The Embedded I/O Company

TEWS TECHNOLOGIES

TPCE276

PCI Express XMC Carrier

Version 1.0

User Manual

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TPCE276-10R

PCI Express x1 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

TPCE276-11R

PCI Express x1 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

TPCE276-20R

PCI Express x1 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

TPCE276-21R

PCI Express x1 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

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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

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1 Product Description

The TPCE276 is a standard height PCI Express Revision 2.0 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 TPCE276 is a versatile solution to upgrade well known XMC I/O solutions to the PCI Express signalling standard.

The PCI Express x1 link from the host board to the XMC module is enhanced by a PCIe Gen2 Redriver, allowing safe operation of XMC modules on PCIe mainboards.

VPWR is selectable via order option. The TPCE276-x0R variants provide for 12V VPWR and the TPCE276-x1R order options provide 5V VPWR.

The TPCE276 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 TPCE276-1xR uses the +12V of the PCIe edge card connector to generate all power supply voltages for the XMC slot (+3.3V, VPWR and +12V).

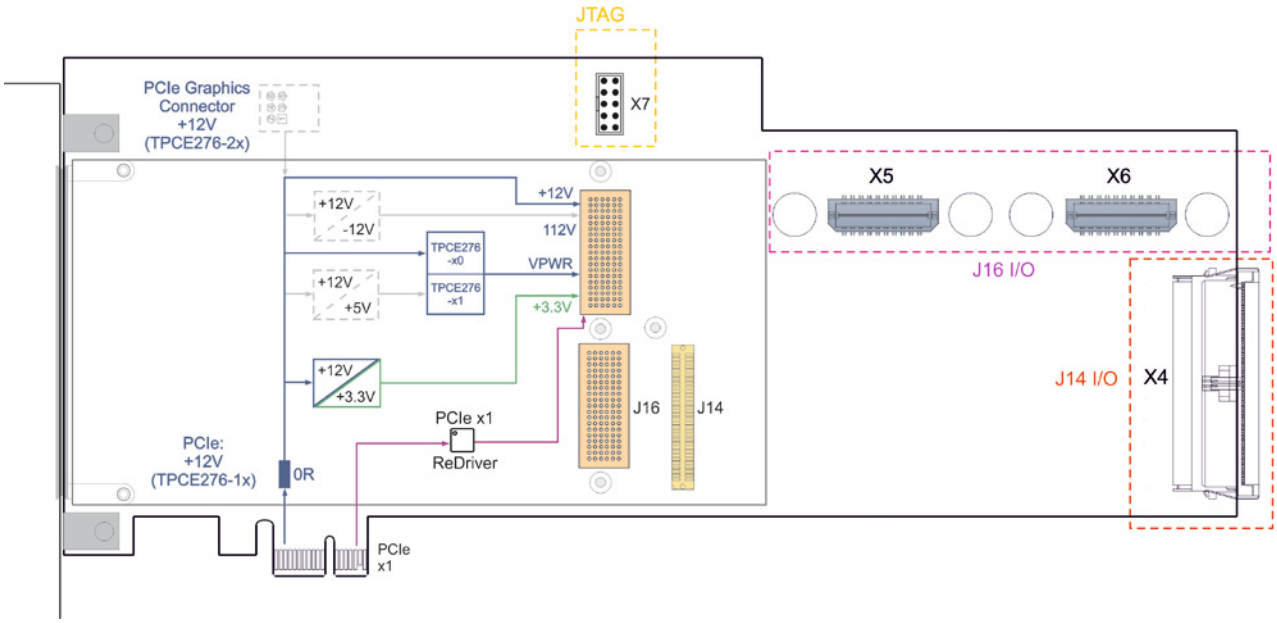


Figure 1-1 : TPCE276 Block Diagram

2 Technical Specification

Mechanical and Electrical Interfaces		
PCI Express	PCI Express x1, Revision 2.1 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	PI3EQX5801 (Pericom)	
Physical Data		
Power Requirements	125mA maximum @ +3.3V DC 75mA 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 20ms 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	TPCE276-1xR: 603000 h TPCE276-2xR: 535000 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	TPCE276-10R: 120 g TPCE276-11R: 126 g TPCE276-20R: 122 g TPCE276-21R: 128 g	

Table 2-1 : Technical Specification

3 Handling and Operating Instructions

3.1 ESD Protection

The TPCE276 is sensitive to static electricity. Packing, unpacking and all other handling of the TPCE276 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 TPCE276, be sure that the system is powered off.
Also, follow the installation instructions in the "XMC Interface" chapter.

