SBC-COMEX

A Windows/Linux Embedded Single Board Computer with dual XMC IO Sites

FEATURES

- Combines an industry standard COM Express CPU module with dual XMC IO modules in a compact, stand alone design
- Scalable CPU performance from Celeron to Core2 Duo using COM Express
- Small form factor: 250 x170 mm
- Rugged, stand-alone operation
- Able to operate diskless and headless
- Runs Windows or Linux applications
- Configurable IO uses standard XMC IO modules. Add anything from RF receivers to industrial control modules.
- PCI Express IO sites (VITA 42.3) deliver >1000MB/s to CPU memory**
- Integrated timing and triggering support for IO includes optional GPS-disciplined clock
- Supports Innovative X3 and X5 IO module features for private data channels, triggering and timing features
- USB2.0 x6, Gigabit Ethernet, SATA x4, VGA, AC '97 audio
- System expansion supported with Cabled PCI Express – use other eInstruments
- Boots from SATA HDD or USB FLASH
- Optional GPS module support
- AC or 12V DC operation

APPLICATIONS

- Embedded instrumentation
- Remote, autonomous IO
- Mobile instrumentation
- Distributed data acquisition

SOFTWARE

- Windows and Linux compatible
- Runs standard desktop applications
- MSVC++ Developers Kit supporting IO integration and customization
- Device drivers, example software and support applets supplied for all peripherals

** Data rate dependent on the COM Express module capabilities

DESCRIPTION

The SBC COMEX is a user-customizable, turnkey embedded instrument that includes a full Windows/Linux PC and supports a wide assortment of ultimate-performance XMC modules. With its modular IO, scalable performance, and easy to use PC architecture, the SBC COMEX reduces time-to-market while providing the performance you need.

Distributed Data Acquisition – Put the SBC COMEX at the data source and reduce system errors and complexity. Optional GPS-synchronized timing, triggering and sample control is available for remote IO. Limitless expansion via multiple nodes.

Uniquely customizable - dual XMC sites for IO, user-programmable FPGA for IO interfaces, triggering and timing control, USB ports.

Remote or Local Operation - Continuous data streaming up to 220MB/s (10m, cabled-PCIe LAN) or 1Gb/s Ethernet. Optional, stand-alone, autonomous operation with GPS-timed sampling.

Rugged – Runs diskless from FLASH drive in a compact, rugged 250x170mm footprint that is ready for embedded operation.

12V DC-Only Operation - Perfect for portable or automotive data loggers or waveform generators.

06/16/11

SBC-COMEX

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**
SBC COMEX	90190-0	SBC-ComEx - (low-power) with Celeron CPU with active heat sink and fan, 4GB (2x2GB SODIMMS, 667MHz FSB). 2 SATA 1.5Gbps, 6 USB 2.0. 125W 8-24V DC power supply, uses 20W consumption.
	90190-1	SBC-ComEx - (high-performance) with Core2 Duo CPU with active heat sink and fan, 4GB (2x2GB DDR2 SODIMMS, 800MHz FSB). 2 SATA 1.5Gbps, 6 USB 2.0. 125W 8-24V DC power supply, uses 60W.
	90190-2	SBC-ComEx - (ultra-performance) with 2.53 GHz Penryn Core2 Duo CPU with active heat sink and fan, 4GB (2x2GB DDR3 SODIMMS, 1067MHz FSB). 4 SATA 1.5Gbps, 6 USB 2.0. 125W 8-24V DC power supply, uses 50W.
Enclosure	80206-0	Aluminum Enclosure for SBC-ComEx. Accomodates ventilation for up to two XMC and one COMEX processor module, front/rear panel I/O.
Storage Options		
Flash Drive	49016	USB Flash Drive, 4 GB
Solid State Disk Drive	36019	Fast, rugged, solid-state disk drive with 160 GB capacity
Performance Hard Disk	80212-0	Single 200GB 7200 RPM SATA 3.0Gb/s Hard Drive
	80212-1	Dual 200GB 7200 RPM SATA 3.0Gb/s Hard Drives
GPS Options		
Receiver	68012G	GPS receiver module, TYCO A1029-D. Mounts onto SBC-ComEx carrier
Antenna	68013G	Tyco A1029-D GPS antenna, Active, +25dB, 3.3V, SMA cable
Power Supply Options		
AC Power Supply (USA/Japan/Korea)	80200-1	AC Power Supply for SBC COMEX, 110-240VAC, with 12V DC output for SBC COMEX. USA/Japan/Korea/Taiwan power cord.
AC Power Supply	80200-2	AC Power Supply for SBC COMEX, 110-240VAC, with 12V DC output for SBC COMEX.

