SBC3003 LX2160A Single Board Computer

High-Performance DO-254 Certifiable SBC IP

FEATURES AND BENEFITS

- State of the art processing technology from NXP®
  - 16 Arm® A72 cores, each with 1 MB dedicated L2 cache
  - 4x the performance of the T2080 processor
  - Dual 64-bit memory controllers with ECC
  - PCIe Gen 3 switch supporting NTB
- Part of the COTS-D family of safety certifiable modules
- Rugged conduction-cooled module - 3U SOSA-aligned VITA 65 (OpenVPX™) solution
  - SOSA 3U I/O Intensive module profile: MOD3-PAY-1F1F2U1TU1T1U1T-16.2.15– 2
- A complete hardware solution with data package to support certification to RTCA DO-254/EUROCAE ED-80
- Board Support Packages (BSP) available, as well as data packages to support certification to RTCA DO-178C/ EUROCAE ED-12C
- The provision of all IP and data to enable manufacture, support, and repair of the module

INTRODUCTION

The SBC3003 LX2160A 3U VPX Single Board Computer (SBC) is ideal for avionics and defense applications looking for the next generation processor after the popular T2080/T2081. The SBC3003 provides a safety certifiable Arm-based multi-core processor including an XMC expansion site to maximize the functionality in a single-slot of a 3U VPX system. The SBC complements the GPM3001 graphics module with an eight lane PCIe Gen 3 interface for high-performance graphics and compute.

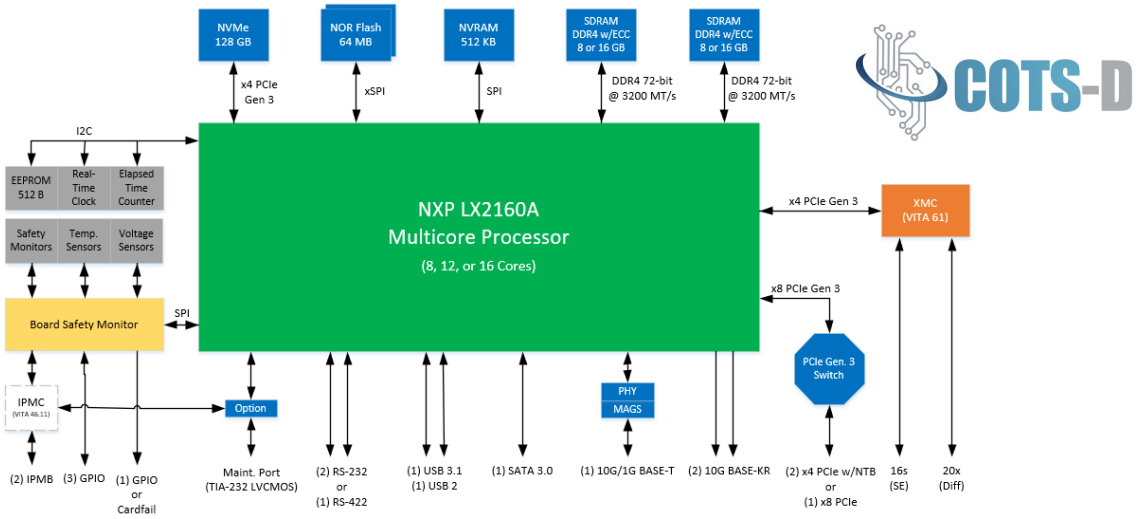

Figure 1: SBC3003 LX2160A Block Diagram

The LX2160A SBC design comes with all the data needed for support, manufacture, and repair of the module, as well as data to support DO-254/ED-80 hardware certification. The SBC also comes with off-the-shelf certifiable BSPs for most certifiable O/Ss, complete with data to support DO-178C/ED-12C software certification. The available data kits support both FAA and EASA certification authority needs.

PROCESSING

The Central Processing Unit (CPU) is the Arm-based LX2160A from NXP's QorIQ™ Layerscape family.

