



# **The ImageStream PCI 530-TEJ Series Installation Guide and Technical Reference**

ImageStream Internet Solutions, Inc.  
Industrial Series Routers  
Router Distribution Version 4.1.0 or later release

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# General Information

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## AUDIENCE

This guide is designed for qualified system administrators and network managers, and for persons with a working knowledge of networking and routing. This reference is intended for hardware and software engineers who are incorporating the 530-TEJ into a system.

## ACCURACY

All information in this manual is based on the latest product information available at the time of printing. ImageStream has carefully reviewed the accuracy of this manual, but cannot be held liable for omissions or errors that may appear. ImageStream reserves the right to revise this publication and to make changes in its contents without obligation of notifying any persons of such revision changes.

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ImageStream Internet Solutions, Inc. warrants that at the time of shipment the router product and its installed components shall be free from defect in material and workmanship. ImageStream Internet Solutions, Inc. warrants that the router will meet the product's standard specifications at the time of shipment. This warranty excludes damage resulting from mishandling, tampering, improper installation and misuse by the purchaser.

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The ImageStream Support Team is available 24 hours a day, 7 days a week. For phone support please call 574-935-8484. The ImageStream fax number is 574-935-8488. For email support please send mail to [support@imagestream.com](mailto:support@imagestream.com).

## **TRADEMARKS**

UNIX is a registered trademark of AT&T Bell Labs.

Linux is a registered trademark of Linus Torvalds.

Cisco is a registered trademark of Cisco Systems.

## DOCUMENT CONVENTIONS

The following conventions are used in this guide:

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<i>Convention</i>	<i>Use</i>	<i>Examples</i>
<b>Bold font</b>	Indicates a user entry—a command, menu option, button, or key—or the name of a file, directory, or utility, except in code samples.	<ul style="list-style-type: none"><li>• Enter <b>description</b> to set the interface description.</li><li>• Press <b>Enter</b>.</li><li>• Open the <b>wan.conf</b> file.</li></ul>
<i>Italic font</i>	Identifies a command line placeholder. Replace with a real name or value.	<b>ip address</b> <i>address</i> <b>vrrp vrid</b> <i>address</i>
Courier font	Identifies display output from the router	Re-enter new password:
Square brackets [ ]	Enclose optional keywords and values in command syntax.	<b>rate-limit</b> <i>bits per second</i> <b>[input output]</b>
Curly braces { }	Enclose a required choice between keywords and/or values in command syntax.	<b>service-module t1 framing</b> { <i>esf</i>   <i>sf</i> }
Vertical bar 	Separates two or more possible options in command syntax.	<b>service-module e1 framing</b> { <i>ccs</i>   <i>cas</i> }
“Caution!”	Points out possible ways the product can be damaged if proper precautions are not followed.	Caution! Only trained service personnel at an approved ESD workstation should handle the adapter.
“Warning!”	Describes potential dangers to the user if a procedure is not properly followed.	Warning! The 530-TEJ is installed in a PCI slot in a computer that operates from AC main voltages that can be lethal.
“Note:”	Provides information that is important to the surrounding text.	Note: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules.

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## **FCC CLASS A LIMITS**

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Shielded cables must be used with this unit to ensure compliance with FCC Class A limits.

## **CANADIAN DEPARTMENT OF COMMUNICATIONS CLASS A LIMITS**

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class A prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

## **FCC PART 68 RULE DISCLOSURE**

The following information is required by FCC Part 68 Rules which informs the user of his rights and obligations in connecting this equipment to the network and in ordering service.

This equipment complies with Part 68 of FCC Rules. Please note the following:

1. When you order service, the telephone company needs to know:

- a. The Facility Interface Code:  
04DU-B (1.544 MB D4 framing format)  
04DU9-C (1.544 MB ESF framing format)
- b. The Service Order Code: 6.0F

A signal power affidavit may be required to guarantee encoded analog content and billing protection unless this unit is used in combination with an XD type device or no encoded analog signals and billing information are transmitted.

c. The USOC Jack Required: RJ48C

In addition, if requested, please inform the telephone company of the make, model and FCC Registration Number, which are on the label.

2. Your telephone company may make changes in its facilities, equipment, operations or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

3. If your telephone equipment causes harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance, but if advance notice is not practical, you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC.