(UK)		UK/Australia/India power cord.
AC Power Supply (EU)	80200-3	AC Power Supply for SBC COMEX, 110-240VAC, with 12V DC output for SBC COMEX. EU power cord
Cable Options		
SMA to BNC Cable	67048	50 Ohm SMA to BNC Cable (for reference clock input or sample clock outputs)
Mezzanine Card	80208-1	Mezzanine card for eInstrumentPC exposing J16 signals from XMC sites 0 and 1, plus SBC-ComEx baseboard digital I/O signals
XMC Modules from Innovative Integration		
X5-400M	80180-1	XMC module with Xilinx Virtex5 SX95, memory and 2 channels 400 MSPS, 14-bit input and 2 channels 500 MSPS DAC; 1GB/s PCIe interface
X5-210M	80190-0	XMC module with Xilinx Virtex5 SX95, memory and 4 channels 210 MSPS, 14-bit input; 1 GB/s PCIe interface
X3-SD	80168-0	XMC module with Xilinx Spartan3 1M gate FPGA, memory and 16 channels of 24-bit, 216 ksps A/D
X3-SDF	80175-0	XMC module with Xilinx Spartan3 1M gate FPGA, memory and 4 channels of 24-bit, 5MSPS A/D
X3-10M	80192-0	XMC module with Xilinx Spartan3A DSP 1.8M gate FPGA, memory and 8 channels of 16-bit, 10 MSPS A/D
X3-25M	80176-0	XMC module with Xilinx Spartan3A DSP 1.8M gate FPGA, memory and 2 channels of 16-bit, 80 MSPS A/D, and 2 channels of 16-bit 50 MSPS DAC
X3-Servo	80179-0	XMC module with Xilinx Spartan3A DSP 1.8M gate FPGA, memory and 12 channels of 16-bit, 250 ksps A/D, and 12 channels of 16-bit 2 MSPS DAC
X3-A4D4	80177-0	XMC module with Xilinx Spartan3A DSP 1.8M gate FPGA, memory and 4 channels of 16-bit, 4 MSPS A/D, and 4 channels of 16-bit 50 MSPS DAC
X3-DIO	80178-0	XMC module with Xilinx Spartan3A DSP 1.8M gate FPGA, memory and 64 bits of digital IO

