XMC Adapter for 3U cPCI/PXI

Innovative Integration
... real time solutions!

PCI Express XMC to Compact PCI Adapter with PXI support; Air or Conduction Cooling

V 1.3

FEATURES

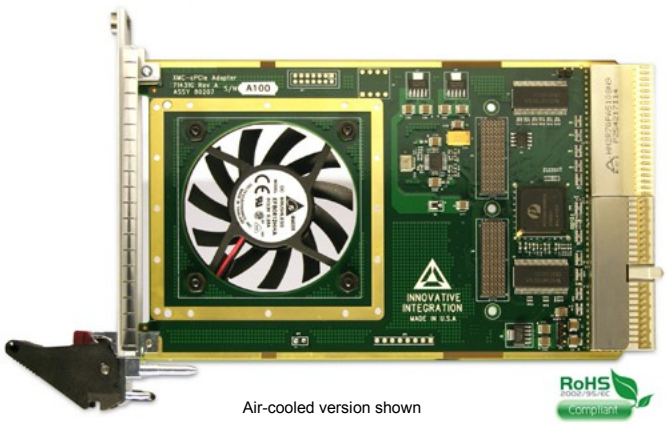
- Adapt one XMC.3 (PCI Express VITA 42.3) module to a 3U compact PCI/PXI
- PCI/PCI-X 64 bit, 133MHz interface
- XMC.3 PCI Express, 4 lane interface
- Transparent operation
- 490 MB/s sustained rate (host dependent)
- Support for PXI triggering, clocks and data
- IEEE 1384 XMC mechanicals
- Fan provides ~8 CFM cooling air directly on module
- Conduction cooling option
- Environmental ratings for -40 to 85C
  9g RMS sine, $0.1g^2$/Hz random vibration
- 3U height

APPLICATIONS

- Add XMC.3 modules to standard compact PCI host systems
- Integrate X3 and X5 IO modules into PXI test system
- Synchronized multi-card systems using PXI

SOFTWARE

- No software required
- Enumerates as a standard bridge device



Air-cooled version shown

DESCRIPTION

The XMC.3 module adapter allows a single width PCI Express XMC module to be used in a compact PCI/PCI-X slot. The XMC module is VITA 42.3 compatible and supports x4 Gen1 PCI Express lanes.

The adapter is completely transparent to PCI-X operations through a PCI-X to PCI Express bridge. The bridge enumerates as a standard PCI device. When used in a PCI-X 133 MHz 64 bit slot, the adapter provides 490 MB/s sustained transfer rates between the XMC module and the host system.

The PXI triggering and clock features are mapped to XMC P16 to allow multiple cards to synchronize sampling and coordinate triggering. Innovative's X3/X6 families of XMC IO modules can use the PXI triggers to coordinate sampling. The PXI 10 MHz reference clock can be used to generate synchronous sample clocks on the X3/X6 modules to provide precise sample timing on multiple modules.

The adapter is available in air-cooled and conduction-cooled versions. The air-cooled version has a removable fan directly under the XMC. The conduction-cooled version conducts heat from the XMC to the chassis using a heat spreader assembly. XMC modules with VITA20 conduction diretly attach to the heat spreader. The heat spreader clamps into the chassis using card locks.

No software is required to operate the adapter. The bridge driver is a standard device in Windows and Linux systems.

