SBC-Nano

A Windows/Linux Embedded Single Board Computer with XMC IO Site and 1 GbE Link V1.6

FEATURES

- Combines an industry standard COM Express CPU module with XMC IO module in a compact, stand-alone design
- Powerful performance using Intel-based CPU core on a Type 10 mini size COM Express module
- Very small form factor: 150 x 75 mm
- Rugged, stand-alone operation
- Able to operate headless
- Runs Windows or Linux applications including RTOS variants
- Configurable IO uses standard XMC IO modules. Add anything from RF receivers to industrial control modules.
- PCI Express IO site (VITA 42.3) delivers up to1600 MB/s to CPU memory
- Supports ISI XMC module features for private data channels, triggering and timing
- USB 3.0/2.0 x2, USB 2.0 x2 (internal), mini DisplayPort; 1 Gb Ethernet; Two Internal Generic Serial Ports
- PCI Express 1x4 (Gen 2) configuration for XMC interface
- Storage: 2 internal mSATA slots
- On-board XMC FPGA JTAG programmer
- Flexible 6V - 14V DC operation

APPLICATIONS

- Embedded instrumentation
- Remote autonomous IO
- Mobile instrumentation
- Sensor data processing
- Distributed data acquisition

DESCRIPTION

The SBC-Nano is a 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-Nano reduces time-to-market while providing the performance you need.

Distributed Data Acquisition – Put the SBC-Nano at the data source and reduce system errors and complexity.

Limitless flexibility – Different functionality can be achived by simply replacing the XMC module.

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

Remote or Local Operation - Continuous data streaming up to 500 MB/s (local SSDs) or 1 Gb/s Ethernet.

Rugged – Runs from the mSATA SSD drive in a compact, rugged 150 x 75 mm footprint that is ready for embedded operation.

Two Generic Serial Ports for system extension.

On-board JTAG programmer allows XMC module FPGA in-system programming directly from the Xilinx development tools.

6V -14V DC Operation - Perfect for portable or automotive battery-operated data loggers or waveform generators.

Xilinx Cool-Runner CPLD based System voltage and temperature monitor for safe operation.

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Interconnect Systems International, LLC products and disclaimers thereto at the end of this datasheet. All trademarks are the property of their respective owners.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Interconnect Systems International, LLC standard warranty. Production processing does not necessarily include testing of all parameters.

This electronics assembly can be damaged by ESD. Interconnect Systems International, LLC 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.

SBC-Nano

ORDERING INFORMATION

Product	Part Number	Description
SBC-NANO x4 PCIE x1 Gbe	90654-0-L0 90654-1-L0 90654-2-L0 90654-3-L0 90654-4-L0 90659-0-L0 90659-1-L0 90659-2-L0 90659-3-L0 90659-4-L0	SBC-NANO x4 PCIE 1 Gbe DEV KIT XA/X6* (No mSATA) SBC-NANO x4 PCIE 1 Gbe DEV KIT XA/X6* (x1 512 MB mSATA) SBC-NANO x4 PCIE 1 Gbe DEV KIT XA/X6* (x2 512 MB mSATA) SBC-NANO x4 PCIE 1 Gbe DEV KIT XA/X6* (x1 1024 MB mSATA) SBC-NANO x4 PCIE 1 Gbe DEV KIT XA/X6* (x2 1024 MB mSATA) SBC-NANO x4 PCIE 1 Gbe DEV KIT X3** (No mSATA) SBC-NANO x4 PCIE 1 Gbe DEV KIT X3** (x1 512 MB mSATA) SBC-NANO x4 PCIE 1 Gbe DEV KIT X3** (x2 512 MB mSATA) SBC-NANO x4 PCIE 1 Gbe DEV KIT X3** (x1 1024 MB mSATA) SBC-NANO x4 PCIE 1 Gbe DEV KIT X3** (x2 1024 MB mSATA) **Kits Include:** • SBC-NANO WINDOWS/LINUX SINGLE-BOARD COMPUTER (SBC-Nano Carrier) • COM EXPRESS MINI TYPE 10 MODULE INTEL x7-E3950 ATOM PROCESSOR 8GB DDR3L INDUSTRIAL TEMP • X4 PCIe LANES AND 1 Gbe ETHERNET • SBC-NANO EXTENSION BOARD x2 mSATA capability x16 DIO x2 EXTERNAL USB x2 INTERNAL USB x2 INTERNAL SERIAL PORT • FANSINK ASSEMBLY QUAD FAN • CHASSIS, HEATSINKS, CONDUCTIVE COOLING to CHASSIS AND OTHER REQUIRED HARDWARE • AC-DC POWER ADAPTER, USA Plug
Operating System	2222210110 2222210113	WIN 10 x64 PRO CENTOS 7 X64
SOLID STATE DRIVES (mSATA)***	2226003444 2226013150 2226003445	SAMSUNG 850 EVO MSATA 250GB SATA III SAMSUNG MEM MSATA 860 EVO 500GB SATA III SAMSUNG 850 EVO MSATA 1TB MINI-SATA III
XMC MODULES		Consult Sales for ISI XMC MODULE listing (InnovativeSales@Molex.com)
DIO BREAKOUT	80365-0-L0 2226003475	DIO 2X13 TWINAX BREAKOUT BOARD NO CABLE ASSY CABLE DIO 2X13 TWINAX W/ LATCH 36"

