



GENERAL MICRO SYSTEMS, INC.
TRUSTED AND DEPLOYED SINCE 1979



1U and 2U sizes:
Available conduction-cooling (no fans)
Available 38999 mil-circular connectors

TITAN Family of Rugged 1U and 2U Servers (TITAN, TITAN-2U and TITAN-QUAD)
Rugged, Expandable, 1U/2U Rackmount Servers with Dual/Quad Socket Intel® Scalable Xeon® Processors, 1/10/40 GbE, 20-Port Ethernet Switch, RAID 16x SSD Cartridges and Up to 10 PCIe Add-in Slots

Dual/Quad Intel® Scalable
Xeon® CPUs
Up to 28 cores each

Dual Removable cartridges
16x SSDs
SATA/SAS/NVMe Gen 3

8 Copper/Fiber
1/10/40 Gb
Ethernet Ports

Air and Conduction-cooled
-20° to +55°C
Available in Rugged Level 1-5

SYSTEM HIGHLIGHTS

- Dual or Quad Intel® Scalable Xeon® processors with up to 28 cores (2.50 GHz) and Turbo Boost (3.80 GHz); 38.5 MB of Smart L3 Cache (server-class processors: Platinum and Gold)
- Air- and conduction-cooled (sealed) versions with commercial (COTS) connectors or mil-circular 38999 connectors for ultimate reliability
- Available in 1U and 2U variants, with either dual (2S) or quad (4S) CPUs
- 3x UPI (10.4 GT/s) interconnects for HPEC, SMP, NUMA architecture
- Up to 1 TB DDR4 ECC memory (8 DIMMs) per CPU
- Up to 10 PCIe Gen 3 add-in cards (4x in 1U and 10x in 2U; factory-installed)
- Optional 20-port segregated Ethernet and 10GbE switch in TITAN-2U
- TITAN-1U has two drive bays plus one 8x RAID cartridge
- TITAN-1U has 4x 1/10 GbE and 4x 1/10/40 GbE QSFP+
- TITAN-2U adds another 8x RAID cartridge



TITAN-2U
Conduction-cooled

- AI version > 400 TFLOPs supports up to 4x Nvidia V100 GPGPUs in 2U
- Encryption and security via Intel® AES-NI encryption and Trusted Platform Module 2.0 (TPM)
- Dual-redundant MIL-STD-1275 500 W power supplies (single/three phase; 60-400 Hz 110/220 VAC; 28 VDC). 2x PSU's in 1U; 4x PSU's in 2U
- Optional MIL-STD-704F power supplies with 50 ms hold-up

SYSTEM OVERVIEW

The rugged "TITAN" 1U and 2U servers are unique expandable standard rackmount servers using Intel's second-generation Scalable Xeon® processors. Designed for high-reliability aerospace, defense, military and industrial applications, "TITAN" is set apart by extreme density and expandability with air- and conduction-cooling options. It includes more networking I/O, memory, PCIe card add-in options, and removable storage than found anywhere in a 1U or 2U rackmount server.

Additionally, "TITAN" is exceptionally rugged and designed for technology refresh and pre-planned product improvement (P3I) in long-life applications. Available in air-cooled and sealed conduction-cooled versions, "TITAN" is like no other server on the market. Air-cooled versions feature either internal fans or external rack-supplied plenum .cooling, and either COTS or mil-circular (38999) connectors. In shock- and vibration-resistant conduction-cooled versions, "TITAN"

is equipped with military-style circular 38999 connectors for assured reliability. "TITAN" uses patented internal cold plates and thermal mitigation in a sealed chassis to protect against ingress and EMI.

"TITAN" is also expandable from a 1U high, 2S dual-socket version to a 2U high, 4S (four socket) four-way symmetric multi-processing (SMP) 2U version with exceptionally high-performance inter-processor UPI connections. Alternatively, the system can remain a dual socket server (2S) but grow from 1U to 2U, adding additional storage (up to 18 SSDs total), additional PCIe slots (up to 10 total), and a segregated 20-port managed Ethernet switch. In either 1U or 2U variants, "TITAN" is an exceptionally rugged, densely packed, well-equipped rackmount server with Intel's very latest server technology.



