The Embedded I/O Company

TEWS TECHNOLOGIES

TPMC395

Conduction Cooled, Four Channel 10/100/1000 Mbit/s Ethernet

Version 1.0

User Manual

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TEWS TECHNOLOGIES GmbH
Am Bahnhof 7 25469 Halstenbek, Germany
Phone: +49 (0) 4101 4058 0 Fax: +49 (0) 4101 4058 19
e-mail: info@tews.com www.tews.com

TPMC395-10R

Conduction Cooled, Four Channel 10/100/1000 Mbit/s Ethernet, Intel I210IT, P14 Back I/O

(RoHS compliant)

Issue	Description	Date
1.0.0	Initial issue	December 2021

Table of Contents

List of Figures

List of Tables

1 Product Description

The TPMC395 is a Conduction Cooled PCI Mezzanine Card (CCPMC) compatible module providing a four channel Ethernet 10Base-T / 100Base-TX / 1000Base-T interface.

A transparent 64 bit, up to 133 MHz PCI-X/PCI to PCIe Bridge and a PCIe Switch provide access to the Intel I210IT Gigabit Ethernet controllers. Each Ethernet interface supports 10, 100 and 1000 Mbit/s transmission rates and is equipped with a 16 Mbit Serial Flash to support PXE and iSCSI boot.

The four Ethernet interfaces of the TPMC395 are capable of performing an auto negotiation algorithm which allows both link-partners to determine the best link-parameters. The TPMC395 supports IEEE 1588/802.1AS Precision Time Protocol (PTP) and IEEE 802.1Qav Audio/Video Bridging (AVB) traffic shaping (with software extensions).

The TPMC395-10R routes four Ethernet ports to the Back I/O P14 connector.

All ports are galvanically isolated from the Ethernet controllers and LEDs on the board indicate the different network activities.

The module meets the requirements to operate in extended temperature range from -40°C to +85°C.

Software Support:

- Software support for Intel I210IT at www.intel.com
- For operating systems not supported by Intel, please contact TEWS.

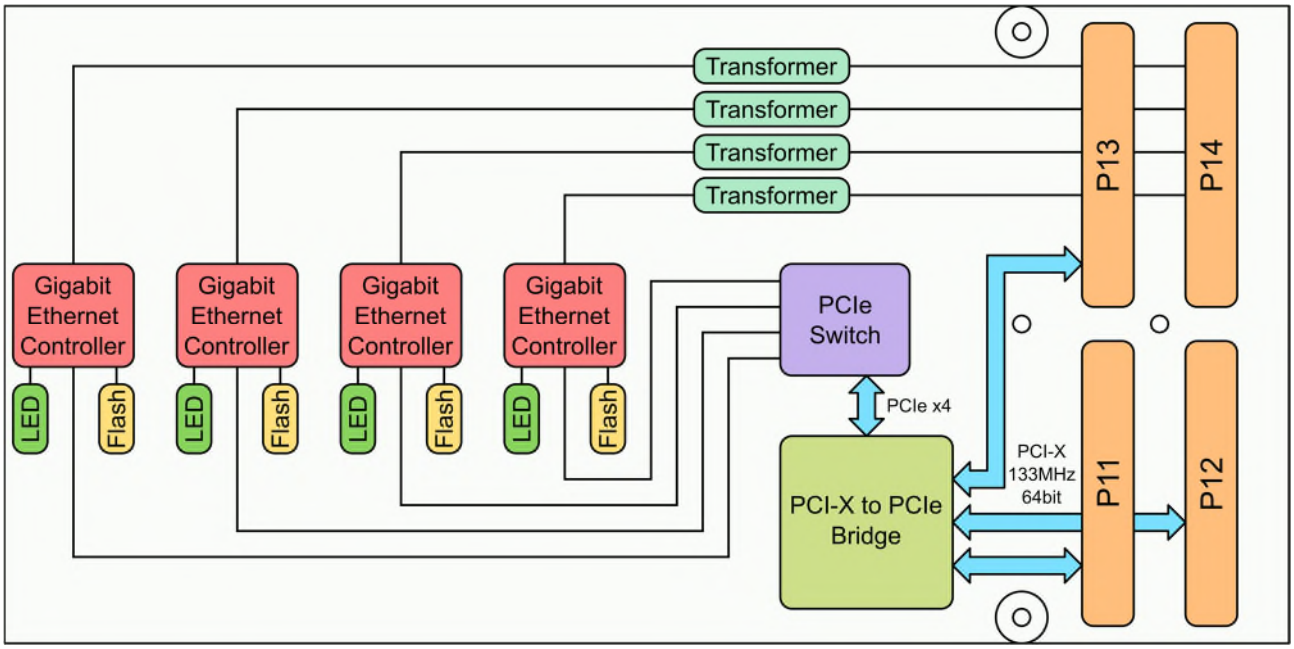


Figure 1-1 : Block Diagram

2 Technical Specification

PMC Interface	
Mechanical Interface	Conduction Cooled PCI Mezzanine Card (CCPMC) Interface conforming to IEEE P1386/P1386.1 and ANSI/VITA 20 Standard single-width (143.75 mm x 74 mm)
Electrical Interface	64 bit PCI (Specification 3.0) up to 66 MHz and 64 bit PCI-X (Specification 2.0a) up to 133 MHz compliant interface conforming to 3.3V PCI signaling with 5V I/O tolerance