Notes: 1. Use with ISI XA or X6 Series XMC Modules.

2. Use with ISI X3 Series XMC Modules.

3. System can accommodate two mSATA SSDs; one is required for OS and other software storage and must be always installed, second is optional.

BLOCK DIAGRAM

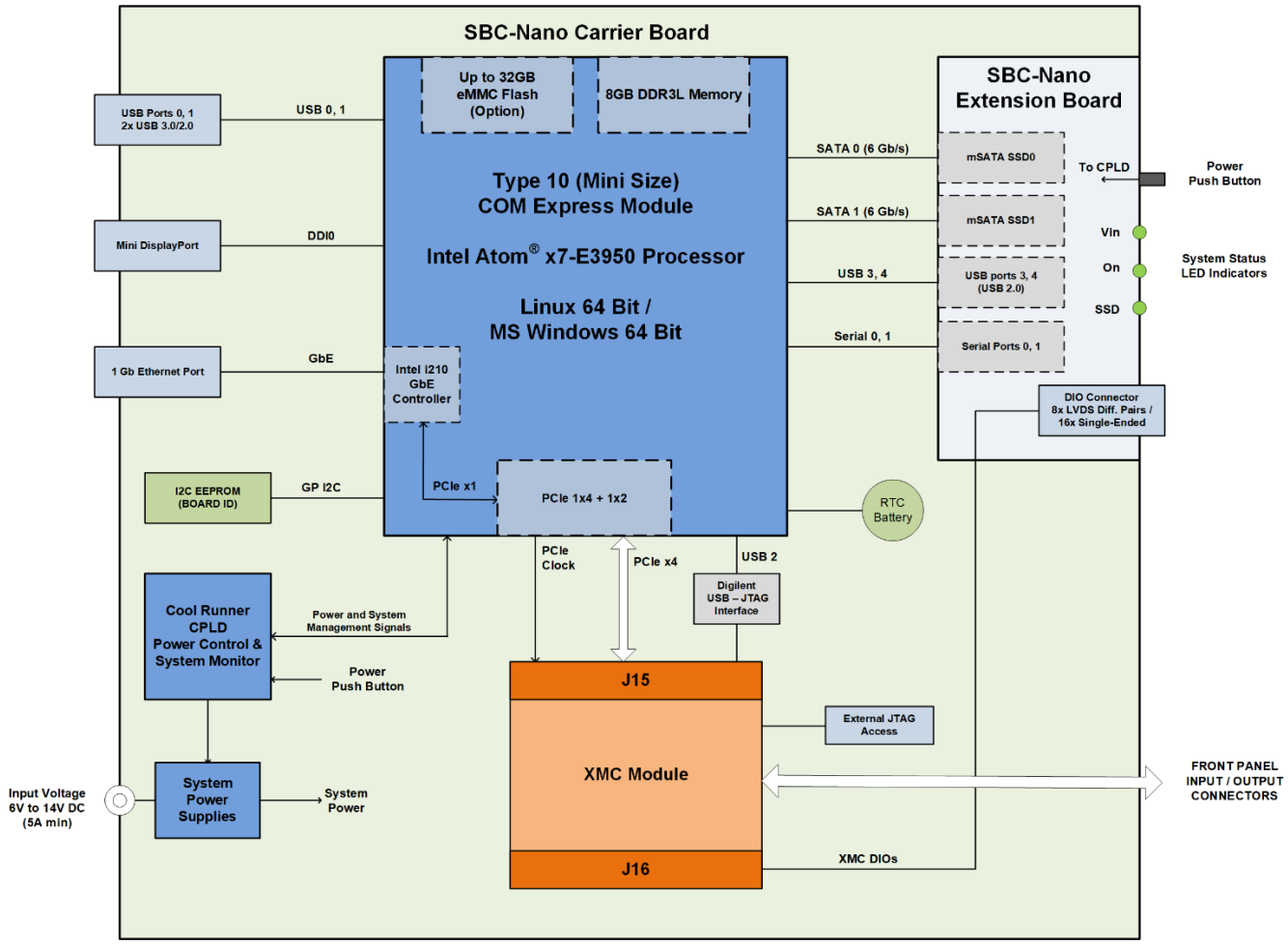


Figure 1. SBC-Nano System Simplified Block Diagram

Figure 2. Front view of SBC-Nano system in a chassis with XMC module installed. Fansink (on the top) can be substituted with a coldplate in conduction-cooled applications.

Figure 3. Rear view of SBC-Nano system in a chassis.

Figure 4. Front isometric view of SBC-Nano system in a chassis.

Figure 5. Rear isometric view of SBC-Nano system in a chassis.

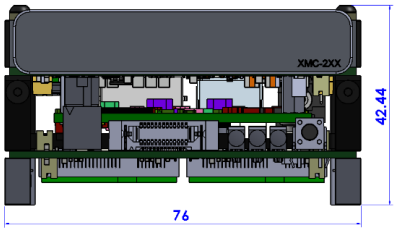


Figure 6. Nominal dimensions of SBC-Nano electronics stack, front view (SBC-Nano Carrier + SBC-Nano Extension Board + XMC module).

Figure 7. Nominal dimensions of the SBC-Nano chassis, front view.

