

THE WORLD'S FIRST ULTRA-MOBILE / SCALABLE &

SINGLE BOAR

Intel[®] 8 Core **CORE™ i7 11th GEN** Up to 2.6 GHz (4.6 GHz Burst) Upgradeable DIMMs **64GB DDR4** PC3200 ECC Dual 100Gb Ethernet **4x USB4** GPGPU or x16 Expansion

BUVPX SYSTEM

2x 10 GigE Base-KR **6x USB TYPE-C** 4x with 100W+ Pwr Aligned with the **SOSA™** Technical Standard

SYSTEM HIGHLIGHTS

- Extensible open-standards "single-board systems" that scale up and out via high-speed USB4 and 100Gb Ethernet
- Intel® Tiger Lake-H up to 8 cores (2.6GHz, 4.6GHz Turbo Boost)
- 64GB DDR4 ECC DRAM via upgradeable SO DIMMs
- Boasts massive 455 Gbits/s bandwidth to external I/O
- x16 and x8 PCIe Gen 4 onboard/off-board inter-connect fabric with optional fiber extender frees OpenVPX bus
- Full size MXM for GPGPU, FPGA, or bus extension
- 4x USB4/Thunderbolt™ (40Gbps each) USB-C with optional fiber (100m) and 100W+ Power Delivery (each)
- Dual 100Gb Ethernet ports
- Dual 10 GigE Base-KR to VPX (P1)
- RAID-capable, quad M.2 sites for storage or I/O
- 2x USB 3.2 Gen 1 (5 Gbps) via USB-C w/power for console and I/O
- 1x GigE, 8x GPIO, 2x COM, 2x USB, SATA/PCIe to VPX (P2)
- Dual SAM™ I/O add-in modules for MIL-1553, ARINC-429, NTDS, GPS, or legacy I/O

- GMS-patented cooling rails and floating "clamshell" for superior cooling, shock/vibration tolerance and reliability (USPTO: 4456790)
- TPM 2.0 for root of trust, Secure Boot or Windows 10/11
- Display Port/DVI to VPX (P2)
- Embedded System Controller for Control Plane / Intelligent Power
- Operates on single 12 VDC supply from VPX backplane
- VITA 65 profile SLT3-PAY-1F1F2U1TU1T1U1T-14.2.16
- Modular stack (CPU/Carrier/HSIO) for upgradeable processor and OpenVPX pinout/profile changes without changing backplane
- Available as single- or dual-slot air- or conduction-cooled modules (1" pitch for conduction, 0.8" pitch for convection)

Aligned with the SOSA Technical Standard





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SINGLE BOARD SYSTEM: FOLDED INTO THREE

The X9 SPIDER OpenVPX family starts with an upgradeable GMS processor "engine" connected to the GMS carrier board, forming the X9 SPIDER VPX-S module. This single slot, 1-inch pitch IEEE 1102.2 conduction-cooled SBC merges the industry's very latest commercial technology into an exceptionally high-performance module with a massive amount of super-speed I/O. The two-slot X9 SPIDER VPX-S adds a high-speed I/O board to the stack, bringing two 100Gbps Ethernet ports and an unheard of 455Gbps of I/O bandwidth to/from the X9 SPIDER VPX-HS module.

Both module types are designed for extended temperature, long life, conduction- or optional convection-cooling, and operate from a single 12 VDC supply.

To realize this incredible slot density, GMS took a feature-rich server-sized monolithic motherboard and "folded" it into stackable 3U-sized modules-a technique GMS has pioneered, patented and refined through over 40 years of small form factor (SFF) system leadership. The 3-board X9 SPIDER VPX-HS PCBs are interconnected via ultra-high-speed board-to-board connectors that route signals such as PCIe Gen 4 and Gen 3 between the modules with no speed degradation. The CPU "engine" module connects to the VPX "carrier" module, which then connects with the "HS" I/O module. Each module is carefully groomed for timing, signal integrity, EMI mitigation, and maximum performance. Techniques applied to our 4S (four-socket) rackmount servers give us GMS-unique technology that allows 16 lanes of PCIe Gen 4 (16 GT/s) and 11 lanes of PCIe Gen 3 (8 GT/s) to be routed effectively between all three boards.

