MEMKOR

SOLID STATE STORAGE
Secure. Ruggedized. Reliable.

Fulfilling your programs SSD requirements is Memkor's mission. Dedicated to providing Rugged Military Grade SSD's to the Defense Industry, Memkor offers secure data, long life span, locked Bill-of-Materials (BOM), standard and non-standard form factor COTS solutions utilizing high reliability components, specialized firmware and a commitment to customer service throughout the program life cycle. Whether SATA, PCIe, PATA, SAS or SCSI interfaces, Memkor has the experience and engineering talent to make your program successful.

M$^+$ Secure Data SSD Families for the Defense Market

Memkor has developed different M$^+$ Secure Data Solid State Storage families that while sharing the wide range of the most commonly used features, functions and options, are optimized targeting diverse Defense applications:

⇒ ORANGE Series family built to comply with several standard form factors and covering the most commonly used functionalities and ruggedness levels required for the air, land and sea Defense applications.

⇒ BLUE Series family covering add-on and expansion standard and specialized Storage cards as well as non-standard SSD form factors to enable the M$^+$ Capacity feature geared towards achieving extra storage capacity.

⇒ BLACK Series family consisting of standard and non-standard form factor M$^+$ Ruggedized SSD solutions engineered for the most extreme environmental requirements such as resilience to 30g RMS vibration level.

Featured M$^+$ Secure SSD Solutions

Storage Cards

Memkor SSD technology is leveraged in Memkor BLUE Series M$^+$ Secure Storage Cards in form factor such as PMC, XMC and VPX/Open VPX with various levels of ruggedization up to REDI. Both SATA and PCIe/NVMe interfaces are supported with up to 24 TB of Capacity. Memkor Blue Series Storage Card solutions support data security features such as Write Protect, Secure Erase (Fast Erase and Purge) and encryption spanning from TCG OPAL/Emerald to CSfC to FIPS 140-2 complaint implementations.

BLUE Series: VPX Card

PCIe/NVMe Storage

Up to now, PCIe/NVMe based SSD solutions were lacking security features so well defined in SATA based SSDs. Through collaborative efforts with other SSD vendors, Memkor introduces a matching set of hardware controlled Military Grade Security features on the PCIe/NVMe solutions that include Secure Erase, Write Protect, optional Encryption management and reporting. In addition, the security features can be controlled via Vendor Specific NVMe commands.

ORANGE Series: 4TB PCIe/NVMe U.2 SSD

192TB SATA or NVMe/PCIe 1U SSD

Consider Memkor's Blue Series 1U, short depth, 19" rack mounted, detected by computer as a standard SATA or PCIe device Solid State Drive (SSD). It offers up to 192TB of capacity, reliable operations in extended temperatures and security features such hardware triggered Military Secure Erase and encryption validated for up to FIPS 140-2 applications. Other optional features can include multiple hardware or logical partitions with different security levels or optional internal RAID.

BLUE Series: 1U 19" SSD

FRED$^©$ Add-on ATR Storage

Consider Flash Ruggedized External Drive (FRED), part of Memkor's Black Series SATA and PCIe SSDs. FRED provides an easy to deploy, highly ruggedized and high performance non-volatile storage module that can be attached to ATR and ATR-like enclosures via 38999 level connectors. FRED may be used as a replacement to storage cards, freeing valuable slots for other functions that can help to extend the life of the existing systems. FRED supports Memkor standard data at rest security features for up to FIPS 140-2.

BLACK Series FRED

ORANGE Series: Standard Form Factor PCIe, SATA and PATA SSD's

Memkor's 3rd generation ORANGE Series standard form factor SATA and PCIe SSDs aim to provide the highest throughput performance and a broad range of capacities and features required by the Defense storage market. Memkor offers from 128/32GB of MLC/SLC NAND for up to 8192/4096 GB of MLC/SLC NAND in the most popular SSD form factor: 2.5"/U.2 with 9.5mm height and a number of other standard form factor SSDs populated with high density flash chips to ensure unmatched capacity. The superior ruggedization of the ORANGE Series covers a wide range of deployments in portable computers, desktops, and servers deployable within $-45^{o}C$ and $85^{o}C$ operating temperature range, up to 16.3g RMS vibration. The write/read performance can be maintained for up to 550/1200 MB/s in those extended temperatures for SATA and PCIe SSDs respectively. Addressing the on-going segmentation of the SSD application requirements, a number of M^{+} Security features, performance and power consumption options are offered.

BLUE Series: Form Factor Modified to Maximize Capacity

The SSD capacity is often limited by a mechanical envelope for a given standard Form Factor (FF) definition. Memkor's ORANGE Series SSDs comply with the FF requirements and maximize the capacity within these pre-defined constraints. However, Memkor's current SSD architecture can offer M^{+} Capacity, with a slight increase of the height of a standard 2.5" FF enabling to add additional NAND, thus allowing the capacity to double or triple. Furthermore, SSD technology can adapt with ease other computer related standard FF's to build SSD's with extreme capacity, maximizing storage density and/or capacity per port or lane. Memkor BLUE Series SSD's are standard and non-standard form factors geared towards addressing such applications. For example, Memkor M^{+} Capacity BLUE Series 2.5" FF SSD's scale for up to 24 TB (MLC NAND) in 0.602" (15.3mm) height for both Commercial and Defense/Industrial versions. Up to 192 TB SSD is offered in 1U 19" rack mounted enclosure. Memkor BLUE Series provide M^{+} Security with built-in hardware AES-256 encryption engine and on most models built in firmware functions enabling either FIPS, OPAL/Emerald or CSfC data at rest protection management scenarios.