4. If you experience trouble with the telephone equipment, please contact us for information on obtaining service or repairs. Only ImageStream or our authorized agents should perform repairs.

5. You are required to notify the telephone company when this unit is disconnected from the network.

## TRAINING COURSES

ImageStream offers hands-on, technical training courses on ImageStream products and their applications. For more information, visit the ImageStream Web site at <http://www.imagestream.com/Training.html>.

## MAILING LISTS

ImageStream maintains the following Internet mailing lists for ImageStream router users:

- **isis-announce** — a general announcements list that carries announcements from ImageStream regarding product releases, news releases and general company information. To subscribe, send email to [majordomo@imagestream.com](mailto:majordomo@imagestream.com) with **subscribe isis-announce** in the body of the message.
- **isis-support** — a general discussion list that carries announcements from the isis-announce list, as well as software version release announcements and product releases. To subscribe, send email to [majordomo@imagestream.com](mailto:majordomo@imagestream.com) with **subscribe isis-support** in the body of the message.

**Please read this entire manual before contacting ImageStream for technical assistance. Please report any errata or change recommendations to [support@imagestream.com](mailto:support@imagestream.com).**

# I. Introduction and Installation

This chapter discusses the following topics:

- “About this Manual”
- “Unpacking the Card”
- “Installing the Adapter”
- “Installation for Standard PCI Bus”
- “Inserting the Adapter”

## Introduction: About This Manual

This manual is the technical reference for the 530-TEJ adapters:

- 531-TEJ (single port)
- 532-TEJ (dual port)
- 534-TEJ (quad port)

Throughout this reference, the term 530-TEJ is used to refer to all three adapters. Except where noted, the information in this reference applies to all three adapters.

The *530-TEJ Technical Reference* includes the following:

- Introduction and background on the 530-TEJ controller
- Installation instructions
- Physical characteristics and specifications of the adapter

This 530 series design facilitates communication via one, two, or four ports (depending on the adapter) at T1/E1/J1 rates (1.544MHz, 2.048MHz, and 2.048MHz/1.544MHz, respectively) with other types of systems. Channelized DS0 support and drop-and-insert capabilities are available for T1/E1 or J1. The 530-TEJ can use SS7 or HDLC protocols.

## Unpacking the Card

1. If the carton is damaged when you receive it, request that the carrier's agent be present when you unpack and inspect the equipment.
2. After unpacking, verify that all items listed in the packing list are present.
3. Inspect the equipment for shipping damage.
4. Save all packing material for storage or return shipment of the equipment.

5. For repairs or replacement of equipment damaged during shipment, contact ImageStream to obtain a Return Materials Authorization (RMA) number and further shipping instructions.

The 530-TEJ adapter uses CMOS components easily damaged by static electrical discharge. To avoid damage, familiarize yourself with electrostatic discharge (ESD) procedures, which include the following precautions:

Caution! Only trained service personnel at an approved ESD workstation should handle the adapter.

- Refer to ANSI/IPC-A-610 developed by the Institute for Interconnecting and Packaging Electronic Circuits (IPC).

Caution! DO NOT insert the adapter into or remove it from the adapter cage while power is applied.

- Keep the adapter in a sealed conductive plastic bag while in transit.
- When installing the adapter in the field, ground yourself to the computer before removing the adapter from the sealed conductive plastic bag (the power plug must be installed on the computer for this to be effective).
- Any equipment used to work on the adapter must be grounded. Any person handling the adapter must be grounded.
- Check alignment and polarization of cables and connectors before applying power.
- Do not apply external voltages to any devices on the adapter with power removed from the adapter.
- Do not attempt to straighten any part soldered to the adapter. This can cause pin breakage or internal damage to the adapter or its components.

## **Installing the Adapter**

These instructions apply to installing adapters in a system with a PCI bus, including ImageStream Industrial Series Routers. Check the manual that came with your system for any special instructions that might apply to your system. The installation process may vary slightly depending on your system. Check your system documentation.

Warning! The 530-TEJ is installed in a PCI slot in a system that operates from AC mains voltages that can be lethal. Before you remove the cover from your system, you must take the following precautions to protect yourself and prevent damage to your computer system:

1. **TURN OFF THE COMPUTER AND DISCONNECT IT FROM ITS POWER SOURCE.**
2. Remove any jewelry from your hands and wrists.