PROCESSORS, MEMORY AND STORAGE

"TITAN" uses Intel second-generation scalable Xeon server processors based upon the Cascade Lake-SP (refresh) family of CPUs. GMS chooses Gold and Platinum versions for the highest performance and maximum number of UPI and PCIe connections. Embedded roadmap (long lifecycle) CPUs are available up to 24 cores, while standard server versions (market lifecycle) are available up to 28 cores. The CPU choice affects performance, "TITAN" features, and operational temperature range. Each CPU accommodates eight DDR4 DIMM slots and "TITAN" uses ECC DRAM with up to 1.0 TB per CPU; DRAM choice strongly influences performance and price.

The primary "TITAN" motherboard is the GMS-designed, American-made SMB-X2 dual socket architecture, used in all TITAN variants. Each socket supports Scalable Xeon CPUs with three UPI interconnects where one UPI connects the two CPUs on SMB-X2. Each CPU also routes two additional UPI interconnects to the optional 2U SEB-X2 upper motherboard containing two additional CPUs. "TITAN-QUAD" (2U high) is equipped with 4 sockets in a 4-way mesh interconnect that's perfect for high-performance computing (HPC), NUMA and symmetric multi-processing (SMP) workloads.

Standard storage includes dual front panel removable 2.5-inch 9 mm SSDs (SATA III, SAS-3, or NVMe U.2) or an optional quad-M.2 removable cartridge. Non-removable storage includes two 80 mm M.2 drive sites. The M.2s can be used for OS boot, multiple OS images, or non-removable mass storage. Two optional M.2's can be added in lieu of the dual 2.5-inch drives or quad-M.2 cartridge. There's also a PCIe-Mini (GMS SAM™ site) designed for I/O such as MIL-STD-1553, HD-SDI, CANBus and more.

Unique to "TITAN" is the 8-drive secure high-speed storage (SHS) cartridge. In 1U format and equipped with a 10,000 cycle reliable connector, the rear-removable SHS supports Gen 3 speeds for SAS, SATA and NVMe (all drives must be the same type). A hardware RAID controller maximizes speed and reliability, or Intel's VROC software RAID can be used. The 2U "TITAN-QUAD" 4S server can be equipped with two removable, RAID-ready SHS cartridges for a total of 16 SSDs in two cartridges. SHS cartridges can be substituted with 8x EDSFF (E1.L) cartridges for up to 256 TB per cartridge, or a whopping 512 TB of easily removable storage in only 2U.

I/O AND EXPANSION

What makes the "TITAN" family of rugged servers compelling is the amount of built-in I/O and flexible add-in card options. In only 1U, there are four QSFP+ 1/10/40 Gb Ethernet cages that can be equipped with copper or fiber inserts; four 1/10 Gb Ethernet ports, and one 1 Gb Ethernet service port for the BMC. With eight total native Ethernet ports, an external switch may not be required, hence saving shelf space in the rack. The 40GbE cages can break out to 8x 10GbE with inserts and adapter cables, bringing to twelve the number of 10GbE ports in only 1U. Two front panel USB 2.0 ports are for keyboard and mouse, plus two USB 3.0 ports are for external

peripherals and I/O. A standard VGA port, serial port, audio in/out and eight GPIO lines are included for low-speed I/O.

Servers are most compelling when users can specify unique I/O on add-in PCIe cards. The 1U "TITAN" with RAID includes two x16 PCIe Gen 3 slots and one x8 PCIe Gen 3 add-in slot. There's also PCIe-Mini on GMS SAM I/O™, plus four M.2 cards used for mass storage or I/O. Of the two removable front panel disk drive slots, one can be used for a GMS B-Drive PCIe module to add SMPTE video, Thunderbolt, additional Ethernet SFP+ ports, and more.

