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# TPCE261

**PCI Express x1 PMC Carrier**

Version 1.0

## **User Manual**

Issue 1.0.2

January 2022

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## TPCE261-10R

PCI Express x1 Carrier for 32-Bit, 33/66MHz PMC Modules, 5V PMC I/O signaling voltage, +12V power supply from PCIe connector used

## TPCE261-11R

PCI Express x1 Carrier for 32-Bit, 33/66MHz PMC Modules, 3.3V PMC I/O signaling voltage, +12V power supply from PCIe connector used

## TPCE261-20R

PCI Express x1 Carrier for 32-Bit, 33/66MHz PMC Modules, 5V PMC I/O signaling voltage, +12V power supply from external PCIe graphics power connector used

## TPCE261-21R

PCI Express x1 Carrier for 32-Bit, 33/66MHz PMC Modules, 3.3V PMC I/O signaling voltage, +12V power supply from external PCIe graphics power connector used

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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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<b>Issue</b>	<b>Description</b>	<b>Date</b>
1.0.0	Initial Issue	December 2018
1.0.1	Clarified the maximum PCIe link speed. The mentioning of PCIe Gen2 might imply a link speed of 5GT/s but the XIO2001 is only capable of 2.5GT/s link speed	March 2019
1.0.2	Order Options -2xR: removed the PCIe VGA power connector adapter cable	January 2022

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# 1 Product Description

The TPCE261 is a standard height PCI Express Revision 2.0 compatible module that provides one slot for a single-width PMC 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 TPCE261 is a versatile solution to upgrade well known PMC I/O solutions to the PCI Express signaling standard.

On the PCI Express side, an x1 link with 2.5GT/s speed to the host board is provided.

The bridging between the system host board and the PMC slot is handled by the transparent PCIe-to-PCI Bridge XIO2001 from Texas Instruments.

On the PMC side, PCI signaling voltages of 3.3V (TPCE261-x1R) and 5V (TPCE261-x0R) are supported. 32-bit PCI accesses are possible with 33MHz or 66MHz.

The TPCE261 supports PMC front-panel I/O and also PMC P14 Rear-I/O through a 68-pin ERNI SMC 1.27mm flat cable connector.

The PCIe edge card connector provides +12V and +3.3V. All TPCE261-xx variants do not use the +3.3V at all. The TPCE261-1xR uses the +12V of the PCIe edge card connector to generate all four power supply voltages for the PMC slot (+3.3V, +5V, +12V and -12V). According to the PCIe specification, a PCIe x1 card is limited to 6W on the +12V which allows to operate most of the available 32-bit 33/66 MHz PMC modules on the TPCE261-1xR.

For PMC modules with increased power requirements, the TPCE261-2xR offer an additional PCIe Graphics Power Connector to supply the +12V for generating all the power supply voltages for the PMC slot providing a power of up to 25W.

