The Embedded I/O Company

TEWS TECHNOLOGIES

TPCE278

PCI Express x4, Gen3 XMC Carrier

Version 1.0

User Manual

Issue 1.0.1

June 2016

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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

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

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

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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.

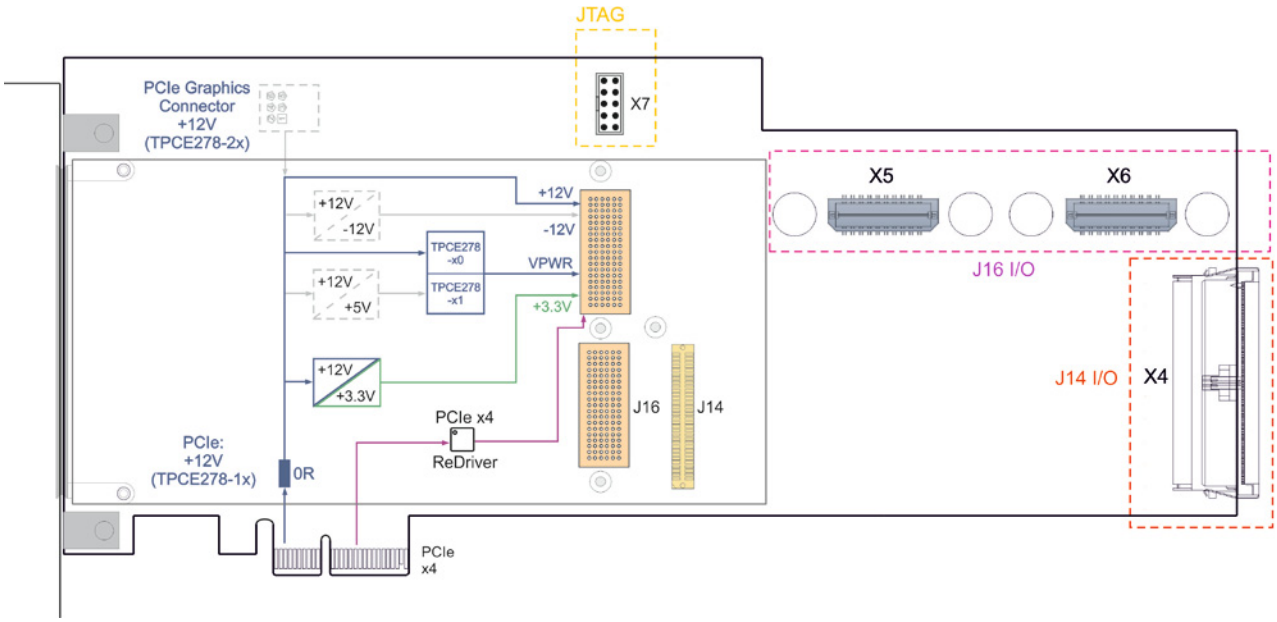


Figure 1-1 : TPCE278 Block Diagram

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 Storage	-40°C to +85°C -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 ±8%, whereas the XMC specification allows only for ±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.

