

Think Memory.  
Think SMART.

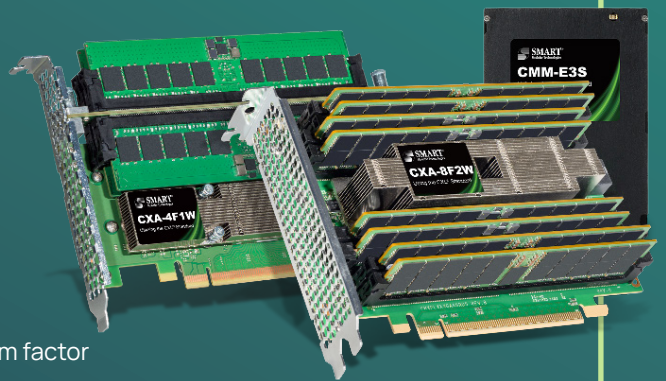
DuraMemory™ / DuraFlash™

Zefr™ ZDIMMs / Data Center SSDs / CXL® Memory



# Key to Memory Capacity & Bandwidth Expansion

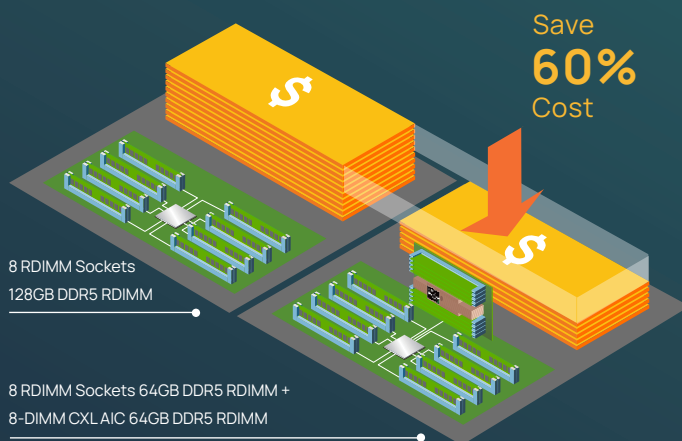
## Advanced Serial Memory Utilizing CXL<sup>®</sup> Standard



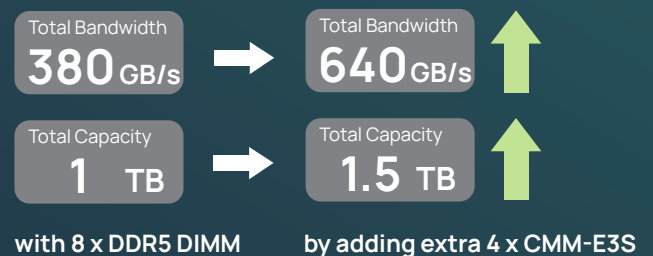
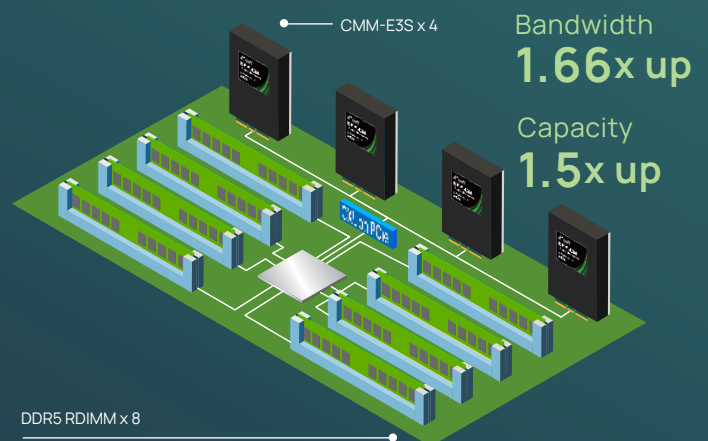
### Features

- Available in Add-in Card (AIC) and EDSFF E3.S 2T (2U short) form factor
- ASIC and FPGA-based memory modules supporting multiple interconnect standards
- Customization of features like RAS, memory interleaving, performance tuning, and support for low-power mode
- Debug capabilities for memory and Phy
- Custom packaging, processing, and testing