SBC-COMEX

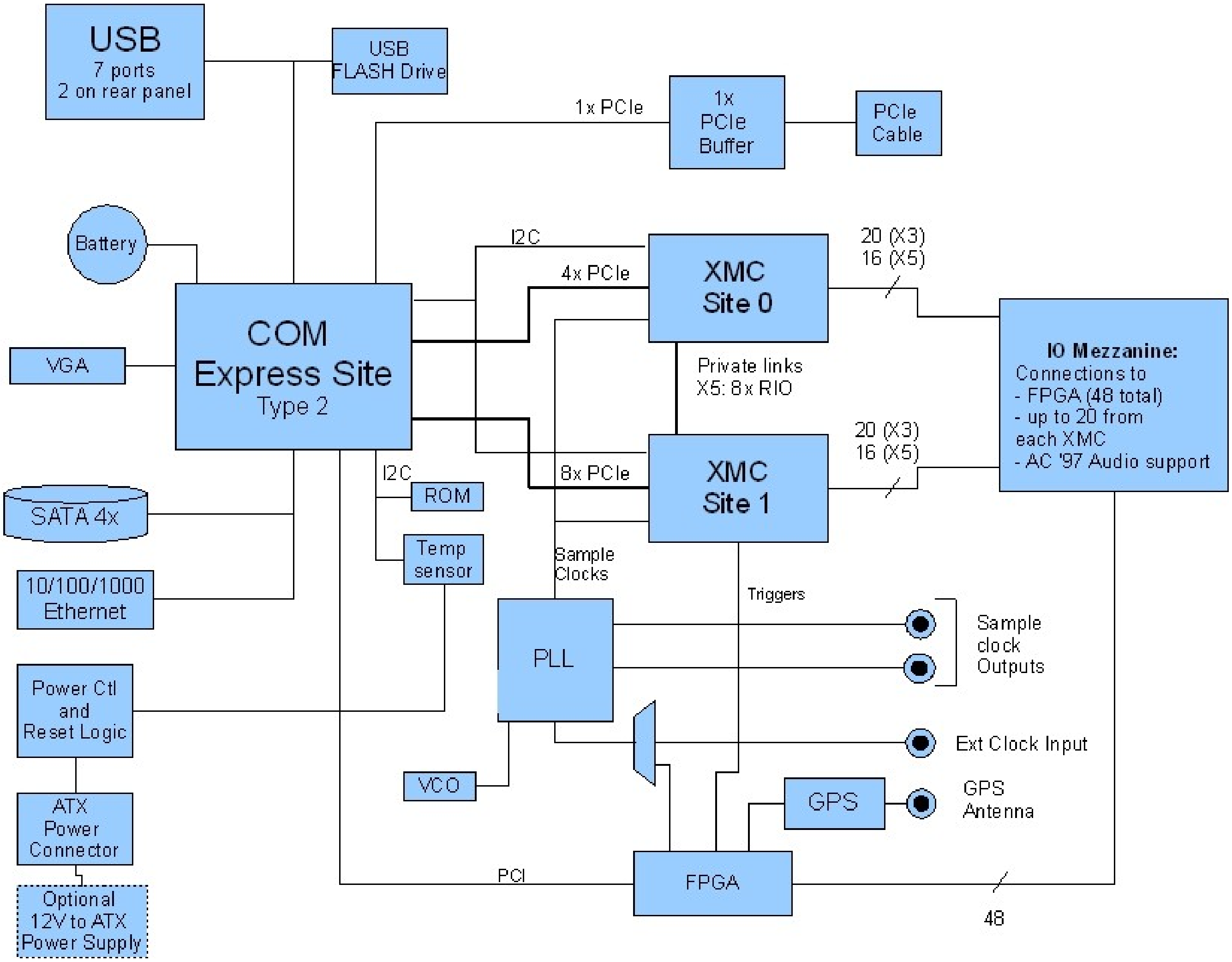


Figure 1. SBC-ComEx Block Diagram

SBC-COMEX

Figure 2. SBC-ComEx Carrier Board with Dual XMC modules installed

SBC-COMEX

Standard Features

COM Express Site	
Standards	PCIMG COM.0 COM Express Base Specification 1.0 Compliant
Type	2
Size	Supports 95 x 125 mm modules
Verified Modules	Kontron ETXexpress MC series Radisys Procelerant CE945GM series
CPU Types	Low Power: Celeron M 423M @ 1.06 GHz High Performance: Core DuoL2400 @ 2 GHz
COM Express Memory	Up to 4 GB (2 SODIMMs) See approved memory list for each COM Express module.
IO Ports	
USB	USB 2.0 2 Type A rear panel ports 5 internal USB ports when using approved COM Express modules
Ethernet	10/100/1000 port on rear panel **Speed depends on COM Express
Video	Analog VGA up to QXGA (2048x1536)
Cabled PCI Express	1x lane (2.5Gbps full duplex) Complies with PCIMG PCI Express Cable Specfication 1.0
XMC Sites	
Module Sites	2
Standards	VITA 42.3 XMC for PCI Express VITA 20 Conduction cooling
Size	75 x 150 mm, 10mm mezzanine height
PCI Express Connections	XMC Site 0 (4 lanes) XMC Site 1 (8 lanes using PEG interface)
J16 Support	8x High speed serial pairs 20 direct connections to IO mezzanine

USB FLASH Drive	
Capacity	4GB
Type	USB 2.0, internal drive
Use	Boot drive or data storage