BLACK Series: M^{+} Ruggedized and for Unique Applications

Memkor BLACK Series combines Memkor ORANGE and BLUE Series SSD capabilities, with the innovative M^{+} Ruggedized mechanical design and very special Bill of Materials to achieve exceptional durability and resistance to the most extreme shock and vibration levels defined in the MIL-810G standard. With a capacity ranging from 16GB to 2048GB using SLC NAND, featuring Write Protect, Data Elimination and optional highly ruggedized HiVibe SATA connector, the BLACK Series considerably expands the deployment flexibility of the Memkor family of SSD's. Memkor BLACK Series provide M^{+} Security with built-in hardware AES-256 encryption engine and on most models built in firmware functions enabling either FIPS, OPAL/Emerald or CSfC data at rest protection management scenarios.

Performance [MB/s]

BLUE SATA	BLUE PCIe
ORANGE SATA	ORANGE PCIe
BLACK SATA	BLACK PCIe

500   1000

Capacity [GB]

	BLUE (2.5"/U.2)
ORANGE (2.5"/U.2)	
BLACK (2.5"/U.2)	

2000 4000   8000   24000

Vibration [g's RMS]

| BLUE | BLACK |
| ORANGE | |

10   20   30

BLACK Series
2.5" SATA up to
512/1024GB SLC/MLC NAND

ORANGE Series
U.2/2.5" PCIe/SATA
8 TB MLC NAND

BLUE Series
2.5" 0.591" H, 24 TB SATA and
USB with HiVibe Connector

BLACK Series
2.5" SATA up to
1024/2048GB SLC/MLC NAND

		SATA
Form Factors and Capacity Range	• 2.5″ (0.374″/9.5mm H) up to 8192/4096GB MLC/SLC NAND • 2.5″ (0.602″/15.3mm H) up to 24576/12288GB MLC/SLC/NAND • mSATA up to 512/256GB MLC/SLC NAND • M.2 (SATA) up to 2048/1024GB MLC/SLC NAND • 1.8″ up to 1024/512GB MLC/SLC NAND • Up to 192 TB in 1U Rack mounted package • Contact us about other form factors and related capacities	
Performance and Insusceptibility	• SATA 6Gb/s: Up to 550/550 MB/s max sustained write/read rate • SATA 3Gb/s: Up to 280/280 MB/s max sustained write/read rate	
High speed interfaces	• Ultra DMA Mode-6; Multiword DMA Mode-2; PIO Mode-4	
Operating Temperature Range	• 0°C to 70°C Commercial • -40°C to 85°C Industrial/Military • Contact us about other ranges and those exceeding -40°C and/or 85°C	
Data Reliability and Integrity	• Flash managed by static and dynamic wear leveling and ECC/EDC • Up 27+ years write endurance when overwriting disk 10 times/day (SLC) • Uncorrected Bit Error Rate $<1 \times 10^{-15}$ • End-to-End and Data Path Protection • Extended Data Retention on selected products • HW or SW enabled Write Protect	
Data Security	• Optional Data Elimination (HW and SW triggered Fast Erase and Purge) • Optional FIPS 140-2, TCG OPAL/EMERALD, CSfC • Secure Firmware change	
SSD/SATA Health monitoring	• Extensive S.M.A.R.T. and logs to monitor and diagnose	
High level of ruggedization	• Humidity (non-condensing): 95% • Shock: 50g, 11ms, half sine • Vibration: 16.3g (20Hz—2000Hz); operating • Contact us about standard solutions requiring 30g resilience	

		NVMe/PCIe
Form Factors and Capacity Range	• U.2 (0.374″/9.5mm H) up to 8192/4096GB MLC/SLC NAND • U.2 (0.602″/15.3mm H) up to 16382/8192GB MLC/SLC/NAND • M.2 2242/2260/2280/22110 up to 1024/512GB MLC/SLC NAND (M.2 22110) • Contact us about other form factors and related capacities	
Performance (Extended Temp)	• Up to 1200/1200 MB/s max sustained write/read rate	
High speed interfaces	• PCIe Gen2x4 with NVMe 1.1a	
Operating Temperature Range	• 0°C to 70°C Commercial • -40°C to 85°C Industrial/Military	
Data Reliability and Integrity	• Flash managed by static and dynamic wear leveling and ECC/EDC • Up 27+ years write endurance when overwriting disk 10 times/day (SLC) • Uncorrected Bit Error Rate $<1 \times 10^{-15}$ • End-to-End and Data Path Protection • Extended Data Retention on selected products • HW or SW enabled Write Protect	
Data Security	• Optional Data Elimination (HW and SW triggered Fast Erase and Purge) • Optional FIPS 140-2, TCG OPAL/EMERALD, CSfC • Secure Firmware change	
SSD/SATA Health monitoring	• Extensive S.M.A.R.T. and logs to monitor and diagnose	
High level of ruggedization	• Humidity (non-condensing): 95% • Shock:50g/11ms half sine; Vibration:16.3g (20Hz—2000Hz); operating	

