

The Embedded I/O Company



TPCE278

PCI Express x4, Gen3 XMC Carrier

Version 1.0

User Manual

Issue 1.0.1

June 2016

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

TPCE278-10R

PCI Express x4 Carrier for one XMC module, +12V Power Supply from PCIe Connector, 12V VPWR, J14 I/O, J16 I/O, JTAG connections to XMC module via 10-pin header

TPCE278-11R

PCI Express x4 Carrier for one XMC module, +12V Power Supply from PCIe Connector, 5V VPWR, J14 I/O, J16 I/O, JTAG connections to XMC module via 10-pin header

TPCE278-20R

PCI Express x4 Carrier for one XMC module, +12V power supply from external PCIe graphics power connector used (cable adapter enclosed in order), 12V VPWR, J14 I/O, J16 I/O, JTAG connections to XMC module via 10-pin header

TPCE278-21R

PCI Express x4 Carrier for one XMC module, +12V power supply from external PCIe graphics power connector used (cable adapter enclosed in order), 5V VPWR, J14 I/O, J16 I/O, JTAG connections to XMC module via 10-pin header

This document contains information, which is proprietary to TEWS TECHNOLOGIES GmbH. Any reproduction without written permission is forbidden.

TEWS TECHNOLOGIES GmbH has made any effort to ensure that this manual is accurate and complete. However TEWS TECHNOLOGIES GmbH reserves the right to change the product described in this document at any time without notice.

TEWS TECHNOLOGIES GmbH is not liable for any damage arising out of the application or use of the device described herein.

Style Conventions

Hexadecimal characters are specified with prefix 0x, i.e. 0x029E (that means hexadecimal value 029E).

For signals on hardware products, an 'Active Low' is represented by the signal name with # following, i.e. IP_RESET#.

Access terms are described as:

| | |
|-----|------------|
| W | Write Only |
| R | Read Only |
| R/W | Read/Write |
| R/C | Read/Clear |
| R/S | Read/Set |

©2016 by TEWS TECHNOLOGIES GmbH

All trademarks mentioned are property of their respective owners.

| Issue | Description | Date |
|-------|--|------------|
| 1.0.0 | Initial Issue | March 2016 |
| 1.0.1 | - Added the mating connector part number for X4 (Tyco 0.050 x 0.100 AMPMODU System 50) | June 2016 |
| | | |

Table of Contents

| | | |
|----------|---|-----------|
| 1 | PRODUCT DESCRIPTION | 6 |
| 2 | TECHNICAL SPECIFICATION | 7 |
| 3 | HANDLING AND OPERATING INSTRUCTIONS | 8 |
| 3.1 | ESD Protection | 8 |
| 3.2 | Power Limits for XMC Modules | 8 |
| 3.3 | Installation of XMC Modules | 8 |
| 3.4 | Installation of TPCE278-2xR | 8 |
| 3.5 | Installation of TPCE278-x0R | 8 |
| 4 | XMC INTERFACE | 9 |
| 4.1 | Power Limits for XMC Modules | 9 |
| 4.2 | Stable Power Supply..... | 9 |
| 4.3 | Installation of an XMC Module..... | 9 |
| 5 | INDICATORS | 10 |
| 5.1 | LED Indicators..... | 10 |
| 6 | PIN ASSIGNMENTS | 11 |
| 6.1 | XMC J15 | 11 |
| 6.2 | XMC J14 | 12 |
| 6.3 | XMC J16 | 13 |
| 6.4 | X4 - VG64 Connector (XMC J14 Rear-I/O)..... | 14 |
| 6.5 | X5/X6 - Samtec High-Speed Connectors (XMC J16 Rear-I/O) | 15 |
| 6.5.1 | X5 - QTH-DP I/O Connector #1 | 15 |
| 6.5.2 | X6 – QTH-DP I/O Connector #2 | 16 |
| 6.6 | X7 - 10-Pin JTAG Header | 17 |