Timing and Triggering Support Features	
Sample Clock Sources	PLL, external
PLL Range	200 kHz to 140 MHz (with 100 to 140 MHz VCO) Additional ranges may be custom ordered
PLL Reference	10 MHz reference or optional GPS-disciplined clock
GPS disciplined clock accuracy	+/-100 ns RMS from UTS
Trigger Modes	Software, GPS-synchronized, GPS Time, external input
Trigger Outputs	2 per XMC site, two IO Mezzanine
Clock input	Use as sample clock or PLL Reference SMA on rear panel
Clock Outputs	50 ohm, SMA internal connectors < 0.5 ps RMS jitter Sine output
Module Synchronization	Simultaneously trigger both modules Matched clocks
System Synchronization	Output clocks and triggers for system functions

SBC-COMEX

Customization Features	
FPGA	Xilinx Spartan3E 250K gate FPGA Controls triggering and has 48 pin connections to IO Mezzanine PCI Interface to COM Express CPU FrameWork Logic available for FPGA in VHDL
IO Mezzanine	Add functionality and rear terminal connectors for special features 48 bits connections to FPGA AC '97 audio signals from COM Express 20 bits to each XMC J16

GPS Option	
Type	12 satellite, parallel tracking
Position Accuracy	3m CEP
Time to first fix (TTFF)	Cold <60s Warm <32s Obscuration recovery <1s
Maker	Tyco Electronics, model A1029
Interface	Serial interface to FPGA (PCI device peripheral to COM Ex CPU)

Power Requirements	
Input	8 to 16V DC
Consumption	*Varies according to XMC and COM Express module requirements* 35W: SBC COMEX with Celeron ULV 1.06 GHz COM Express module, 1GB memory and NO XMCs 65W: SBC COMEX with Core2 Duo 2 GHz, 1 GB memory and NO XMCs

Power Management	
Power States	Low power states supported including wake features from PCI Express and LAN
Temperature Monitors	2 total : COM Express module and SBC COMEX assembly each have a temperature sensor
Alarms	Software programmable warning and failure levels
Over-temp Monitor	Disables power supplies
Conductive Cooling	Conduction cooling supported for SBC COMEX assembly includes heat conduction bars on each edge and VITA20 pattern for each XMC module
Fans	Two integrated, 12 CFM fans Active cooling assembly for COM Express module also has an integrated fan

Physicals	
Form Factor	250 x170 mm, ~30 mm height (depends on COM Express module)
Weight	1500g (est.)
Hazardous Materials	Lead-free and RoHS compliant
MTBF	17021 Hours

ABSOLUTE MAXIMUM RATINGS

!Exposure to conditions exceeding these ratings may cause damage!

Parameter	Min	Max	Units	Conditions
Supply Voltage	+8.0	+16	V	
Operating Temperature	0	60	C	Non-condensing, forced air cooling required
Storage Temperature	-65	+150	C	
ESD Rating	-	1k	V	Human Body Model
Vibration	-	5	g	9-200 Hz, Class 3.3 per ETSI EN 300 019-1-3 V2.1.2 (2003-04)
Shock	-	40	g peak	Class 3.3 per ETSI EN 300 019-1-3 V2.1.2 (2003-04)

SBC-COMEX

Architecture and Features

The SBC COMEX combines a Windows/Linux compatible embedded PC with XMC IO modules and supporting peripherals to create a customizable instrument for a variety of applications.

Embedded PC

The embedded PC architecture is Windows/Linux compatible – it runs the same applications as a desktop computer. The COM Express CPU module is a PC on a module and provides the computing engine, available with a range of Intel processors from low power Celeron to Core2 Duo for ultimate computing power.

COM Express Advantages

- Intel compatible PC runs Windows and Linux software
- Scalable performance
- Latest technologies: PCI Express, Gb Ethernet, USB 2.0
- Upgradeable as requirements change and evolve
- Compact 95 x 125 mm form-factor
- Industry-standard, multi-vendor

The COM Express module provides the PCI Express bus that links the XMC modules to the CPU. XMC modules install just like PCI Express add-in cards on the PC and are software compatible with PC applications. The PCI Express bus tightly couples the CPU to the XMC modules and outperforms previous generation systems by 2 to 4 times. Data transfer rates to CPU memory at 500 MB/s for XMC site 0 and up to 1 GB/s for XMC site 1.