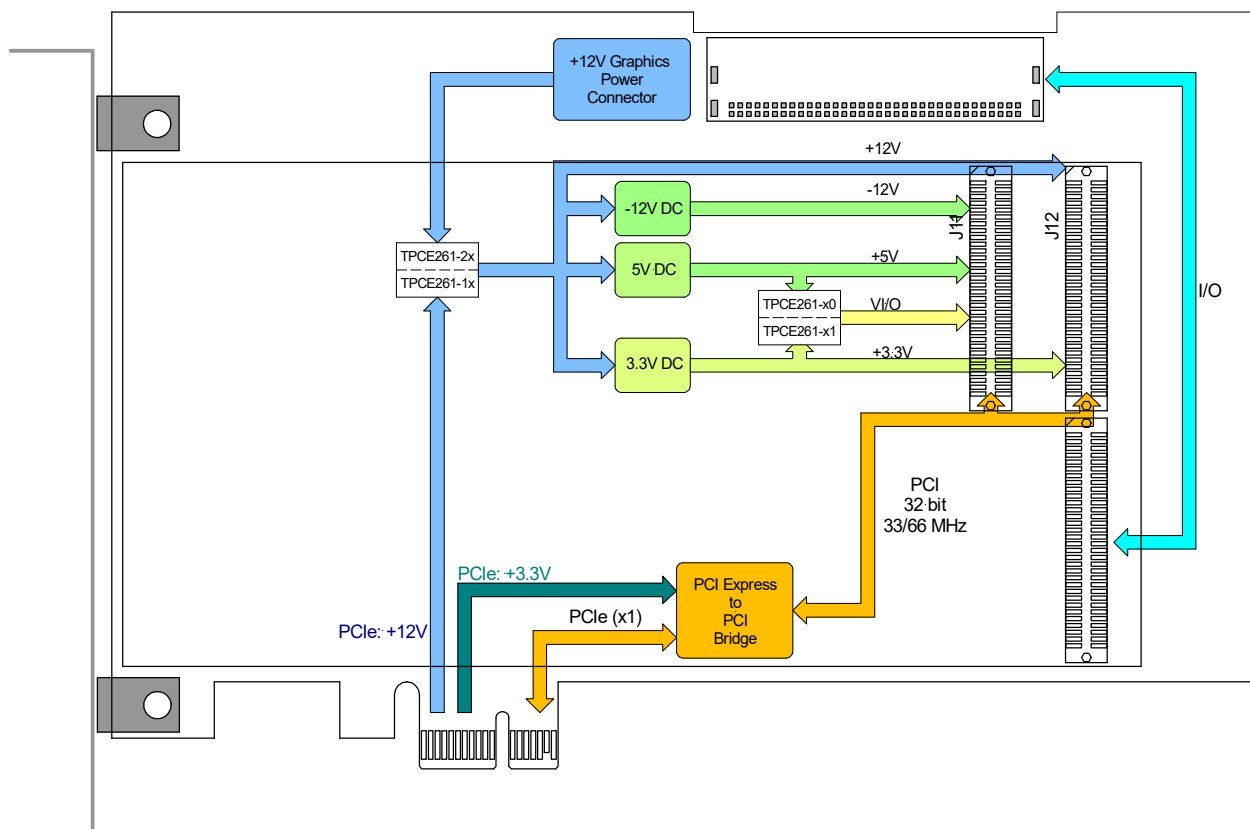


Figure 1-1 : TPCE261 Block Diagram

## 2 Technical Specification

<b>Mechanical and Electrical Interfaces</b>	
<b>PCI Express</b>	PCI Express x1, Revision 2.0 max. 2.5GT/s link speed Standard Height Half-Length
<b>PMC Slot</b>	PCI Mezzanine Card (PMC) Interface conforming to IEEE P1386/P1386.1 Single-Width PCI Rev. 2.3 compliant 33/66 MHz / 32-Bit PCI 3.3V and 5V PCI Signaling Voltage
<b>PMC Interface</b>	
<b>Number of PMC Slots</b>	1
<b>PMC I/O Access</b>	PMC Front Panel I/O PMC P14 Rear-I/O through 68-pin ERNI SMC, right angle male, 1.27mm pitch connector Maximum Current for P14 Rear I/O Lines is 0.5A!
<b>On-Board Devices</b>	
<b>PCIe-to-PCI Bridge</b>	XIO2001 (Texas Instruments)
<b>Physical Data</b>	
<b>Power Requirements</b>	- @ +3.3V DC 100mA maximum @ +12V DC <b>Additional power is required by the PMC Module!</b>
<b>Power Stable for PMC Slot</b>	The power supply for the PMC slot is stable approximately 5ms after the system power supply is stable.
<b>Maximum Power for PMC Slot</b>	The maximum power available for a PMC module is variant dependent. Please see chapter "Power Limits for PMC Modules" for detailed information.
<b>Temperature Range</b>	Operating -40°C to +85°C Storage -40°C to +85°C
<b>MTBF</b>	TPCE261-1xR: 599000h TPCE261-2xR: 533000h MTBF values shown are based on calculation according to MIL-HDBK-217F and MIL-HDBK-217F Notice 2; Environment: G <sub>B</sub> 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.
<b>Humidity</b>	5 – 95 % non-condensing
<b>Weight</b>	TPCE261-1xR: 97 g TPCE261-2xR: 99 g

Table 2-1 : Technical Specification

## 3 Handling and Operating Instructions

### 3.1 ESD Protection



The TPCE261 is sensitive to static electricity. Packing, unpacking and all other handling of the TPCE261 has to be done in an ESD/EOS protected Area.

### 3.2 Installation of TPCE261-2xR



For the TPCE261-2xR variants, it is imperative to always connect a PCI Express VGA power connector to the TPCE261, even if no PMC is mounted.



## 4 PMC Interface

### 4.1 Installation of a PMC Module

The PMC modules are mounted to the TPCE261 prior to installation into the system.

**Before installing a PMC module, be sure that the power supply for the TPCE261 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.**

After the PMC module has been installed, it can be secured on the TPCE261 using the mounting screws that come with the PMC module. There are four screw mounting locations, two at the PMC front panel and two at the standoffs near the PMC bus connectors.

### 4.2 PCI Signaling Voltage

PMC modules are specified either for 3.3V only, 5V only or universal (3.3V or 5V) PCI signaling voltage operation.

The TPCE261 onboard V\_I/O voltage level defines the PCI signaling voltage level for the TPCE261 PCI bus. A voltage keying pin indicates (and also selects) the voltage level and prevents incompatible PMC modules from being plugged onto the carrier.

