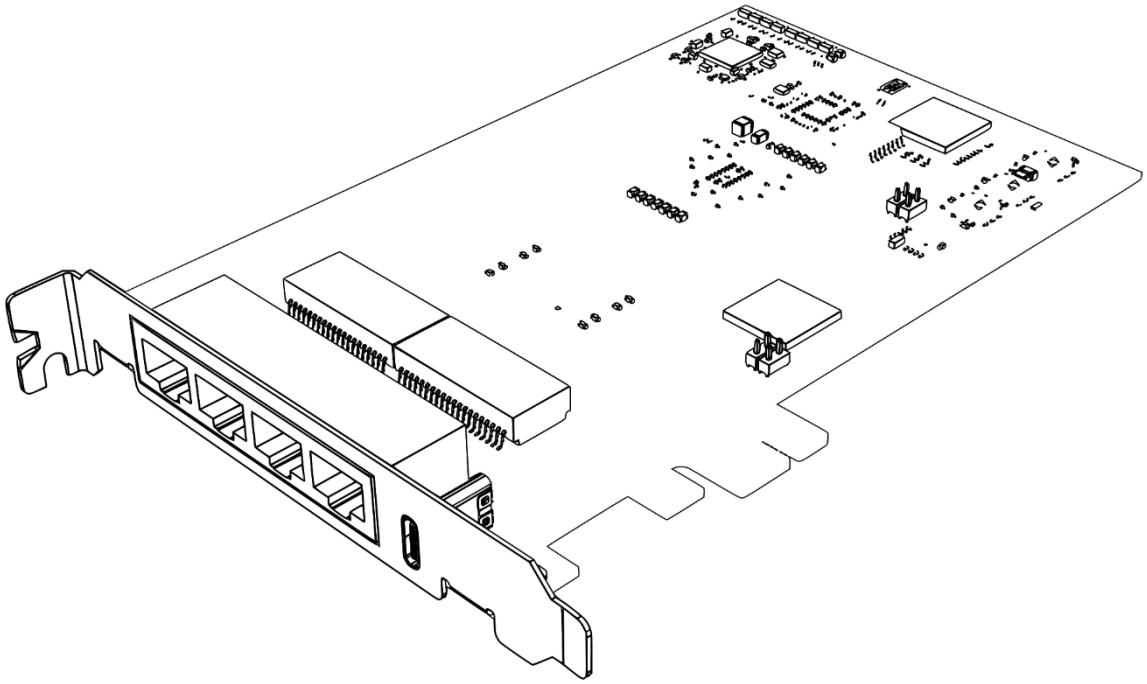
NAT-PCIE-8E1T1

PCIE LINE INTERFACE BOARD

DESIGNED BY N.A.T. GMBH



TECHNICAL REFERENCE MANUAL V1.0

HW REVISION 1.X

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1. PREFACE

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Note:

The release of the Hardware Manual is related to a certain HW board revision given in the document title. For HW revisions earlier than the one given in the document title please contact N.A.T. for the corresponding older Hardware Manual release.

1.2. About This Document

This document is intended to give an overview on the **NAT-PCIe-8E1T1's** functional capabilities.

Preface

General information about this document

Introduction

Abstract on the **NAT-PCIe-8E1T1's** main functionality and application field

Quick Start

Important information and mandatory requirements to be considered before operating the **NAT-PCIe-8E1T1** for the first time

Functional Description

Detailed information on the individual devices and the **NAT-PCIe-8E1T1's** main features

Hardware

Description of the connectors, switches, and LEDs located on the **NAT-PCIe-8E1T1**

Specifications and Compliances

Detailed list of specifications, abbreviations, and datasheets of components referred to in this document and standards, the **NAT-PCIe-8E1T1** complies to

Document's History

Revision record

Note:

It is assumed, that the **NAT-PCIe-8E1T1** is handled by qualified personnel only!

2. INTRODUCTION

The **NAT-PCIe-8E1T1** is a PCI Express (PCIe) add-in card with Line Interfaces (LIF) via RJ45 connectors. Thus, the module processes data between E1/T1 digital data transmission formats on one side and the PCIe interface on the other.