3.4 Installation of TPCE276-2xR

For the TPCE276-2xR variants, it is imperative to always connect a PCI Express VGA power connector to the TPCE276, even if no PMC is mounted.

3.5 Installation of TPCE276-x0R

For the TPCE276-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 TPCE276-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 TPCE276 for the power requirements of the XMC module.

TPCE276	Voltage		Current Limits
TPCE276-1xR		3.3V	2.0 A
	VPWR	5V (TPCE276-11R)	1.2 A
		12V (TPCE276-10R)	0.5 A
		+12V	200 mA
TPCE276-2xR		3.3V	7.5 A
	VPWR	5V (TPCE276-21R)	5.0 A
		12V (TPCE276-20R)	2.1 A
		+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 20ms after the system power supply is stable.

4.3 Installation of an XMC Module

The XMC modules are mounted to the TPCE276 prior to installation into the system.

If the XMC has a front panel, first remove the cover from the XMC front panel cut-out of the TPCE276. 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 TPCE276. 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 TPCE276.

After the XMC module has been installed, it can be mounted on the TPCE276 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.

Before installing an XMC module, be sure that the power supply for the TPCE276 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.

5 Indicators

5.1 LED Indicators

The TPCE276 provides a couple of board-status LEDs as shown below.

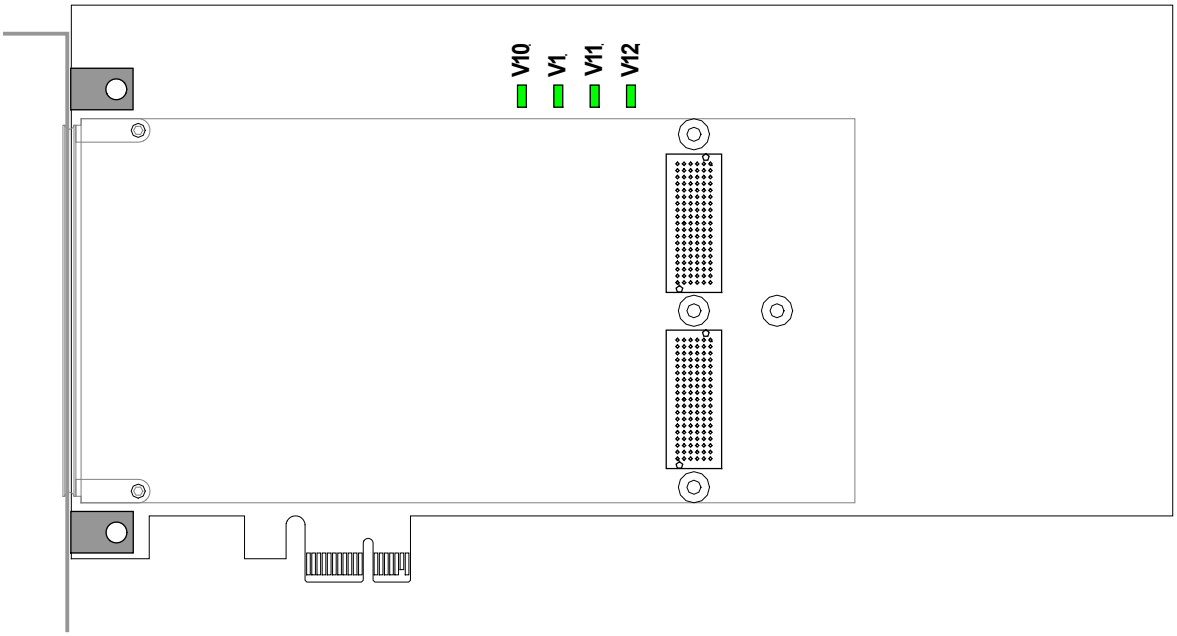


Figure 5-1 : Onboard LED Placement

LED		Color	State	Description
V10	1.5V Power Good	Green	Off	PCIe TX link is down
			On	PCIe TX link is up
V1	3.3V Power Good	Green	Off	3.3V Power Supply is not OK
			On	3.3V Power Supply is OK
V11	5.0V Power Good *)	Green	Off	5.0V Power Supply is not OK
			On	5.0V Power Supply is OK
V12	12V Power Good	Green	Off	12V Power Supply is not OK
			On	12V Power Supply is OK

Table 5-1 : Onboard 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			VPWR
02	GND	GND	TRST [1)]	GND	GND	PERST#
03			3,3V			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				VPWR
12	GND	GND	GA1	GND	GND	
13			3,3V_AUX [2)]			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 onboard, 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 TPCE276 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 TPCE276 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 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 6-2 : XMC J16 Pin Assignment

