The Embedded I/O Company

TEWS TECHNOLOGIES

TPCE210

PCIe x4, Gen2 QMC Carrier

Version 1.0

User Manual

Issue 1.0.0

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TEWS Technologies GmbH
Eggerstedter Weg 14, 25421 Pinneberg, Germany
Phone: +49 (0) 4101 4058 0
info@tews.com www.tews.com

TPCE210-10R

2 Site QMC Carrier, PCIe x4, Gen2, Low-Profile, VHDCI-68 I/O

Document History

Issue	Description	Date
1.0.0	Initial Issue	May 2026

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1 Product Description

The TPCE210 is a low-profile, half-length PCI Express Revision 2.0 compatible carrier board for two single QMC modules or one double QMC module.

It can be used to build modular, flexible and cost effective I/O solutions for all kinds of applications like process control, medical systems, telecommunication and traffic control.

The TPCE210 is a versatile solution to upgrade any system with a PCI-Express Add-in Card slot to the new QMC standard (VITA 93.0).

The PCI Express x4 Link from the host board is routed to the two QMC sites via a PCI Express switch, allowing the operation of two different single QMCs.

QMC I/O is accessible through a VHDCI-68 front-panel connector, supporting access to the full five IOPIPEs of QMC1 and in addition two IOPIPEs of QMC2.

An on-board Management Controller (IPMC) allows access to the QMC's FRU EEPROM and sensors. Ideal for surveillance of the QMC's health status. The IPMC offers FRU information via a USB-C connector in the front panel of the TPCE210.

A unique JTAG header is available for each QMC module for debugging purposes. Four JTAG signals (TRST# not included) are routed directly to the QMC site.

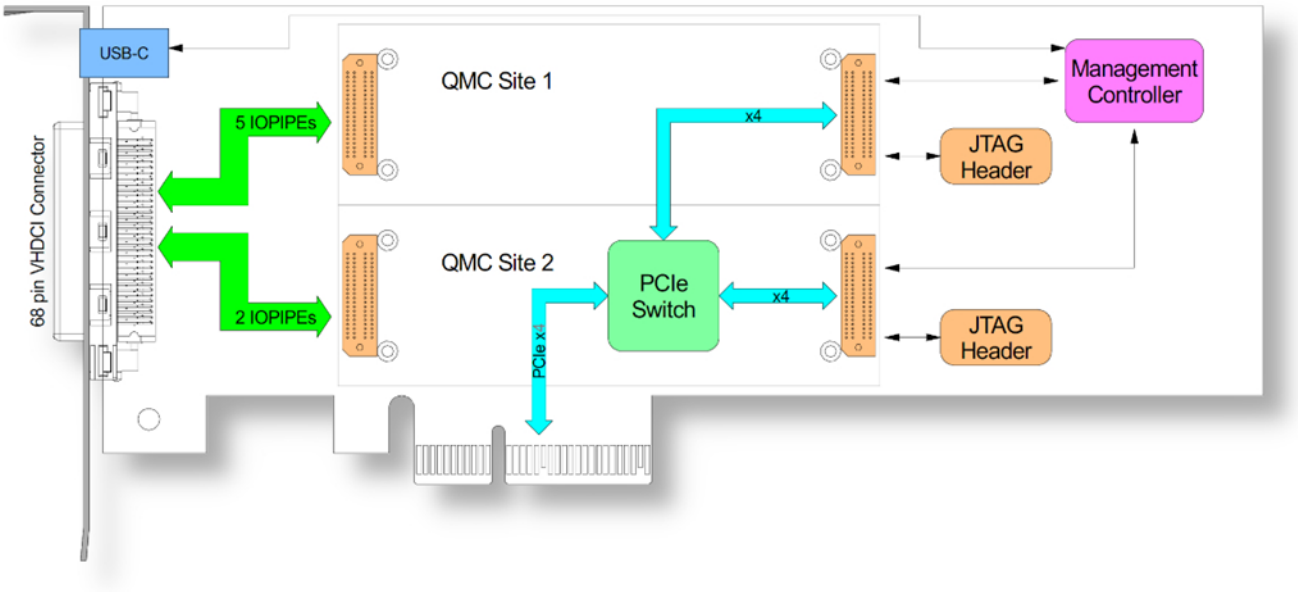


Figure 1-1 : Block Diagram

2 Technical Specification

General	
Mechanical Interface	PCI Express Card Electromechanical Specification, Revision 2.0, Low Profile, Half Length ANSI/VITA 93.0-2025 (QMC – Small Form Factor Mezzanine Card)
Electrical Interface	x4 PCI Express (PCIe Base Specification 2.0) compliant interface conforming to ANSI/VITA 93.0-2025

Main On Board Devices	
PCIe Switch	PI7C9X2G312GP (Pericom)
IPMC	ATxMega256 (Atmel)

QMC Interface	
Number of Sites	2
I/O Connectors	Front I/O: VHDCI-68 Connector (Honda HDRA-EC68LFDT-SL+ or compatible)

Physical Data	
Power Requirements	150 mA typical @ +12V DC 20 mA typical @ +3.3V DC
Temperature Range	Operating -40 °C to +85 °C Storage -40 °C to +125 °C
MTBF	319000 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 PCIe module is sensitive to static electricity.
Packing, unpacking and all other module handling has to be done with appropriate care!

3.2 Isolated I/O Ground

Isolated ground signals on the I/O connector must be connected to the corresponding external ground!

3.3 M1.6 Screws

Be very careful when tightening M1.6 screws!

3.4 Installation of TPCE210

The QMC modules have to be mounted on the TPCE210 prior to installation into the system.

Before installing a QMC module, be sure that the power supply for the TPCE210 is turned off.

The TPCE210 and QMCs are both Electrostatic Sensitive Devices (ESD). Use an anti-static mat connected to a wristband when handling or installing the components.

Make sure that the QMC has the correct orientation before mounting it on the TPCE210.