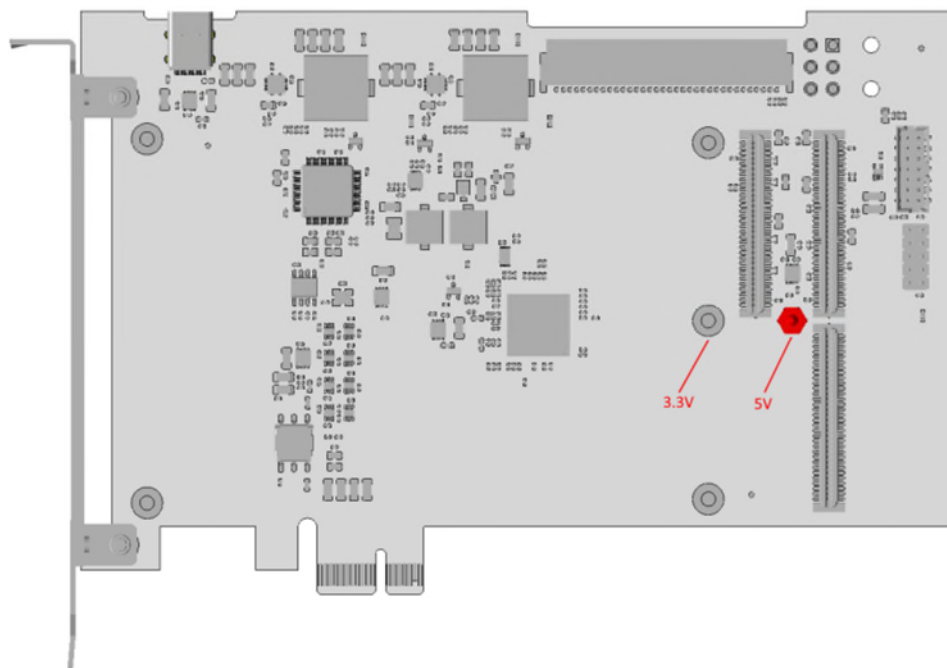


Table 4-1 : TPCE261 PCI Signaling Voltage Keying

V_I/O Configuration	5V Keying Pin	3.3V Keying Pin
5V (-x0R)	Installed	Not Installed
3.3V (-x1R)	Not Installed	Installed

Table 4-2 : TPCE261 PCI Signaling Voltage Factory Defaults

## 4.3 PCIe-to-PCI Bridge Header

ID Type	ID Setting (Description)
Vendor ID	0x104C (Texas Instruments)
Device ID	0x8231 (XIO2001)
Revision ID	0x00
Subsystem ID	0x0000
Subsystem Vendor ID	0x0000
Class Code	0x060400 (PCI-to-PCI Bridge)

Table 4-3 : PCIe ID Configuration

## 4.4 PCI Bus Device Number Mapping

The PCI bus device number of the PMC slot is defined by configuration type translation of the PCI-Express to PCI Bridge.

By default, the PMC slot is mapped to the bus device number 0x0.

PCI Bus Device Number (HEX)	PCI AD Line used as PMC IDSEL	Purpose
0x0	16	Default IDSEL for PMC Slot
0x1	17	Not used on TPCE261
0x2	18	
0x3	19	
0x4	20	Optional IDSEL for PMC Slot
0x5	21	Not used on TPCE261
-	-	
0xF	31	

Table 4-4 : PCI Bus Device Number Mapping

## 4.5 PCI Clock Frequency

The TPCE261 supports 66 MHz PCI clock frequency. The actual PCI clock frequency on the TPCE261 is configured by the plugged PMC module. If the plugged PMC module supports 66 MHz operation, the PCI bus will operate with 66 MHz; otherwise it will operate with 33 MHz.

## 4.6 PMC BUSMODE[4:1] Signals

The BUSMODE[4:1]# signals are defined in the IEEE1386 (CMC) specification and allow a host to identify the used mezzanine card type. The TPCE261 supports PCI capable cards only.

The TPCE261 indicates the “PMC only” support with the signal levels presented in the table below. The PMC card should decode these signals and drive out a logic “0” on BUSMODE1#.

An onboard LED indicates if a valid PMC is detected.

Signal	Logic Level
BUSMODE4#	Pulled LOW
BUSMODE3#	Pulled LOW
BUSMODE2#	Pulled HIGH

Table 4-5 : TPCE261 PMC BUSMODE[4:1] Signals

## 4.7 Stable Power Supply

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

## 4.8 Power Limits for PMC Modules

The following current limits have to be taken into account when choosing the appropriate TPCE261 for the power requirements of the XMC module.

TPCE261	Voltage	Current Limits
TPCE261-1xR	3.3V	3 A
	5V	2 A
	+12V	200 mA
	-12V	200 mA
TPCE261-2xR	3.3V	8 A
	5V	5 A
	+12V	200 mA
	-12V	200 mA

Table 4-6 : Current Limits for the PMC Modules

## 5 Indicators

### 5.1 LED Indicators

The TPCE261 provides a couple of board-status LEDs as shown below. All LEDs are labeled on board for better recognition.