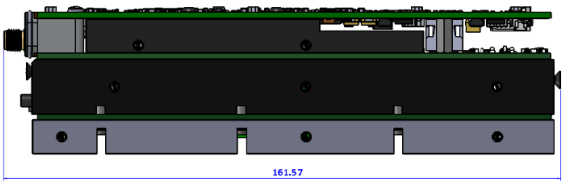


Figure 8. Nominal dimensions of SBC-Nano electronics stack, side view.

Figure 9. Nominal dimensions of the SBC-Nano chassis, side view.

Standard Features

COM Express Site	
Standards	PCIMG Com Express® Module Base Specification COM.0 R2.1 Compliant
Type	10
Size	Supports 84 x 55 mm modules (mini size)
Verified Modules	COMe-mAL10 E2 E3950 8E (Kontron) nanoX-AL-E3950-8G (Adlink)
CPU Type	Intel® Atom™ x7-E3950, 4C, 1.6 / 2.0 GHz, 12 W TDP
COM Express Memory	8 GByte Dual Channel DDR3L-1866 (-1600) memory down
eMMC (optional)	32 GByte on-board Flash
IO Ports	
USB	2x USB 3.0 (incl. USB 2.0) Type A Rear Panel Ports (USB 0, USB 1) 2x USB 2.0 Internal Headers (USB 3, USB 4)
Video	Mini DipsplayPort (Rear Panel Port)
Ethernet	Single 10/100/1000 Mb/s Port (J45 on Rear Panel)
SATA	2x SATA 6 Gb/s internal ports (mSATA)
Serial	2x 2 UART ports COM 0, COM 1 (TX/RX only)
XMC Sites	
Module Sites	1
Standards	ANSI/VITA 42.0-2016

