VPX3U-BW5000E-SWITCH

PRELIMINARY

System Switch and HPC: PCIe & Network Switch, Blackwell GPU

OVERVIEW

The VPX3U-BW5000E-SWITCH is a rugged 3U VPX module that combines an NVIDIA RTX™ 5000 Blackwell embedded GPU with an integrated network switch and PCIe switch architecture. The module is designed to operate as both a system switch and an HPC processing node, enabling efficient use of limited chassis slot space in demanding embedded systems.

The Blackwell GPU has an improved architecture which provides increased efficiency. The module also supports 24GB of GDDR7 memory which provides over 50% higher bandwidth compared to the previous generation. The GPU supports PCIe x16 providing a fast data transfer path to/from the module.

This module can also act as a switch, directing up to 8 ports of 25GbE network traffic per port. The PCIe switch has enough lanes to be used both to send data to the GPU and to direct PCIe data to other modules in the system. WOLF's advanced cooling design provides an efficient thermal path from the major heat-generating components to the wedgelocks for rugged conduction-cooled operation.

KEY FEATURES

- NVIDIA RTX™ 5000 (GB203) Blackwell GPU with 10496 CUDA Cores, 320 Tensor Cores
- 24 GB GDDR7 256-bit VRAM with ECC support
- Network switch and PCIe switch
- Module power: Configurable for lower-power or higher-performance operation; 100W to 180W.

GPU FEATURES

- Blackwell GPGPU parallel processing:
  - CUDA Toolkit 12, Compute capability 10.0
  - OpenCL™ 3.0, DirectX® 12 Ultimate, OpenGL 4.6, OpenGL ES 3.2, Vulkan™ 1.2
- 5th Gen Tensor Cores with new data precisions (new: FP4 and FP6, FP8 Gen2)
- GDDR7 memory provides over 50% more bandwidth compared to the previous generation
- NVENC (9th Gen) and NVDEC (6th Gen) with up to 8K video encoding and hardware decoding support

CONNECTIVITY / SYSTEM MANAGEMENT

- Configurable PCIe Gen4 switch
- Configurable 200 GbE network switch: 8 ports up to 25GbE and one 1000BASE-T
- Time-Sensitive Networking (TSN) supported
- NVIDIA GPUDirect RDMA support
- IPMI system management
- Linux and Windows drivers

MECHANICAL / OPEN SYSTEMS ARCHITECTURE

- High level of ruggedization:
  - Rugged conduction cooled
  - Operating temp: CC: -40°C to +70°C standard, operational to +85°C
  - Vibration Random: VITA 47.1 Class V3 (5 to 2000Hz)
  - Vibration Sine: 10g peak (5 to 2000 Hz)
  - Shock: 40G (MIL-STD-810H, Method 516.8)
- Dimensions: 160mm x 100mm x 25.4mm
- Weight (approximately): 1.6kg
- ANSI/VITA 48, 65 (VPX-REDI, OpenVPX)
- SOSA® Aligned switch slot profile: 14.4.15

