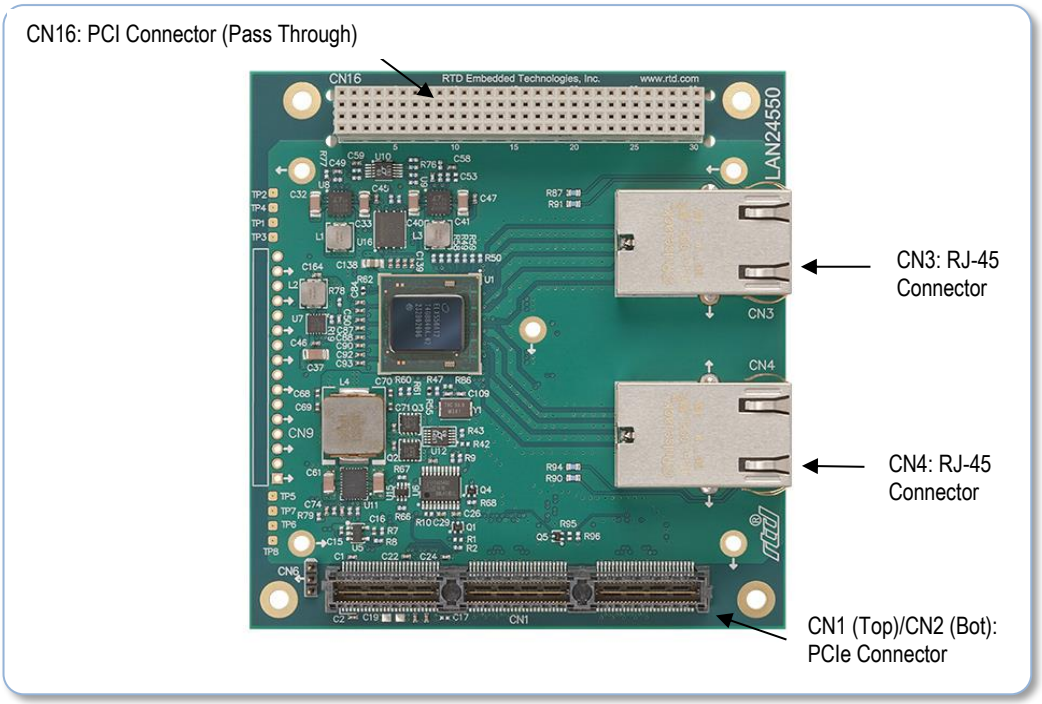


Figure 1: Board Dimensions

3.3 Connectors and Jumpers



3.3.1 External I/O Connectors

CN3: RJ45 Connector

Port 0 twisted pair cable connector

CN4: RJ45 Connector

Port 1 twisted pair cable connector

Link and Activity LEDs

Link and activity LEDs are provided on the edges of the RJ45 connectors. The LEDs provide status information. Each is a green LED. When the link is established, the green Link LED will illuminate on the right side of the RJ-45 connector. When there is activity on that port the green Activity LED will blink.

Link Status LEDs		
Link Speed	**Left LED**	**Right LED**
100 Mb/s	Black	Blinks Green
1 Gb/s	Green	Blinks Green
2.5 Gb/s	Black	Blinks Green
5 Gb/s	Black	Blinks Green
10Gb/s	Yellow	Blinks Green

3.3.2 Bus Connectors

CN16: PCI Connector

The PCI connector is the connection to PCI peripheral modules. This connector is used only as a pass through connector on this board. This connector is not populated on the LAN34550 version.

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 18). The LAN24550/34550 is a Type 2 PCIe/104 device.

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.