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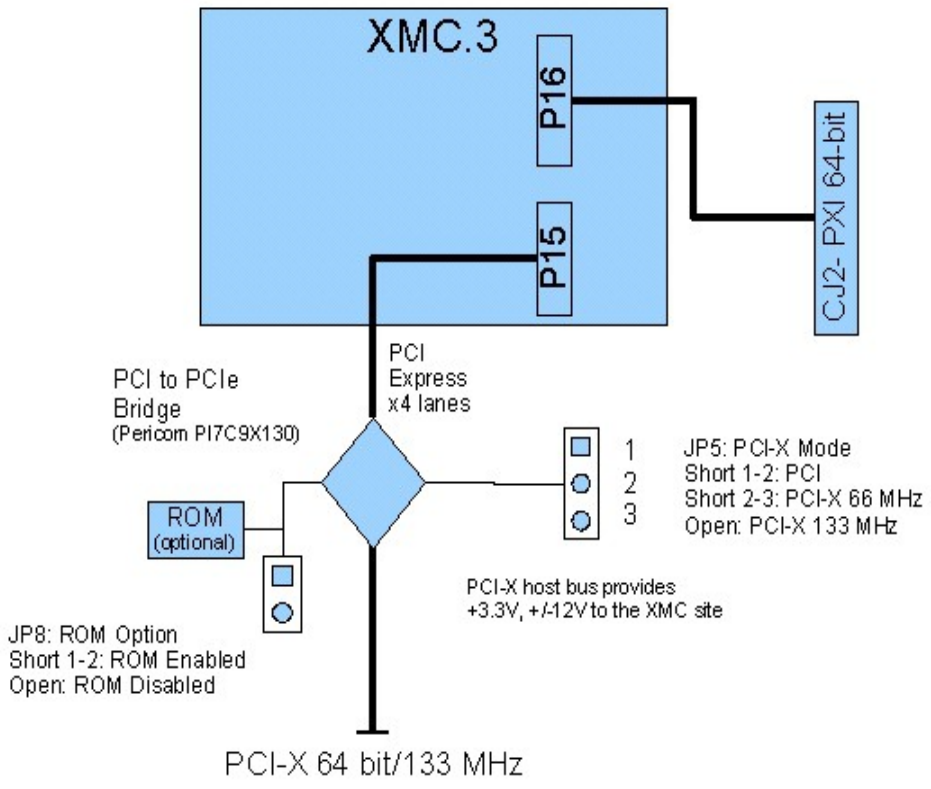
This electronics assembly can be damaged by ESD. Innovative Integration recommends that all electronic assemblies and components circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

ORDERING INFORMATION

Product	Part Number	Description
cPCI-XMC Adapter	80207-0	PCI-XMC Adapter. Air cooled version
cPCI-XMC Adapter	80207-1-<ER>	PCI-XMC Adapter. Conduction-cooled. Specify environmental rating <ER> per following table.



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Operating Environment Ratings

The adatper is offered with ratings for operating environment temperature, shock and vibration. The cards are qualified for wide temperature, vibration and shock to suit a variety of applications in each of the environmental ratings L0 through L4 and 100% tested for compliance.

Environment Rating <ER>		**L0**	**L1**	**L2**	**L3**	**L4**
Environment		Office, controlled lab	Outdoor, stationary	Industrial	Vehicles	Military and heavy industry
Applications		Lab instruments, research	Outdoor monitoring and controls	Industrial applications with moderate vibration	Manned vehicles	Unmanned vehicles, missiles, oil and gas exploration
Cooling		Forced Air 2 CFM	Forced Air 2 CFM	Conduction	Conduction	Conduction
Operating Temperature		0 to +50C	-40 to +85C	-20 to +65C	-40 to +70C	-40 to +85C
Storage Temperature		-20 to +90C	-40 to +100C	-40 to +100C	-40 to +100C	-50 to +100C
Vibration	Sine	-	-	2g 20-500 Hz	5g 20-2000 Hz	10g 20-2000 Hz
	Random	-	-	0.04 g^2/Hz 20-2000 Hz	0.1 g^2/Hz 20-2000 Hz	0.1 g^2/Hz 20-2000 Hz
Shock		-	-	20g, 11 ms	30g, 11 ms	40g, 11 ms
Humidity		0 to 95%, non-condensing	0 to 100%	0 to 100%	0 to 100%	0 to 100%
Conformal coating			Conformal coating	Conformal coating, extended temperature range devices	Conformal coating, extended temperature range devices, Thermal conduction assembly	Conformal coating, extended temperature range devices, Thermal conduction assembly, Epoxy bonding for devices
Testing		Functional, Temperature cycling	Functional, Temperature cycling, Wide temperature testing	Functional, Temperature cycling, Wide temperature testing Vibration, Shock	Functional, Temperature cycling, Wide temperature testing Vibration, Shock	Functional, Testing per MIL-STD-810G for vibration, shock, temperature, humidity

Minimum lot sizes and NRE charges may apply. Contact sales support for pricing and availability.