The LX2160A offers outstanding computing performance with 16 64-bit Armv8 Cortex® -A72 cores, powerful Ethernet controllers, high-speed communications, with low-speed peripherals such as sensors, and the computing power to process and act upon all received information.

The LX2160A includes two high-performance memory controllers providing up to 51 GB/s bandwidth.

NXP QorIQ Layerscape processors are ideal for the aerospace and defense market, providing integrated features such as ECC, parity, support for hardware assisted virtualization and partitioning enforcement, along with safety and security blocks that make them suitable for robust applications. In addition, these processors are manufactured in large volume, providing confidence for "in-service experience".

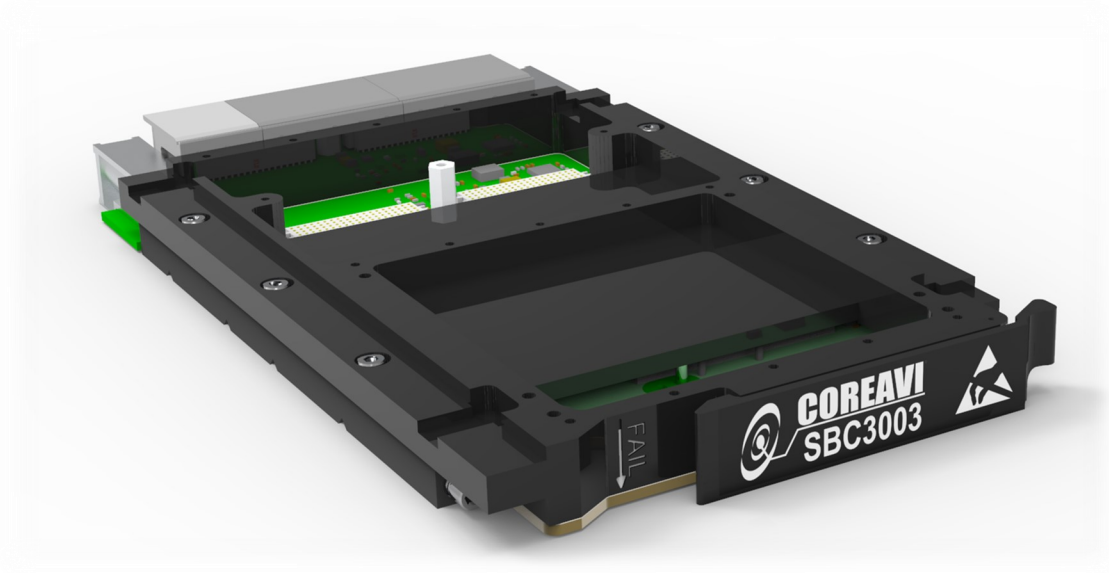

Figure 2: SBC3003 LX2160A-based COTS-D SBC

MEMORY

The following table summarizes available memory.

MEMORY	SIZE	TYPICAL USE
SDRAM Bank A DDR4 72-bit @ 3200 MT/s	8-16 GB	Main application memory (64-bit + ECC)
SDRAM Bank B DDR4 72-bit @ 3200 MT/s	8-16 GB	Main application memory (64-bit + ECC)
NOR Flash	64 MB (Qty. 2)	Primary boot flash. Secondary boot device for recovery
NVRAM	512 KB	Application non-volatile data storage
EEPROM	512 B	Product information (product identification, serial number, MAC address, etc.)
NVMe	128 GB	Mass storage for digital map data, application database information, etc.

INPUTS AND OUTPUTS

The following table summarizes the available input and output interfaces.