The 1U "TITAN" is also available in 2U size. The second "U" tier provides six more card slot sites. Collectively, a 2U "TITAN" has ten PCIe slots. The 2U "TITAN" variant also includes an optional 20-port segregated Ethernet switch with 16x 10Gb Ethernet ports (copper) and 4x QSFP+ cages intended for fiber optic network inserts.

Alternatively, TITAN-QUAD is 2U high, has all the features of TITAN-1U, but adds two additional CPUs in a 4S mesh configuration. Three more add-in slots are also available in TITAN-QUAD.

CONVECTION- OR CONDUCTION-COOLED; MIL-SPEC CONNECTORS

In air-cooled configuration, the 1U "TITAN" uses a combination of thermal techniques to achieve temperature reliability and high system MTBF. Convection-cooled "TITAN" variants can use either system-supplied air or rely on built-in fans. Inlet air is finely managed and directed to hot spots and eventually ejected out the rear of the unit. GMS's patented RuggedCool™ technology is paired with custom heat sinks for all hotspots. GMS's TwoCool™-inspired convection strategy uses multiple hot-swappable internal fans that act as a multi-redundant thermal system under intelligent BMC fan control, providing high confidence and high MTBF. Should one fan fail, the others will keep operational temperature for a period of time sufficient to notify and shut down the system.

Unique to "TITAN" is conduction cooling with MIL-SPEC 38999 "mil circular" style connectors. Using externally-supplied cooling air, a conduction-cooled server is much more reliable as it operates at lower heat. Conduction-cooled "TITAN" servers (TITAN-1U, TITAN-2U, and TITAN-QUAD) have no fans and are *completely silent* and designed for operator-occupied environments. Conduction-cooled TITANs are also sealed, dramatically reducing or eliminating radiated EMI. These servers can withstand higher shock/vibration, and mil-circular connectors can take environmental punishment where pure COTS connectors may easily fail.

"TITAN" is available in ruggedization levels R1-R3 for air-cooled versions, and R1 to R5 for conduction-cooled versions (see separate datasheet). Additional information regarding the ruggedization levels and full environmental specifications for this product can be found on our website at www.gms4sbc.com/technologies/ruggedization.



DRIVES, NAS, AND RAID

"TITAN" servers offer unique storage options beyond the typical 2.5-inch SSD. SATA/SAS/NVMe interfaces are available in 2.5-inch, M.2, EDSFF ("ruler") and high-density cartridge formats. Hardware and software RAID is available, as are OPAL, FIPS, and hardware secure erase media. In 2U version, "TITAN" can be equipped with as many as two 8x cartridges, one quad-M.2 cartridge and still offer 8x PCIe slots for either I/O, processing...or more storage on PCIe cards.

- Removable secure high-speed storage (SHS) cartridges support 64 PCIe Gen 3 lanes or 16 SAS-3 / SATA III lanes for max speed
- 10,000 insertion cycle cartridge is reliable and allows transporting up to 160 TB data-at-rest
- In lieu of 2.5-inch SSDs in cartridge, 8x EDSFF Long ("ruler" drives) provide up to 256 TB of storage
- Optional hardware RAID options:
 - RAID 0, 1, 5, 10, 50, Custom
- Intel Virtual RAID on CPU (VROC) software RAID (requires GMS key)
- Storage cartridge accommodates:
 - Eight Gen 3 SAS / SATA / NVMe (PCIe) SSDs
 - NVMe flash drives use PCIe bus for ultimate speed and lowest latency
 - Standard, Self-Encrypting (SED), or hybrid drives (up to 9 mm height SSD or HDD)
 - Optional 8x EDSFF E1.L ("ruler") drives supports up to 256 TB total
- Two fixed 80mm M.2 SSD for OS boot (SATA/NVMe)
- Two removable 2.5" SATA/NVMe drives or quad-M.2 cartridge
- Support for future Intel® OPTANE™ M.2 memory



TITAN-1U
Air-cooled

I/O AND EXPANSION OPTIONS

In addition to 10, 7, or 4 PCIe add-in card slots (TITAN-2U, TITAN-QUAD, and TITAN-1U, respectively), all "TITAN" servers have a full complement of networking and low-speed I/O. With available 38999 mil circular connectors or conduction cooling for high reliability, "TITAN" servers replace multiple racks' worth of equipment in a smaller shelf space.