XMC Adapter for 3U cPCI/PXI

Specifications	
Power Consumption	3.3V @ 1A maximum (adapter only)
MTBF	768,552 Hours

Physicals	
Form Factor	3U compact PCI card
Size	3.8 in x 7.1 in
Slots	Consumes 2 slots when fan is installed; single slot without fan
Weight	100g excluding XMC

XMC Site	
Form Factor	75x150 mm modules (IEEE 1386)
Mounting height	10mm for single slot
Specification	VITA 42.3

Power Delivered to the XMC	
Volts	Amps
3.3V, +12V, -12V	Supplied by compact PCI bus. Consult system specifications for current ratings

PCI/PCI-X Host Interface	
Modes	PCI/ PCI-X
Clock Rates	133 MHz max; may be configured to 33 or 66 MHz limit by jumper
Width	32 or 64 bit, auto-selecting
PCI-VIO Voltage	5V
Specification	PCI Local Bus Specification 3.0

XMC PCI Express Interface	
Lanes	4 max; auto-selects 1 or 4 lane operation
Ref Clock	100 MHz
Bit Rate per lane	2.5 Gbps
Specifications	PCI Express Base Specification 3.0 VITA 42.3 XMC for PCI Express

Cooling	
Air-cooled	~8 CFM fan
Conduction Cooling	Conduction cooling from module to adapter and chassis
Specifications	VITA 20 Conduction Cooling

Trigging and Clocking Features	
Trigger inputs	2, single-ended, >1M, to J16 pins
Clock Inputs	2, single-ended, 50 ohm, converted to LVDS differential pairs connected to J16
Connector	SMB make, vertical