		PATA
Form Factors and Capacity Range	• 2.5″/3.5″ up to 1280/620GB MLC/SLC/NAND • 1.8″ Up to 256/128GB MLC/SLC NAND	
Performance	• 120/100 MB/s max sustained read/write rates	
High speed interfaces	• Ultra DMA Mode-6, Multiword DMA Mode-2 , PIO Mode-4 • Native IDE controller	
Operating Temperature Range	• 0°C to 70°C Commercial • -40°C to 85°C Industrial/Military	
High Data Reliability	• Flash managed by static and dynamic wear leveling and ECC/EDC • Up 27+ years write endurance when overwriting disk 10 times/day (SLC)	
Data Integrity	• Optional HW enabled Write Protect	
Data Security	• Data Elimination (Fast Erase and Purge)	
SSD Health monitoring	• Extensive S.M.A.R.T. to monitor and diagnose	
High level of ruggedization	• Humidity (non-condensing): 95% • Shock:50g/11ms half sine; Vibration: 16.3g (20Hz—2000Hz); operating	

ORANGE Series
SSDiC (FBGA) up to
128GB MLC
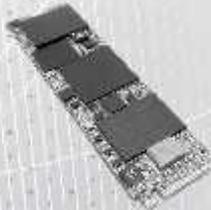
ORANGE Series
M.2 2280 PCIe/SATA up to
512GB/1TB SLC/MLC NAND

ORANGE Series
1.8″ µSATA up to
1024/512 GB

ORANGE Series
mSATA up to
512/256 GB MLC/SLC

ORANGE Series
2.5″ PATA
Up to 640/1280 GB SLC/MLC

Data Elimination

Memkor SSD's optionally include the Data Elimination functions: FAST ERASE, PURGE and CRYPTO ERASE, part of Memkor M$^+$ Security strategy. FAST ERASE eliminates all the data by performing a single rase. Longer duration PURGE eliminates both the data and the data remanence that could otherwise enable user data recovery in the lab. PURGE may require multiple erase/overwrite cycles, and may include verification. CRYPTO ERASE purges encryption key in milliseconds making the data unusable regardless of the SSD capacity.

Data Reliability

Memkor utilizes state of the art wear-leveling combined with up to 125bits/1024B strong ECC, smart cache, data shaping, end-to-end data protection and other sophisticated techniques to ensure even NAND usage across the entire drive, minimized erase/program counts regardless of the application or drive capacity which results in an unparalleled user data integrity and reliability. While Memkor uses superior components, M$^+$ Ruggedized BOM and manufacturing processes provide extra reliability required for some most extreme environments known to man and machines.

Data at Rest

As a part of M$^+$ Security, Memkor SSD's can include on selected models the Data Encryption function, providing 256-bit AES strength, TCG OPAL Security Subsystem Class, NIST&CSE and FIPS140-2 compliant solutions. With a number of ways to support Key Management, Memkor offers deployment flexibility with the ability to tailor the implementation to the specific requirements.

HiVibe$^©$ SATA Connector

Standard SATA connector is typically rated for 6g RMS vibration and 200-600 insertions. The traditional approach to address these limitations requires extra-hardware and cost. Within the M$^+$ Ruggedized strategy, Memkor offers a solution—HiVibe. Built on Micro-Hyberboloid technology, HiVibe, drop in replacement for standard SATA connectors is rated for more than 30g RMS and 20,000 insertion cycles. HiVibe is available as an option on any Memkor 2.5" SATA SSD.
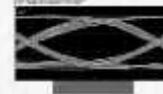
Straddle and Cable
HiVibe SATA Connectors

Product Testing

While ruggedized design and special purpose Bills of Material correlated with the Defense market requirements ensure highest reliability and durability by design, each Memkor production SSD undergoes stiff functional and Environmental Stress Screening (ESS) tests to eliminate risks such as infant mortality and machine and/or human errors.

Obsolescence Management

Part of Memkor Locked Bill of Material (L-BOM) management is periodic scrubbing of the BOM for any potential early warning of risk of obsolescence. Should such risk or issue be identified, Memkor notifies the L-BOM owners, offers Last Time Buy process but mostly work with the customers on alternative solution.

Design Support

Designing new computer and computer storage for Defense applications often pushes system operational envelope into an unknown territory, close to the edges or beyond industry standards, making detailed design a challenge. We've been there. Memkor is happy to offer its expertise and experience and help in this process.

Memkor$^®$ is an American engineering company dedicated to providing flash solid state storage solutions for defense, industrial and enterprise applications. We create secure, reliable, robust and innovative solutions with rich feature sets, tailored, as required, to meet your technology investment objectives. We are dedicated to delivering on our promises. We simply believe that your satisfaction enables the continuous success of our company.

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