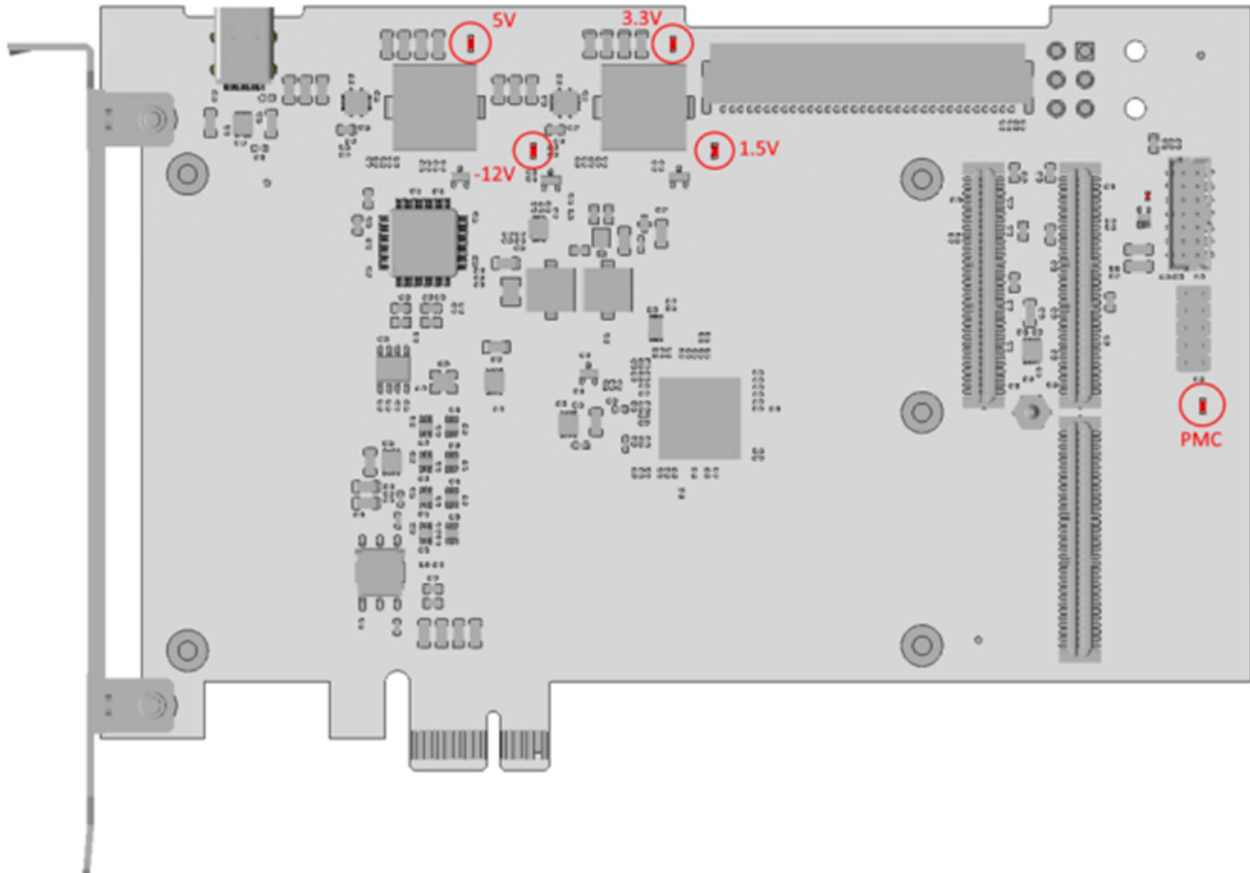


Figure 5-1 : On-board LED Placement

Text	Description	Color	State	Description
1.5V	1.5V Power Good	Green	Off	1.5V Power Supply is not OK
			On	1.5V Power Supply is OK
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
-12V	-12V Power Good	Green	Off	-12V Power Supply is not OK
			On	-12V Power Supply is OK
PMC	PMC Present LED	Green	Off	No PMC Module detected
			On	PMC Module detected

Table 5-1 : On-board LED Description

## 6 JTAG

There is one JTAG chain present on the TPCE261. This chain connects the 14-pin JTAG header with the PMC slot. There are no JTAG-capable devices onboard the TPCE261, so the PMC is the only “device” in this chain.

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

### 6.1 USB Type C Connector

The TPCE261 offers an USB Type C Receptacle as an alternative to the 14-pin flat cable header. This USB receptacle is connected to an FTDI FT2232H chip that translates the USB signals to JTAG signals, allowing access to the PMC JTAG chain with a second source programming software and a simple USB cable.

This USB connector is not mounted in any order options by default. Please contact TEWS if you are interested in using it.

### 6.2 JTAG voltage for PMC Module

The JTAG signaling voltage level on the 14-pin header is always 3.3V.

However, the JTAG voltage that is used for the PMC module, can be setup by a rotary selector switch on the TPCE261; it will be translated to the 3.3V on the JTAG connector.