List of Figures

| | |
|---|----|
| FIGURE 1-1 : TPCE278 BLOCK DIAGRAM | 6 |
| FIGURE 5-1 : ON-BOARD LED PLACEMENT | 10 |

List of Tables

| | |
|--|----|
| TABLE 2-1 : TECHNICAL SPECIFICATION | 7 |
| TABLE 4-1 : CURRENT LIMITS FOR THE XMC MODULES | 9 |
| TABLE 5-1 : ON-BOARD LED DESCRIPTION | 10 |
| TABLE 6-1 : XMC J15 PIN ASSIGNMENT | 11 |
| TABLE 6-3 : XMC J14 I/O PIN ASSIGNMENT | 12 |
| TABLE 6-2 : XMC J16 I/O PIN ASSIGNMENT | 13 |
| TABLE 6-3 : X4 - J14 I/O PIN ASSIGNMENT | 14 |
| TABLE 6-4 : X5 - QTH-DP I/O CONNECTOR #1 | 15 |
| TABLE 6-5 : X6 - QTH-DP I/O CONNECTOR #2 | 16 |
| TABLE 6-5 : X7 - JTAG HEADER | 17 |

1 Product Description

The TPCE278 is a standard height PCI Express Revision 3.0 compatible module that provides one slot for a single-width XMC module 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 TPCE278 is a versatile solution to upgrade well known XMC I/O solutions to the PCI Express signalling standard.

The PCI Express x4 link from the host board to the XMC module is enhanced by a PCIe Gen3 Redriver, allowing safe operation of XMC modules on PCIe mainboards.

VPWR is selectable via order option. The TPCE278-x0R variants provide 12V VPWR and the TPCE278-x1R order options provide 5V VPWR.

The TPCE278 supports XMC front panel I/O, and also P14 and P16 rear I/O independently.

XMC P14 rear I/O is provided through a Tyco AMPMODU System 50 0.050x0.100 flat ribbon cable connector. The I/O lines are routed differentially.

XMC P16 rear I/O is implemented through two Samtec QTH-DP 0.50mm Q Pairs® High Speed Ground Plane Socket Strip, Differential Pair connector providing access to all P16 I/O lines.

The PCIe edge card connector provides +12V and +3.3V. The TPCE278-1xR uses the +12V of the PCIe edge card connector to generate all power supply voltages for the XMC slot (+3.3V, VPWR and +12V).

According to the PCIe specification, a PCIe x4 card is allowed to use 25W on the +12V which allows to operate most of the available XMC modules on the TPCE278-1xR. For increased power requirements of an XMC module, the TPCE278-2xR offer a PCIe Graphics Power Connector to supply the +12V for generating all the power supply voltages for the XMC slot providing power of up to 75W.

A 10-pin JTAG header is available for XMC module debugging purposes. All five JTAG signals are routed directly to the XMC slot.