Timing and Triggering Support Features	
Clock and Trigger	XMC Module dependent
Power Requirements	
Input Voltage	6V DC to 14V DC; 12V DC Nominal
Power Consumption	Varies according to XMC and COM Express module requirements 30W to 40W typical <15W with standard COM Express module excluding XMC
Power Input Connector	36V / 10A DC Power Jack; 2.5mm x 5.5mm
Power and Thermal Management	
Power States	Low power states supported including wake features from PCI Express and LAN
Power Monitoring	System will not power up or the power will be shut down with the input voltage outside of the 6V to 14V range
Temperature Monitors	Separate Temperature Monitors on COM Express Module and XMC
Alarms	Software programmable warning and failure levels
Over-temperature Monitor	Failure level alarm disables power
Power Control	Power sequencing; power good indication
Cooling	Forced Air (Fansink)*
Physicals	
Form Factor	165 x 85 x 85 mm

	XMC: Switched Mezzanine Card Base Specification ANSI/VITA 42.3-2014 XMC: PCI Express Protocol Layer ANSI/VITA 20-2005 (S2018) Conduction cooled PMC
PCI Express Connections	XMC Site: 4 Lanes Gen 2
J16 Support	16 single/8 differential direct connections to Front Panel DIO connector
XMC Power	
VPWR	12V +/-5%; 4A max (with supplied AC-DC Adapter)
3.3V	3.3V +/-3%; 6A max
3.3VAUX	3.3V +/-3%; 0.5A max

Weight	1,150g typical (SBC-Nano Carrier + SBC-Nano Extension + mSATA SSD (1) + X6-1000M in a chassis with Fansink)
Hazardous Materials	Lead-free / RoHS compliant
MTBF	17,000 Hours
AC-DC Power Adapter	
Input Voltage	90 – 264 V AC; 50/60Hz
Output Voltage	12V DC
Output Current	8.33A
Dimensions	136 x 58.5 x 33.7mm (W x H x D)
Environmental	
Operating Temperature	0°C to + 50°C, non-condensing **

Notes: 1. Contact Sales if conduction cooling option is desired.

2. Standard (-L0) option. Contact Sales if other options are required.

ABSOLUTE MAXIMUM RATINGS

Exposure to conditions exceeding these ratings may cause system damage!

Parameter	Min	Max	Units	Conditions
Input Supply Voltage (Vin)*	6.0	14.0	V	Recommended input supply voltage is 12V.
Operating Temperature	0	+70	°C	Non-condensing, with forced air cooling
Storage Temperature	-40	+100	°C	
ESD Rating	-	2,000	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-Nano designed to withstand input voltage up to 20V without damage, but it would not get powered-up.
Input voltage must never exceed 20V or connected in reversed polarity – this will cause system damage!

Operating Environment Ratings

The SBC-Nano can be used in a variety of applications with different operating environment temperature, shock and vibration levels. Contact Sales for available Ruggedization Levels.

SBC-Nano

Architecture and Features

The SBC-Nano combines a Windows/Linux compatible embedded PC with XMC IO module and supporting peripherals to create a customizable instrument for a wide 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 four low power Atom cores for ultimate computing power.

COM Express Advantages

- Intel compatible PC runs Windows and Linux software
- Scalable performance
- Latest technologies: PCIe gen2, Gb Ethernet, USB 3.0
- Upgradeable as requirements change and evolve
- Tech refresh every 18 months
- Ultra-Compact 84 x 55 mm form-factor (Type 10)
- Industry-standard, multi-vendor

The COM Express module provides the PCI Express bus that links the XMC module to the CPU. The XMC module behaves identically to PCI Express add-in cards within a 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. In the SBC-Nano architecture, the XMC module linked to CPU with 4 lane PCIe bus at Gen 2 speed providing data transfer rates between the XMC module and CPU at speed up to 1600 MB/s.

SBC-Nano provides familiar PC interfaces for expansion and connectivity: Ethernet, USB ports, and mSATA SSD. Multiple SBC-Nano's may be connected into a mesh using the 1 Gb Ethernet port for high performance IO supporting up to ~100 MB/s transfer rates to external devices such as other eInstruments.

The mini DisplayPort video port and USB keyboard/mouse make operating the SBC-Nano to operate just like any PC. Standard PC screens with up to 4K resolution are supported. “Headless” operation is also supported for truly embedded applications without keyboard/monitor/mouse attached. In the headless mode, the SBC-Nano can be remotely controlled and accessed over Ethernet or via remote protocols such as RDP or VNC.