The SBC COMEX provides familiar PC interfaces for expansion and connectivity: Gigabit Ethernet, USB ports, and SATA HDD. System expansion using a cabled PCI Express port is also provided for high performance IO supporting up to ~180MB/s transfer rates to external devices such as other eInstruments.

The VGA video port and USB keyboard/mouse make operating the SBC COMEX to operate just like any PC. Standard PC screens supporting VGA up to 2048x1536 are supported. “Headless” operation is also supported for truly embedded applications without keyboard/monitor/mouse attached. In the headless mode, the SBC COMEX can be remotely controlled and accessed over Ethernet.

XMC IO Sites

Dual XMC IO module sites enable the SBC COMEX to be configured with a wide variety of IO modules. The XMC sites are for PCI Express mezzanine cards conforming to VITA 42.3 standard, which are 75 x 150 mm modules (IEEE 1386). Each module site has a cooling fan mounted directly under the module.

XMC Modules for IO

- Flexible, modular IO
- Industry-standard VITA 42.3
- PCI Express with up to 1 GB/s transfer rates
- X5 modules: IF Rx, Tx, GSPS A/D with Virtex5 FPGA
- X3 modules: Analog and digital IO with FPGA
- Industry-standard, multi-vendor

Innovative offers two lines of XMC IO modules: the X3 and X5 families. The X3 and X5 module families off a range of analog performance mated to high performance FPGA computing cores, with the X5 family featuring the Xilinx Virtex5 and the X3 using the Xilinx Spartan3 family. Innovative's Velocia architecture data packet system allows these modules to stream data continuously to system memory at rates up to 1 GB/s – making the SBC COMEX well suited for data logging and playback functions. When configured with a four SSD RAID0 array, sustained rates to 400MB/s are achievable (limited by the currently-available COM chipset, not the drive array)

SBC-COMEX

Special features supporting both X3 and X5 module families are provided in the SBC COMEX for simultaneously sampling, triggering, controls and private inter-module communications. System triggers and matched clocks from an on-card PLL provide simultaneously sampling for the two modules. X5 modules can communicate over private Rocket IO links at over 1 GB/s in each direction for real-time applications demanding low latency and deterministic performance. Each X3 module has J16 interface also has 20 single-ended connections to the IO Mezzanine for custom applications, X5 modules have 16 connections to the IO Mezzanine.

Triggering and Sample Clocks

The SBC COMEX has unique clocking and triggering features for the XMC modules. Each module receives two triggers from the Application FPGA and two clock inputs through its J16 connector. Innovative X3 and X5 modules can use these to support simultaneous sampling and unique trigger scenarios using the Application FPGA.

Sample clocks for the XMC modules can be generated using an on-card PLL or from an external clock input. The PLL can use either the external clock input or an GPS-disciplined clock as a reference. The GPS-disciplined clock allows multiple, remote instruments to sample simultaneously and act cooperatively. Position and time data is also available from the GPS when installed.

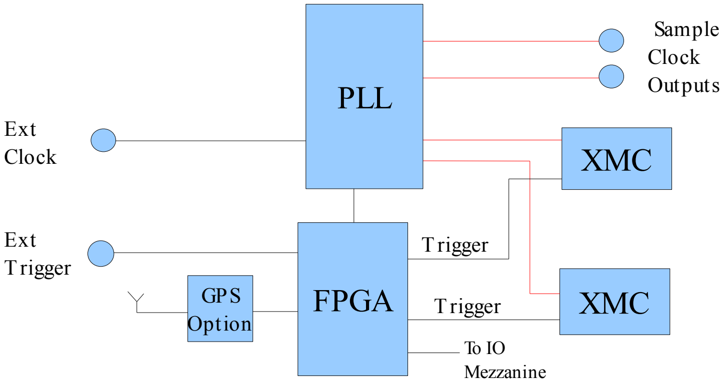
Remote Operation

SBC COMEX can be operated using Ethernet as a remote computer or embedded instrument. For pure embedded operation, the SBC COMEX can operate “headless” without monitor, keyboard or mouse. The system boots from either FLASH hard drive or SATA HDD.