A Xilinx Spartan-7 FPGA with dedicated security features provides processing power. Its PCI interface connects with the PCI-to-PCIe Bridge, which interfaces towards the PCIe interface of the carrier e.g., PC mainboard. TDM data from the FPGA is linked to the Maxim Dallas DS26518 framer, converted to E1/T1, and vice versa.

Clock is generated by a Texas Instruments LMK05028 PLL, which is supplied by a TCXO and a standard oscillator.

2.1. Applications

Typical field of application for the **NAT-PCIe-8E1T1** may be converting between PSTN and VoIP networks.

2.2. Main Features

Table 1 – Technical Data

Form Factor	
	• PCI Express x1 add-in card • Width: 167 mm, depth: 110 mm
Processing Resources	
	• Xilinx Spartan-7 FPGA • 32MB SPI Flash • Atmel Microchip ATxmega 128 as IPMI controller
Clocking / Sync	
	• Texas Instruments LMK05028 PLL with TXCO 7 standard oscillator
Framer	
	• Maxim Dallas DS26518 E1/T1
PCI-to-PCIe-Bridge	
	• Diodes Incorporated PI7C9X112SL
Front Panel Interconnect	
	• 8x LIF via 4x RJ45 • Micro-USB
Mainboard Interconnect	
	• PCIe x1
Compliance	
	• PCI Express Base Specification Rev. 1.1 • PCI Express CEM Specification Rev. 1.1 • PICMG 2.15 Rev. 1.0 • ITU-T G.703 (for E1/T1 Standard) • ITU-T G.823 (Jitter Attenuation • RoHS
Environmental	
Operating Environment	• 0 to +55 degrees Celsius (extended temperature range on request) • Humidity: 5% to 95% (non-condensing)
Storage Environment	• -40 to +100 degrees Celsius • Humidity: 5% to 95% (non-condensing)

3. QUICK START

To ensure proper functioning of the **NAT-PCIe-8E1T1** during its usual lifetime, take the following precautions before handling the board.

3.1. Unpacking

Electrostatic discharge, incorrect board installation, and uninstallation can damage circuits or shorten their lifetime. Before touching integrated circuits ensure to take all required precautions for handling electrostatic devices.

Avoid touching gold contacts of the PCIe edge connector to ensure proper contact when inserting the **NAT-PCIe-8E1T1** onto the mainboard.

Make sure that the board and its attachments are undamaged and complete according to delivery note.

3.2. Mechanical Requirements

The **NAT-PCIe-8E1T1** can be plugged onto any PC mainboard supporting PCIe standards.

Before installing or uninstalling the **NAT-PCIe-8E1T1**, read the Installation Guide and the User's Manual of the mainboard used.

Check all installed boards and modules for steps that you have to take before turning on or off the power. After taking those steps, turn on or off the power if necessary.

Make sure the part to be installed / removed is hot-plug-capable, if you don't switch off the power.

Ensure that the **NAT-PCIe-8E1T1** is connected to the mainboard with the connector completely inserted.

When operating the board in areas of strong electromagnetic radiation, ensure that the module is bolted to the front panel or rack, and shielded by closed housing.

3.3. Voltage Requirements

3.3.1. Power supply

The power supply for the **NAT-PCIe-8E1T1** must meet the following specifications:

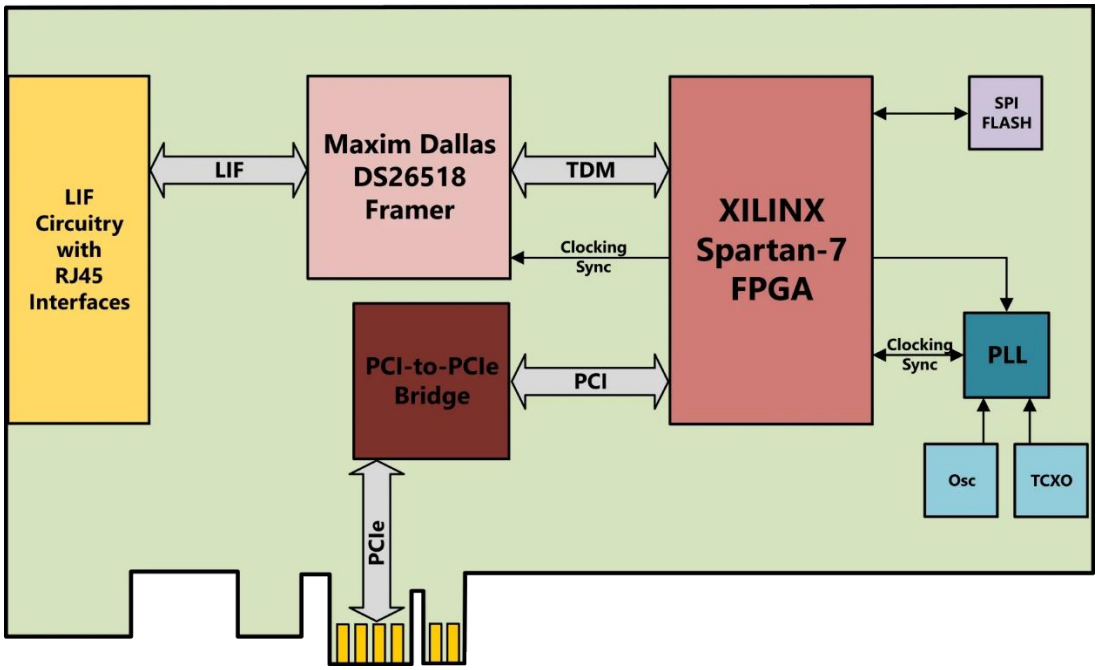
+12V / 1.0A max.

+ 3,3V_AUX / 0.1A max.

4. FUNCTIONAL DESCRIPTION

The **NAT-PCIe-8E1T1** can be divided into a number of functional blocks, which are described in the following paragraphs.

Figure 1 – Block Diagram



4.1. FPGA

Main processing resource of the **NAT-PCIe-8E1T1** is a Xilinx Spartan-7 FPGA. It is a cost-optimized device featuring a good amount of logic resources for implementation of the TDM data handling engine, that performs E1/T1 data transfer via DMA into the host memory.

It is accompanied by 32 MB SPI Flash for configuration purposes.

4.2. Microcontroller

An Atmel Microchip ATxmega128 Microcontroller is located on the **NAT-PCIe-8E1T1** for I^2C communication. It contains high-level functionality needed for board management.

4.3. E1/T1-Framer

Conversion between TDM from the system side to the E1/T1 network is processed by a Maxim Dallas DS26518 E1/T1 framer.

4.4. PCI-to-PCIe Bridge

The Diodes Incorporated PI7C9X112SL is a power-efficient, high-performance PCI-to-PCIe bridge.

4.5. Clocking / Sync

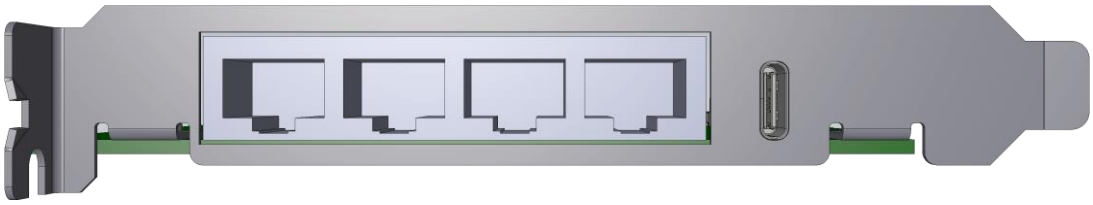
The Texas Instruments LKM05028 PLL is supplied by a TXCO and a standard oscillator for clock generation.

5. HARDWARE

5.1. Front Panel

The figure below shows the **NAT-PCIe-8E1T1** front panel.