MOSA APPLICATIONS

X9 SPIDER is designed to provide the ultimate open-standard 3U OpenVPX SBC for MOSA (modular open standard approach) and was developed in alignment with the SOSA™ Technical Standard. Using GMS's latest 11th generation CPU, the X9 SPIDER family represents the state of the art in SBCs. As a Slot 1 controller, the SBC is so loaded with I/O that it can replace multiple other I/O cards in an OpenVPX backplane. In fact, one X9 SPIDER VPX-HS may be all that's needed in many conduction-cooled, rugged applications. The single-slot, two board set includes the expected SOSA 10GBase-KR and PCIe lanes to the backplane, plus additional unexpected I/O to the front panel.

In-chassis inter- and intra-board front panel connectivity via USB4, 100Gb Ethernet or USB 3.2 provides massive bandwidth and eliminates bus contention or the need for switch boards (although both OpenVPX modules play nicely with VITA 65 backplane requirements).

The X9 SPIDER VPX-HS is ideal for defense applications that are both processing and I/O intensive with the need for additional add-in functions. SPIDER modules fit best where investments have been made on an OpenVPX platform, where more bandwidth is required than is available on the OpenVPX backplane by itself, or when additional high-speed I/O is required between systems that are not closely coupled on the local chassis backplane.

X9 SPIDER modules can also be used without the OpenVPX backplane; consult GMS for details. SPIDER modules may be ordered from the factory with operating systems such as Windows® or Linux® pre-installed. Other common or real-time operating systems such as VxWorks[®] are available.

X9 SPIDER VPX-HS (Dual Slot System)

XESPIDER

WORLD'S FIRST SINGLE-BOARD SYSTEM PCIe Gen 4 is used to the fullest to add an additional 2x dual full speed 100 Gb Ethernet ports, plus off-board PCIe lanes for over 455Gbps of The "X9 SPIDER" is available in two 3U OpenVPX versions, each of I/O. X9 SPIDER VPX-S omits the 2x 100GbE ports and boasts 255Gbps which offers more I/O, processing, and add-on co-processing than of I/O. Each of the high density, high-performance compute and I/O is found on two 6U-sized boards (VME or OpenVPX). The 2-slot X9 modules packs more in one or two 3U slots than is possible in even two SPIDER VPX-HS version uses dual 1-inch pitch slots for I/O, power and 6U-size boards. conduction cooling, and has over 455 Gbps of external bandwidth across 13 ports. The 1-slot (1-inch pitch) conduction-cooled X9 SPIDER With all this bandwidth, systems can reside and share data on the same VPX-S offers 11 ports and 255 Gbps of I/O bandwidth. Each version OpenVPX backplane or can be remotely connected via USB4 (copper or represents a complete computer system, replacing two or more 6U fiber), 100Gb Ethernet, or PCIe Gen 4. The modular design of the twomodules. This is unheard of for 3U OpenVPX, which is complimented for or three-board stacks provide mix-and-match features with an onboard its small size but then criticized for the lack of user I/O to the backplane. PCIe Gen 4 backbone fabric, and they allow future processor, memory, GMS has solved this 3U OpenVPX I/O problem, freeing users to take co-processor and even OpenVPX signal routing changes without advantage of 3U's size, weight and power (SWaP) advantages without changing the backplane. Tech refresh is now as simple as plugging in the limitations of P1/P2 I/O. Of course, both X9 SPIDER products use different I/O, connecting to external modules via USB4, or having GMS VITA 65 profiles, and were developed in alignment with the SOSA™ revise one of the modules to accommodate new backplane routing. Technical Standard

SYSTEM OVERVIEW: STDS/OPENVPX/SOSA™

X9 SPIDER modules use Intel's i7-11850HE Tiger Lake-H- the very The X9 SPIDER VPX-HS and X9 SPIDER VPX-S air- and conduction-cooled latest-and are available up to 8 cores/16 threads operating at up 3U OpenVPX single board systems are the fastest, smallest, most to 4.6GHz Turbo Boost at only 45W (CPU). There's up to 64GB of dense, highest performance compute and I/O processors anywhere in upgradeable (and commercial market-friendly) DDR4 ECC DRAM via SO DIMMs, and guad M.2 sites for data/code storage or additional I/O the world. They are open standards-based, developed in alignment or co-processing. The sites use either PCIe Gen 4 or Gen 3 and can with the SOSA™ Technical Standard, follow VITA 65 3U OpenVPX and be used in a software RAID configuration as shown in the table. This IEEE 1102.2, and scale up performance and I/O bandwidth, or scale kind of storage capability in a single OpenVPX module is absolutely out to other modules and chassis via quad 40Gbps USB4 (Thunderbolt unheard of! 4[™]), dual 100GbE, or PCIe Gen 4 (16Gbps). As a modular stack, each brings upgradeability, backplane profile independence, and each offers between 255 - 455Gbps of interconnectivity to the very highest performing systems. Uniquely, the SPIDER architecture frees designers from the limitations of the OpenVPX backplane while maintaining interoperability with DoD MOSA (modular open systems approach) requirements. X9 SPIDER is the epitome of the MOSA mantra.