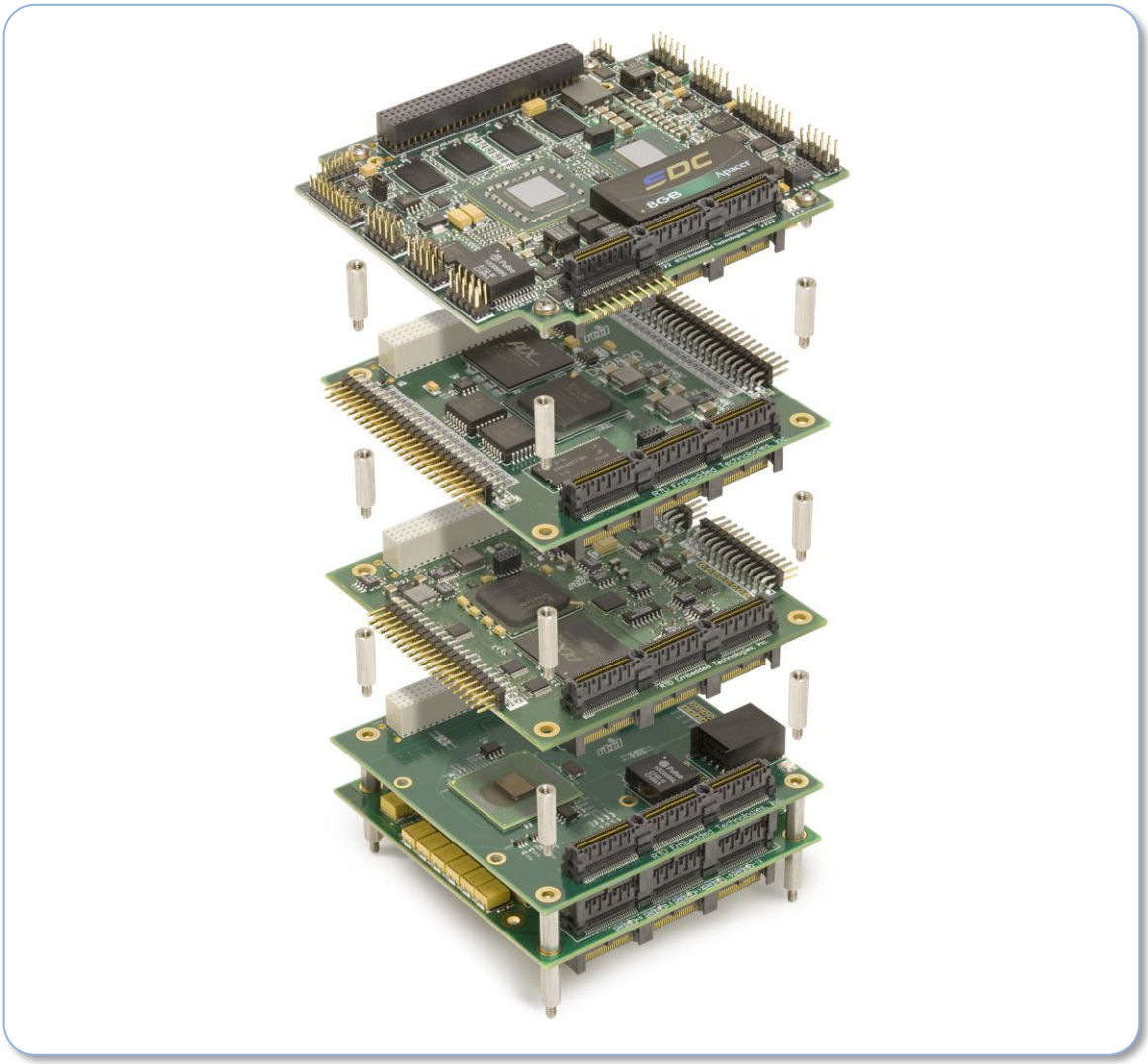


Figure 3: Example 104™ Stack

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 0.5 Kg (1.10 lbs.)
- Dimensions: 152.0 mm L x 130.0 mm W x 17.0mm H (5.98 in L x 5.12 in W x 0.67 in H)