Position	PMC JTAG Voltage
0	+1.5V
1	+1.8V
2	+2.5V
3	+3.3V

Table 6-1 : Rotary Selector Switch configuration

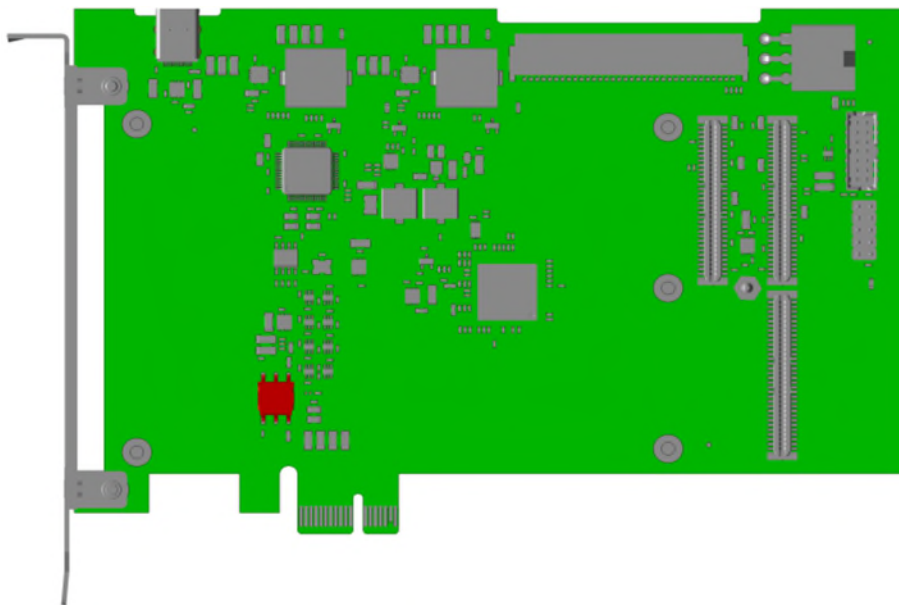


Figure 6-1 : JTAG voltage rotary selector switch location (Top View of TPCE261)

## 7 Pin Assignments

### 7.1 J11 – PMC Connector

Pin	Signal		Signal	Pin
1	TCK		-12V	2
3	GND		INTA#	4
5	INTB#		INTC#	6
7	BUSMODE1#		+5V	8
9	INTD#		PCI-RSVD	10
11	GND		3.3Vaux	12
13	CLK		GND	14
15	GND		GNT#	16
17	REG#		+5V	18
19	V (I/O)		AD[31]	20
21	AD[28]		AD[27]	22
23	AD[25]		GND	24
25	GND		C/BE[3]#	26
27	AD[22]		AD[21]	28
29	AD[19]		+5V	30
31	V (I/O)		AD[17]	32
33	FRAME#		GND	34
35	GND		IRDY#	36
37	DEVSEL#		+5V	38
39	GND		LOCK#	40
41	PCI-RSVD		PCI-RSVD	42
43	PAR		GND	44
45	V (I/O)		AD[15]	46
47	AD[12]		AD[11]	48
49	AD[09]		+5V	50
51	GND		C/BE[0]#	52
53	AD[06]		AD[05]	54
55	AD[04]		GND	56
57	V (I/O)		AD[03]	58
59	AD[02]		AD[01]	60
61	AD[00]		+5V	62
63	GND		REQ64#	64

Table 7-1 : PMC J11/P11 Pin Assignment

## 7.2 J12 – PMC Connector

Pin	Signal		Signal	Pin
1	+12V		TRST#	2
3	TMS		TDO	4
5	TDI		GND	6
7	GND		PCI-RSVD	8
9	PCI-RSVD		PCI-RSVD	10
11	BUSMODE2#		+3.3V	12
13	RST#		BUSMODE3#	14
15	+3.3V		BUSMODE4#	16
17	PME#		GND	18
19	AD[30]		AD[29]	20
21	GND		AD[26]	22
23	AD[24]		+3.3V	24
25	IDSEL		AD[23]	26
27	+3.3V		AD[20]	28
29	AD[18]		GND	30
31	AD[16]		C/BE[2]#	32
33	GND		PMC-RSVD	34
35	TRDY#		+3.3V	36
37	GND		STOP#	38
39	PERR#		GND	40
41	+3.3V		SERR#	42
43	C/BE[1]#		GND	44
45	AD[14]		AD[13]	46
47	M66EN		AD[10]	48
49	AD[08]		+3.3V	50
51	AD[07]		PMC-RSVD	52
53	+3.3V		PMC-RSVD	54
55	PMC-RSVD		GND	56
57	PMC-RSVD		PMC-RSVD	58
59	GND		PMC-RSVD	60
61	ACK64#		+3.3V	62
63	GND		PMC-RSVD	64

Table 7-2 : PMC J12/P12 Pin Assignment

## 7.3 J14 to X4 – PMC I/O Connector

<b>Pin Count</b>	68
<b>Connector Type</b>	ERNI SMC, right angle male, 1.27mm pitch
<b>Source &amp; Order Info</b>	ERNI 154766