- Four 1/10 Gigabit Ethernet ports (Copper)
- Four QSFP+ cages for 1/10/40 Gb Ethernet (fiber or copper inserts)
- Optional additional 20-port 1/10 GbE in TITAN-2U
- Four USB 3.0 ports
- Two USB 2.0 ports
- One Serial port with RS-232/422/485 options
- One VGA video port
- Eight buffered Digital I/O (DIO) lines
- HD Audio with Mic, Headphones and Amplified Mono Speaker Out
- One SAM™ PCIe-Mini site for custom I/O (MIL-STD-1553, Wi-Fi/BT, GPS, etc.)
- 32 MB BIOS with optional write-protect
- Real Time Clock (RTC) with field-replaceable battery
- Trusted Platform Module (TPM) 2.0 for secure boot operation
- Baseboard Management Controller (BMC) running IPMI for out-of-band control and signaling
- Optional GMS SecureDNA™ includes: zeroize (SSDs), sanitize (MCUs), BIOS erase, and SourceSafe™ BIOS



TITAN-1U
Conduction-cooled with SHS drive cartridge

ENVIRONMENTAL SPECS

- Greatest computing density, cores and RAM in one footprint
- 2x (N+1) redundant, load-sharing 500W power supplies per 1U
- 2x PSUs in TITAN and 4x PSUs in TITAN-2U and TITAN-QUAD
- MIL-STD-704F PSUs available at: 110/220/240 VAC, 60-400 Hz, single- and three-phase
- MIL-STD-810G, MIL-STD-1275D, MIL-S-901D, DO-160D, MIL-STD-461E
- Operates up to extended temp -20 °C to +75 °C (Optional, conduction-cooled)
- IP64 compliant and sealed against moisture and EMI ingress (conduction-cooled version; cartridge installed)
- Available in ruggedization levels R1-R5 (conduction-cooled version)