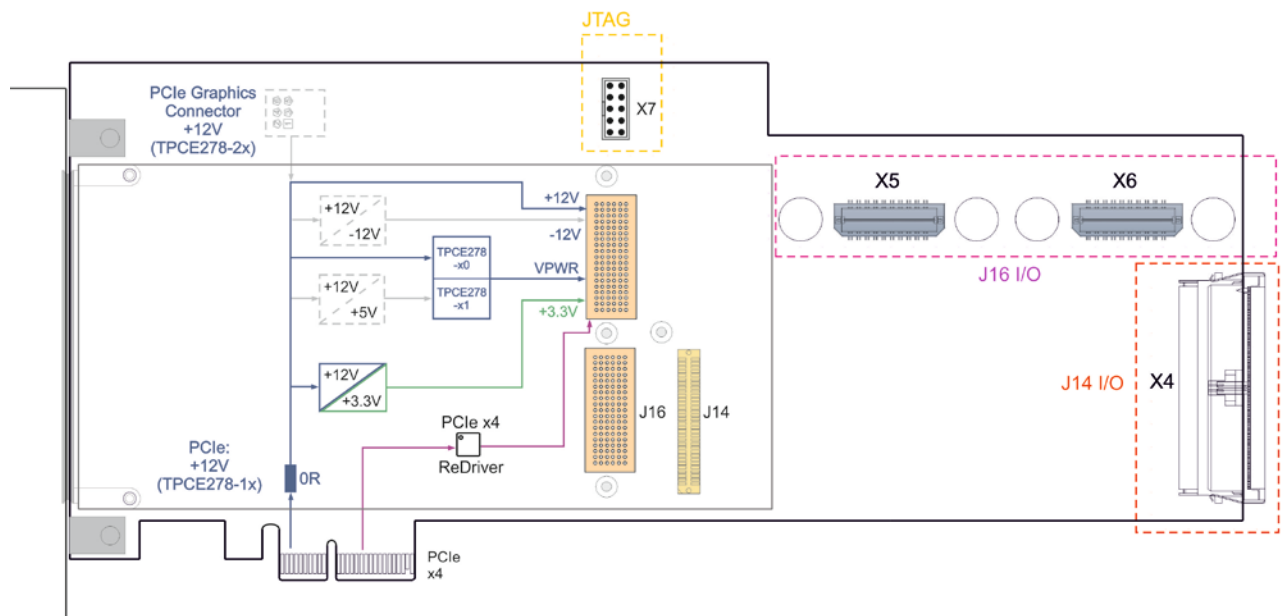


Figure 1-1 : TPCE278 Block Diagram

2 Technical Specification

| Mechanical and Electrical Interfaces | |
|--------------------------------------|---|
| PCI Express | PCI Express x4, Revision 3.0 Standard Height Full Length |
| XMC Slot | ANSI/VITA 42.0-2008 (R2014) ANSI/VITA 42.3-2006 (R2014) Single-Width |
| XMC Interface | |
| Number of XMC Slots | 1 |
| XMC I/O Access | XMC Front Panel I/O XMC P14 Rear I/O through Tyco AMPMODU System 50 0.050x0.100 flat ribbon cable XMC P16 Rear I/O through Samtec QTH-DP 0.50mm Q Pairs® High Speed Ground Plane Socket Strip, Differential Pair connector Maximum Current for all Rear I/O Lines is 0.5A! |
| On-Board Devices | |
| PCI Express ReDriver | DS80PCI402 (Texas Instruments) |
| Physical Data | |
| Power Requirements | 15mA maximum @ +3.3V DC 80mA maximum @ +12V DC Additional power is required by the XMC Module! |
| Power Stable for XMC Slot | The power supply for the XMC slot is stable approximately 5ms after the system power supply is stable. |
| Maximum Power for XMC Slot | The maximum power available for an XMC module is variant dependent. Please see chapter "Power Limits for XMC Modules" for detailed information. |
| Temperature Range | Operating -40°C to +85°C Storage -40°C to +85°C |
| MTBF | TPCE278-10R: 564000h TPCE278-11R: 551000h TPCE278-20R: 505000h TPCE278-21R: 494000h 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 | TPCE278-10R: 125 g TPCE278-11R: 129 g TPCE278-20R: 127 g TPCE278-21R: 131 g |

Table 2-1 : Technical Specification

3 Handling and Operating Instructions

3.1 ESD Protection



The TPCE278 is sensitive to static electricity. Packing, unpacking and all other handling of the TPCE278 has to be done in an ESD/EOS protected Area.

3.2 Power Limits for XMC Modules



The PCIe specification limits the power for PCIe add-in cards. These limitations have implications for the use of XMC modules. Refer to the chapter “Power Limits for XMC Modules” for details.

3.3 Installation of XMC Modules



Before mounting XMC Modules on the TPCE278, be sure that the system is powered off. Also, follow the installation instructions in the “XMC Interface” chapter.

3.4 Installation of TPCE278-2xR



For the TPCE278-2xR variants, it is imperative to always connect a PCI Express VGA power connector to the TPCE278, even if no PMC is mounted.

3.5 Installation of TPCE278-x0R



For the TPCE278-x0R variants, VPWR is +12V. This voltage is directly connected from the PCIe connector. The PCIe specification allows for tolerances of $\pm 8\%$, whereas the XMC specification allows only for $\pm 5\%$.

This has to be taken into consideration before plugging the XMC module onto the TPCE278-x0R.

