XMC Adapter for PCI/PCI-X

PCI Express XMC to PCI Slot Adapter with J16 Connector Breakout

V 2.0

FEATURES

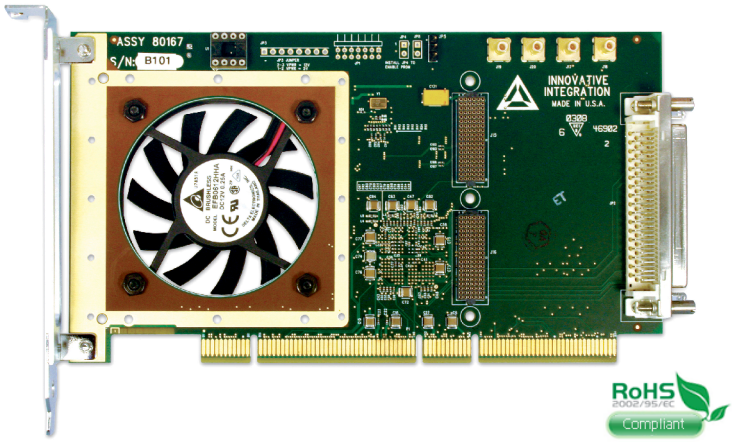
- Adapt one XMC.3 (PCI Express VITA 42.3) module to a PCI/PCI-X slot
- PCIX 64 bit, 133MHz interface
- XMC.3 PCI Express, 4 lane interface
- Transparent operation
- 490 MB/s sustained rate (host dependent)
- P16 connector breakout to MDR68
- SMB Trigger and clock inputs for Innovative X3 IO module family
- IEEE 1384 XMC mechanicals
- Robust end bracket
- Fan provides ~8 CFM cooling air directly on module
- VITA20 Conduction cooling support
- ½ size PCI card

APPLICATIONS

- Add XMC.3 modules to standard PCI host systems
- Custom interfaces to XMC P16
- Integrate X3 and X5 IO modules into PCI systems
- Synchronized multi-card systems using X3 I/O modules

SOFTWARE

- No software required
- Enumerates as a standard bridge device



DESCRIPTION

The PCI-X to XMC.3 module adapter allows a single width PCI Express XMC module to be used in a PCI/PCI-X slot. The XMC module is VITA 42.3 compatible and supports x4 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 J16 connector breakout provides convenient access to all J16 signals through an MDR 68 connector. Signals from J16 are routed as differential pairs to JP1 so that high speed IO standards can be used to the cable.

Special support for triggering and clocks for Innovative's X3 family of XMC IO modules supports multi-card systems and easier system integration. Sharing sample or reference clocks, as well as triggers, is simplified the dedicated SMB inputs on the adapter.

XMC cooling is provided using both a fan and conduction cooling. Conduction cooling pattern conforms to VITA20 specification.

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

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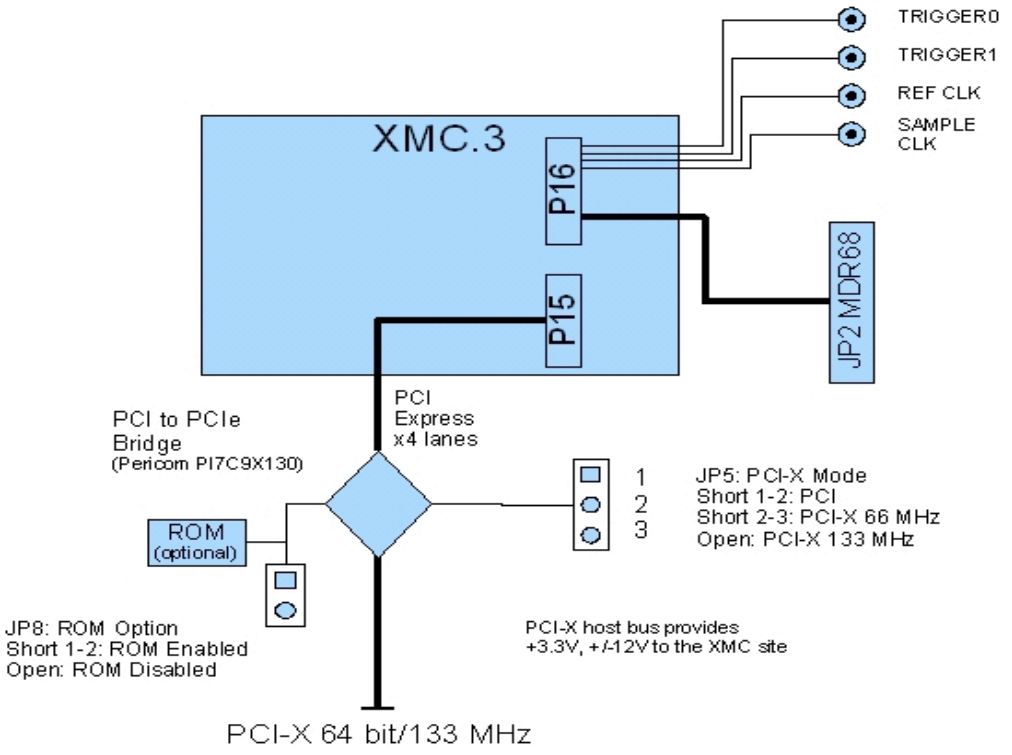
This electronics assembly can be damaged by ESD. Innovative Integration recommends that all electronic assemblies and components circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