After the QMC module has been installed, it can be secured on the TPCE210 using the mounting screws that come with the TPCE210. There are four screw mounting locations per single QMC module, two at the QMC I/O connector and two at the QMC system connector.

3.5 QMC Module Installation

QMCs are protected against mis- (or reverse-) insertion by a polarization feature incorporated in the connector. By virtue of the connector's size, this feature does not withstand brute force.

QMCs are easily installed by placing them aligned with the carrier's connectors and gently pressing them onto the carrier. There is a tactile snap when the QMC has taken seat on the carrier.

The QMC can now be screwed down as needed.

3.6 QMC Module Removal

When removing the QMC from the Carrier, care must also be taken to ensure that both plugs are disconnected simultaneously and in parallel. To do this, grasp both short sides of the PCB with both hands at the tabs and carefully lift the QMC.

- Remove the screws that secure the QMC on the carrier, if needed.
- Gently and simultaneously un-plug both connectors of the QMC.

Be aware that there is the potential for damaging the QMC Module or Carrier during QMC Module extraction. Applying an unequal force to the two connectors while unplugging can cause a misalignment, which then can potentially result in damaging the connectors or boards.

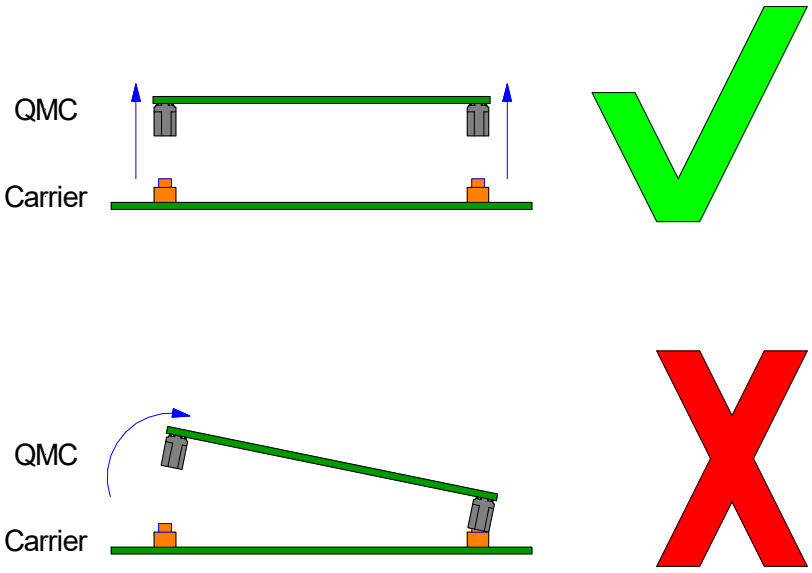


Figure 3-1 : QMC Removal

4 Terms and Definitions

4.1 Register Bit Access Types

Register Bit Access Type		Description
R	Read	The bit is readable by software (not writeable)
W	Write	The bit is writeable by software (not readable)
R/W	Read/Write	The bit is readable and writeable by software
R/C	Read/Clear	The bit is readable by software The bit is set by firmware Software may clear the bit by writing a '1'
R/S	Read/Set	The bit is readable by software Software may set this bit to '1' The bit is cleared by firmware

Table 4-1 : Register Bit Access Types

When reading reserved register bits, the read value is undefined.

For future software compatibility: For register write access, reserved bits shall be written '0'.

4.2 Signal Direction Types

Signal Direction Types as stated in Pin Assignment tables.

Signal Direction (Dir)	Description
I	TEWS card input Externally driven signal into the TEWS card
O	TEWS card output Signal driven out by TEWS card
I/O	Bi-Directional Signal
OD	TEWS card Open Drain output Signal driven low or tri-stated by TEWS card

Table 4-2 : Signal Direction Types

4.3 Style Conventions

Hexadecimal values are shown with prefix 0x (i.e. 0x029E).

Binary values are shown with prefix 0b (i.e. 0b0110).

"Active Low" signals are shown with a # suffix (i.e. RESET#).

5 QMC Interface

5.1 QMC Sites

The TPCE210 has two QMC sites. They can be used independently for two single-width QMC modules or together for one double-width QMC module. They are arranged in the following way:

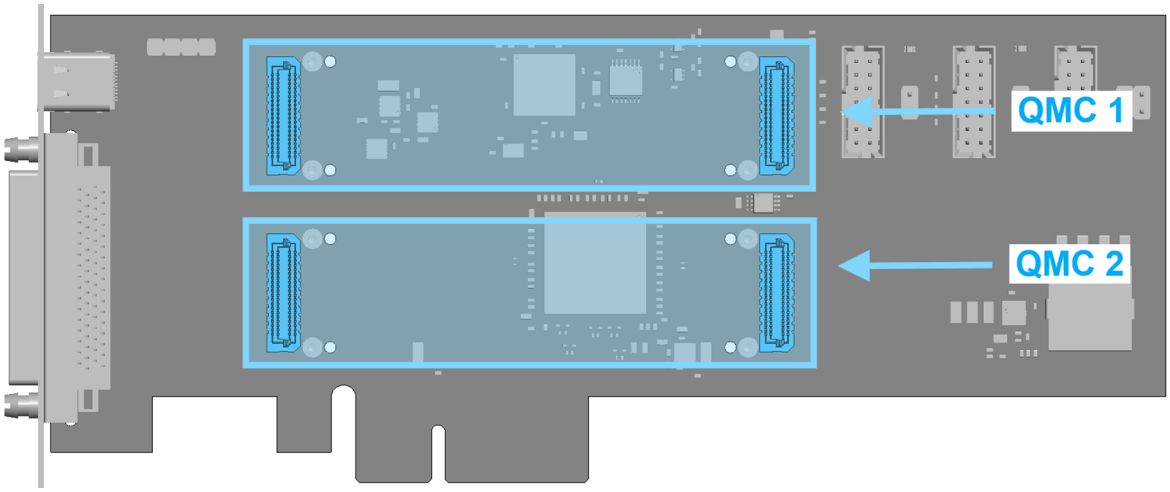


Figure 5-1 : On-board QMC sites

5.2 PCI Express Device Topology

The TPCE210 connects the PCIe x4 Link from the mainboard via a PCIe Switch to the two QMC sites, each also as x4 link.