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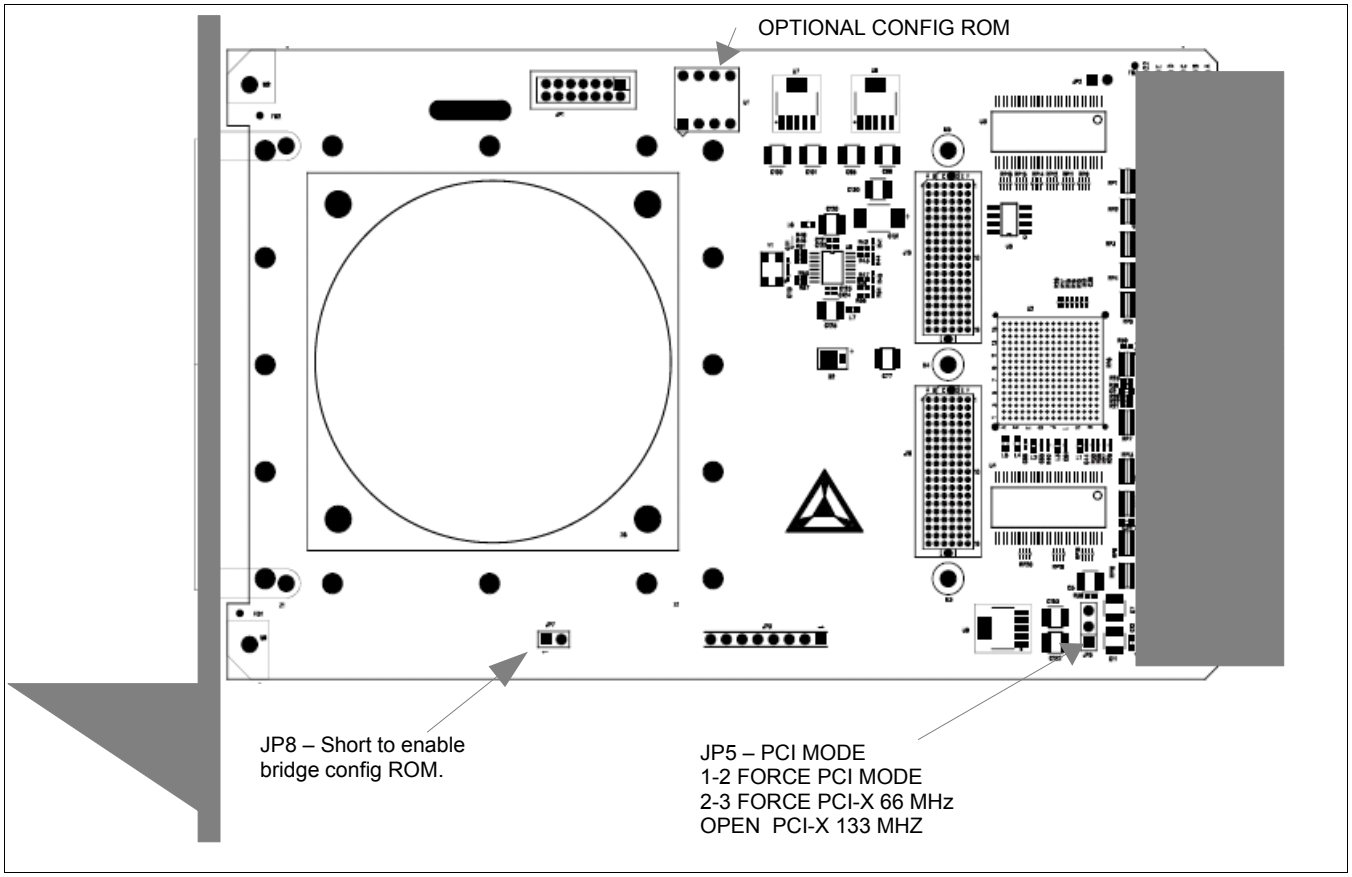

Applications Information

Hosting XMC Modules in PCI-X systems

The adapter is used to host PCI Express XMC modules in desktop PCI/PCI-X slots.

The adapter card has a single XMC module site conforming to VITA 42, with standard IEEE 1386 mechanicals. The module is the same size as older PMC modules. The module has a 10mm mounting height. If the fan is mounted to the adapter, the assembly consumes two slots. If the fan is removed, the adapter with a module mounted on it fits in a single PCI-X slot.

PCI Express Compatibility

The adapter uses a Pericom PI7C9X130BNDE bridge from the PCI-X host bus to XMC PCI Express interface. This bridge supports 1 or 4 active lanes and is compatible with *PCI Express Base Specification* Rev 1.0a. Each lane operates at 2.5 Gbps.

Single lane (x1) PCI Express modules are also compatible with the bridge and may be used without any special configuration.

PCI-X Compatibility

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The adapter is compatible with *PCI Local Bus Specification* Rev 3.0. It can operate as PCI-X or PCI, as determined by the host slot capabilities. In PCI-X mode, the host interface can operate at up to 133 MHz as 32 or 64 bit bus. In PCI mode, the host interface supports 64 or 32-bit operation up to 66 MHz. Signaling is 3V or 5Vin either bus mode.

The adapter senses the host bus type, clock rate and data width and automatically configures itself to operate at the highest performance mode. Jumper JP5 can be used to force the adapter to operate at lower rates or force PCI bus mode for compatibility. The card is shipped in the PCI 66 MHz mode, which is the most compatible but lowest performance mode.