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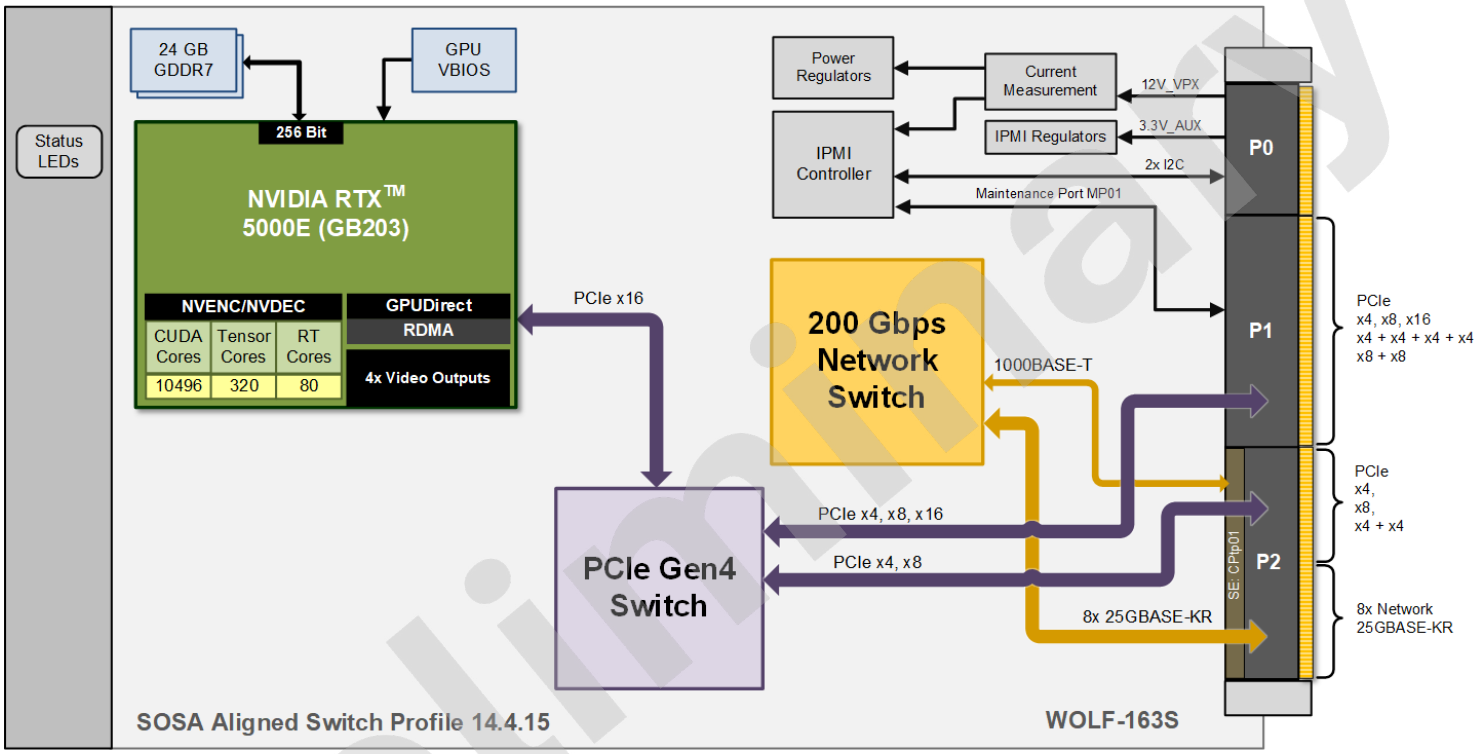
The VPX3U-BW5000E-SWITCH combines switch functionality and NVIDIA Blackwell GPU technology on a highly rugged 3U VPX module for aerospace and defense applications. WOLF designs and manufactures these modules in North America with full component traceability.

This SOSA aligned module supports the 14.4.15 switch slot profile with PCIe Gen4 support and 200 GbE. It integrates both high-performance compute capability and high-speed switching within a single rugged form factor.



SWITCH AND HPC IN ONE MODULE

The WOLF-163S is designed to serve as both a system switch and an HPC processing node, enabling more efficient use of 3U VPX chassis space. The integrated network switch can direct Ethernet traffic among system modules with 8 ports, each up to 25 GbE, while the PCIe switch architecture enables high-speed routing of PCIe data to the GPU as well as to other system resources.

By combining switching and compute on a single module, the WOLF-163S supports compact, high-capability system architectures where slot count, power budget, and ruggedization are critical design constraints.

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POWER AND PERFORMANCE

An NVIDIA GPU clock speed is dependent on the TGP (total GPU subsystem power) and the GPU temperature. The highest clock speeds are available at the highest TGP power allowed by the GPU. When the TGP setting is decreased the clock speed will also decrease resulting in a decrease in processing speed. If the GPU temperature exceeds 87°C the GPU clock speed will also decrease to protect the GPU from heat damage. If the GPU temperature is below 86.5°C the GPU can operate at maximum boost clock speeds at the currently available power when the GPU detects that higher processing is required.

The Blackwell GB203 GPU used on this 3U VPX module supports configurable power / performance operating modes. At 100W TGP the operating point is 1125 MHz base / 23.6 TFLOPS and up to 1792 MHz boost / 37.6 TFLOPS. At 150W TGP, the operating point is 1657 MHz base / 34.8 TFLOPS and up to 2370 MHz boost / 49.8 TFLOPS. Preliminary low-power measurements at 60W and 80W still provides 25.7 and 33.8 TFLOPS respectively a meaningful compute performance even when system power or cooling constraints require reduced-power operation. Actual sustained performance will depend on thermal conditions, workload, and total board power allocation.