XMC IO Site

A single XMC module site enables the SBC-Nano to be configured with a wide variety of IO modules. The XMC site is for PCI Express mezzanine cards conforming to ANSI/VITA 42.3 standard, which are 75 x 150 mm size modules (IEEE 1386). Each installed module must employ a suitable heat spreader to conduct heat to the thermal rails running on the long edge of the SBC-Nano carrier and connected to a coldplate within the system.

XMC Modules for IO

- Flexible, modular IO
- Industry-standard ANSI/VITA 42.3
- PCI Express with up to 1.6 GB/s transfer rates
- XU, XA, X6 and X3 module Families available from ISI
- Industry-standard, multi-vendor

XMC Modules

SBC-Nano makes it easy to build your custom, turnkey embedded instrument by simply adding an XMC module with desired functionality. ISI offers an array of high-performance PCI Express XMC modules to create your own solution.

ISI XMC module families feature analog and digital IO with FPGA computing cores on high performance PCI Express modules and offered in XU, XA, X6 and X3 families. The XU family features Xilinx Kintex Ultrascale FPGA, the XA - Xilinx Artix-7, the X6 - Xilinx Virtex 6 and the X3 - Xilinx Spartan 3. ISI's Velocia architecture data packet system allows these modules to stream data continuously to system memory at rates up to 1.6 GB/s – making the SBC-Nano well suited for data logging and playback functions.

SBC-Nano supports ISI XMC module families' special features for sampling, triggering, and controls. Each XMC module's J16 interface also routes 8 differential/16 single ended connections to a high-speed DIO connector for custom applications.

A list of all currently available XMC modules can be found on the ISI website here. Software and Logic tools are available for all ISI XMC Modules. Please refer to used XMC module's documentation for additional details, including ordering information, pricing and conditions; contact Sales if more information is required.

Triggering and Sample Clocks

Sample clocks for the XMC modules can be generated using an XMC module's on-card PLL or from an external clock input. The PLL can use the external clock input as a reference.

Triggering on XMC modules can be done via the software or by using the external trigger signal. More details on the clock and triggering features can be found in used XMC module's specifications.

Remote Operation

SBC-Nano can be operated using Ethernet as a remote computer or embedded instrument. For pure embedded operation, the SBC-Nano can operate "headless" without monitor, keyboard or mouse. The system can be configured to boot from an optional 32 GB eMMC flash drive located on the COM Express module itself. Thus, the two SATA links and bandwidth can be dedicated to storage of application-specific data.