PCI/PCI-X Mode	**JP5 jumper**
PCI, up to 66 MHz , 32 or 64 bit	1-2 (default)
PCI-X, up to 66 MHz, 32 or 64 bit	2-3
PCI-X, up to 133 MHz, 32 or 64 bit	open

Hot plug operation is not supported on the adapter.

Transfer Rates

Maximum sustained transfer rates between the XMC and host computer are dependent on the host computer and supporting software. The following benchmarks were measured using x1 and x4 lane XMC modules in various host computers .

Host Bus Mode	**Motherboard**	**CPU/Chipset**	**XMC lanes**	**Sustained Transfer Rate (MB/s)**
PCI, 32 bit, 33 MHz	Dell Dimension 8400	Intel P4/Intel 925E	1	116
PCI, 32 bit, 33 MHz	Gigabyte GA-MA69VM	AMD Athlon/AMD 690V	1	109
PCI, 32 bit, 33 MHz	Gigabyte GA-MA69VM	AMD Athlon/AMD 690V	4	109
PCI-X, 64-bit, 133 MHz	SuperMicro X7DAL-E	Dual Intel Xeon/Intel 5000X	4	490

Power to the XMC Module

The XMC site provides +3.3V, +12V and -12V to the module. The power is sourced from the PCI-X bus slot. Consult your system documentation to determine the maximum power available in the slot.

Configuring the PCI Bridge

The PCI to PCI Express bridge device has many options for tuning performance. This ROM is not needed in most applications. If you need to configure the bridge device for special functionality, consult the Pericom PI7C9X130 User Guide.

Short JP8 to enable the ROM to configure the bridge.

The ROM is an ATMEL AT25640A or equivalent.

PXI Support

The XMC module has connection to the PXI trigger, clock and bus signals through its P16 connector and bus connector CJ2.

PXI Local Bus Connections

The local bus signals are connected from CJ2 to J16, providing the XMC access. The signals are LVTTL and are 5V tolerant. See the XMC documentation for connections to the XMC logic.

For Innovative X3 modules, the corresponding Digital IO (DIO) for J16 is shown.

X3 J16 DIO	J16 Pin	CJ2 Pin	PXI Signal	X3 J16 DIO	J16 Pin	CJ2 Pin	PXI Signal
DIO10	C11	C20	LBL0	DIO24	F6	C21	LBR1
DIO11	C12	E20	LBL1	DIO25	F7	D21	LBR2
DIO12	C13	A19	LBL2	DIO26	F8	E21	LBR3
DIO13	C14	C19	LBL3	DIO27	F9	A20	LBR4
DIO14	C15	D19	LBL4	DIO28	F10	B20	LBR5
DIO15	C16	E19	LBL5	DIO29	F11	A3	LBR7
DIO17	C18	D2	LBL7	DIO30	F12	C3	LBR8
DIO18	C19	E2	LBL8	DIO31	F13	D3	LBR9
DIO19	F1	A1	LBL9	DIO32	F14	E3	LBR10
DIO20	F2	C1	LBL10	DIO33	F15	A2	LBR11
DIO21	F3	D1	LBL11	DIO35	F17	B2	LBR12
DIO22	F4	E1	LBL12	DIO36	F18	D15	LBL6
DIO23	F5	A21	LBR0	DIO37	F19	E15	LBR6

Triggering and Clock Inputs for Innovative X3 Family of I/O Modules

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The adapter has special support that allows Innovative's X3 and X5 XMC IO module families to use the PXI triggers and clocks inputs. These signals can be used to for system synchronization and triggering such as simultaneous sampling across many modules. The signals map from the PXI bus to the XMC module P16 connector, providing access to the XMC module FPGA.