4 XMC Interface

4.1 Power Limits for XMC Modules

The following current limits have to be taken into account when choosing the appropriate TPCE278 for the power requirements of the XMC module.

| TPCE278 | Voltage | | Current Limits |
|-------------|---------|-------------------|----------------|
| TPCE278-xxR | 3.3V | | 7.5 A |
| | VPWR | 5V (TPCE278-x1R) | 5.0 A |
| | | 12V (TPCE278-x0R) | 2.1 A |
| | +12V | | 200 mA |
| | -12V | | 200 mA |

Table 4-1 : Current Limits for the XMC Modules

4.2 Stable Power Supply

The power supply for the XMC slot is stable approximately 5ms after the system power supply is stable.

4.3 Installation of an XMC Module

The XMC modules are mounted to the TPCE278 prior to installation into the system.

Before installing an XMC module, be sure that the power supply for the TPCE278 is turned off.

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

If the XMC has a front panel, first remove the cover from the XMC front panel cut-out of the TPCE278. Install the XMC at an angle so that the XMC front panel penetrates the XMC front panel cut-out. Then rotate down to mate with the XMC connectors on the TPCE278. If the XMC has no front panel, simply plug in the XMC, and leave the cover in the XMC front panel cut-out of the TPCE278.

After the XMC module has been installed, it can be mounted on the TPCE278 using the mounting screws that come with the XMC module. There are four screw mounting locations, two at the XMC front panel and two at the standoffs near the XMC bus connectors.

5 Indicators

5.1 LED Indicators

The TPCE278 provides a couple of board-status LEDs as shown below.

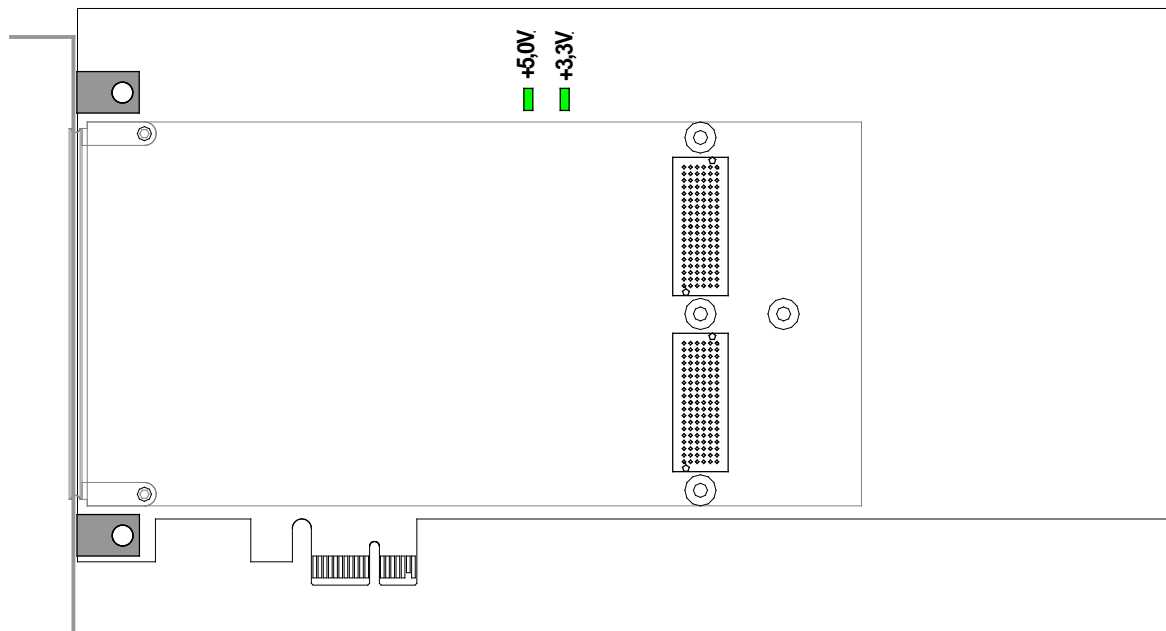


Figure 5-1 : On-board LED Placement

| LED | | Color | State | Description |
|-------|--------------------|-------|-------|-----------------------------|
| +3.3V | 3.3V Power Good | Green | Off | 3.3V Power Supply is not OK |
| | | | On | 3.3V Power Supply is OK |
| +5.0V | 5.0V Power Good *) | Green | Off | 5.0V Power Supply is not OK |
| | | | On | 5.0V Power Supply is OK |