The x4 Upstream Port of the PCIe Switch is connected to the PCIe Edge Card Connector on the mainboard.

The x4 Downstream Ports of the PCIe Switch are connected to the two QMC sites.

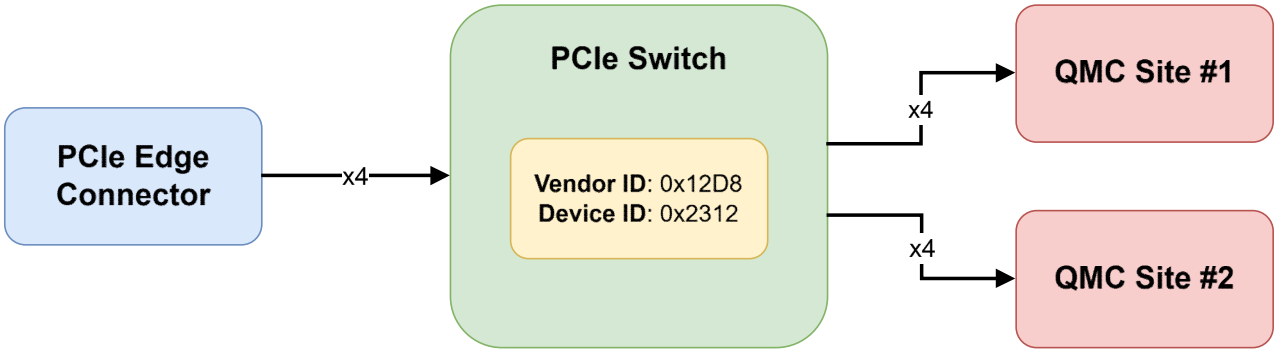


Figure 5-2 : PCI Express Device Topology

5.3 Power

The TPCE210 provides the following power supplies to each QMC site:

- 12V
- 3.3V
- 3.3V_AUX

5.3.1 Power Limits for QMC Modules

The following power limits apply to the QMC sites. Please take into consideration, that the TPCE210 uses the PCIe 12V for all its power supplies and is, therefore, limited by the amount of current that is present on the PCIe slot. This total available current is then distributed between 12V and 3.3V.

Variant	Voltage	Tolerance %	Current Limit *)
TPCE210-10R	12V	±10%	2.1 A
	3.3V	±5%	4.8A
	3.3V_AUX	±10%	20 mA

Table 5-1 : Power Limits for each QMC Site

***) System dependent:** After power-up, the PCI-Express specification limits the total power consumption of x4 PCIe Add-In Cards to 25W. This has to be taken into account for all the limits in the table. These can be lower than allowed in the QMC specification for that matter.

In principle, a QMC could draw around 30W per QMC module. Since most QMCs tend to convert the delivered power into heat, users should keep in mind that it needs appropriate system cooling solutions when such high power QMCs are used.

6 JTAG

6.1 JTAG Chains

There are three independent JTAG chains present on the TPCE210.

One JTAG chain for each QMC site and one JTAG chain for the IPMC.

TDI and TDO of the PCIe connector will be interconnected on-board to maintain system board JTAG-Chain integrity.

The pin assignments for all JTAG connectors is presented in the pin assignment chapters.

6.2 JTAG Voltage for QMC Modules

The JTAG signaling voltage level for the two QMC sites is the respective TVREF of the QMC module. This voltage is available on one pin of the QMC modules JTAG connector. See the Pin Assignment chapter for details.

Take care to use a programmer that matches the QMC's JTAG voltage level or a programmer that automatically adjusts to the QMC's JTAG voltage level.

6.3 JTAG Voltage for IPMC

The JTAG signaling voltage level for the IPMC is 3.3V.

7 USB

For more information about the USB-C connector in the front panel of the TPCE210 and the possibilities it provides to the TPCE210, please refer to the IPMC User Manual.

8 Indicators

8.1 LED Indicators

The TPCE210 provides two QMC-present LEDs as shown below.

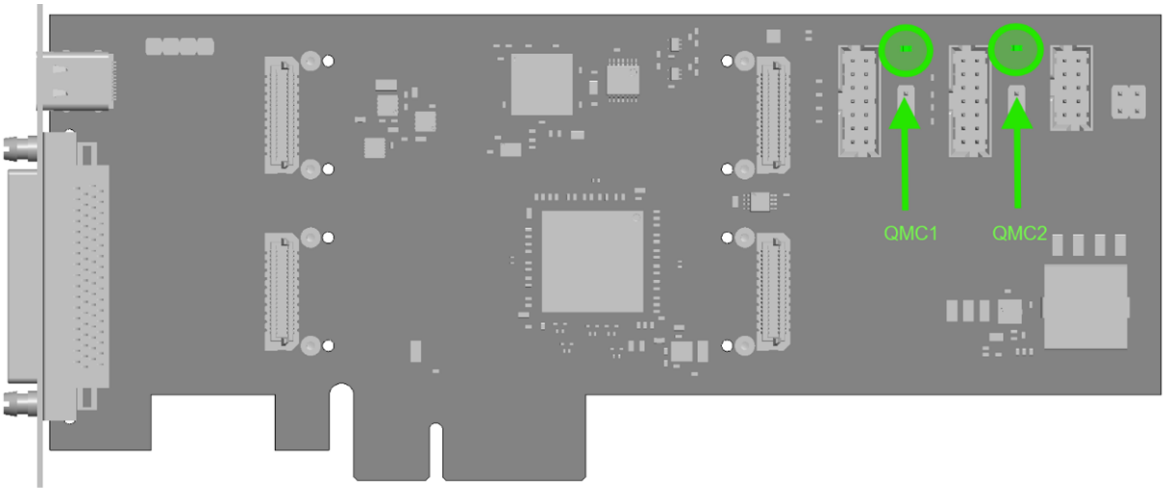


Figure 8-1 : On-board LED Placement

LED		Color	State	Description
QMC 1	QMC 1 Present	Green	Off	No QMC module present in Site 1
			On	QMC module present in Site 1
QMC 2	QMC 2 Present	Green	Off	No QMC module present in Site 2
			On	QMC module present in Site 2