On Board Devices	
PCI/PCI-X to PCIe Bridge	PI7C9X130 (Diodes Incorporated)
PCIe Switch	PI7C9X2G608GP (Diodes Incorporated)
Gigabit Ethernet Controllers	For each interface: I210-IT (Intel)
16 Mbit Serial Flashes for Boot ROM	For each interface: W25Q16JV (Winbond)

I/O Interface	
Number of Channels	4
I/O Standards	1000Base-T 100Base-TX 10Base-T
I/O Connector	Back I/O P14 (Molex 714362864 or compatible)

Physical Data		
Power Requirements	1000mA typical @ +5V (four channel, no link) app. additional 10mA to 100mA per link	
Temperature Range	Operating Storage	-40°C to +85°C -40°C to +85°C
MTBF	587000 h MTBF values shown are based on calculation according to MIL-HDBK-217F and MIL-HDBK-217F Notice 2; Environment: G_B 20°C. The MTBF calculation is based on component FIT rates provided by the component suppliers. If FIT rates are not available, MIL-HDBK-217F and MIL-HDBK-217F Notice 2 formulas are used for FIT rate calculation.	
Humidity	5 – 95 % non-condensing	
Weight	69 g	

Table 2-1 : Technical Specification

3 Handling and Operation Instructions

3.1 ESD Protection

This CCPMC module is sensitive to static electricity.
Packing, unpacking and all other module handling has to be done with appropriate care.

3.2 Power Dissipation

This CCPMC module requires adequate conduction cooling!

4 PCI Interface

4.1 TPMC395 PCI Device Topology

The TPMC395 uses four Gigabit Ethernet Controllers (Intel I210-IT) each communicating via a PCIe Rev. 2.1 compliant x1 Interface.

To be able to access the Ethernet controllers they are connected to the x1 Downstream Ports of a PCIe Switch (Diodes Incorporated PI7C9X2G608GP).

The x4 Upstream Port of the PCIe Switch is connected to a PCI/PCI-X to PCIe Bridge (Diodes Incorporated PI7C9X130) which communicates with the host system.

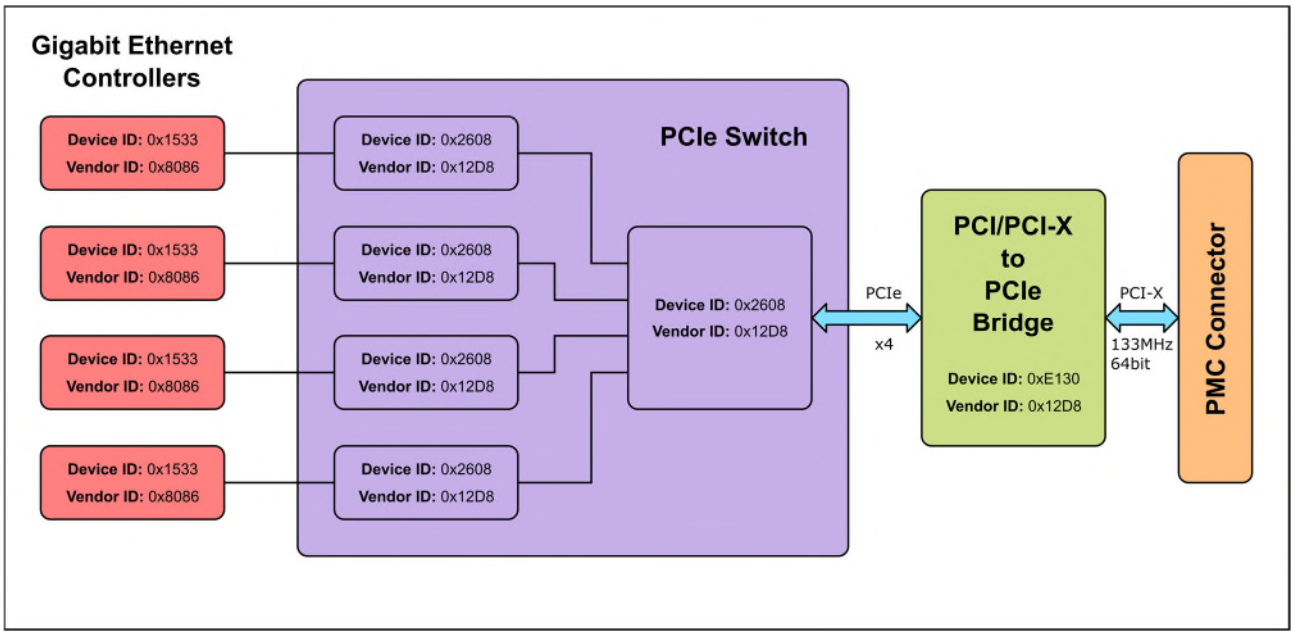


Figure 4-1 : TPMC395 PCI Device Topology

4.2 TPMC395 PCI Memory and I/O Size Requirements

PCI Space Mapping	Four Channel (Byte)	Two Channel (Byte)
MEM	4M	2M
I/O	16K	8K

Table 4-1 : TPMC395 PCI Memory and I/O Size Requirements

4.3 I210 PCI Identifiers

Vendor-ID	0x8086 (Intel)
Device-ID	0x1533 (I210-IT copper only)
Class Code	0x020000 (Ethernet Controller)
Subsystem Vendor-ID	0xFFFF
Subsystem Device-ID	0x0000