TITAN-1U
Conduction-cooled with 38999 mil-circular connectors



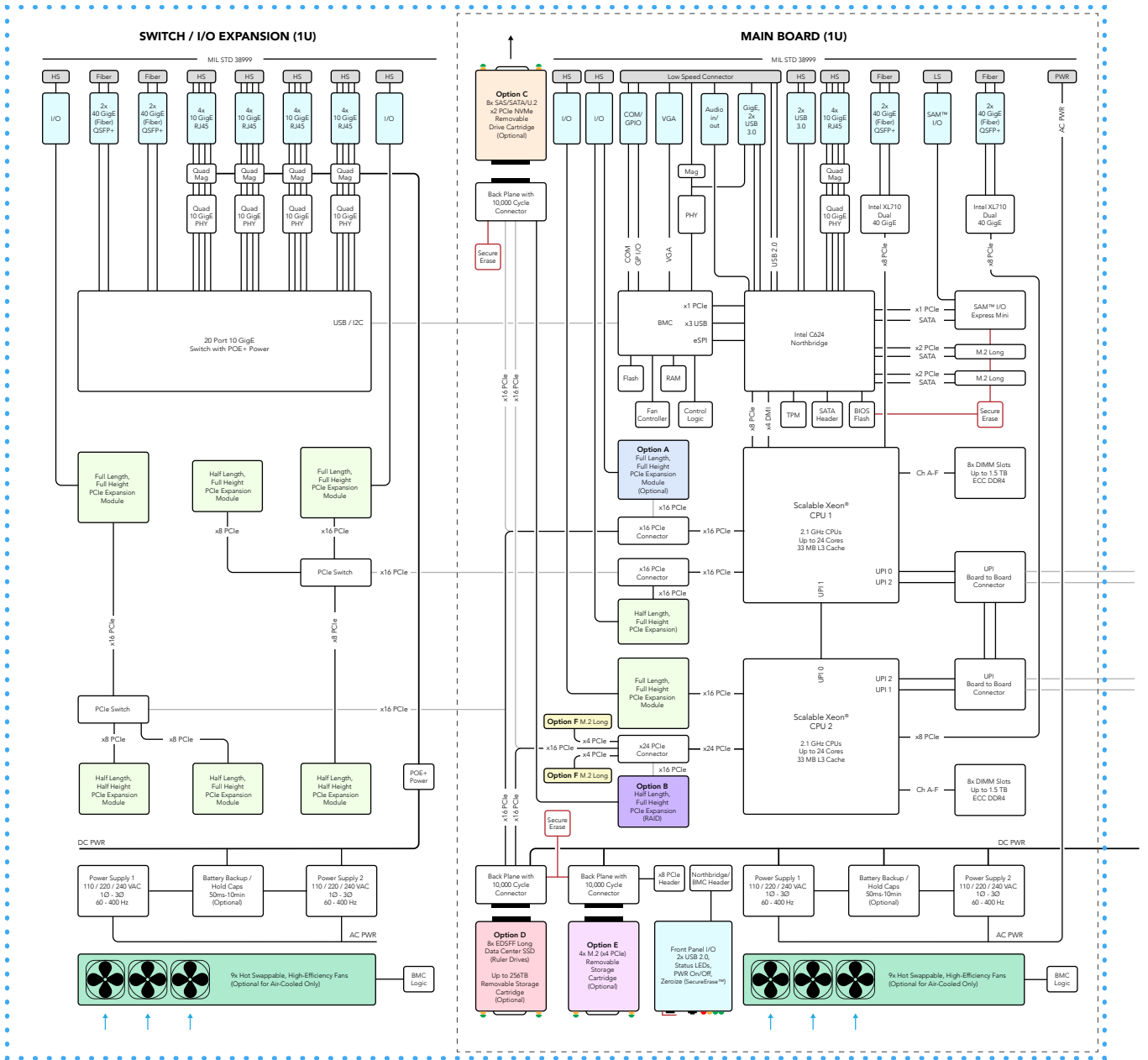
| | TITAN | TITAN-2U | TITAN-QUAD |
|---|--|--|---------------------------------------|
| Height | 1U | 2U | 2U |
| Processors (24C max if "embedded") | Intel Scalable Xeon, Gold/Platinum, up to 28 cores | | |
| # CPUs | 2 | 2 | 4 |
| # UPIs | 3, one between CPUs | 3, one between CPUs | 4, "one-to-every" |
| Compute architecture | Workload-balanced, flow-through data: SMP, NUMA, HPC | | |
| Max memory/CPU | 1 TB/CPU | 1 TB/CPU | 1 TB/CPU |
| # DIMM Slots/CPU (w/ECC) | 8 | 8 | 8 |
| Add-in cards | 4 | 10 | 7 |
| # x16 (FLFH) slots | 2 | 4 | 4 |
| # x8 (HLFH) slots | 2 | 4 | 2 |
| # x8 (HLHH) slots | 0 | 2 | 1 |
| Mini-PCIe (GMS SAM I/O™) | 1 | 1 | 1 |
| PCIe speed: 8 GT/s, Gen 3 | PCIe Gen 3 | PCIe Gen 3 | PCIe Gen 3 |
| # SSD slots, 10 mm max (SATA, SAS, NVMe, B Drive I/O) | 2 | 2 | 2 |
| # M.2 slots | 2 full (2 extra via riser) | 2 full (2 extra via riser) | 2 full (2 extra via riser) |
| SHS 8x SSD cartridge w/RAID (cartridge reduces one x16 PCIe slot) | 1 (up to 60 TB w/12TB SSDs) | 1 (up to 60 TB w/12TB SSDs) | 1 (up to 120 TB w/12TB SSDs) |
| SHS 8x E1.L cartridge w/RAID (cartridge reduces one x16 PCIe slot) | 1 in lieu of SHS SSD (up to 256 TB) | 1 in lieu of SHS SSD (up to 256 TB) | "2 in lieu of SHS SSD (up to 512 TB)" |