PXI Signal	Signal	Direction	CJ2 Pin	J16 Pin	X3 J16 DIO	Use
PXI_CLK10+	EXT REF	Input	E17	D9	DIO40	PXI 10 MHz reference clock input. X3 modules: reference to PLL
PXI_CLK10-				E9	DIO41	
PXI_STAR+	EXT CLK	Input	D17	A9	DIO38	Sample clock input. X3 modules can use this signal divided by 1 to 32 as a sample clock. X3 modules: sample clock input (J16)
PXI_STAR-				B9	DIO39	
PXI TRIG0	Trigger 0	I/O	B16	C1	DIO0	Trigger input 0..7 X3: Connect to DIO0..7 on P16 pins C1..C8 X5: Supports trigger inputs 1,3,5,7 on P16 pins C2, C4, C6, C8
PXI TRIG1	Trigger 1	I/O	A16	C2	DIO1	
PXI TRIG2	Trigger 2	I/O	A17	C3	DIO2	
PXI TRIG3	Trigger 3	I/O	A18	C4	DIO3	
PXI TRIG4	Trigger 4	I/O	B18	C5	DIO4	
PXI TRIG5	Trigger 5	I/O	C18	C6	DIO5	
PXI TRIG6	Trigger 6	I/O	E18	C7	DIO6	
PXI TRIG7	Trigger 7	I/O	E16	C8	DIO7	

The two clock inputs, EXT REF and EXT CLK, are converted from LVTTL to LVDS on the adapter card. The X3 modules require LVDS clock inputs for these two signals. The signals are then routed as differential pairs to J16 as shown in the preceding table.

Cooling the XMC Module

Many XMC modules will require additional cooling for reliable operation. The adapter consumes about 3W typically.

The adapter is available in either conduction-cooled or air-cooled versions.

The air-cooled adapter provides a fan directly under the XMC module that provides ~8 CFM force air. This fan is mounted to the back of the adapter card and does protrude into the adjacent slot. Therefore, it is not possible to use the slot next to the adapter when the fan is used. The fan is always on. The fan is easily removed if not needed.

The conduction cooled version supports wide temperature operation from -40C to 85C and is conformal coated. A thermal spreader assembly is used to conduct heat from the XMC to the chassis. The thermal spreader has card locks to firmly clamp it to the chassis. The thermal spreader form-fits the standard XMC module and attaches to the VITA 20 thermal pattern to provide a conduction path from the module to the chassis. The adapter also has an integrated heat plane that conducts heat into the adapter and spreads it across the card. The front panel bracket is connected to the thermal plane and can conduct heat to the chassis. The thermal plane is common to the system ground, but is NOT connected to electrical ground on the adapter.

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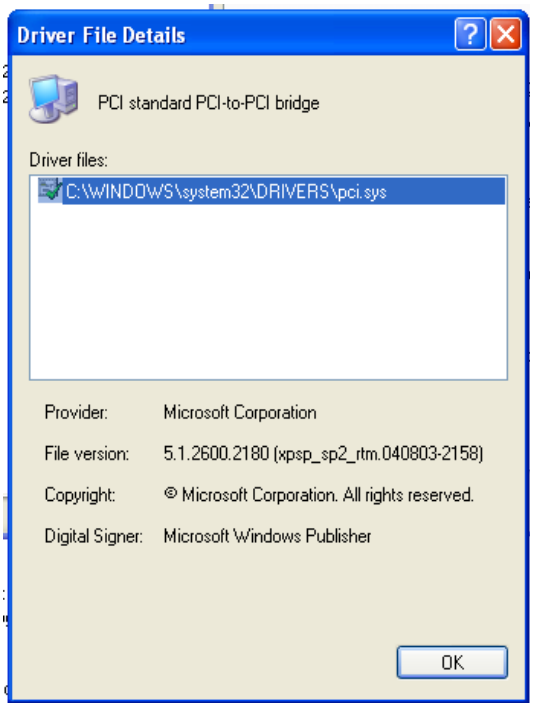
Software Driver:

Software driver for the PCI bridge is provided as a standard device in Windows or Linux. The adapter enumerates as a PCI bridge and automatically installs itself. The XMC module mounted on the adapter will enumerate after the bridge and subsequently appears on a PCI bus originating at the adapter bridge.



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