Table 5-1 : On-board LED Description

*) Only for VPWR = 5V variants

6 Pin Assignments

6.1 XMC J15

| | A | B | C | D | E | F |
|----|----------|----------|------------------------|---------------------|----------------------|---------------------|
| 01 | PET0p0 | PET0n0 | 3.3V | PET0p1 | PET0n1 | VPWR |
| 02 | GND | GND | TRST ¹⁾ | GND | GND | PERST# |
| 03 | PET0p2 | PET0n2 | 3.3V | PET0p3 | PET0n3 | VPWR |
| 04 | GND | GND | TCK ¹⁾ | GND | GND | |
| 05 | | | 3.3V | | | VPWR |
| 06 | GND | GND | TMS ¹⁾ | GND | GND | +12V |
| 07 | | | 3.3V | | | VPWR |
| 08 | GND | GND | TDI ¹⁾ | GND | GND | -12V |
| 09 | | | | | | VPWR |
| 10 | GND | GND | TDO ¹⁾ | GND | GND | GA0 |
| 11 | PER0p0 | PER0n0 | | PER0p1 | PER0n1 | VPWR |
| 12 | GND | GND | GA1 | GND | GND | |
| 13 | PER0p2 | PER0n2 | 3.3V_AUX ²⁾ | PER0p3 | PER0n3 | VPWR |
| 14 | GND | GND | GA2 | GND | GND | SMCLK ⁶⁾ |
| 15 | | | | | | VPWR |
| 16 | GND | GND | MVMRO ³⁾ | GND | GND | SMDAT ⁶⁾ |
| 17 | | | | | | |
| 18 | GND | GND | | GND | GND | |
| 19 | REFCLK+0 | REFCLK-0 | | WAKE# ⁴⁾ | ROOT0# ⁵⁾ | |

Table 6-1 : XMC J15 Pin Assignment

Notes:

- 1) JTAG lines are routed to a 10pin header on-board, not to the PCIe edge card connector
- 2) 3.3V_AUX is connected to the PCIe edge card connector, so it is up to the mainboard to deliver this power supply. If a mainboard does not provide this power supply, it can be changed to 3.3V on the TPCE278 with a resistor.
- 3) MVMRO is set to logic high by default, prohibiting write access. It can be changed via a resistor.
- 4) WAKE# is connected to the PCIe edge card connector, so it is up to the mainboard to provide for this signal. If this is not the case, WAKE# may be separated from the mainboard via a resistor.
- 5) ROOT# is not supported; this pin is not connected on the TPCE278 by default. It can be pulled high via a resistor.
- 6) SMCLK and SMDAT are not connected to the PCIe edge card connector by default. Both signals can be connected via series resistors.

6.2 XMC J14

| Signal | Pin | | Pin | Signal |
|------------|-----|--|-----|------------|
| XMC I/O 1 | 1 | | 2 | XMC I/O 2 |
| XMC I/O 3 | 3 | | 4 | XMC I/O 4 |
| XMC I/O 5 | 5 | | 6 | XMC I/O 6 |
| XMC I/O 7 | 7 | | 8 | XMC I/O 8 |
| XMC I/O 9 | 9 | | 10 | XMC I/O 10 |
| XMC I/O 11 | 11 | | 12 | XMC I/O 12 |
| XMC I/O 13 | 13 | | 14 | XMC I/O 14 |
| XMC I/O 15 | 15 | | 16 | XMC I/O 16 |
| XMC I/O 17 | 17 | | 18 | XMC I/O 18 |
| XMC I/O 19 | 19 | | 20 | XMC I/O 20 |
| XMC I/O 21 | 21 | | 22 | XMC I/O 22 |
| XMC I/O 23 | 23 | | 24 | XMC I/O 24 |
| XMC I/O 25 | 25 | | 26 | XMC I/O 26 |
| XMC I/O 27 | 27 | | 28 | XMC I/O 28 |
| XMC I/O 29 | 29 | | 30 | XMC I/O 30 |
| XMC I/O 31 | 31 | | 32 | XMC I/O 32 |
| XMC I/O 33 | 33 | | 34 | XMC I/O 34 |
| XMC I/O 35 | 35 | | 36 | XMC I/O 36 |
| XMC I/O 37 | 37 | | 38 | XMC I/O 38 |
| XMC I/O 39 | 39 | | 40 | XMC I/O 40 |
| XMC I/O 41 | 41 | | 42 | XMC I/O 42 |
| XMC I/O 43 | 43 | | 44 | XMC I/O 44 |
| XMC I/O 45 | 45 | | 46 | XMC I/O 46 |
| XMC I/O 47 | 47 | | 48 | XMC I/O 48 |
| XMC I/O 49 | 49 | | 50 | XMC I/O 50 |
| XMC I/O 51 | 51 | | 52 | XMC I/O 52 |
| XMC I/O 53 | 53 | | 54 | XMC I/O 54 |
| XMC I/O 55 | 55 | | 56 | XMC I/O 56 |
| XMC I/O 57 | 57 | | 58 | XMC I/O 58 |
| XMC I/O 59 | 59 | | 60 | XMC I/O 60 |
| XMC I/O 61 | 61 | | 62 | XMC I/O 62 |
| XMC I/O 63 | 63 | | 64 | XMC I/O 64 |