Table 8-1 : On-board LED Description

9 I/O Interface Description

9.1 Front I/O Connector

9.1.1 Pin Assignment

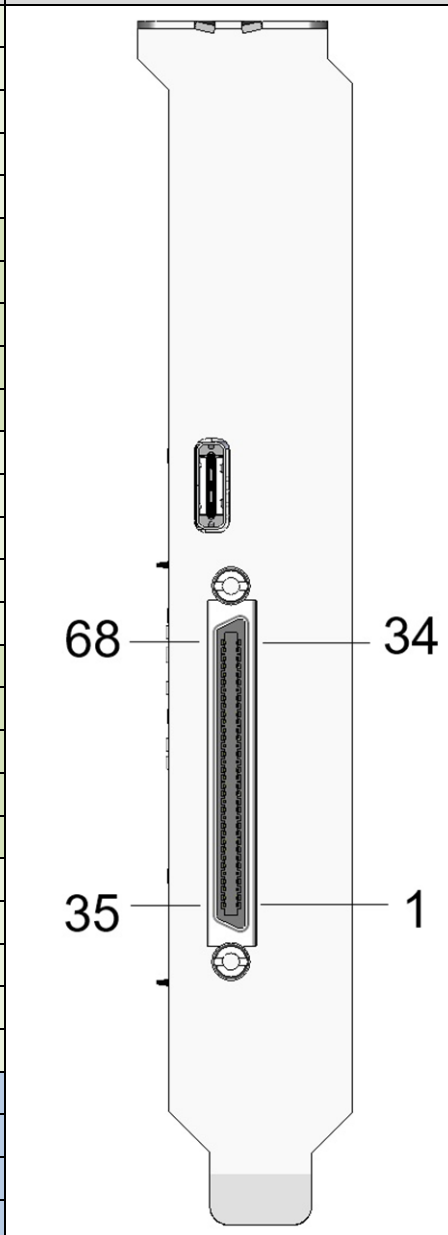
Signal	Pin		Pin	Signal
QMC1_IO01_A-	68		34	QMC1_IO01_A+
QMC1_IO01_B-	67		33	QMC1_IO01_B+
QMC1_IO01_C-	66		32	QMC1_IO01_C+
QMC1_IO01_D-	65		31	QMC1_IO01_D+
GND_1	64		30	GND_1
QMC1_IO02_A-	63		29	QMC1_IO02_A+
QMC1_IO02_B-	62		28	QMC1_IO02_B+
QMC1_IO02_C-	61		27	QMC1_IO02_C+
QMC1_IO02_D-	60		26	QMC1_IO02_D+
GND_2	59		25	GND_2
QMC1_IO03_A-	58		24	QMC1_IO03_A+
QMC1_IO03_B-	57		23	QMC1_IO03_B+
QMC1_IO03_C-	56		22	QMC1_IO03_C+
QMC1_IO03_D-	55		21	QMC1_IO03_D+
GND_3	54		20	GND_3
QMC1_IO04_A-	53		19	QMC1_IO04_A+
QMC1_IO04_B-	52		18	QMC1_IO04_B+
QMC1_IO04_C-	51		17	QMC1_IO04_C+
QMC1_IO04_D-	50		16	QMC1_IO04_D+
GND_4	49		15	GND_4
QMC1_IO05_A-	48		14	QMC1_IO05_A+
QMC1_IO05_B-	47		13	QMC1_IO05_B+
QMC1_IO05_C-	46		12	QMC1_IO05_C+
QMC1_IO05_D-	45		11	QMC1_IO05_D+
GND_5	44		10	GND_5
QMC2_IO01_A-	43		9	QMC2_IO01_A+
QMC2_IO01_B-	42		8	QMC2_IO01_B+
QMC2_IO01_C-	41		7	QMC2_IO01_C+
QMC2_IO01_D-	40		6	QMC2_IO01_D+
GND_7	39		5	GND_6
QMC2_IO02_A-	38		4	QMC2_IO02_A+
QMC2_IO02_B-	37		3	QMC2_IO02_B+
QMC2_IO02_C-	36		2	QMC2_IO02_C+
QMC2_IO02_D-	35		1	QMC2_IO02_D+

Table 9-1 : Front I/O Connector Pin Assignment

9.1.2 Connector Type

Pin-Count	68
Connector Type	VHDCI68 Connector
Source & Order Info	Honda Connectors HDRA-EC68LFDT-SL+ or compatible