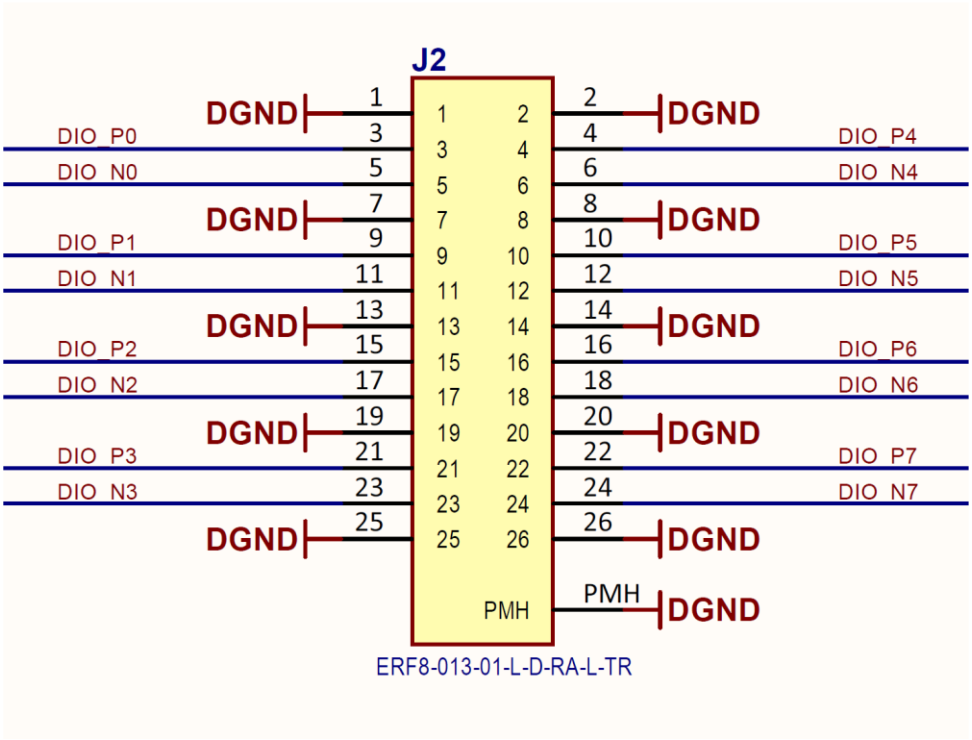
XMC Module FPGA Configuration

The SBC-Nano has a built-in USB-JTAG Interface circuitry which allows convenient loading of the FPGA application image directly from the Xilinx Vivado or Impact development tools without the external USB JTAG programming hardware such as Xilinx Platform Cable USB and disassembling the SBC-Nano system. This helps significantly accelerate FPGA custom logic development. Please note that the XMC module must support JTAG programming via the J15 connector to be able to use this feature.

DIO SIGNAL CONNECTIONS

The following table and pictures show the DIO Signals available on the SBC-Nano front panel DIO connector. DIO signals are routed from the FPGA on XMC module internally all the way to the SBC-Nano DIO connector as impedance controlled 100 Ohms differential / 50 Ohms single ended traces to maintain best signal integrity. It is recommended to use LVDS signaling from FPGA with proper termination on receiving end whenever possible for best possible performance. For the XMC FPGA DIO signal mapping please refer to the specific XMC module's documentation. A special high performance / high speed DIO cable and a breakout board with SMA connectors (available from ISI) provide user with convenient way to access DIO signals (see ordering section of this document for more information).

DIO SIGNAL	Front Panel DIO Connector
DIO_0_P	3
DIO_0_N	5
DIO_2_P	15
DIO_2_N	17
DIO_4_P	4
DIO_4_N	6
DIO_6_P	16
DIO_6_N	18
DIO_1_P	9
DIO_1_N	11
DIO_3_P	21
DIO_3_N	23
DIO_5_P	10
DIO_5_N	12
DIO_7_P	22
DIO_7_N	24
Signal Ground	1, 2, 7, 8, 13, 14, 19, 20, 25, 26



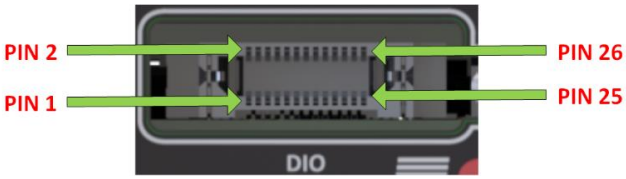


Figure 10. Front Panel DIO Connector Signals

Usage and Market

The SBC-Nano is a digital device and apparatus exclusively for use in business, industrial and commercial environments. The SBC-Nano is not marketed, sold or otherwise made available for home or residential environment use.

The SBC-Nano is exclusively for use with wired input and output signals. The SBC-Nano is not an intentional radio transmitter or receiver and is not marketed, sold or otherwise made available for connection to wireless media (with an antenna, etc.).

The SBC-Nano is not a “PC” (“personal” or “portable computer” marketed for home or residential environment use) or “PC” peripheral and is not marketed, sold or otherwise made available as a “PC” or “PC” peripheral.

The SBC-Nano may be sold as a subassembly where the integrator/purchaser takes responsibility for their assembled digital device’s or apparatus’s compliance. Consult ISI/Molex for clarification and assistance.

IMPORTANT NOTICES

Interconnect Systems International, LLC (ISI) 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 ISI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

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

Reproduction of information in ISI 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.

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

USA Compliance Notice: This device has not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased, until authorization is obtained.

EU Compliance Notice: This equipment may not be made available on the market and/or put into service until it has been brought into conformity with the EU directive(s), specifically the 'Blue Guide' on the implementation of EU products rules.

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

www.isipkg.com

Mailing Address: Interconnect Systems International, LLC.

741 Flynn Road, Camarillo, CA 93012