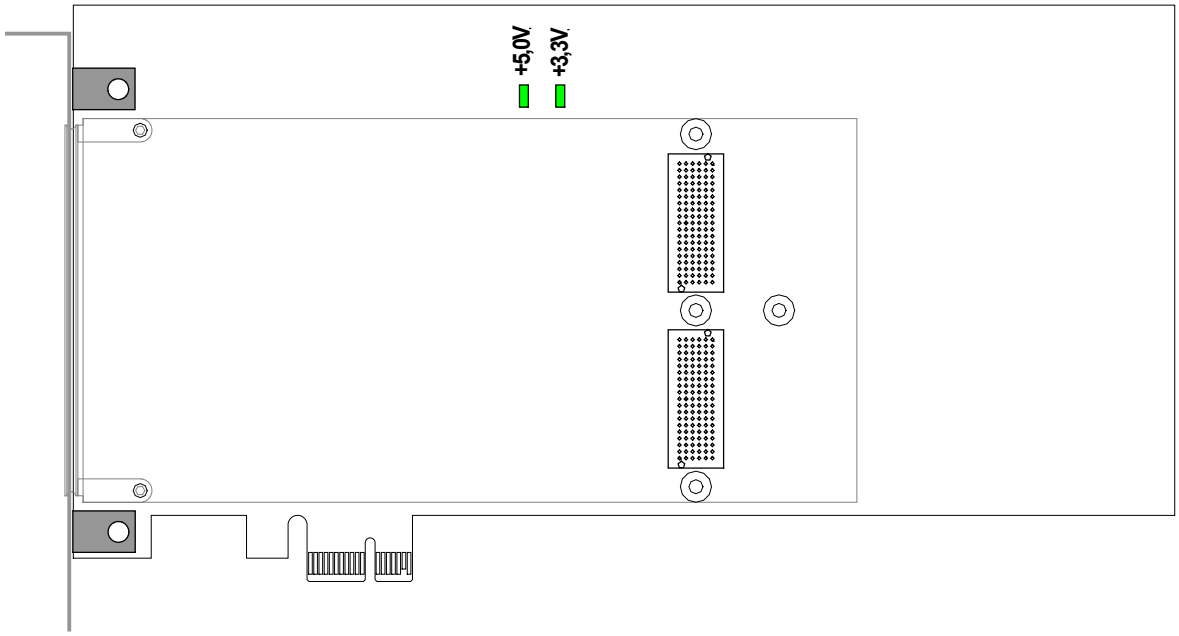


Figure 5-1 : On-board LED Placement

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

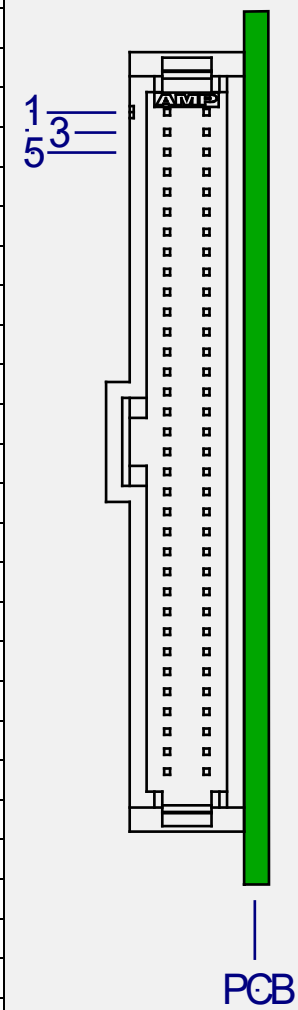
Signal	Pin	Connector view	Pin	Signal
I/O 1	**1**		**2**	I/O 2
I/O 3	**3**		**4**	I/O 4
I/O 5	**5**		**6**	I/O 6
I/O 7	**7**		**8**	I/O 8
I/O 9	**9**		**10**	I/O 10
I/O 11	**11**		**12**	I/O 12
I/O 13	**13**		**14**	I/O 14
I/O 15	**15**		**16**	I/O 16
I/O 17	**17**		**18**	I/O 18
I/O 19	**19**		**20**	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

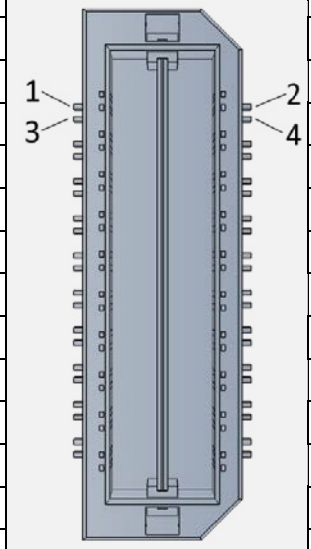
Pin Assignment				
Description	**Pin**	**Connector View**	**Pin**	**Description**
DP00+	**1**		**2**	DP10+
DP00-	**3**		**4**	DP10-
DP01+	**5**		**6**	DP11+
DP01-	**7**		**8**	DP11-
DP02+	**9**		**10**	DP12+
DP02-	**11**		**12**	DP12-
DP03+	**13**		**14**	DP13+
DP03-	**15**		**16**	DP13-
DP08+	**17**		**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

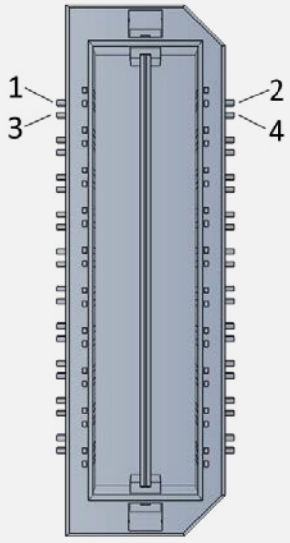
Pin Assignment				
Description	**Pin**	**Connector View**	**Pin**	**Description**
DP04+	**1**		**2**	DP14+
DP04-	**3**		**4**	DP14-
DP05+	**5**		**6**	DP15+
DP05-	**7**		**8**	DP15-
DP06+	**9**		**10**	DP16+
DP06-	**11**		**12**	DP16-
DP07+	**13**		**14**	DP17+
DP07-	**15**		**16**	DP17-
DP18+	**17**		**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.

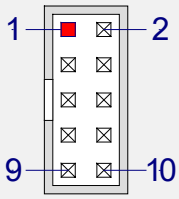
Signal	Pin	Connector View	Pin	Signal
TCK	**1** *)		**2**	GND
TMS	**3**		**4**	GND
TDO	**5**		**6**	GND
TDI	**7**		**8**	GND
TRST#	**9**		**10**	-

Table 6-7 : X7 - JTAG Header

Notes:

***)** Pin 1 has a squared pad for better recognition