Table 9-2 : Front I/O Connector Type

9.2 QMC1 JTAG Connector

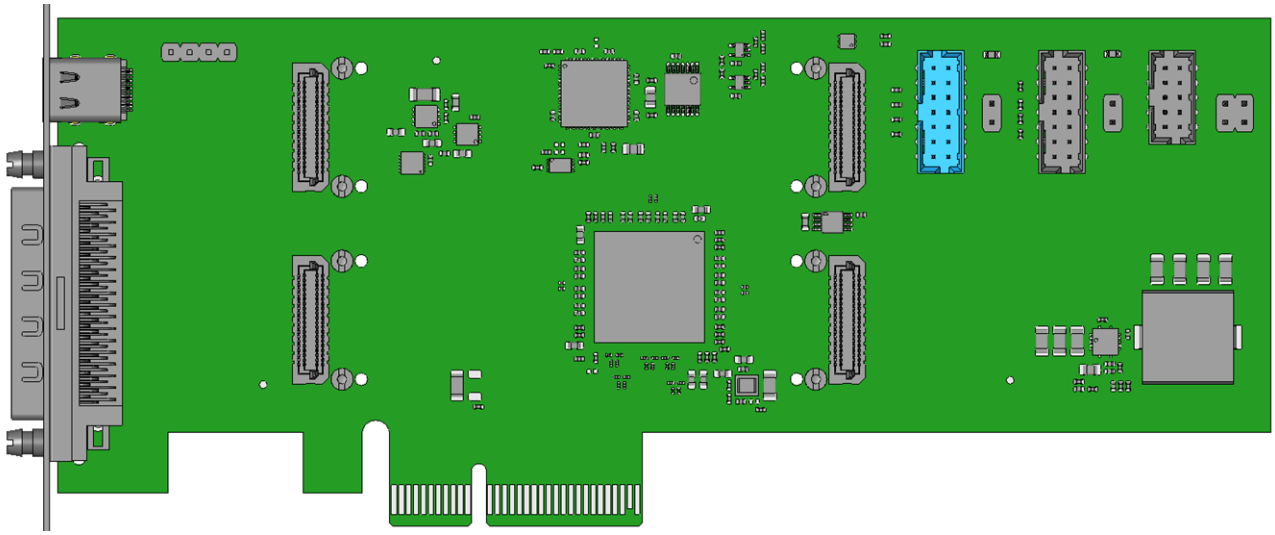


Figure 9-1 : QMC1 JTAG Connector Placement

9.2.1 Pin Assignment

All pins are described from the perspective of the QMC module.

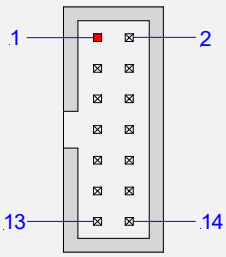
Signal	Pin	Connector View	Pin	Signal
-	**1**		2	QMC2_TVREF
GND	**3**		4	TMS
GND	**5**		6	TCK
GND	**7**		8	TDO
GND	**9**		10	TDI
GND	**11**		12	-
-	**13**		14	-

Table 9-3 : QMC1 JTAG Connector Pin Assignment

9.2.2 Connector Type

Pin-Count	14
Connector Type	2 mm Shrouded Header Connector
Source & Order Info	MOLEX 87832-142 or compatible

Table 9-4 : QMC1 JTAG Connector Type

9.3 QMC1 I2C Connector

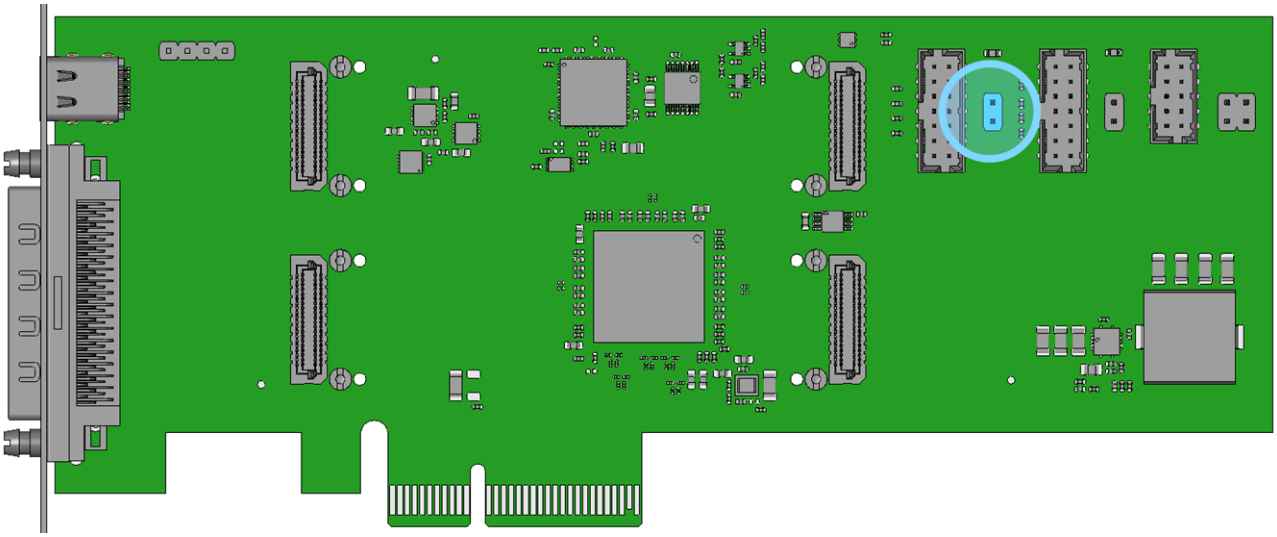


Figure 9-2 : QMC1 I2C Connector Placement

9.3.1 Pin Assignment

All pins are described from the perspective of the QMC module.

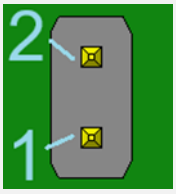
Signal	Pin	Connector View
SDA	**2**	
SCL	**1**	