| Intel VROC software RAID (key is required) | Yes | Yes | Yes |
| Ethernet (copper, 1 GbE) | 2 (1 for BMC) | | |
| Ethernet (copper, 1/10 GbE) | 4x, 1/10 GbE | 4x, 1/10 GbE | 4x, 1/10 GbE |
| Ethernet (fiber, 1/10/40 GbE) | 4x QSFP+ (copper, fiber inserts) | 4x QSFP+ (copper, fiber inserts) | 8x QSFP+ (copper, fiber inserts) |
| Ethernet switch 40GbE @ 20 ports (optional) | N/A | 16x 10 GbE (copper) 4x 40 GbE (fiber) | N/A |
| USB 2.0 | 2 | 2 | 2 |
| USB 3.0 | 4 | 4 | 4 |
| VGA | 1 | 1 | 1 |
| BMC with Ethernet port | 1 BMC with dedicated 1 GbE port | | |
| Audio | Mic In/Stereo Out | | |
| General purpose I/O; serial port | 8 GPIO; 1 RS232/422/485 | 8 GPIO; 1 RS232/422/485 | 8 GPIO; 1 RS232/422/485 |
| # N+1 500 W MIL-S-704 PSUs w/50 ms hold-up (optional) 110/220/240 VAC; 1Φ/3Φ; 60-400 Hz | 2 | 4 | 4 |
| # Optional B Drive I/O modules | 1 | 1 | 1 |
| Cooling | Convection- or conduction-cooling (sealed) (Conduction-cooled TITAN requires mil-circular 38999 connectors) | | |
| Connectors | COTS/commercial-style or 38999 mil-circular | | |
| SecureDNA™ Zeroize, Status, SourceSafe™ BIOS | Yes | Yes | Yes |
| Temperature, standard | 0 to +55C | 0 to +55C | 0 to +55C |
| Temperature, optional (excl. add-ins) | -20C to +55C | -20C to +55C | -20C to +55C |