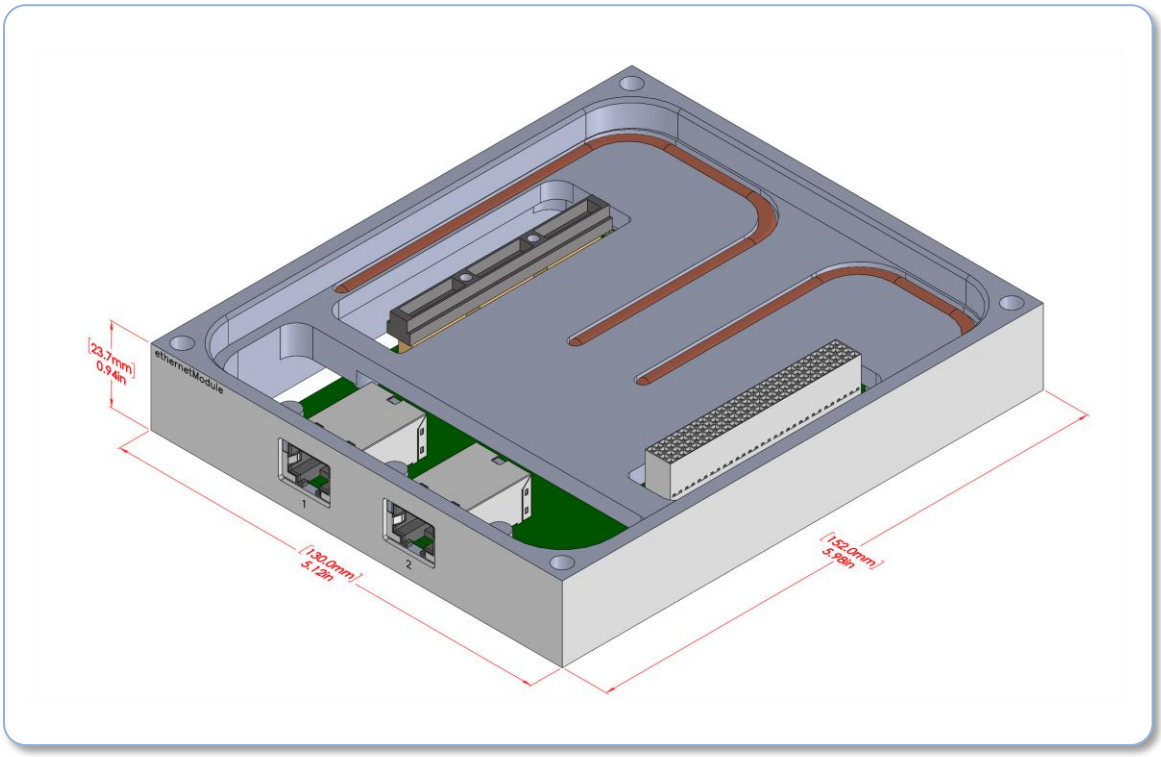


Figure 4: IDAN Dimensions

4.3 Connectors

4.3.1 External I/O Connectors

The Diagram below shows the connector locations for the transceivers of the LAN24550 as they are brought out on the front panel of the IDAN-LAN34550.