3. Use only insulated tools.

Caution! The standard PCI bus is NOT “hot-swappable” or “hot-pluggable.” Do not attempt to install the adapter in a machine that is running. Attempting to install the adapter in a running system can result in serious damage to both the adapter and the system itself.

Warning! Some computers contain batteries or other small backup power devices that maintain memories, clocks, or other features even when the computer is turned off. Personal jewelry and conductive tools may short-circuit these internal components, which can create hazards from burns or fire. Equipment damage or data loss may also result from failing to follow proper precautions while working inside a computer.

## **Installation for a Standard PCI Bus**

Consult the documentation that came with your system. Following your system documentation:

1. Remove the system cover to expose the PCI bus slots.
2. Choose an empty PCI slot. Because these adapters use a 33 Mhz clock speed with a 32-bit bus, the adapter will operate correctly on a PCI bus version 2.1 or 2.2. It is best not to choose a slot that is capable of operating at 66 MHz or 64 bits, so that other cards that require the faster bus speeds may still use the slot.
3. Remove the hold down screw in the blank cover plate and remove the blank cover plate.

Caution! Be careful not to drop the screw into the interior of the computer. If this does occur, you must find the screw before proceeding any further. Seek assistance from a qualified technician if it becomes lost in an inaccessible part of the computer. Lost screws can short-circuit the electrical parts and cause serious damage when power is next applied or later.

## **Inserting the Adapter**

1. Grasp the adapter by the back plate and the opposite top corner of the circuit board, and guide the card into the desired slot.
2. Secure the card in the slot using the backplate screw removed earlier. If the backplate screw is not in place, the card will dislodge and be damaged when attaching the cable connectors. PCI connectors require significant force to seat properly.
3. Replace the cover on the system and reconnect all previously disconnected cables.

4. Attach the cable. Use an 8-position modular (RJ-48) straight-through patch cord to make the connection between the RJ-48 jack on the adapter and the RJ-48 jack in your wall or test system.
5. Turn on the system power. Adapter installation is complete.

Note: Check the alignment and polarization of connectors before applying any power to the module. Failure to install the module correctly can cause damage to the board. In addition, it is important to remove power from the host system before connecting or disconnecting cables and connectors.

## **II. Adapter Specifications**

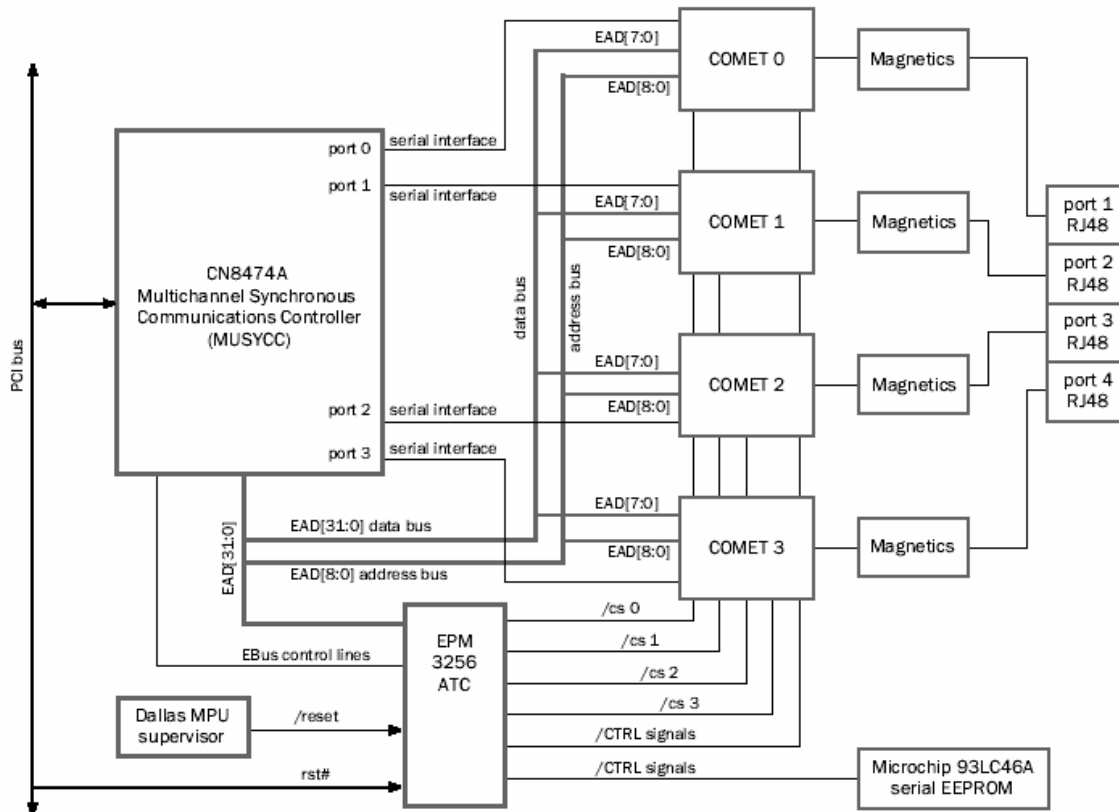
This chapter discusses the following topics:

- “Functional Block Diagram”
- “Physical Characteristics and Operating Requirements”
- “Mean Time Between Failures”
- “Industry Standards Compliance”

### **Functional Block Diagram**

This chapter details the physical characteristics and specifications for the 530-TEJ communications controller. See Figure 2-1 for a block diagram of the 530-TEJ functionality.

Figure 2-1 530-TEJ functional block diagram



## Conexant CN8474A Communications Controller

The 530-TEJ uses a Conexant CN8474A communications controller as the HDLC processing engine.

- The CN8474A Multichannel Synchronous Communications Controller (MUSYCC) is an advanced, multichannel, synchronous communications controller that frames and deframes 128 HDLC channels in a single CMOS IC.
- The MUSYCC provides HDLC channels for internetworking applications such as Frame Relay, X.25, Signaling System 7 (SS7), ISDN D-channel signaling, and LAN/WAN data transport.
- Under minimal host supervision, the MUSYCC manages a linked list of channel data buffers in host memory by performing direct memory access (DMA) for the 128 channels, Tx and Rx.

The MUSYCC interfaces with four independent serial data streams, such as T1/E1/J1 signals, and then transfers data across the peripheral component interface (PCI) bus to system memory at a rate of 132Mbps. The 530-TEJ will operate for both T1 (1.544MHz) or E1 (2.048MHz). Logical channels can be mapped as any combination of DS0 time slots to support ISDN hyperchannels (Nx64Kbps) or as any number of bits in a DS0 for subchanneling applications (Nx8Kbps).

## **COMET Framer**

The four PMC-Sierra framer interface components (PM4351 COMETs) allow the software to select between T1 (100 Ohm), E1 (120 Ohm), and J1 configurations.

### **T1/E1/J1 Port I/O**

The 530-TEJ (depending on the model) supports one, two, or four T1/E1/J1 ports. Four onboard COMET chips provide the framer and LIU supporting the four T1/E1/J1 ports. The CSU components reside on the module. The tip and ring for each port are routed to fully shielded RJ48C connectors mounted behind the PCI bezel.

## **Physical Characteristics and Operating Requirements**

The 530-TEJ products are designed to function within the environmental parameters:

The PCI interface conforms to the PCI 2.1 specification. It will transfer 32 bits of data at up to 66 MHz. The PCI version of the 530-TEJ requires only 5V power, but both 3.3V and 5V PCI bus signaling are supported. The 530-TEJ is available in a PCI Mezzanine Connector (PMC) form factor if you require a version that uses only 3.3V power.

Caution! Bring the 530-TEJ communications controller to operating temperature in a non-condensing environment. The rate of change in board temperature should not exceed 2 °C (35.6 °F) per minute.

### **Physical Characteristics**

The 530-TEJ incorporates up to four T1/E1/ J1 framers, DSUs, CSUs, and fuses as well as the communications controller on a single PCI adapter. Table 2-1 lists the physical characteristics and dimensions of the 530-TEJ adapter. Figure 2-2 shows the physical profile.