Table 6-2 : XMC J14 I/O Pin Assignment

6.3 XMC J16

| | A | B | C | D | E | F |
|----|-------|-------|--------|-------|-------|--------|
| 01 | DP00+ | DP00- | UD_C01 | DP01+ | DP01- | UD_F01 |
| 02 | GND | GND | UD_C02 | GND | GND | UD_F02 |
| 03 | DP02+ | DP02- | UD_C03 | DP03+ | DP03- | UD_F03 |
| 04 | GND | GND | UD_C04 | GND | GND | UD_F04 |
| 05 | DP04+ | DP04- | UD_C05 | DP05+ | DP05- | UD_F05 |
| 06 | GND | GND | UD_C06 | GND | GND | UD_F06 |
| 07 | DP06+ | DP06- | UD_C07 | DP07+ | DP07- | UD_F07 |
| 08 | GND | GND | UD_C08 | GND | GND | UD_F08 |
| 09 | DP08+ | DP08- | UD_C09 | DP09+ | DP09- | UD_F09 |
| 10 | GND | GND | UD_C10 | GND | GND | UD_F10 |
| 11 | DP10+ | DP10- | UD_C11 | DP11+ | DP11- | UD_F11 |
| 12 | GND | GND | UD_C12 | GND | GND | UD_F12 |
| 13 | DP12+ | DP12- | UD_C13 | DP13+ | DP13- | UD_F13 |
| 14 | GND | GND | UD_C14 | GND | GND | UD_F14 |
| 15 | DP14+ | DP14- | UD_C15 | DP15+ | DP15- | UD_F15 |
| 16 | GND | GND | UD_C16 | GND | GND | UD_F16 |
| 17 | DP16+ | DP16- | UD_C17 | DP17+ | DP17- | UD_F17 |
| 18 | GND | GND | UD_C18 | GND | GND | UD_F18 |
| 19 | DP18+ | DP18- | UD_C19 | DP19+ | DP19- | UD_F19 |

Table 6-3 : XMC J16 I/O Pin Assignment

6.4 X4 - VG64 Connector (XMC J14 Rear-I/O)

The TPCE278 routes the XMC I/O lines to one 68-pin flat cable connector. The actual signal assignment of the XMC P14 connector is XMC specific.

| | |
|--------------------------------|--------------------------------------|
| Connector Type | Tyco 0.050 x 0.100 AMPMODU System 50 |
| Source & Order Info | Tyco Part-No.: 6-104069-8 |
| Mating Connector | Tyco Part-No.: 3-111196-4 |