Table 4-2 : I210 PCI Identifiers

4.4 I210 PCI Base Address Register Configuration

PCI Base Address Register (Offset in PCI Configuration Space)	PCI Space Mapping	Size (Byte)	Description
0 (0x10)	MEM	128K	Internal Registers
1 (0x14)	-	-	-
2 (0x18)	I/O	32	Internal Registers via I/O Space
3 (0x1C)	MEM	16K	MSI-X

Table 4-3 : I210 PCI Base Address Register Configuration

5 Ethernet Interface Status LEDs

The TPMC395 provides an individual Status LED for every Ethernet Interface. Due to the fact that CCPMCs are mounted upside-down on the carrier card the Status LEDs are visible on the back side of the TPMC395. A marking is placed close to each Status LED to indicate the Ethernet Port it corresponds to.

See table below for more details:

Status LED	Description
OFF	No cable is connected or no link is established
ON	A link is established
BLINKING	Activity (the Ethernet Port transmits or receives data)

Table 5-1 : Status LED

6 Pin Assignment – I/O Connectors

6.1 Back I/O P14 Connector

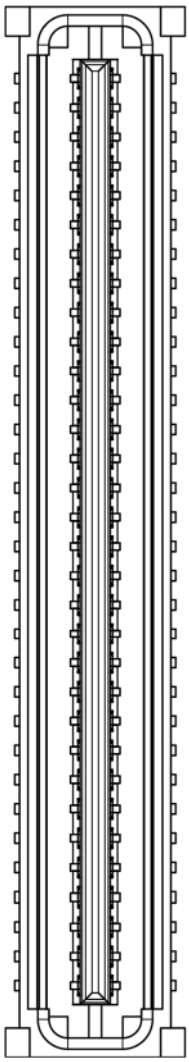
Signal	Pin		Pin	Signal
TERM_PLANE	63		64	TERM_PLANE
ETHERNET_2_TX3/RX3-	61		62	ETHERNET_1_TX3/RX3-
ETHERNET_2_TX3/RX3+	59		60	ETHERNET_1_TX3/RX3+
TERM_PLANE	57		58	TERM_PLANE
ETHERNET_2_TX2/RX2-	55		56	ETHERNET_1_TX2/RX2-
ETHERNET_2_TX2/RX2+	53		54	ETHERNET_1_TX2/RX2+
TERM_PLANE	51		52	TERM_PLANE
ETHERNET_1_TX0/RX0-	49		50	ETHERNET_1_TX1/RX1-
TERM_PLANE	47		48	TERM_PLANE
ETHERNET_1_TX0/RX0+	45		46	ETHERNET_1_TX1/RX1+
TERM_PLANE	43		44	TERM_PLANE
TERM_PLANE	41		42	TERM_PLANE
ETHERNET_2_TX0/RX0-	39		40	ETHERNET_2_TX1/RX1-
TERM_PLANE	37		38	TERM_PLANE
ETHERNET_2_TX0/RX0+	35		36	ETHERNET_2_TX1/RX1+
TERM_PLANE	33		34	TERM_PLANE
TERM_PLANE	31		32	TERM_PLANE
ETHERNET_3_TX0/RX0-	29		30	ETHERNET_3_TX1/RX1-
TERM_PLANE	27		28	TERM_PLANE
ETHERNET_3_TX0/RX0+	25		26	ETHERNET_3_TX1/RX1+
TERM_PLANE	23		24	TERM_PLANE
TERM_PLANE	21		22	TERM_PLANE
ETHERNET_4_TX0/RX0-	19		20	ETHERNET_4_TX1/RX1-
TERM_PLANE	17		18	TERM_PLANE
ETHERNET_4_TX0/RX0+	15		16	ETHERNET_4_TX1/RX1+
TERM_PLANE	13		14	TERM_PLANE
ETHERNET_4_TX2/RX2-	11		12	ETHERNET_3_TX2/RX2-
ETHERNET_4_TX2/RX2+	9		10	ETHERNET_3_TX2/RX2+
TERM_PLANE	7		8	TERM_PLANE
ETHERNET_4_TX3/RX3-	5		6	ETHERNET_3_TX3/RX3-
ETHERNET_4_TX3/RX3+	3		4	ETHERNET_3_TX3/RX3+
TERM_PLANE	1		2	TERM_PLANE

Table 6-1 : Back I/O P14 Connector