BLOCK DIAGRAM: TITAN and TITAN 2U

TITAN 1U

TITAN 2U

REAR PANEL



FRONT PANEL

CONFIGURATION MATRIX

| | Option A | Option B | Option C | Option D | Option E | Option F |
|----------|----------|----------|----------|----------|----------|----------|
| Option A | • | • | • | • | • | • |
| Option B | • | • | • | • | • | • |
| Option C | • | • | • | • | • | • |
| Option D | • | • | • | • | • | • |
| Option E | • | • | • | • | • | • |
| Option F | • | • | • | • | • | • |

CONFIGURATION NOTES

- Option A - Cannot be used with Option C or Option D
- Option B - Cannot be used with Option D
- Option C - Cannot be used with Option A or Option D
- Option D - Cannot be used with Option A, Option B or Option C
- Option E - Cannot be used with Option F
- Option F - Cannot be used with Option E

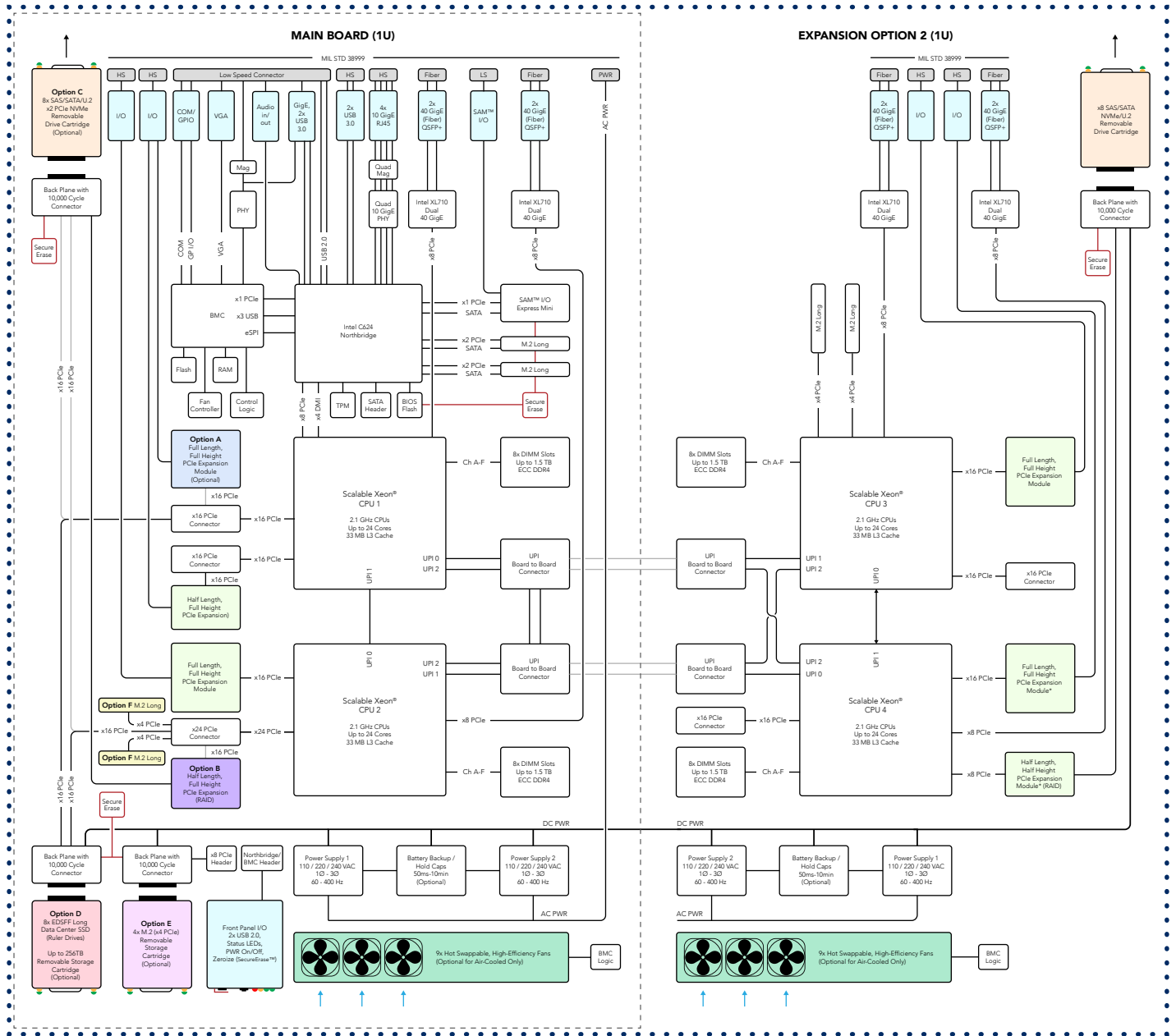


BLOCK DIAGRAM: TITAN and TITAN QUAD

TITAN 1U

TITAN QUAD

REAR PANEL



FRONT PANEL

CONFIGURATION MATRIX

| Optional Configuration | Cannot be used together | | | | | |
|------------------------|-------------------------|----------|----------|----------|----------|----------|
| | Option A | Option B | Option C | Option D | Option E | Option F |
| Option A | • | • | | | • | • |
| Option B | • | • | | | • | • |
| Option C | | | • | | • | • |
| Option D | | | | • | • | • |
| Option E | | | | | • | • |
| Option F | | | | | | • |

CONFIGURATION NOTES

- Option A - Cannot be used with Option C or Option D
- Option B - Cannot be used with Option D
- Option C - Cannot be used with Option A or Option D
- Option D - Cannot be used with Option A, Option B or Option C
- Option E - Cannot be used with Option F
- Option F - Cannot be used with Option E