Table 2-1 530-TEJ Physical Characteristics

Parameter	Specification
Storage Temperature	-40 to 85 °C (-40 to 176 °F)
Operating Temperature	-5 to 55 °C (23 to 136 °F) at ambient temperature with power applied
Relative Humidity	20% to 80% relative humidity non-condensing
Storage Humidity	10% to 95% non-condensing
Power Requirements	2.5 watts maximum at 3.3V
Voltages	5V and 3.3V (3.3V < 50mV pp ripple) required
Height	4.2 inches
Length	5.5 inches
Maximum component height (primary side)	0.606 inches
Maximum component height (secondary side)	0.136 inches
Board thickness	0.062 inches

Figure 2-2 530-TEJ physical profile

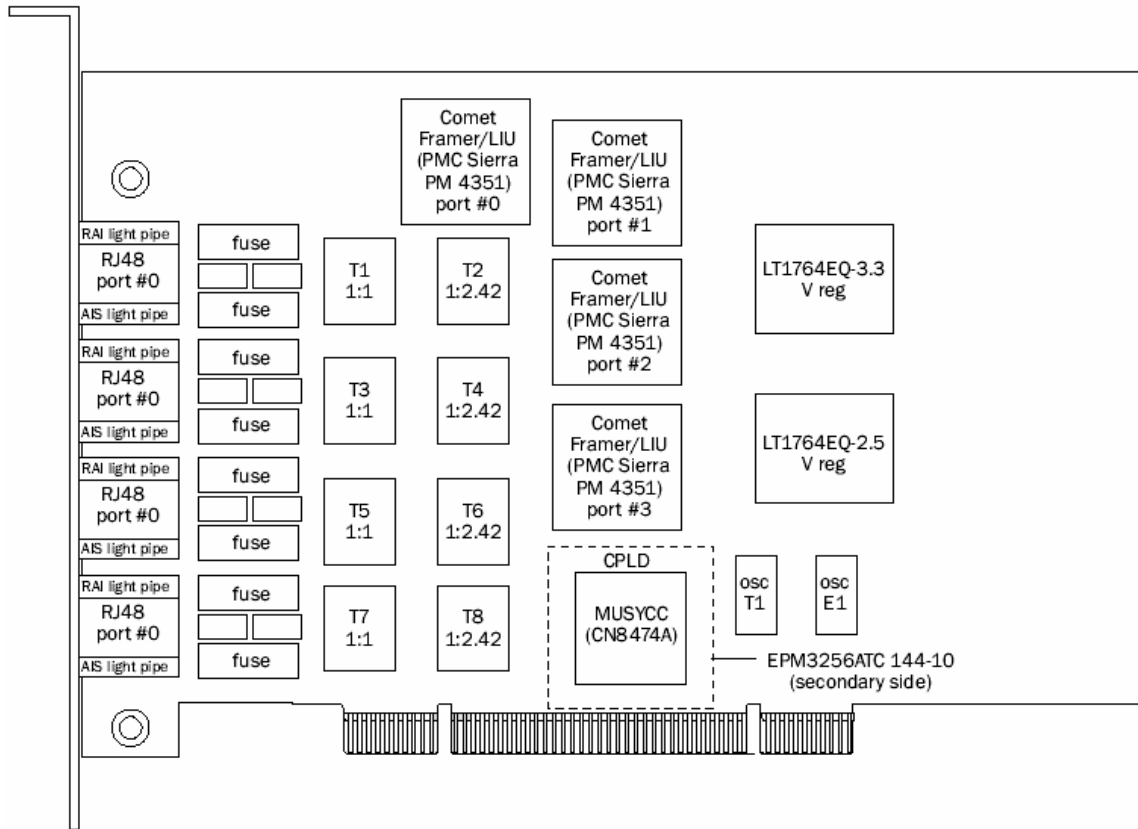
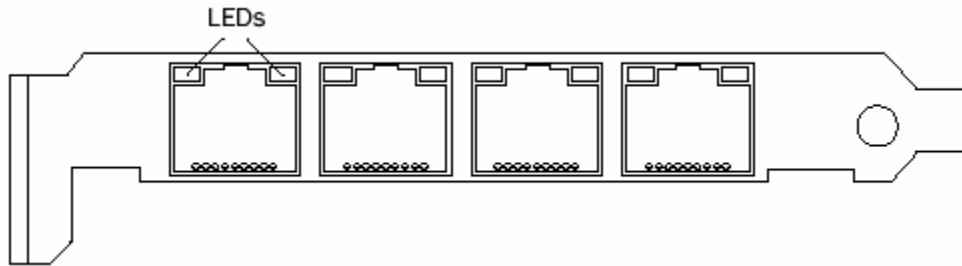


Figure 2-3 530-TEJ front bezel



## Mean Time Between Failures

The part failure source rate for the 530-TEJ was calculated in accordance with the TELCORDIA TECHNOLOGIES Specification TR-332, version 6, using the Stress Analysis method. This is based on an ambient temperature of 50 °C (122 °F) in a benign, controlled environment, using Quality Level II parts. The 530-TEJ has an expected mean time between failures (MTBF) of 395,000 hours.