Table 9-5 : QMC1 I2C Connector Pin Assignment

9.3.2 Connector Type

Pin-Count	2
Connector Type	2.54 mm Header
Source & Order Info	

Table 9-6 : QMC1 I2C Connector Type

9.4 QMC2 JTAG Connector

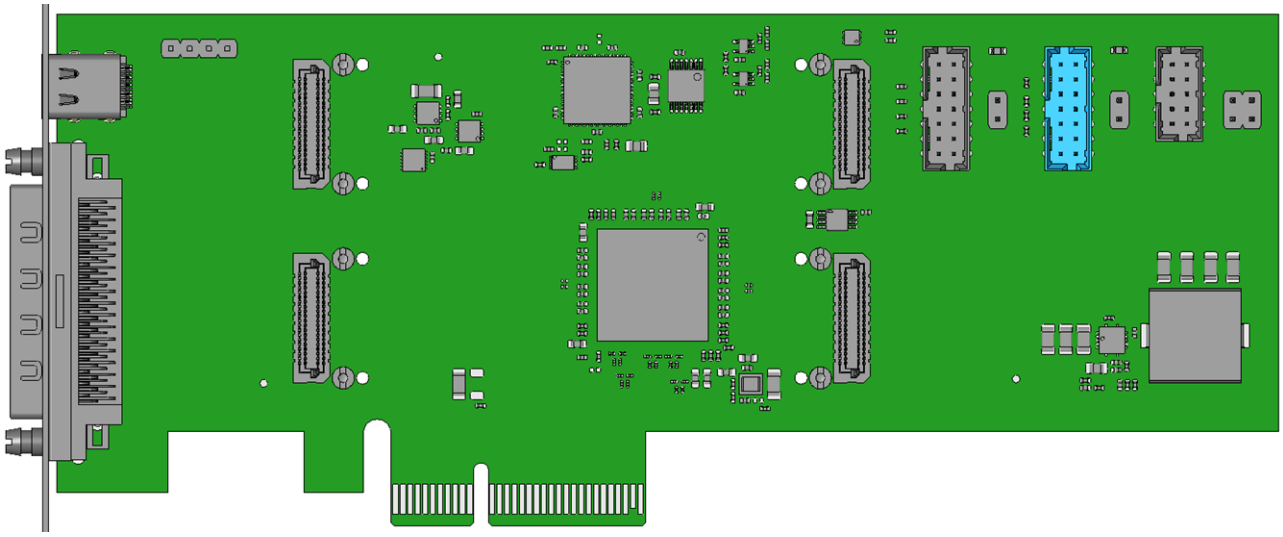


Figure 9-3 : QMC2 JTAG LED Placement

9.4.1 Pin Assignment

All pins are described from the perspective of the QMC module.

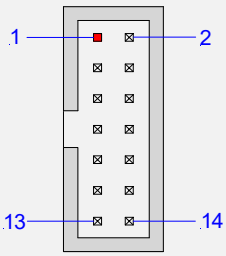
Signal	Pin	Connector View	Pin	Signal
-	**1**		2	QMC2_TVREF
GND	**3**		4	TMS
GND	**5**		6	TCK
GND	**7**		8	TDO
GND	**9**		10	TDI
GND	**11**		12	-
-	**13**		14	-

Table 9-7 : QMC2 JTAG Connector Pin Assignment

9.4.2 Connector Type

Pin-Count	14
Connector Type	2 mm Shrouded Header Connector
Source & Order Info	MOLEX 87832-142 or compatible

Table 9-8 : QMC2 JTAG Connector Type

9.5 QMC2 I2C Connector

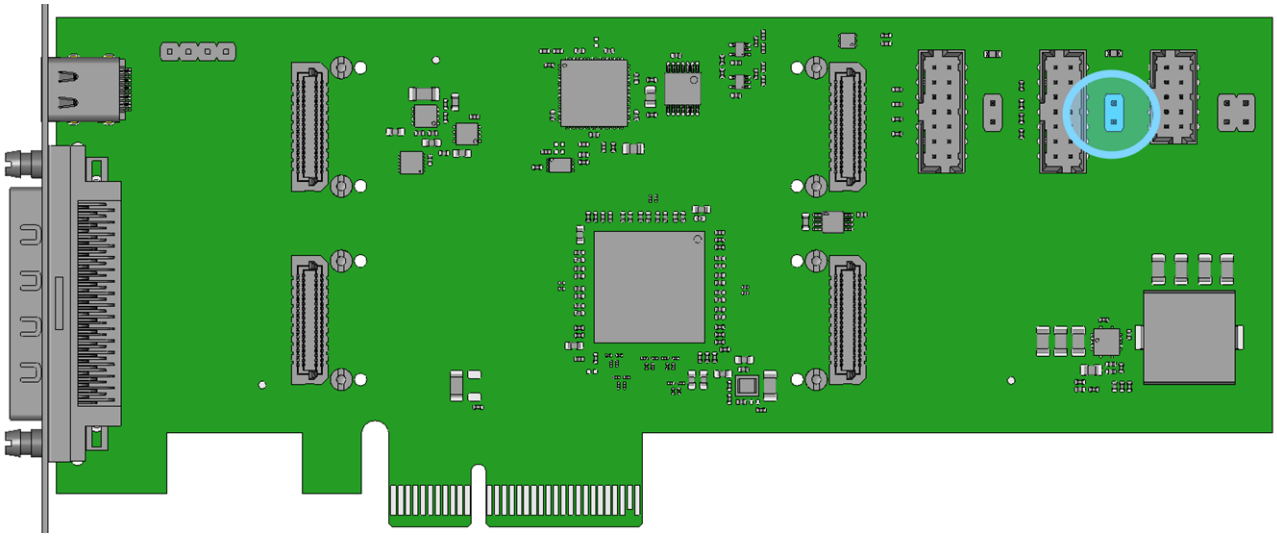


Figure 9-4 : QMC2 I2C Connector Placement

9.5.1 Pin Assignment

All pins are described from the perspective of the QMC module.

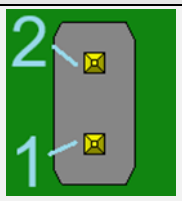
Signal	Pin	Connector View
SDA	**2**	
SCL	**1**	