HIGH-SPEED I/O: USB4, 100GB Ethernet and PCIe 4 X9 SPIDER is designed around a balanced PCIe Gen 4 architecture for super-speed I/O. For X9 SPIDER VPX-HS there are a total of six USB-C ports for inter-chassis or front panel I/O. Four of these ports are USB4 455 GB/S I/O: FIRST OF ITS KIND ON 3U OPENVPX (40Gbits/s) each with 100W+ Power Delivery; two additional USB-C The X9 SPIDER VPX-HS has over 455 Gbps of I/O (255 Gbps in X9 ports support USB 3.2 Gen 1 (5Gbps). Plus, 2x 10GbE ports SPIDER VPX-S). Never have dual 100Gbps fiber ports with optional remote power been available on a 3U OpenVPX board. To service the and a control 1GbE port is routed to the backplane.

X9 SPIDER VPX-S (Single Slot System)

PROCESSOR, MEMORY, RAID, PCIe FABRIC

ON-BOARD RAID TYPE	STORAGE CAPACITY (using 4x 8TB M.2s)	
RAID 0 (STRIPE)	32TB	
RAID 1 (MIRROR)	8TB	
RAID 5 (PARITY)	24TB	
RAID 10 (MIRROR + STRIPE)	16TB	



DEVELOPED IN ALIGNMENT WITH THE SOSA™ TECHNICAL STANDARD

dual 100Gb Ethernet ports, GMS routes x16 PCIe Gen 4 from the Intel Tiger Lake-H CPU "engine" board up to the HSIO board—no small feat with 16Gbps differential signals.

The 4x front panel USB4 Type-C ports each provide 40Gbps with up to 100W+ of power delivery per port. They can be used, along with the 2x 100Gb Ethernet, to connect to and power remote embedded systems, additional chassis, high-rate sensors, or any electronics outside of the current chassis/box in which the X9 SPIDER is installed. Remote power on fiber is a unique GMS patent-pending technology. See below.

There are also two front panel USB 3.2 Gen 1 Type-C ports (5 Gbps each) to supplement the USB4 ports. These six ports are used for inter-card communication inside an OpenVPX chassis to free the P1/ P2 backplane for additional in-chassis traffic, such as from the dual 10Gb-BaseKR Ethernet ports, the dual x4 PCIe Gen 3 lanes, or other lower-speed I/O routed to P1/P2.

ADD-IN FUNCTIONS, CO-PROCESSORS

X9 SPIDER OpenVPX modules are equipped with four to six add-in sites, providing limitless flexibility. There are up to four M.2 sites used for storage (including a RAID array) or I/O, plus two GMS SAM™ I/O PCIe-Mini sites. There's also a x8 PCIe Gen 4 full size MXM site.

PCIe-Mini SAM[™] I/O sites are used to add low-speed I/O like MIL-STD-1553, ARINC-429, and legacy communications schemes. SAM[™] I/O is taken to a convenient front panel connector or is routed to the backplane via the XMC profile pins. Unlike typical VPX modules that use an XMC mezzanine for add-in I/O, the X9 SPIDER has an MXM graphics card site for high-bandwidth add-in processing like 100Gbps Ethernet, FPGA processing, or for GPGPU coprocessing. What makes these modules unique is that the MXM site is fed by x8 PCIe Gen 4 with 128 Gbps of available bandwidth and up to 100W+ of power.

With x8 PCIe Gen 4 routed to the MXM, 64 Gbps of bandwidth is available for co-processing modules. The Type B MXM site is available for co-processors from NVIDIA, or FPGAs from Intel/Altera and Xilinx to compliment the Intel[®] Tiger Lake-H CPU. As well, the co-processor and one of the 100Gbps Ethernet ports are coupled to the CPU to provide high data rate, flow-through processing.