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
PCI-XMC Adapter	80167-0	PCI-XMC Adapter.
Breakout and Cable	80116-1	Screw terminal assembly and 36 inch (0.91 m) pleated foil flat ribbon MDR68 cable
MDR68 cable	65057	MDR68 male to male cable assembly, pleated foil shielded flat ribbon, 36 inches (0.91 m)
SMB-BNC cable	67021	SMB to BNC cable, 1m length, RG174 coax.



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Specifications	
Power Consumption	3.3V @ 1A maximum (adapter only)

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

XMC Site	
Form Factor	75x150 mm modules (IEEE 1386)
Mounting height	10mm for single slot
Specification	VITA 42

Power Delivered to the XMC	
Volts	Amps
3.3V, +12V, -12V	Supplied by PCI bus. Consult motherboard specifications.

PCI/PCI-X Host Interface	
Modes	PCI/ PCI-X
Clock Rates	133 MHz max; may be limited to 66 MHz;
Width	32 or 64 bit, auto-selecting
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	
Fan	~8 CFM
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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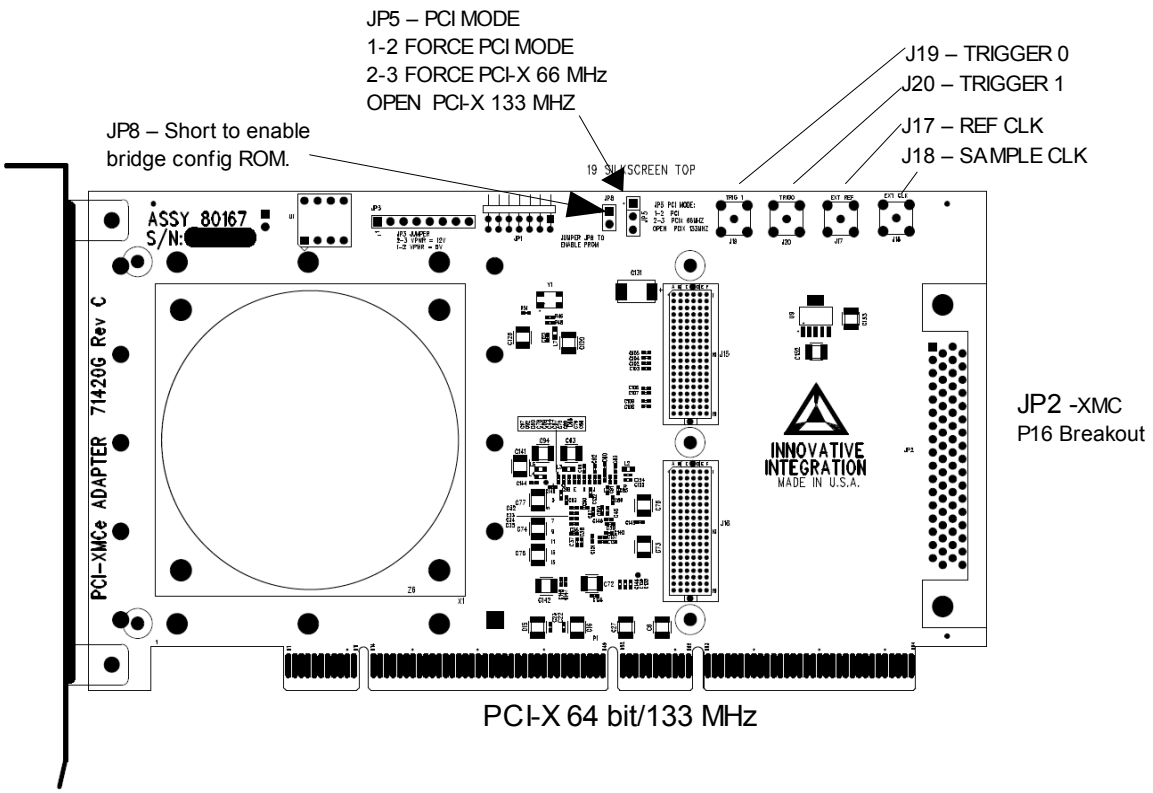

Applications Information

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

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.