Table 9-9 : QMC2 I2C Connector Pin Assignment

9.5.2 Connector Type

Pin-Count	2
Connector Type	2.54 mm Header
Source & Order Info	

Table 9-10 : QMC2 I2C Connector Type

9.6 ATxMega IPMC JTAG Connector

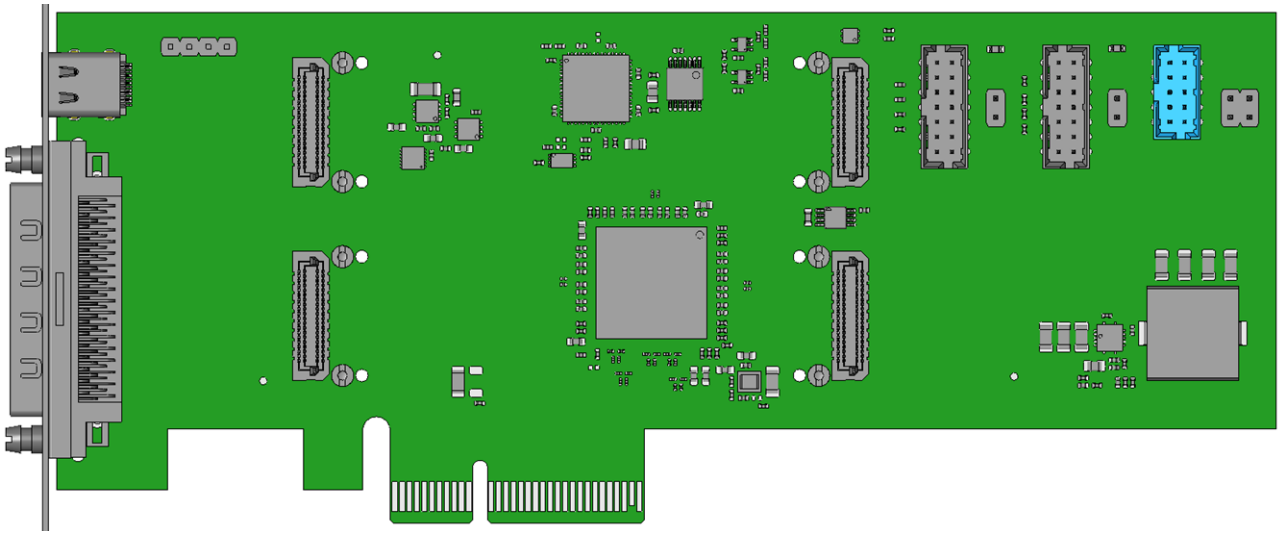


Figure 9-5 : ATxMega JTAG Connector Placement

9.6.1 Pin Assignment

All pins are described from the perspective of the QMC module.

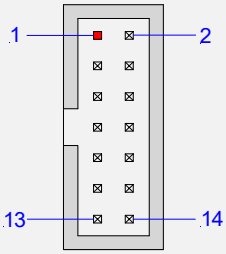
Signal	Pin	Connector View	Pin	Signal
-	**1**		2	QMC2_TVREF
GND	**3**		4	TMS
GND	**5**		6	TCK
GND	**7**		8	TDO
GND	**9**		10	TDI
GND	**11**		12	-
-	**13**		14	-

Table 9-11 : ATxMega JTAG Connector Pin Assignment

9.6.2 Connector Type

Pin-Count	10
Connector Type	2 mm Shrouded Header Connector
Source & Order Info	MOLEX 87832-102 or compatible

Table 9-12 : ATxMega JTAG Connector Type

9.7 ATxMega I2C+NVMRO Connector

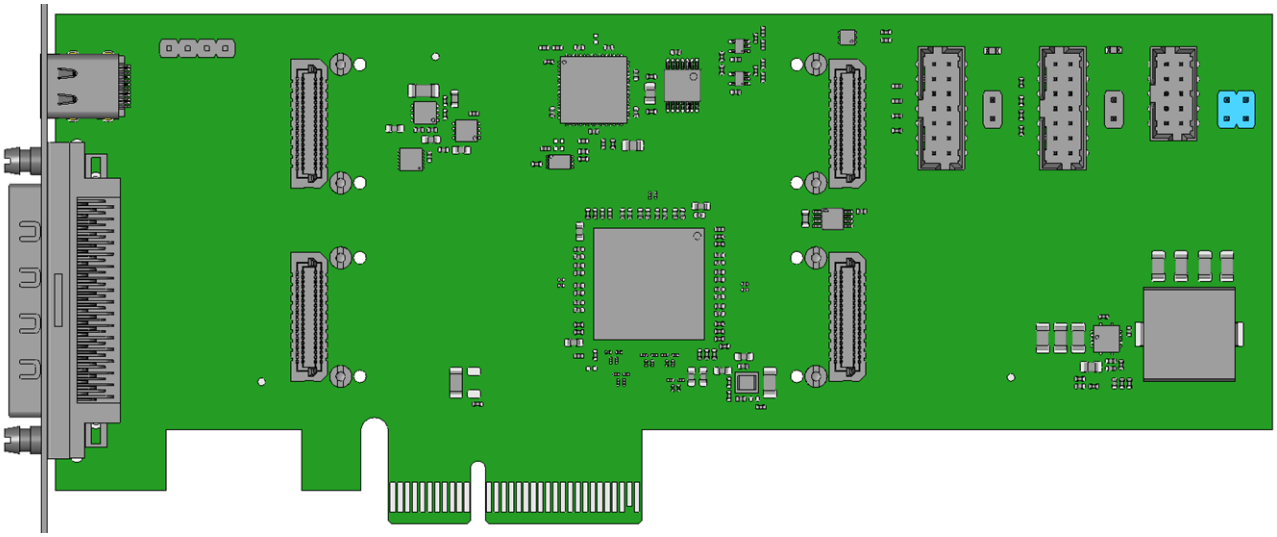


Figure 9-6 : ATxMega I2C+NVMRO Placement

9.7.1 Pin Assignment

All pins are described from the perspective of the QMC module.