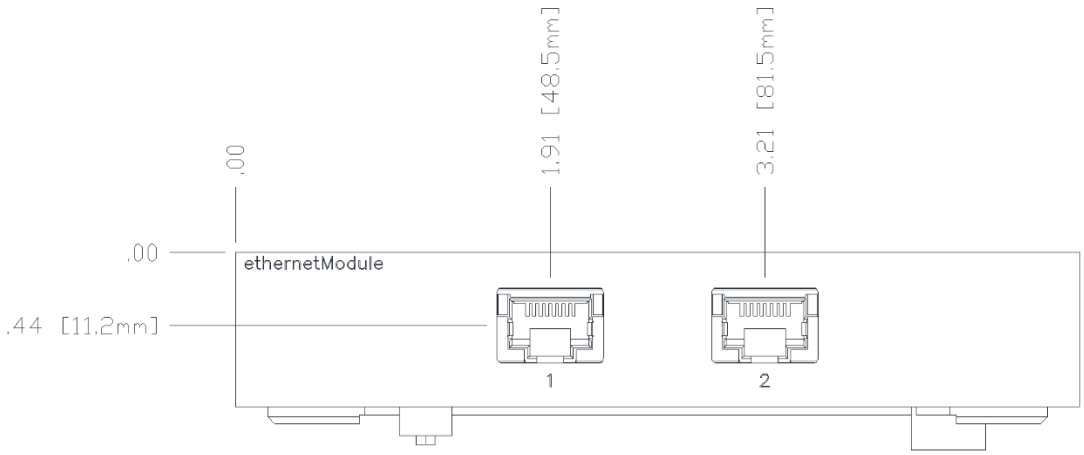


Figure 5: IDAN Front Panel Connectors

CN3: RJ45 Connector

Port 0 Twisted pair cable connector

CN4: RJ45 Connector

Port 1 Twisted pair cable connector

4.3.2 Bus Connectors

CN1: PCI Connector

The PCI connector is the connection to PCI peripheral modules. This connector is used only as a pass through connector on this board. This connector is not populated on the LAN34550 version.

CN2/3: PCI-Express 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 18)

The LAN34550 is a Type 2 PCIe/104 device.

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.

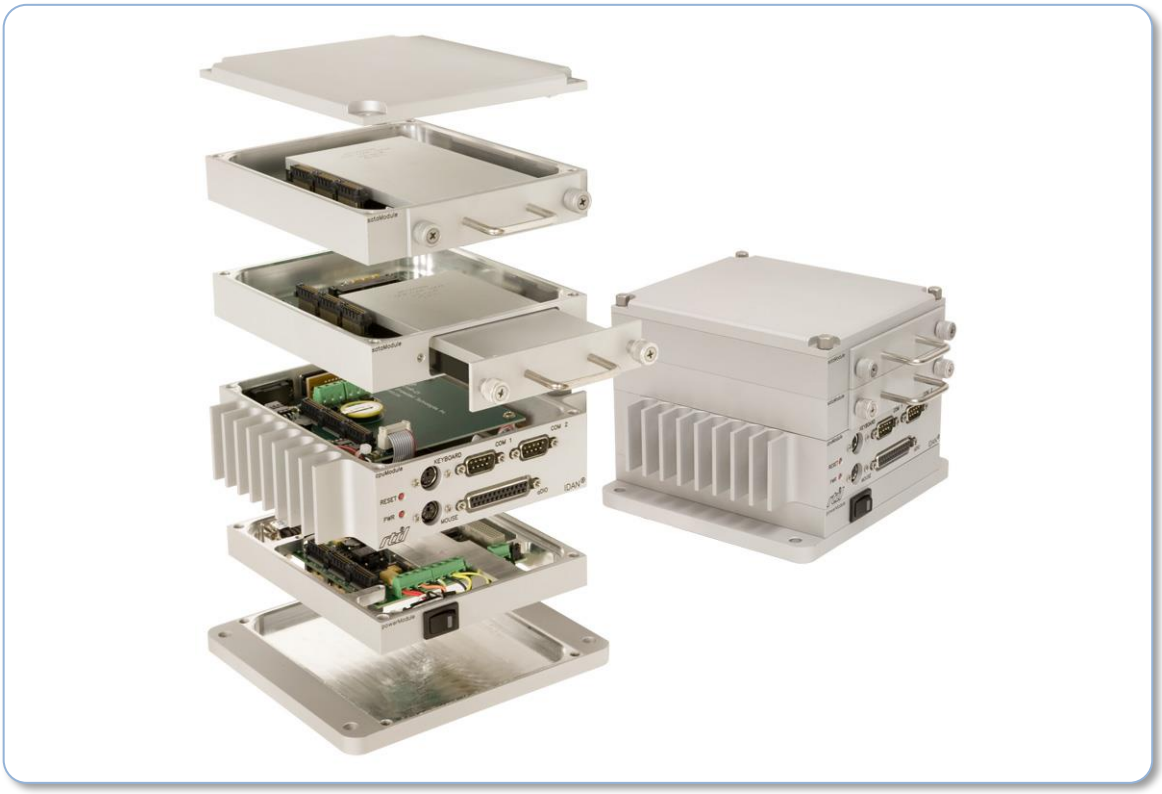


Figure 6: Example IDAN System

5 Functional Description

5.1 Block Diagram

The Figure below shows the functional block diagram of the LAN25215/35215. The various parts of the block diagram are discussed in the following sections.