The MXM site also serves as an additional off-board PCIe Gen 4 bus extender, offering x8 lanes to other distant sub-systems. This is an ideal way to implement reflective memory, bus extension, or to make remote PCIe peripherals appear as local entities for ultra-fast, low latency data transfer. This is another example of X9 SPIDER's extensible and scalable architecture. See list of add-in modules shown on the back page.

RUGGED, LONG-DISTANCE TYPE-C OPTIONS

Used in X9 SPIDER, the six Type-C connectors were defined by the USB-IF[™] and each offers the advantage of "either way" plug-in, 40Gbps bandwidth, and power delivery, but Type-C is intended for commercial, non-rugged applications. GMS has patent-pending modifications to the Type-C cables that provide four options: Type-C (copper), rugged Type-C (jack screw, IP66-like water-tight seal), fiber optic, and fiber optic with power delivery.

TYPE-C CABLE	KEY SPECIFICATION	
USB-IF standard Copper, suitable for USB4 or Thunderbolt 4 [™] , supports Power Delivery	Standard Type-C cable Up to 2m Power Delivery up to 100W+	
Locking cable Same as USB-IF standard plus: Retention screw or mechanism Optional copper-to-38999 connection	Up to 2m Power Delivery up to 100W+ Connects OpenVPX module to chassis panel with mil-circular connector Meets shock and vibration Prevents accidental disconnect Up to 100m EMI and RFI immune Minimal side channel cyber threat Connects OpenVPX module to chassis panel via 38999 connector Allows inter-chassis 40Gbps communication	
Fiber-to-38999 w/out power Same as USB-IF standard plus: Fiber instead of copper Locked-in-place cable No Power Delivery		
Fiber-to-38999 with power Same as above plus: 100W+ Power Delivery Locked-in-place cable	Up to 100m Power Delivery up to 100W+ EMI and RFI immune Minimal side channel cyber threat Connects OpenVPX module to chassis via 38999 connector for inter-chassis USB4 communication	

USB-C cable options including power and/or fiber Similar fiber options exist for 100Gb Ethernet

For fiber options, patent-pending GMS technology at the cable head takes power from the Type-C socket and converts 40Gbps signals into laser light for bi-directional transmission down a rugged fiber cable. the bundle, providing 100W+ up to a distance of 100m or more.

SPIDER modules are available in air- or conduction-cooled versions. Additionally, a bonded-to-fiber long-distance power cable is added to Air-cooled modules are 0.8-inch pitch and conduction-cooled modules are 1-inch pitch; X9 SPIDER VPX-HS requires two slots and X9 SPIDER VPX-S is a single slot assembly. For the most rugged applications, Mounted in an ATR or other style chassis, X9 SPIDER modules can route GMS patented "floating conduction plate" and 3-sided multi-segment these cables out of a chassis or other equipment via 38999 mil-circular wedgelocks are used to provide the industry's highest thermal connectors. Adapters are available from GMS to convert USB Type-C or conductivity. This cooling technology has been used successfully for 100Gbps Ethernet to mil-circular connectors for chassis mounting. For nearly 40 years in both 6U VME and 6U VPX systems. copper cables, Power Delivery is maintained. For fiber cables, optional Power Delivery is a GMS patent-pending feature.

On SPIDER modules, this patented cooling technique can conduct up YOU WON'T MISS THE (OPENVPX) BUS to 220W per slot-that's 440W for the X9 SPIDER VPX-HS and 220W The X9 SPIDER VPX-HS and X9 SPIDER VPX-S have more available for the X9 SPIDER VPX-S. This is more cooling in 3U than is available high-bandwidth I/O, more processing plus add-in co-processing, and in 6U-size cards. 220W per slot is more than sufficient cooling for the more cooling per-slot than any 3U OpenVPX module in the market. modules in their "factory" configuration with all the high-speed I/O, The pair has superlative features and uses ground-breaking technology but it also provides headroom for the flexible add-in options available never before available to modular open standard architectures. But on these modules including M.2, SAM™ I/O and MXM cards. The what makes these modules even more unique is that they are not MXM site takes advantage of GMS' floating cold plate and patented constrained to live in an OpenVPX backplane and be either air- or wedgelocks. Mounted on the top PCB on the X9 SPIDER VPX-HS conduction-cooled the traditional way. Instead, with 255-455Gbps module, heat from the MXM is conducted to the secondary wedgelocks of total I/O bandwidth and superior cooling, each module can form and the companion slot. the basis for an extensible, modular architecture of inter-connected high-speed standalone single-board systems.