## Industry Standards Compliance

The 530-TEJ complies with these industry standard specifications:

- European ITU CEPT Telecom Network Facilities.
- PCI Special Interest Group, "PCI Local Bus Specification," Revision 2.1, June 1995.
- GR-63-CORE, "Network Equipment-Building Systems (NEBS) Requirements: Physical Protection," Issue 1, October 1995.
- G.703, "Physical/Electrical Characteristics Of Hierarchical Digital Interfaces," CCITT Blue Book, 1989.
- G.704, "Synchronous Frame Structures Used at Primary and Secondary Hierarchical Levels," CCITT Blue Book, 1989.
- G.705, "Characteristics Required to Terminate Digital Links on a Digital Exchange," CCITT Blue Book, 1989.
- G.706, "Frame Alignment and Cyclic Redundancy Check (CRC) Procedures Relating to Basic Frame Structures Defined in Recommendation G.704," CCITT Blue Book, 1989.
- ANSI T1.403, "Carrier-to-Customer Installation - DS1 Metallic Interface," 1995.
- AT&T PUB 43801, "Digital Channel Banks - Requirements and Objectives," November 1982.
- CB 142, "The Extended Superframe Format Interface Specification," Issue 3, December 1983.
- AT&T TR 54016, "Requirements for Interfacing Digital Terminal Equipment to Services Employing the Extended Superframe Format," May 1986.
- AT&T TR 62411, "ACCUNET T1.5 Service Description and Interface Specification," December 1990.

- TR-TSY-000510, “System Interfaces, LATA Switching Systems Generic Requirements (LSSGR): Section 10,” Issue 2, July 1987.
- I.431, “Primary Rate User-Network Interface - Layer 1 Specification,” CCITT Blue Book 1989.
- ANSI T1.102, “Digital Hierarchy - Electrical Interfaces,” 1993.
- ANSI T1.107, “Digital Hierarchy - Formats Specifications,” 1995.

### III. Hardware Connectors, Pinouts and LEDs

This chapter discusses the following topics:

- “Memory Mappings”
- “Serial EEPROM”
- “PCI Connector Pinout Definitions”
- “Clock/Frame Pulse Routing Matrix”
- “Connectors and LEDs”

#### Memory Mappings

The Expansion Bus (EBus) that carries the data on the 530-TEJ is connected to six byte-wide devices. These devices are the four COMETs, the serial EEPROM, and the iSPLD. The EBus interface uses the lower 20 bits from the PCI address line (AD[19:0]) to construct a byte address for the EBus.

Specifically, PCI address lines AD[19:2] are remapped to EBus address lines EAD[17:0]. Table 3-1 shows the memory map for the six I/O devices. Only single D-word (32-bit) PCI operations can be performed when accessing the EBus. Please refer to the CN8474/CN8474A specification for more detail. All EBus accesses are on the least significant byte of the PCI bus and are aligned on the 32-bit boundary.

Table 3-1 530-TEJ memory map

Device	PCI Address
COMET 1	xxx80000 Hex
COMET 2	xxx90000 Hex
COMET 3	xxxA0000 Hex
COMET 4	xxxB0000 Hex
Serial EEPROM	xxxC0000 Hex
iSPLD	xxxD0000 Hex

## Serial EEPROM

Board serial numbers are stored in a Microchip 93LC46A and packaged in a small outline integrated circuit. This device can hold 1024 bits organized in a 128x8 format. The PCI host reads and writes to this device in a bit serial fashion. Table 3-2 shows the 93LC46A instruction set. Table 3-3 lists the extended address bit definitions.