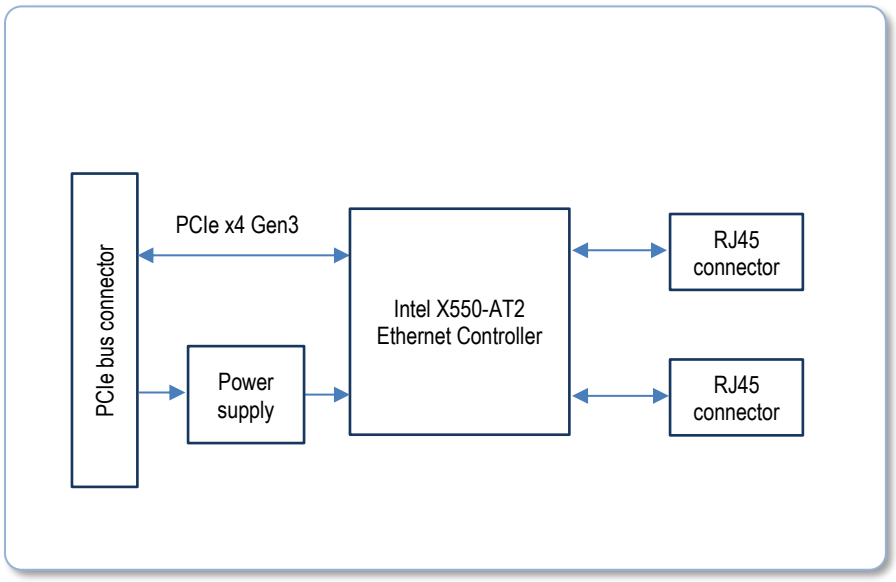


Figure 7: LAN24550/345550 Block Diagram

5.2 Twisted Pair Connection

5.2.1 Intel X550 Ethernet Controller

The LAN24550/34550 features Intel's X550-AT2 10 Gigabit Ethernet controller used to interface with twisted pair cable Ethernet connections. The X550 is a converged network adapter that not only supports LAN traffic, but also FCoE and iSCSI. The integrated MAC and PHY drives down power consumption and cost. Backward compatibility with existing Gigabit Ethernet (and Fast Ethernet) systems is provided by the auto-negotiation feature which ensures that the highest possible link speed is used at all times.

5.2.2 Twisted Pair Interface

The board provides two RJ-45 connectors for Ethernet connectivity. The pinout of the modular connectors should be according to ANSI/TIA-568 standard. The 10GBASE-T link could be used up to 100 meters (330 feet) with at least CAT6a cable, and 55 meters (180 feet) with CAT6 cable (in accordance with the IEEE802.3an standard) Although unshielded cabling is accepted by the standards, RTD recommends using shielded cables and connectors at all times because 10 Gigabit Ethernet is highly susceptible to external fields coupling into the cable. The following guidelines should be followed when installing and using twisted pair cables, especially long ones:

- Use shielded cables and connectors, for best performance double shielding (where individual pairs are also shielded) is recommended (eg. SFTP)
- Verify the continuity of the shield along the path, eliminate unshielded segments
- Keep cable length and the number of connectors minimal
- Use CAT7 (or better) cable
- Minimize the length of unshielded and untwisted segments at the connectors
- Test cabling with an analyzer before use
- Avoid routing the cables close to high current/high voltage lines
- For long distances, use solid core cable (wall cable)

5.3 Driver Support

For Windows, the Ethernet controller is supported by a 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) or the Intel web site (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 ***ixgbe*** kernel module that is included from Linux kernel 2.6.18 up through 5.8. Both 32-bit and 64-bit versions of Linux are supported. 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 Ethernet controller may be natively supported via built-in drivers. Your operating system vendor should be able to provide the necessary information.

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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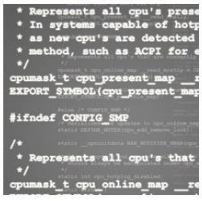

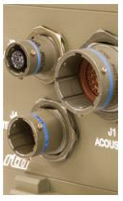
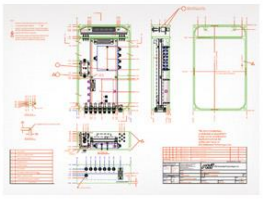

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