The single board system modules can also be used separately to create distributed, scalable high-performance systems.

The breakthrough extensible I/O technology GMS added in the X9 SPIDER VPX-HS and X9 SPIDER VPX-S modules take defense system architectures to infinite possibilities. Besides providing dual 100Gbps fiber connections between cards inside of a chassis, these 100Gbps fiber ports provide the highest bandwidth outside of the chassis across the distance of kilometers, useful for test ranges or avionics airframe routing. The ports can, for example provide "backhaul" fat pipes to networks or distant remote locations with other high-rate equipment. Before now, 100Gbps Ethernet was unavailable on 3U OpenVPX.

Using GMS patent-pending cables, the USB4 ports with power can bolt up to high-resolution sensors such as 8K EOIR, SAR radar, and RF receivers—one X9 SPIDER VPX-HS can easily connect with four of these sensors, power them via power delivery, and simplify the cable routing using thin USB4 cables or GMS fiber optic cables. Using the 40Gbps bandwidth with power alleviates the need for power supplies at the sensors and saves weight and complexity with the cables. As well, for fault tolerance, dual ports (two 40Gbps) can be cable routed differently such as on opposites of a vehicle, providing mitigation from battle damage.

OVER 455 GB/S EXTERNAL I/O THOUGHPUT

64 Gbps (2x x4 PCle Gen3 to P1)

> 20 Gbps (2x 10 Gbe to P1)

15 Gbps (3x USB 3.2 Gen 1 via hub)

1 Gbps (Gbe to P1) **X9SPIDER** VPXHS

40 Gbps 40 Gbps 100 Gbps 100 Gbps

40 Gbps

40 Gbps

SUPERIOR COOLING



X9 SPIDER VPX-S (Single Slot System)

X9 SPIDER VPX-HS (Dual Slot System)

ENVIRONMENTAL SPECS

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FACTORY INSTALLED AND SUPPORTED I/O

FUNCTION	MODEL NO.	
MXM I/O	NVIDIA P1000 / P3000	
	AMD E8860	
	PCIe Re-timers / Fiber Interface	
	FPGA (Xilinx / Altera)	
SAM™ I/O	MIL-STD-1553 (dual and dual-dual redundant)	
	CANBus	
	Profibus	
	A to D Converter	F
	Dual Gigabit ENET	
	RS-170 (8-channel)	F
	ARINC-429	F
	GPS	F
	WiFi/BT	F
	Brandywine IRIG-B (Mini PCIe Syncclock32)	F
	EPIX CameraLink Frame Grabber PIXCI EB1mini	F
	Magewell (Pro Capture Mini-SDI) PCIe-Mini	F

RUGGEDIZATION LEVELS

	TEMP	SHOCK	VIBRATION
RUGGED 1	0° - 55°C	20G	.0001 g²/Hz
RUGGED 2	-20° - 55°C	20G	.0008 g²/Hz
RUGGED 3	-20° - 75°C	52G	.003 g²/Hz
RUGGED 4	-40° - 85°C	100G	.003 g²/Hz

SERVICES, SYSTEMS AND SUPPORT

GMS is a DoD prime contractor with the industry's most extensive board-level and system-level design expertise. We work closely with customers to ensure that our rugged products are optimized for the system, the program, and the entire lifecycle. Our rich, long-term relationship with Intel gives us unparalleled early access to new technology, so we can create customer-specific architectures that meet the most challenging program requirements.

ADVANTAGES:

- Prime contractor status allows direct buying from GMS, via GSA schedule, or via the PEO C3T CHS catalog (through a GMS partner)
- Complete system management includes kitting, tactical cables, chassis, software, and cooling solutions
- Customer pre-installed system software image is added prior to shipment
- Program-specific chassis coatings and OEM/customer labeling are available
- Value-engineering optimizes cost and performance for volume programs
- Sales, VARs, and technical support are available in North America, Europe, Asia, and Southeast Asia







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