INTERFACE	QUANTITY	TYPICAL USE
RS-232/RS-422	2/1	Asynchronous communication with one transmit and one receive signal for development and maintenance. The option is available to select between 1 or 2 serial port interfaces with transmit and receive functions. 1. When configured for two serial ports, each serial interface is configured as RS-232. If the configuration is for one port, the serial interface will be configured as RS-422. 2. Baud rates are independently configurable for each serial port and support standard baud rates from 300 to 115200 Bd.
Ethernet 10G/1G BASE-T	1	High-speed data transfer with other systems, sensors, and central storage.
Ethernet 10G BASE-KR	2	High-speed data transfer with other systems.
LVTTL Discrete I/O	4*	Single-ended, discrete signal monitoring and driving (5V tolerant). *When used, CARDFAIL consumes one GPIO.
PCIe x8 Gen 3 or Two PCIe x4 Gen 3	1	High-speed bus interconnect to communicate with other modules within a system.
SATA 3.0	1	Interface to recorder, removable storage to provide mission data and recording.
USB 3.0/2	2	Adding storage or peripherals for use by a non-certifiable application partition. 1x USB 3.0, 1x USB 2

LOCAL FUNCTIONS

Local functions include an Elapsed Time Counter (ETC) to track module up-time to assist with maintenance activities, and a Real Time Clock (RTC) for 1PPS timing synchronization related requirements.

EXPANSION

Within a 3U VPX system, the capabilities of the module can be expanded. The processor may be configured to have two x4 PCIe Gen 3 communication/data links with up to two independent modules.

Local card expansion is supported by a standard XMC 2.0 (VITA 61) expansion interface with a 4-lane PCIe Gen 3 interface. The Pn6 I/O is mapped per SOSA 3U I/O Intensive SBC module -2 profile (VITA 46.9 P1W9-X12D, P2 X16S, P2 X8D) to the backplane. VITA 61 is based on the VITA 42 XMC replacing the connectors with alternative footprint-compatible, ruggedized high-speed mezzanine interconnectors. VITA 61 is pin compatible with the VITA 42 standard, therefore it supports VITA 42 as a build option. The XMC site supports industry standard XMC modules including the CoreAVI GPMX002 E9171 COTS-D Graphics Processor Module, which is available to provide high-performance graphics capability.

SAFETY AND SECURITY FEATURES

In addition, the module provides a suite of safety monitors to support safety requirements. These include temperature, voltage, and clock. The temperature monitors, two for monitoring module temperature and one for monitoring the LX2160A die temperature, are under application control, while voltage and clock out-of-range would result in the module being shut down. A failure of any of the monitors, or a software failure indicator, results in the assertion of a CardFail indicator to the backplane. In addition to the monitors, there is an independent watch dog timer that will time out and cause a module reset if not “kicked” by the application before timing out.

SOFTWARE

RTOS Board Support

DO-178C/ED-12C certifiable Board Support Packages (BSP) are available off-the-shelf for the following operating systems. Please contact CoreAVI for other RTOS BSP support. In addition to the Board Support Package, CoreAVI is able to provide a complete DO-178C/ED-12C certifiable software package, including the Real Time Operating System and its artifacts, certifiable Built-In-Test (BIT) software, and certifiable graphics drivers – all pre-integrated and ready to go. As the single provider of the entire software suite, support is easy to obtain and CoreAVI’s expertise in software certification ensures the lowest risk.

- VxWorks® HVP
- DDC-I Deos™
- Lynx Software LynxOS®-178
- Green Hills® Software INTEGRITY®-178

Firmware

The LX2160A SBC includes boot loader firmware to perform basic initialization of the module prior to loading and starting the application. Two versions of the boot loader are provided; a development boot loader with which you can develop, load, and debug the application, and a DO-178C/ED-12C certifiable boot loader, included with the RTOS BSP, which is needed to start the application once it is developed.

REAR TRANSITION MODULE (RTM)

For development purposes, an RTM that plugs into the backside of the backplane in the same slot as the LX2160A SBC is available. The RTM provides access to the LX2160A SBC I/O through commercial industry standard connectors, headers, and cables.

LIFECYCLE

The LX2160A is part of NXP's Product Longevity program, which ensures stable supply for 15 years from product launch (2020), making it one of the longest available Arm processors on the market today.