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Short JP8 to enable the ROM to configure the bridge.

The ROM is an ATMEL AT25640A or equivalent.

J16 Breakout to JP2

The P16 connector from the XMC module is connected to JP2 according to the schematic shown. There are 46 signals routed to the connector, most of them as signal pairs (100 ohm differential impedance, 50 ohm single ended). The signals pairs are well suited for use as LVDS or LVPECL differential pairs. All signal pairs are matched to within 0.020 inches. Signal pairs are denoted by the circled wires on the following schematic.

Connector is 3M 10268-55H3VC or equivalent. Mating connector is 3M 10168-6010EC or equivalent.

Signal Pair	J16 pins	JP2 pins	Signal	J16 pin	JP2 pin
DIO0/DIO1	C1/C2	1/35	DIO22/DIO23	F4/F5	17/51
DIO2/DIO3	C3/C4	2/36	DIO24/DIO25	F6/F7	19/53
DIO4/DIO5	C5/C6	4/38	DIO26/DIO27	F8/F9	20/54
DIO6/DIO7	C7/C8	5/39	DIO28/DIO29	F10/F11	22/56
DIO8/DIO9	C9/C10	7/41	DIO30/DIO31	F12/F13	23/57
DIO10/DIO11	C11/C12	8/42	DIO32/DIO33	F14/F15	25/59
DIO12/DIO13	C13/C14	10/44	DIO34/DIO35	F16(Trig 1)/F17	26/60
DIO14/DIO15(Trig 0)	C15/C16	11/45	DIO36/DIO37	F18/F19	28/62
DIO16/DIO17	C17/C18	13/47	DIO38/DIO39	A9/B9	29/53
DIO18	C19	14	DIO40/DIO41	D9/E9	31/65
DIO19	F1	48	DIO42/DIO43	A19/B19	32/66
DIO20/DIO21	F2/F3	16/50	DIG_CLKP/ DIG_CLKN	D19/E19	34/68

Note: For Rev C and higher, the J16 pinout is identical to Innovative 80172 XMC-PCI Express adapter.

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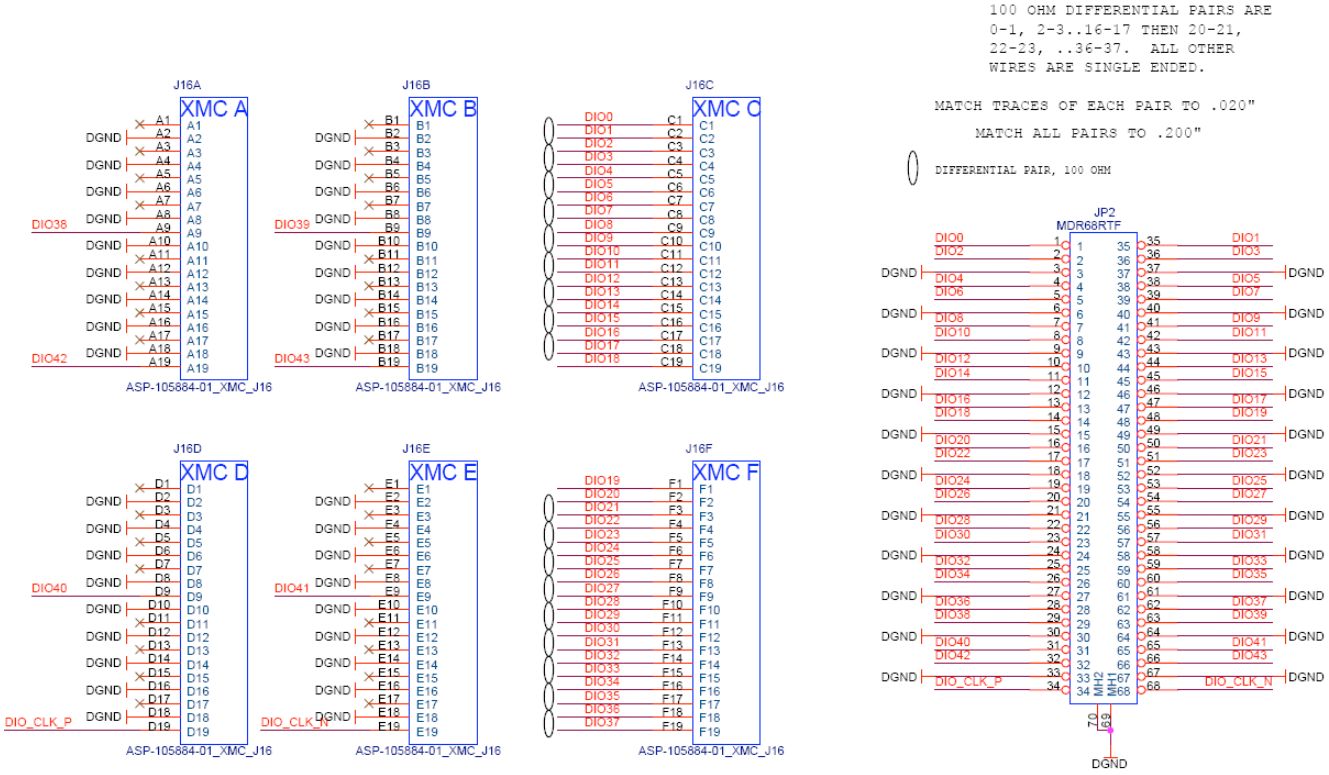