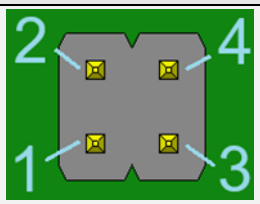
Signal	Pin	Connector View	Pin	Signal
SDA	**2**		4	SCL
GND	**1**		3	NVMRO

Table 9-13 : ATxMega I2C+NVMRO Connector Pin Assignment

9.7.2 Connector Type

Pin-Count	4
Connector Type	2.54 mm Header
Source & Order Info	

Table 9-14 : ATxMega I2C+NVMRO Connector Type

9.8 ATxMega USB-C Connector

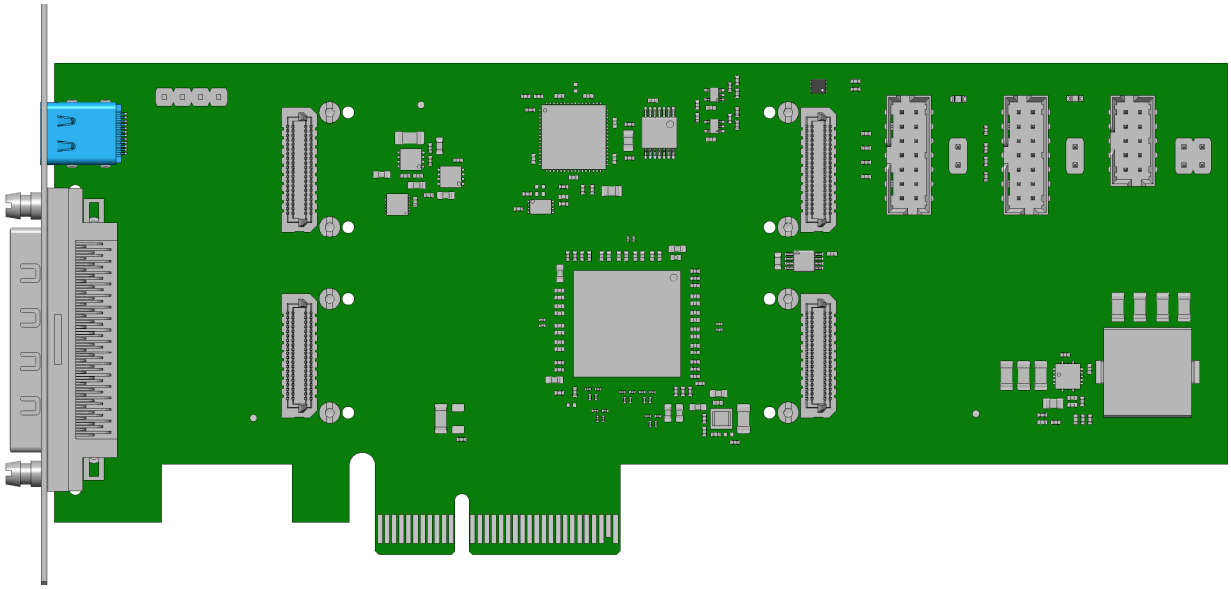


Figure 9-7 : ATxMega USB-C Connector Placement

9.8.1 Pin Assignment & Connector Type

The USB-C connection on the TPCE210 uses only the data lines and the 5V supply pins.

9.8.2 Connector Type

Pin-Count	24 (only data lines used)
Connector Type	USB-C receptacle
Source & Order Info	Würth 632723300011 or compatible

Table 9-15 : ATxMega USB-C Connector Type

9.9 ATxMega USB 4-Pin Connector

The 4-pin USB connector is connected to the same signals as the front panel USB-C connector, it is only another possibility to connect to the ATxMega via USB.

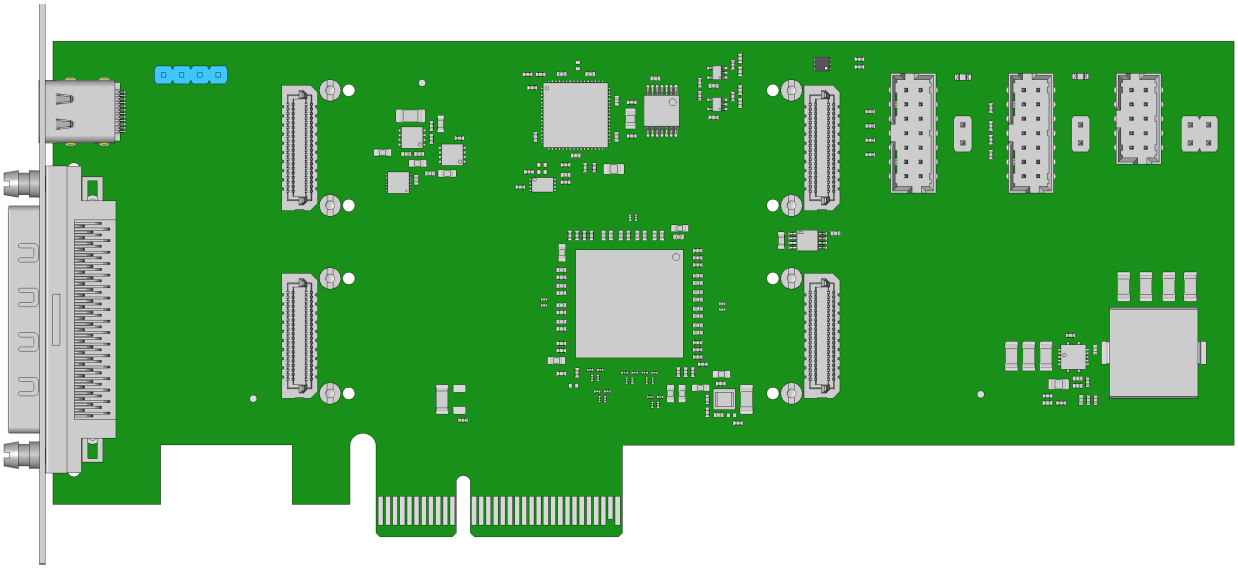


Figure 9-8 : ATxMega USB 4-Pin Connector Placement

9.9.1 Pin Assignment

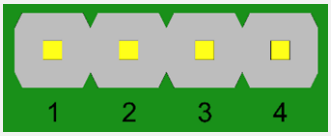
Signal	Pin	Connector View
5V_USB	**1**	
USB_D-	**2**	
USB_D+	**3**	
GND	**4**	

Table 9-16 : ATxMega USB 4-Pin Connector Pin Assignment

9.9.2 Connector Type

Pin-Count	4 (1-row)
Connector Type	2.54 mm Header
Source & Order Info	

Table 9-17 : ATxMega USB 4-Pin Connector Type