Signal	J14 Pin	X5 ERNI Pin	Connector view	X5 ERNI Pin	J14 Pin	Signal
I/O 2 (I/O00-)	2	b1		a1	1	I/O 1 (I/O00+)
I/O 4 (I/O01-)	4	b2		a2	3	I/O 3 (I/O01+)
I/O 6 (I/O02-)	6	b3		a3	5	I/O 5 (I/O02+)
I/O 8 (I/O03-)	8	b4		a4	7	I/O 7 (I/O03+)
I/O 10 (I/O04-)	10	b5		a5	9	I/O 9 (I/O04+)
I/O 12 (I/O05-)	12	b6		a6	11	I/O 11 (I/O05+)
I/O 14 (I/O06-)	14	b7		a7	13	I/O 13 (I/O06+)
I/O 16 (I/O07-)	16	b8		a8	15	I/O 15 (I/O07+)
I/O 18 (I/O08-)	18	b9		a9	17	I/O 17 (I/O08+)
I/O 20 (I/O09-)	20	b10		a10	19	I/O 19 (I/O09+)
I/O 22 (I/O10-)	22	b11		a11	21	I/O 21 (I/O10+)
I/O 24 (I/O11-)	24	b12		a12	23	I/O 23 (I/O11+)
I/O 26 (I/O12-)	26	b13		a13	25	I/O 25 (I/O12+)
I/O 28 (I/O13-)	28	b14		a14	27	I/O 27 (I/O13+)
I/O 30 (I/O14-)	30	b15		a15	29	I/O 29 (I/O14+)
I/O 32 (I/O15-)	32	b16		a16	31	I/O 31 (I/O15+)
I/O 34 (I/O16-)	34	b17		a17	33	I/O 33 (I/O16+)
I/O 36 (I/O17-)	36	b18		a18	35	I/O 35 (I/O17+)
I/O 38 (I/O18-)	38	b19		a19	37	I/O 37 (I/O18+)
I/O 40 (I/O19-)	40	b20		a20	39	I/O 39 (I/O19+)
I/O 42 (I/O20-)	42	b21		a21	41	I/O 41 (I/O20+)
I/O 44 (I/O21-)	44	b22		a22	43	I/O 43 (I/O21+)
I/O 46 (I/O22-)	46	b23		a23	45	I/O 45 (I/O22+)
I/O 48 (I/O23-)	48	b24		a24	47	I/O 47 (I/O23+)
I/O 50 (I/O24-)	50	b25		a25	49	I/O 49 (I/O24+)
I/O 52 (I/O25-)	52	b26		a26	51	I/O 51 (I/O25+)
I/O 54 (I/O26-)	54	b27		a27	53	I/O 53 (I/O26+)
I/O 56 (I/O27-)	56	b28		a28	55	I/O 55 (I/O27+)
I/O 58 (I/O28-)	58	b29		a29	57	I/O 57 (I/O28+)
I/O 60 (I/O29-)	60	b30		a30	59	I/O 59 (I/O29+)
I/O 62 (I/O30-)	62	b31		a31	61	I/O 61 (I/O30+)
I/O 64 (I/O31-)	64	b32		a32	63	I/O 63 (I/O31+)
GND	-	b33		a33	-	GND
GND	-	b34		a34	-	GND

Table 7-3 : X4 - J14 I/O Pin Assignment

All +/- signal pairs are routed differential, impedance controlled and equal-lengthed.