Figure 2 – Front Panel NAT-PCIe-8E1T1



6. SPECIFICATIONS AND COMPLIANCES

6.1. Standards Compliance

- PCI Express Base Specification Rev. 1.1
- PCI Express CEM Specification Rev. 1.1
- PICMG 2.15 Rev. 1.0
- ITU-T G.703 (for E1/T1 Standard)

6.2. Compliance to RoHS Directive

Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the "Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS) predicts that all electrical and electronic equipment being put on the European market after June 30th, 2006 must contain lead, mercury, hexavalent chromium, poly-brominated biphenyls (PBB) and poly-brominated diphenyl ethers (PBDE) and cadmium in maximum concentration values of 0.1% respective 0.01% by weight in homogenous materials only.

As these hazardous substances are currently used with semiconductors, plastics (i.e. semi-conductor packages, connectors) and soldering tin any hardware product is affected by the RoHS directive if it does not belong to one of the groups of products exempted from the RoHS directive.

Although many of hardware products of N.A.T. are exempted from the RoHS directive it is a declared policy of N.A.T. to provide all products fully compliant to the RoHS directive as soon as possible. For this purpose since January 31st, 2005 N.A.T. is requesting RoHS compliant deliveries from its suppliers. Special attention and care has been paid to the production cycle, so that wherever and whenever possible RoHS components are used with N.A.T. hardware products already.

6.3. Compliance to WEEE Directive

Directive 2002/95/EC of the European Commission on "Waste Electrical and Electronic Equipment" (WEEE) predicts that every manufacturer of electrical and electronical equipment which is put on the European market has to contribute to the reuse, recycling and other forms of recovery of such waste so as to reduce disposal. Moreover this directive refers to the Directive 2002/95/EC of the European Commission on the "Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

Having its main focus on private persons and households using such electrical and electronic equipment the directive also affects business-to-business relationships. The directive is quite restrictive on how such waste of private persons and households has to be handled by the supplier/manufacturer; however, it allows a greater flexibility in business-to-business relation-ships. This pays tribute to the fact with industrial use electrical and electronical products are

commonly integrated into larger and more complex environments or systems that cannot easily be split up again when it comes to their disposal at the end of their life cycles.

As N.A.T. products are solely sold to industrial customers, by special arrangement at time of purchase the customer agreed to take the responsibility for a WEEE compliant disposal of the used N.A.T. product. Moreover, all N.A.T. products are marked according to the directive with a crossed out bin to indicate that these products within the European Community must not be disposed with regular waste.

If you have any questions on the policy of N.A.T. regarding the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the "Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS) or the Directive 2002/95/EC of the European Commission on "Waste Electrical and Electronic Equipment" (WEEE) please contact N.A.T. by phone or e-mail.

6.4. Compliance to CE Directive

Compliance to the CE directive is declared. A 'CE' sign can be found on the PCB.

6.5. Compliance to REACH

The REACH EU regulation (Regulation (EC) No 1907/2006) is known to N.A.T. GmbH. N.A.T. did not receive information from their European suppliers of substances of very high concern of the ECHA candidate list. Article 7(2) of REACH is notable as no substances are intentionally being released by NAT products and as no hazardous substances are contained. Information remains in effect or will be otherwise stated immediately to our customers.

6.6. Abbreviation List

Table 2 – Abbreviation List

Abbreviation	Description
ADC	Analog-Digital-Converter
E1	PDH signal – data rate 2.048 Mbit/s
I^2C	Inter-Integrated Circuit
IPMI	Intelligent Platform Management Interface
LIF	Line Interface
FPGA	Field Programmable Gate Array
PCI(e)	Peripheral Component Interconnect (Express)
PLL	Phase-Locked Loop
PSTN	Public Switched Telephone Network
SPI	Serial Peripheral Interface (FLASH)
T1	PDH signal – data rate 1.544 Mbit/s
TXCO	Temperature Compensated Crystal Oscillator
TDM	Time Division Multiplex
VoIP	Voice over IP
USB	Universal Serial Bus

7. DOCUMENT'S HISTORY

Table 3 – Document's History

Rev	Date	Description	Author
1.0	09.04.2024	• initial release	se