Application FPGA

The Application FPGA allows the SBC COMEX to be customized for many IO functions, such as triggering and control features. The FPGA is a PCI bus peripheral to the COM Express CPU. New functions can added to the system as PCI devices by adding them to the FPGA design. FPGA logic is provided in the FrameWork Logic tools, which includes the standard functionality that can be modified or used as an example.

Sample Controls and Clocking



The FPGA device is a Xilinx Spartan3E, 250K gate device. The logic is loaded from an on-card ROM which is field reprogrammable. Development using Xilinx USB JTAG cable is supported.

IO Mezzanine Expansion

The SBC COMEX can be expanded using the IO Mezzanine. The IO Mezzanine has 48 connections to the application FPGA, and AC'97 audio port, and 20 connections to each XMC J16 connector. The IO Mezzanine is used to provide application-specific rear connectors and is large enough to integrate IO buffers and other logic.

The AC'97 audio port provides support for standard PC sound ports functions on the IO mezzanine card.

Mechanicals and schematics for the IO Mezzanine are available for design support.

Software Tools

Software development tools for the SBC COMEX provide comprehensive support application development including device drivers, peripheral configuration and control, and utilities that allow developers to be productive from the start. Software classes provide C++ developers a powerful, high-level interface to the system devices that makes system integration and achieving real-time, high speed data acquisition easier.

Software for data logging and analysis are provided with every Innovative X3 and X5 module. Data can be logged to system memory at full rate or to disk drives at rates supported by the drive and controller. Triggering and sample rate controls are provided to support data acquisition applications without writing code. Innovative software applets include *Binview* which provides data viewing, analysis and import to MATLAB for large data files.

Support for MS Visual C++ is provided. Supported OS include Windows and Linux. For more information, the software tools User Guide and on-line help may be downloaded.

Logic Tools

Customized IO interfaces, triggering and other unique features may be added to the SBC COMEX by modifying the FPGA logic. The FrameWork Logic tools provide support for VHDL/Verilog developments. Application logic can be modified by building upon the Innovative components for hardware interfaces and system functions. Each design is provided as a Xilinx ISE project with VHDL source for top level logic with a ModelSim testbench illustrating logic functionality.

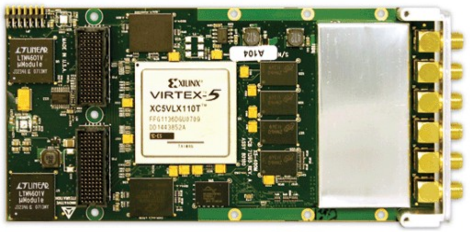
XMC Modules

Plug XMC modules into the SBC COMEX to build your custom, turnkey embedded instrument. Innovative Integration offers an array of ultra-performance, PCI Express XMC modules to create your solution.

Innovative X3 and X5 XMC module families feature analog and digital IO with FPGA computing cores on high performance PCI Express modules. The FrameWork Logic development tools allow you to design in MATLAB and VHDL and rapidly implement high speed signal processing on the XMC.

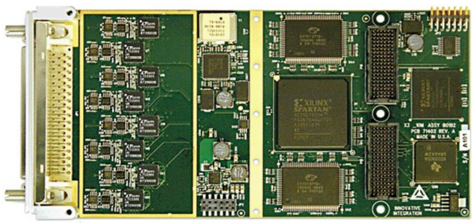
X5 Module Family – Ultimate Performance
Xilinx Virtex5 SX95
1GB/s PCIe
512MB DRAM
8MB QDR SRAM

X5-400M - (2) 400 MSPS, 14-bit A/Ds and (2) 500 MSPS, 16-bit DACs



X3 Module Family – Multi-channel IO with FPGA
Analog/Digital IO
Xilinx Spartan3A DSP 1.4 Mgate
180 MB/s PCIe
4 MB SRAM