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

The TPCE276 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

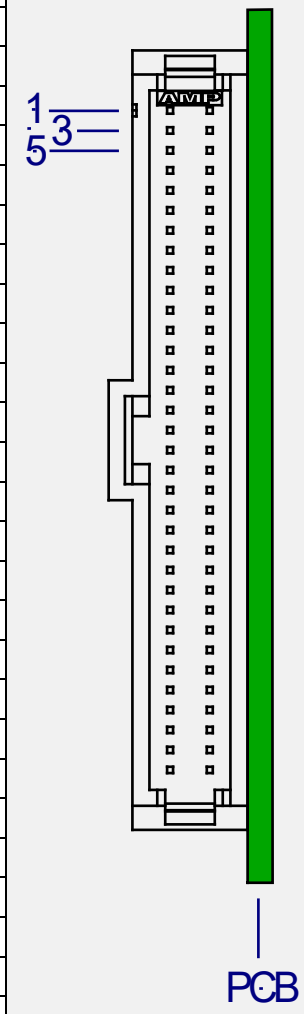
Signal	Pin	Connector view	Pin	Signal
I/O 1	**1**		**2**	I/O 2
I/O 3	**3**		**4**	I/O 4
I/O 5	**5**		**6**	I/O 6
I/O 7	**7**		**8**	I/O 8
I/O 9	**9**		**10**	I/O 10
I/O 11	**11**		**12**	I/O 12
I/O 13	**13**		**14**	I/O 14
I/O 15	**15**		**16**	I/O 16
I/O 17	**17**		**18**	I/O 18
I/O 19	**19**		**20**	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 6-3 : X4 - J14 I/O Pin Assignment

6.4 XMC J16 Rear-I/O (Samtec High-Speed Connectors)

6.4.1 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

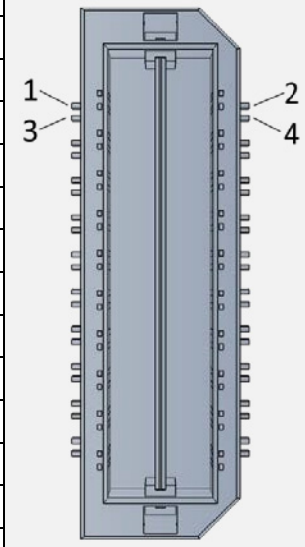
Pin Assignment				
Description	**Pin**	**Connector View**	**Pin**	**Description**
DP00+	**1**		**2**	DP10+
DP00-	**3**		**4**	DP10-
DP01+	**5**		**6**	DP11+
DP01-	**7**		**8**	DP11-
DP02+	**9**		**10**	DP12+
DP02-	**11**		**12**	DP12-
DP03+	**13**		**14**	DP13+
DP03-	**15**		**16**	DP13-
DP08+	**17**		**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 6-4 : X5 - QTH-DP I/O Connector #1

6.4.2 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

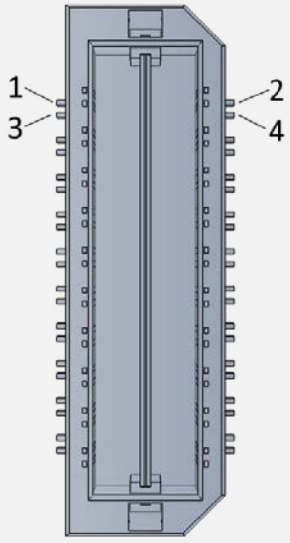
Pin Assignment				
Description	**Pin**	**Connector View**	**Pin**	**Description**
DP04+	**1**		**2**	DP14+
DP04-	**3**		**4**	DP14-
DP05+	**5**		**6**	DP15+
DP05-	**7**		**8**	DP15-
DP06+	**9**		**10**	DP16+
DP06-	**11**		**12**	DP16-
DP07+	**13**		**14**	DP17+
DP07-	**15**		**16**	DP17-
DP18+	**17**		**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 6-5 : X6 - QTH-DP I/O Connector #2

6.5 10-Pin JTAG Header (X7)

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.

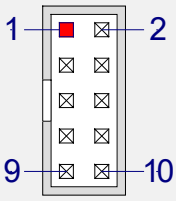
Signal	Pin	Connector View	Pin	Signal
TCK	**1** *)		**2**	GND
TMS	**3**		**4**	GND
TDO	**5**		**6**	GND
TDI	**7**		**8**	GND
TRST#	**9**		**10**	-

Table 6-6 : X7 - JTAG Header

Notes:

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