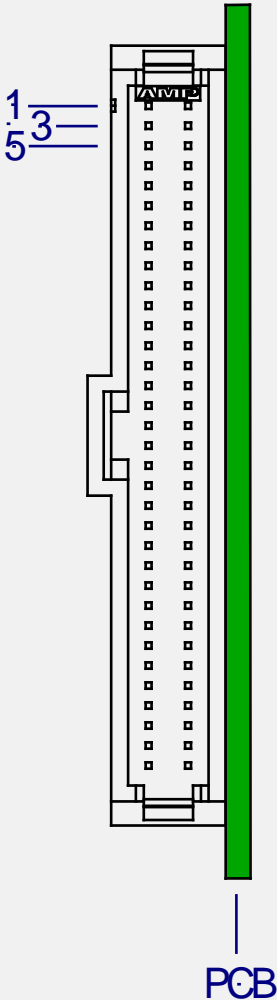
| Signal | Pin | Connector view | Pin | Signal |
|--------|-----|--|-----|--------|
| I/O 1 | 1 |  | 2 | I/O 2 |
| I/O 3 | 3 | | 4 | I/O 4 |
| I/O 5 | 5 | | 6 | I/O 6 |
| I/O 7 | 7 | | 8 | I/O 8 |
| I/O 9 | 9 | | 10 | I/O 10 |
| I/O 11 | 11 | | 12 | I/O 12 |
| I/O 13 | 13 | | 14 | I/O 14 |
| I/O 15 | 15 | | 16 | I/O 16 |
| I/O 17 | 17 | | 18 | I/O 18 |
| I/O 19 | 19 | | 20 | I/O 20 |
| I/O 21 | 21 | | 22 | I/O 22 |
| I/O 23 | 23 | | 24 | I/O 24 |
| I/O 25 | 25 | | 26 | I/O 26 |
| I/O 27 | 27 | | 28 | I/O 28 |
| I/O 29 | 29 | | 30 | I/O 30 |
| I/O 31 | 31 | | 32 | I/O 32 |
| I/O 33 | 33 | | 34 | I/O 34 |
| I/O 35 | 35 | | 36 | I/O 36 |
| I/O 37 | 37 | | 38 | I/O 38 |
| I/O 39 | 39 | | 40 | I/O 40 |
| I/O 41 | 41 | | 42 | I/O 42 |
| I/O 43 | 43 | | 44 | I/O 44 |
| I/O 45 | 45 | | 46 | I/O 46 |
| I/O 47 | 47 | | 48 | I/O 48 |
| I/O 49 | 49 | | 50 | I/O 50 |
| I/O 51 | 51 | | 52 | I/O 52 |
| I/O 53 | 53 | | 54 | I/O 54 |
| I/O 55 | 55 | | 56 | I/O 56 |
| I/O 57 | 57 | | 58 | I/O 58 |
| I/O 59 | 59 | | 60 | I/O 60 |
| I/O 61 | 61 | | 62 | I/O 62 |
| I/O 63 | 63 | | 64 | I/O 64 |
| - | 65 | | 66 | - |
| - | 67 | | 68 | - |

Table 6-4 : X4 - J14 I/O Pin Assignment

6.5 X5/X6 - Samtec High-Speed Connectors (XMC J16 Rear-I/O)

6.5.1 X5 - QTH-DP I/O Connector #1

| | |
|--------------------------------|------------------------------|
| Pin-Count | 40 (20x Differential Pair) |
| Connector Type | Samtec QTH-DP 0.50mm Q-Pairs |
| Source & Order Info | Samtec QTH-020-01-L-D-DP-A |