Table 3-2 Serial EEPROM—93LC46A instruction set

Instruction	Serial Bit	Op Code Binary	EEPROM Address Bits							Data In	Data Out	Required CLKs
Erase	1	11	A 6	A 5	A 4	A 3	A 2	A 1	A 0	---	RDY_/ BSY	10
Erase All	1	00	1	0	X	X	X	X	X	---	RDY_/ BSY	10
Erase/Write DISABLE	1	00	0	0	X	X	X	X	X	---	HIGH-Z	10
Erase/Write ENABLE	1	00	1	1	X	X	X	X	X	---	HIGH-Z	10
READ	1	10	A 6	A 5	A 4	A 3	A 2	A 1	A 0	---	D7-D0	18
WRITE	1	01	A 6	A 5	A 4	A 3	A 2	A 1	A 0	D7-D0	RDY_/ BSY	18
Write All	1	00	0	1	X	X	X	X	X	D7-D0	RDY_/ BSY	18

Table 3-3 Extended address bit definitions

Data Bit	Description
0	Data Out
1	Data In
2	Chip Select

Note: A 500ns delay is inserted between each bit/write operation.

## PCI Connector Pinout Definitions

Table 3-4 shows the standard PCI bus connector pin assignments for a 64-bit PCI card and the direction with respect to the PCB.

Note: The # symbol indicates an active LOW signal.

Table 3-4 PCI connector P1 pin assignments

A	B	Pin	Pin	A	B
TRST#	-12V	1	2	+12V	TCK
TMS	GND	3	4	TDI	TD0
+5V	+5V	5	6	INTA#	+5V
INTC#	INTB#	7	8	+5V	INTD#
Reserved	PRSNT1#	9	10	VC(I/O)	Reserved
Reserved	PRSNT2#	11	12	Keyway	Keyway
Keyway	Keyway	13	14	Reserved	Reserved
RST#	GND	15	16	V(I/O)	CLK
GNT#	GND	17	18	GND	REQ#
Reserved	V (I/O)	19	20	AD[30]	AD[31]
+3.3V	AD[29]	21	22	AD[28]	GND
AD[26]	AD[27]	23	24	GND	AD[25]
AD[24]	+3.3V	25	26	IDSEL	C/BE[3]#
+3.3V	AD[23]	27	28	AD[22]	GND
AD[20]	AD[21]	29	30	GND	AD[19]
AD[18]	+3.3V	31	32	AD[16]	AD[17]
+3.3V	C/BE[2]#	33	34	FRAME#	GND
GND	IRDY#	35	36	TRDY#	+3.3V
GND	DEVSEL#	37	38	STOP#	GND
+3.3V	LOCK#	39	40	Reserved	PERR#
Reserved	+3.3V	41	42	GND	SERR#
PAR	+3.3V	43	44	AD[15]	C/BE[1]#
+3.3V	AD[14]	45	46	AD[13]	GND
AD[11]	AD[12]	47	48	GND	AD[10]
AD[09]	M66EN	49	50	GND	GND
Connector Key	Connector Key	51	52	C/BE[0]#	AD[08]
+3.3V	AD[07]	53	54	AD[06]	+3.3V
AD[04]	AD[05]	55	56	GND	AD[03]