Triggering and Clock Inputs for Innovative X3 Family of I/O Modules

The adapter has special support for Innovative's X3 family of XMC IO modules that provides two trigger and two clock inputs. These signals can be used to for system synchronization and triggering such as simultaneous sampling across many modules.

Connector	Signal	Direction	Termination	P16 Connection	Use
J17	EXT REF	Input	50 ohms	D9(+)/E9(-)	Reference clock input. X3 modules can use this signal as a reference to their PLL for sample rate generation.
J18	EXT CLK	Input	50 ohms	A9(+)/B9(-)	Sample clock input. X3 modules can use this signal, a or 1 to 32 division of it, as a sample clock.
J19	TRIG 0	I/O	>1M ohm	C16	Trigger input 0. X3 modules can use this signal as a trigger input or output.
J20	TRIG 1	I/O	>1M ohm	F16	Trigger input 1. X3 modules can use this signal as a trigger input or output.

The two clock inputs, EXT REF and EXT CLK, are converted from single-ended 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.

Connector is Tyco/AMP 413990-1, SMB vertical. Mating connector is Tyco/AMP 413985-1 or equivalent. Innovative offers an SMB to BNC cable (1m length), part number 67021.

Cooling the XMC Module

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

The 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 adapter card also has provision for conduction cooling from the module to the adapter card using VITA 20 thermal pattern. If the mating XMC has support for conduction cooling, thermal bars can be installed to conduct heat from the module to the adapter. The adapter 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.

Conduction cooling bars and mounting hardware are available from Innovative as a separate purchase.

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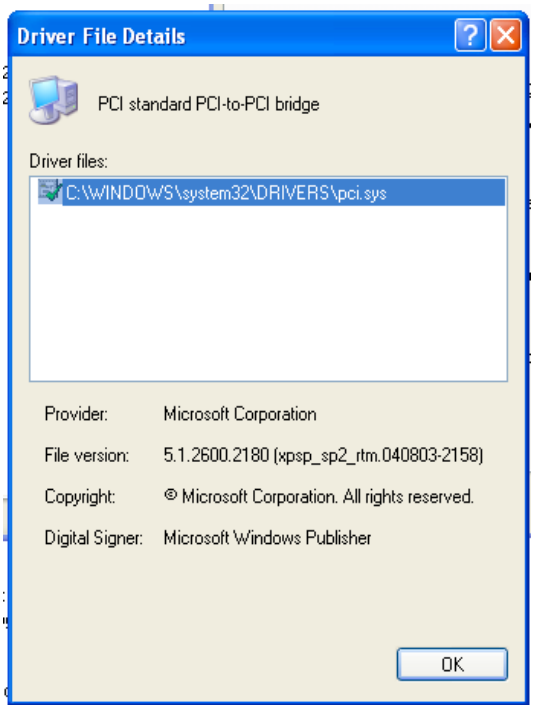
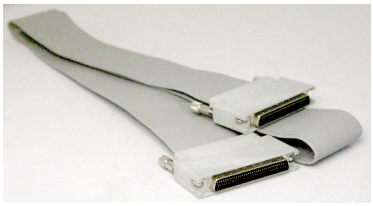
Software Driver:
Software driver for the PCI bridge is provided as a standard device in Windows or Linux. The adapter enumerates as a PCI bridge and automatically installs itself. The XMC module mounted on the adapter will enumerate after the bridge and subsequently appears on a PCI bus originating at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





Cables

The P16 breakout uses a pleated foil ribbon cable assembly mating to the JP2 connector. Innovative offers a cable assembly (P/N 65057) and screw terminal assembly for convenience (P/N 80116-1).

The cable assembly generally offers performance up to >50 MHz when differential signaling such as LVDS is used. Single ended signals are limited to about 10 MHz.

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