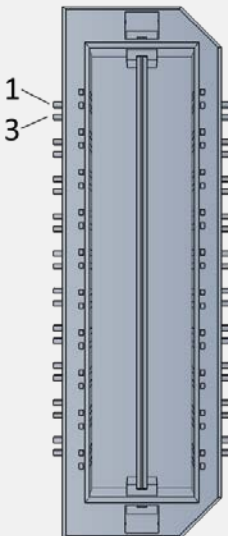
| Pin Assignment | | | | |
|----------------|-----|--|-----|-------------|
| Description | Pin | Connector View | Pin | Description |
| DP00+ | 1 |  | 2 | DP10+ |
| DP00- | 3 | | 4 | DP10- |
| DP01+ | 5 | | 6 | DP11+ |
| DP01- | 7 | | 8 | DP11- |
| DP02+ | 9 | | 10 | DP12+ |
| DP02- | 11 | | 12 | DP12- |
| DP03+ | 13 | | 14 | DP13+ |
| DP03- | 15 | | 16 | DP13- |
| DP08+ | 17 | | 18 | DP09+ |
| DP08- | 19 | | 20 | DP09- |
| UD_C19 | 21 | | 22 | UD_F19 |
| UD_C18 | 23 | | 24 | UD_F18 |
| UD_C17 | 25 | | 26 | UD_F17 |
| UD_C16 | 27 | | 28 | UD_F16 |
| UD_C15 | 29 | | 30 | UD_F15 |
| UD_C14 | 31 | | 32 | UD_F14 |
| UD_C13 | 33 | | 34 | UD_F13 |
| UD_C12 | 35 | | 36 | UD_F12 |
| UD_C11 | 37 | | 38 | UD_F11 |
| UD_C10 | 39 | | 40 | UD_F10 |
| GND | 41 | | 42 | GND |
| GND | 43 | | 44 | GND |

Table 6-5 : X5 - QTH-DP I/O Connector #1

6.5.2 X6 – QTH-DP I/O Connector #2

| | |
|--------------------------------|------------------------------|
| Pin-Count | 40 (20x Differential Pair) |
| Connector Type | Samtec QTH-DP 0.50mm Q-Pairs |
| Source & Order Info | Samtec QTH-020-01-L-D-DP-A |

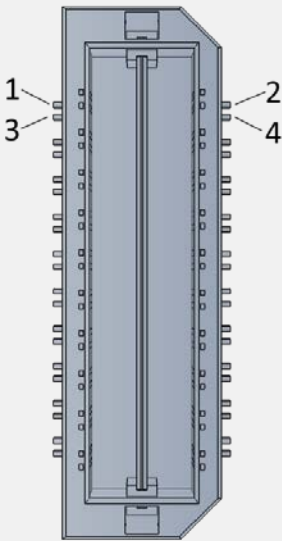
| Pin Assignment | | | | |
|----------------|-----|--|-----|-------------|
| Description | Pin | Connector View | Pin | Description |
| DP04+ | 1 |  | 2 | DP14+ |
| DP04- | 3 | | 4 | DP14- |
| DP05+ | 5 | | 6 | DP15+ |
| DP05- | 7 | | 8 | DP15- |
| DP06+ | 9 | | 10 | DP16+ |
| DP06- | 11 | | 12 | DP16- |
| DP07+ | 13 | | 14 | DP17+ |
| DP07- | 15 | | 16 | DP17- |
| DP18+ | 17 | | 18 | DP19+ |
| DP18- | 19 | | 20 | DP19- |
| UD_C9 | 21 | | 22 | UD_F9 |
| UD_C8 | 23 | | 24 | UD_F8 |
| UD_C7 | 25 | | 26 | UD_F7 |
| UD_C6 | 27 | | 28 | UD_F6 |
| UD_C5 | 29 | | 30 | UD_F5 |
| UD_C4 | 31 | | 32 | UD_F4 |
| UD_C3 | 33 | | 34 | UD_F1 |
| UD_C2 | 35 | | 36 | UD_C1 |
| UD_F2 | 37 | | 38 | - |
| UD_F3 | 39 | | 40 | - |
| GND | 41 | | 42 | GND |
| GND | 43 | | 44 | GND |

Table 6-6 : X6 - QTH-DP I/O Connector #2

6.6 X7 - 10-Pin JTAG Header

The 10-Pin JTAG Header (Connector X7) is connected to the XMC J15 connector with the following pin assignment.

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

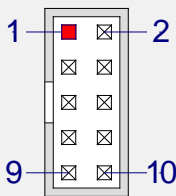
| Signal | Pin | Connector View | Pin | Signal |
|--------|-----------------|---|-----|--------|
| TCK | 1 ^{*)} |  | 2 | GND |
| TMS | 3 | | 4 | GND |
| TDO | 5 | | 6 | GND |
| TDI | 7 | | 8 | GND |
| TRST# | 9 | | 10 | - |

Table 6-7 : X7 - JTAG Header

Notes:

*) Pin 1 has a squared pad for better recognition