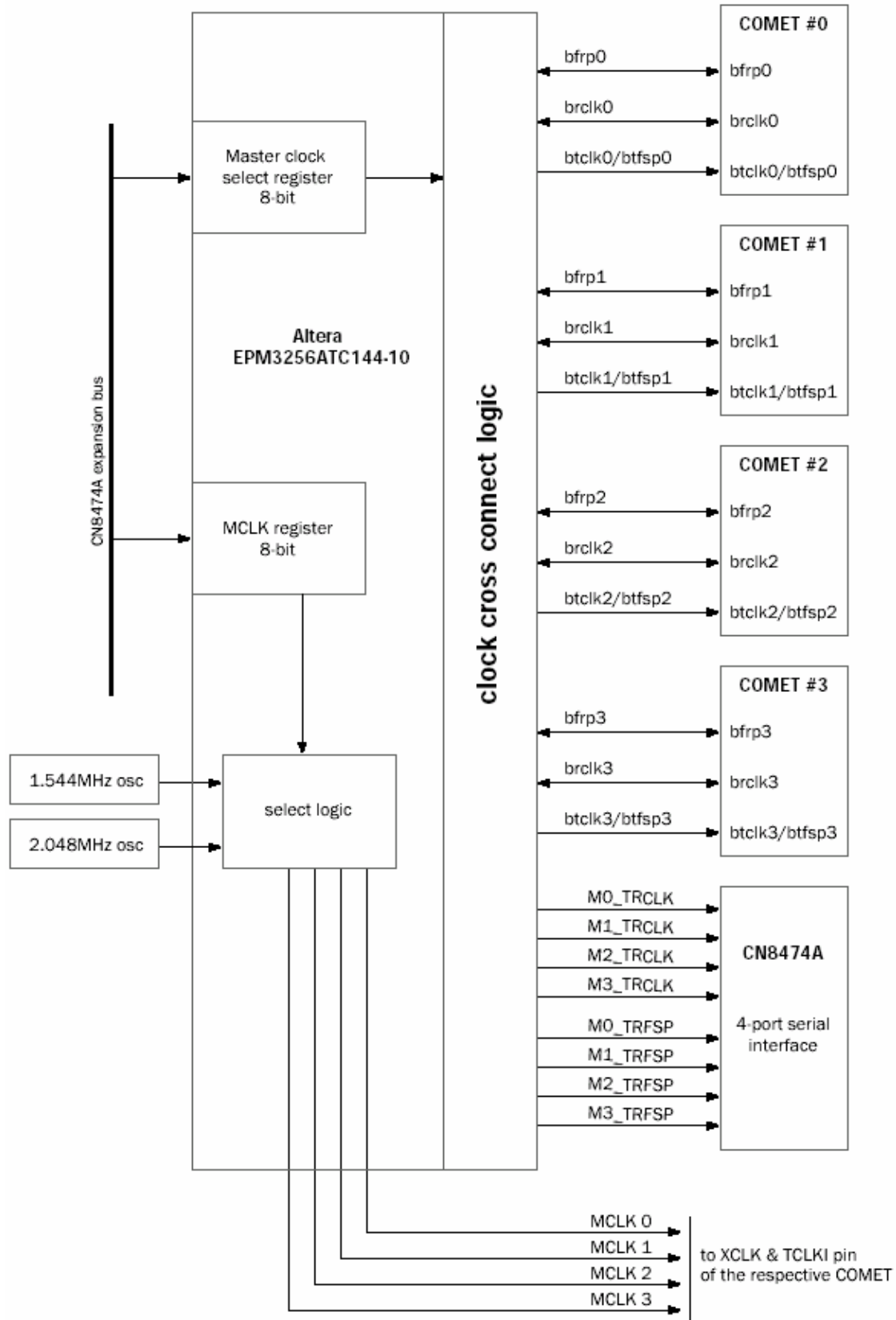
Table 3-4 PCI connector P1 pin assignments (continued)

A	B	Pin	Pin	A	B
AD[02]	GND	57	58	AD[00]	AD[01]
V (I/O)	V (I/O)	59	60	REQ64#	ACK64#
+5V	+5V	61	62	+5V	+5V

### Clock/Frame Pulse Routing Matrix

Any one of the framers can provide the clock for data synchronization. The host, via the MCSR (Master Clock Select Register) can decide which framer provides the clock. After power-up or reset, the MCSR is reset and all framers synchronize to the clock input provide by XCLK. XCLK is an input to the framers and its source is one of the two on board oscillators (T1 or E1) and controlled by the MCLK register. Upon power up or reset, the MCLK register provides T1 clock to all framers. Thereafter, the host can manipulate the MCLK register to provide T1 or E1 to any framer. See Figure 3-1 for a block diagram of the clock and frame pulse routing matrix.

Figure 3-1 Clock and frame pulse routing



## Connectors

The 530-TEJ supports one, two, or four T1/E1/J1 ports (depending on the model). The PM4351 COMET chips provide the framer and LIU to support the four T1/E1/J1 ports. The CSU components reside on the 530-TEJ. The tip and ring for each port are routed to the individual fully shielded RJ48C connector mounted to the PCI bezel.

The front panel accommodates four, two, or one RJ48C connector(s) depending on the board version. Each connector has two integrated light pipes for LEDs as shown below. The LED colors are Yellow for AIS and Green for RAI.

Figure 3-2 530-TEJ front panel