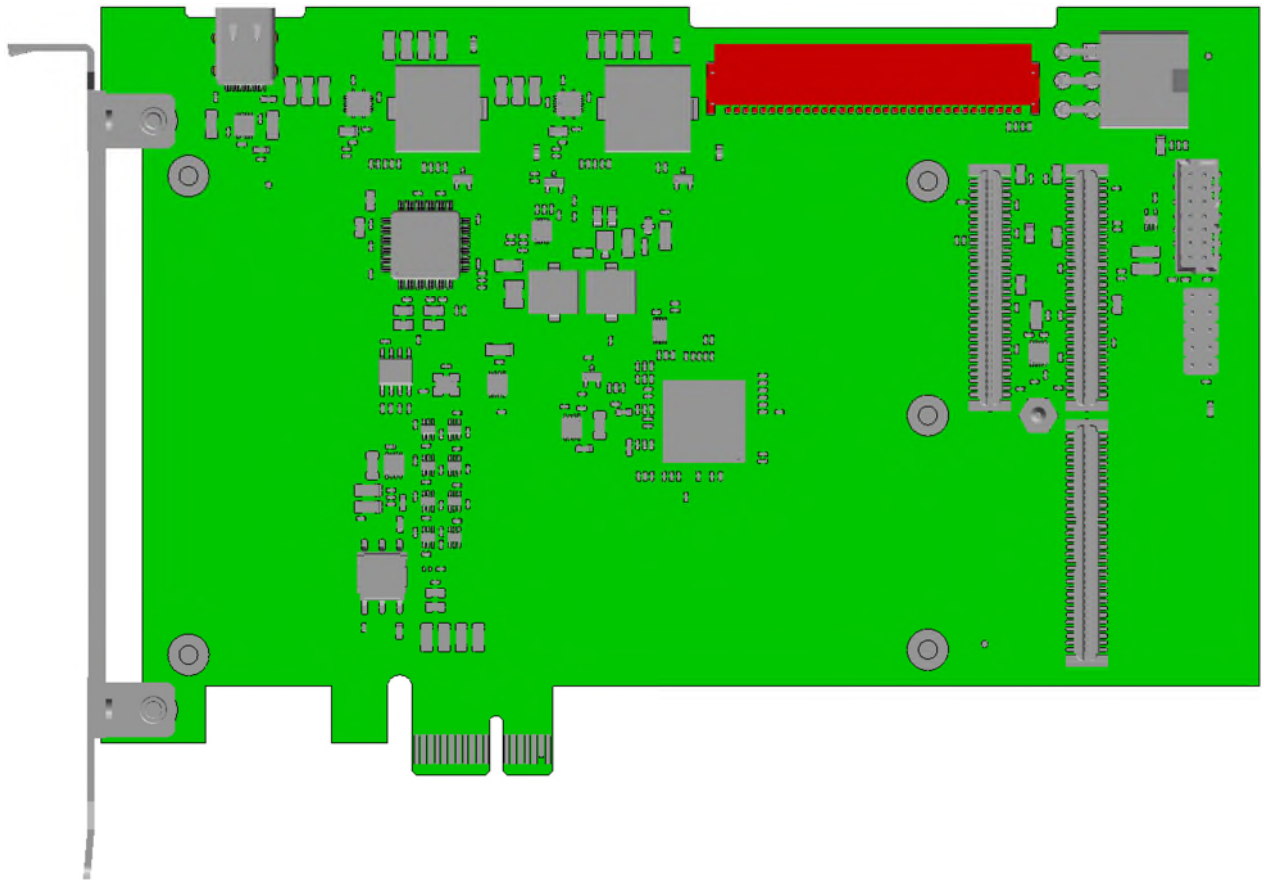


Figure 7-1 : J14 Rear-I/O Connector Location (Top View of TPCE261)

## 7.4 X5 – 14-pin JTAG Header

The following JTAG connector with the below mentioned pin mapping will be provided.

<b>Pin-Count</b>	14
<b>Connector Type</b>	14-position 2mm flat cable header. Compatible with XILINX USB programmer flat cable.
<b>Source &amp; Order Info</b>	Molex 87832-142 (180°)

Pin Assignment				
Description	Pin	Connector View	Pin	Description
NC	1		2	VREF
GND	3		4	TMS
GND	5		6	TCK
GND	7		8	TDO
GND	9		10	TDI
GND	11		12	NC
HDR_EN# *)	13		14	NC

Table 7-4 : X5 – 14-pin JTAG Header Pin Assignment

\*) The JTAG cable has to connect this pin to GND

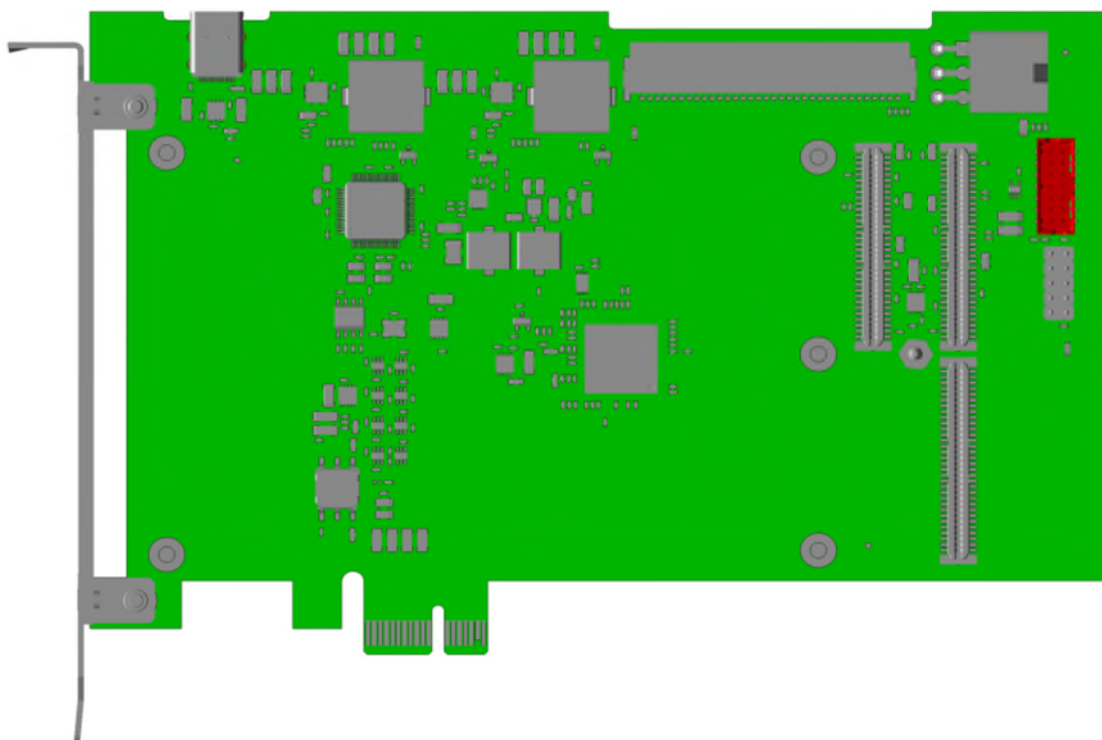


Figure 7-2 : JTAG Connector Location (Top View of TPCE261)

## 7.5 J4 – XIO2001 JTAG Connector

This connector is for factory use only, do not connect.