X3-10M - 8 simultaneous channels of 25 MSPS 16-bit A/D and 1.8M FPGA w ith DSP



SBC-COMEX

PCI Express (PCIe) XMC Modules	
X5 XMC Module Family	
X5-400M	Two 400 MSPS, 14-bit A/Ds and two 500 MSPS, 16-bit DACs, Virtex5 SX95 DSP FPGA and 1GB Memory ; 1GB/s PCIe interface, RIO 8x on J16
X5-210M	Four 210 MSPS 14-bit A/Ds, Virtex5 SX95 DSP FPGA, and DDR2/QDR-II Memory; 1 GB/s PCIe interface, RIO 8x on J16
X3 Module Family	
X3-10M	PCI Express XMC Module with 8 simultaneous channels of 25 MSPS 16-bit A/D, and Xilinx Spartan3A DSP1.8M or 3.4 Mgate FPGA - Digital IO: 44-bits (J16); 180 MB/s PCIe interface
X3-25M	2 A/D, 16-bit, 80MHz, >80 dB SFDR - 2 D/A, 16-bit, 50MHz, >85 dB S/N - Digital IO: 44-bits (J16), 16-bits Front Panel - Xilinx Spartan3A DSP FPGA, 1.8 or 3.4 Mgate - 4MB SRAM; 180 MB/s PCIe interface
X3-A4D4	4 A/D, 16-bit, 4MHz, >85 dB S/N - 4 D/A, 16-bit, 10MHz, >85 dB S/N - Digital IO: 44-bits (J16), 8-bit Front Panel - Xilinx Spartan3A DSP FPGA, 1.8 or 3.4 Mgate - 4MB SRAM; 180 MB/s PCIe interface
X3-DIO	Digital IO: SRAM @ 150MB/s, 44-bits (J16), 64-bits Front Panel, LVDS, LVTTL, CMOS33, CMOS25 - Xilinx Spartan3A DSP FPGA, 1.8 or 3.4 Mgate - 4MB SRAM; 180 MB/s PCIe interface
X3-SD	16 A/D, 24-bit, 216kHz, >100 dB S/N - 44-bits (J16) Digital IO - Xilinx Spartan3 FPGA, 1 or 2 Mgate - 4MB SRAM; 180 MB/s PCIe interface
X3-SDF	4 A/D, 24-bit, 20MHz, >100 dB S/N - 44-bits (J16) Digital IO - Xilinx Spartan3 FPGA, 1 or 2 Mgate - 4MB SRAM; 180 MB/s PCIe interface
X3-Servo	12 A/D, 16-bit, 250kHz, >80 dB S/N - 12 D/A, 16-bit, 1MHz, >80 dB S/N - Digital IO: 44-bits (J16), 8-bits Front Panel - Xilinx Spartan3A DSP FPGA, 1.8 or 3.4 Mgate - 4MB SRAM; 180 MB/s PCIe interface

SBC-COMEX

IMPORTANT NOTICES

Innovative Integration Incorporated reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to Innovative Integration's terms and conditions of sale supplied at the time of order acknowledgment.

Innovative Integration warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with Innovative Integration's standard warranty. Testing and other quality control techniques are used to the extent Innovative Integration deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

Innovative Integration assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using Innovative Integration products. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

Innovative Integration does not warrant or represent that any license, either express or implied, is granted under any Innovative Integration patent right, copyright, mask work right, or other Innovative Integration intellectual property right relating to any combination, machine, or process in which Innovative Integration products or services are used. Information published by Innovative Integration regarding third-party products or services does not constitute a license from Innovative Integration to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from Innovative Integration under the patents or other intellectual property of Innovative Integration.

Reproduction of information in Innovative Integration data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice.

Innovative Integration is not responsible or liable for such altered documentation. Resale of Innovative Integration products or services with statements different from or beyond the parameters stated by Innovative Integration for that product or service voids all express and any implied warranties for the associated Innovative Integration product or service and is an unfair and deceptive business practice. Innovative Integration is not responsible or liable for any such statements.

For further information on Innovative Integration products and support see our web site:

www.innovative-dsp.com

Mailing Address: Innovative Integration, Inc.

2390A Ward Avenue, Simi Valley, California 93065