NVIDIA BLACKWELL GPU

NVIDIA Blackwell GPUs use an improved architecture that increases efficiency. Unlike previous generations, all CUDA cores can handle either FL or INT operations, improving performance for AI and HPC workloads that rely on frequent address calculations and matrix processing. Blackwell also supports GDDR7 memory, providing 55% more memory bandwidth. Together, these improvements enable significant performance gains over the previous generation.

TENSOR CORES FOR ARTIFICIAL INTELLIGENCE AND HPC

Tensor Cores are designed to speed up the tensor / matrix computations used for deep learning neural network training and inferencing operations. NVIDIA Blackwell architecture GPUs include the fifth-generation Tensor Core design which supports many data types for improved performance, efficiency, and programming flexibility, including support for new INT4 and INT6 precision modes and microscaling formats. NVIDIA provides CUDA-X AI and CUDA-X HPEC libraires designed to work with NVIDIA GPUs to provide the tools needed to accelerate development of applications for AI and HPEC.

HARDWARE ACCELERATED VIDEO ENCODE / DECODE

The Blackwell GPU includes the NVENC video encode and NVENC decode hardware acceleration engine. Using the GPU for video encoding provides an efficient, high-quality method to achieve real time 8K and 4K encoding without burdening the system CPU. The Blackwell encoding engine includes support for several popular codecs including AV1 hardware encoding and decoding support. The NVIDIA Video Codec SDK provides APIs, samples and documentation for hardware accelerated video encode and decode.

SOSA SLOT PROFILE SUPPORT

This module provides support for the SOSA aligned switch slot profile. The module is compatible with the previous generation WOLF 134S module, which allows the WOLF-163S to be a plug-in upgrade for the previous WOLF product. The following SOSA aligned profile is supported: 14.4.15 Switch Slot Profile.

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ORDERING CODES

The following table defines series of common order codes for the VPX3U-BW5000E-SWITCH module. The asterisks denote characters of the part number that are defined based on common configuration options. Some configuration options for this module include:

- Network config options
- PCIe config options
- Variant Locked
- Default Power Threshold
- Conformal Coatings

ORDERING NUMBER	DESCRIPTION
3U VPX Switch and Blackwell BW5000E Configurations	
163S33-F***-***VPX3vA0	3U VPX, Conduction Cooled, 1", 14.4.15 switch profile, NVIDIA Blackwell RTX 5000, 24GB GDDR7, PCIe P1 ×16 and P2 ×8, Network 8 ports each 25GbE
163S33-F***-***VPX3vA0	3U VPX, Conduction Cooled, 1", 14.4.15 switch profile, NVIDIA Blackwell RTX 5000, 24GB GDDR7, PCIe P1 ×16 and P2 ×4 + x4, Network 8 ports each 10GbE

* Contact WOLF to determine the appropriate configuration for your system.

MANUFACTURING & QUALITY ASSURANCE

WOLF designs modules to pass the following environmental standards:

- MIL-STD-810 (United States Military Standard for Environmental Engineering Considerations and Laboratory Tests)
- MIL-HDBK-217 (Reliability Prediction of Electronic Equipment)
- RTCA DO-160 (Environmental Conditions and Test Procedures for Airborne Equipment) on request

WOLF complies with the following quality management systems:

- AS9100D: Quality Management System - Requirements for Aviation, Space and Defense Organizations (certified)
- ISO 9001:2015: Quality management systems (certified)
- AS5553: Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition (compliant)
- NIST SP 800-171: Protecting Controlled Unclassified Information in Nonfederal Systems (compliant)

Boards are manufactured to meet the following standards:

- IPC-A-610 CLASS 3 (Acceptability of Electronic Assemblies)
- IPC 6012 CLASS 3 (Qualification and Performance Specification for Rigid Printed Boards, Class 3 for High Reliability Electronic Products)
- IPC J-STD-001 (Requirements for Soldered Electrical and Electronic Assemblies)

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