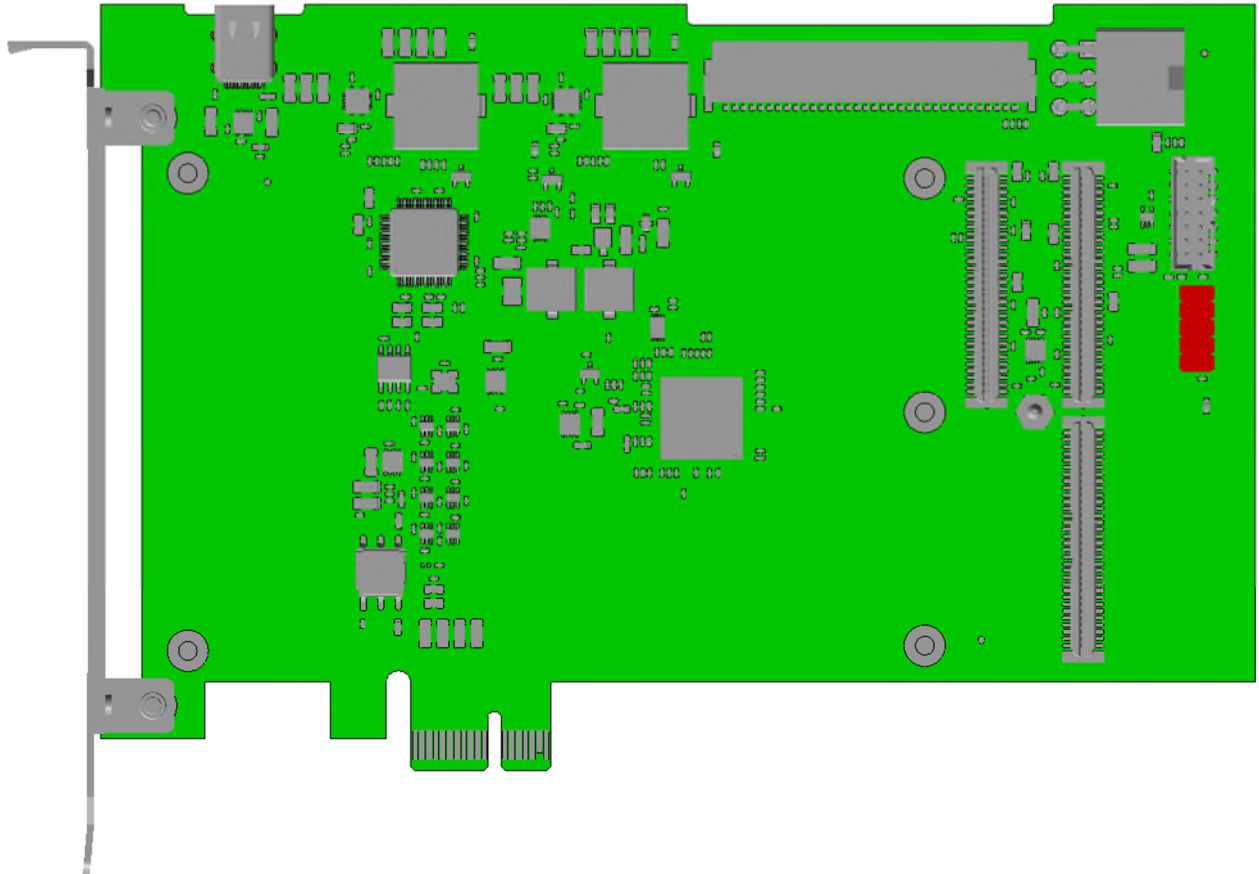


Figure 7-3 : J4 – XIO2001 JTAG Connector Position (top view of TPCE261)

<b>Pin-Count</b>	10
<b>Connector Type</b>	10 pin header, 2.54mm grid

Table 7-5 : J4 Connector Type

## 7.6 X3 – PCIe VGA Graphics Power Connector

The TPCE261-2x variants provide an additional PCIe VGA Graphics Power Connector for increased power requirements.

<b>Pin-Count</b>	6
<b>Connector Type</b>	6-position (2x3) PCI Express auxiliary power connector Mini-Fit Jr. Power Connector
<b>Source &amp; Order Info</b>	Molex 45732-0001

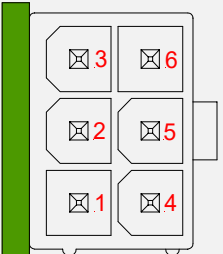
Pin Assignment				
Description	Pin	Connector View	Pin	Description
+12V	3		6	GND
+12V	2		5	GND *)
+12V	1		4	GND

Table 7-6 : X3 – 6-pin Auxilliary Power Connector

\*) The TPCE261 connects this pin to GND and does not do any power supply detection with this pin.