SPECIFICATIONS

The SBC3003 is designed to run from the +12 V rails and +3.3 V auxiliary with maximum typical current as set out in the following table, based on the execution of a representative application at the highest rated operating temperature.

VOLTAGE	TYPICAL CURRENT (AMPS)
+12 V	TBD
-12 V	Not used
+5 V	Not used
+12 V Auxiliary	Not used
-12 V Auxiliary	Not used
+3.3 V Auxiliary	TBD

The SBC3003 SBC dimensions are per VITA 48.2 for a 0.8" pitch conduction-cooled module, without solder-side cover. With 2-level maintenance (2LM) covers, the module conforms to the VITA 48.2 standard and has an 0.85" pitch conduction-cooled. The weight is less than 800 grams.

The environmental specifications are set out in the following table.

ENVIRONMENT	SPECIFICATION
Operating Temperature	-40 to +85°C at module edge
Storage Temperature	-55 to +105°C
Vibration	0.1 g2/Hz (max), 5 to 2000 Hz
Shock	40 g. 11 ms sawtooth
Humidity	0% to 95% non-condensing (dependent on conformal coating used)

COTS-D DATA KIT

The COTS-D Data Kit provides all the data to enable support, manufacture, and repair of the SBC3003 SBC. Key elements of the data package include:

- Manufacturing data
- Theory of Operations
- Bill of Materials including full manufacturers part numbers
- Schematics
- PLD design files
- Mechanical drawings and assembly diagrams
- Printed Circuit Board (PCB) drawings and data
- Qualification data

Please request the COTS-D application note which provides further details on the data items and support provided for the technical transfer. The technical transfer also includes training and support as you introduce the product to your manufacturing facility or that of your chosen contract manufacturer.

DO-254/ED-80 DATA KIT

The DO-254/ED-80 Data Kit provides documentation and evidence for the SBC3003 to support FAA and EASA certification needs of the hardware elements, as well as PLDs to support Item Development Assurance Level (IDAL) A.

DO-178C/ED-12C DATA KIT

The DO-178C/ED-12C Data Kit provides documentation and evidence to support FAA and EASA certification needs of the BSP.

OTHER DATA

Failure Modes and Effects Analysis (FMEA), as well as a safety manual and other documentation to support ARP4761 system safety assessments are also available.

ORDERING

The following SBC3003 SBC products can be ordered from CoreAVI:

- SBC3003-A000 SBC module for development purposes: air-cooled, no IPMI.
- SBC3003-A001 SBC module for development purposes: air-cooled, with IPMI.
- SBC3003-C000 SBC module for development purposes: conduction-cooled, no IPMI.
- SBC3003-C001 SBC module for development purposes: conduction-cooled, with IPMI.
- SBC3003-0020 COTS-D Design/Manufacturing Data Kit & license to use.
- SBC3003-001x Safety Critical Data Kit supporting DO-254/ED-80.
- SBC3003-0021 System Integration Manual (Safety Manual).
- RTM3003-1000 RTM for development purposes (see below).
- RTM3003-1001 RTM for development purposes (see below).
- DO-178C/ED-12C Level A Data Kit for the BSP.

RTM OPTIONS

The Rear Transition Modules listed below are available for order.

PRODUCT	DESCRIPTION	I/O
RTM3003-1000	Development RTM for the SBC3003 with no XMC I/O	• Maintenance port (TIA-232 LVCMOS) • RS-232 x2 (or 422 x1) • USB 3.1 • USB 2 • SATA 3.0 • 10G/1G Base-T • GPIO • CARDFAIL
RTM3003-1001	Development RTM for the SBC3003 with XMC I/O (extended length)	SBC I/O: • Maintenance port (TIA-232 LVCMOS) • RS-232 x2 (or 422 x1) • USB 3.1 • USB 2 • SATA 3.0 • 10G/1G Base-T • GPIO • CARDFAIL XMC I/O: • As per XMC transition module (XTM)

Contact Sales@CoreAVI.com to discuss your requirements and obtain a quote.