### AIC Form Factor Use Case



### E3.S Form Factor Use Case



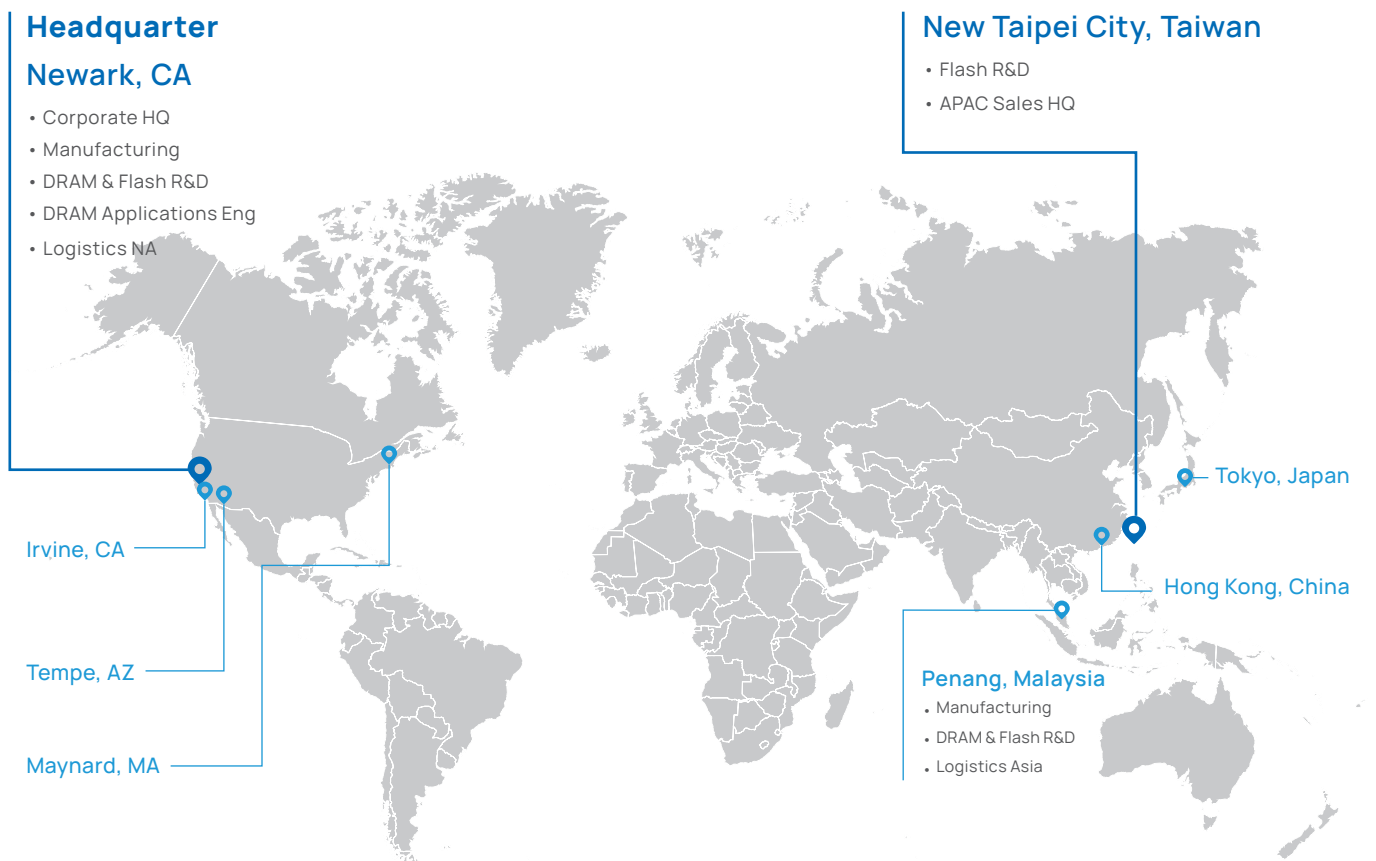
# About SMART Modular Technologies

SMART Modular Technologies, a subsidiary of SGH (NASDAQ: SGH), is a global leader in specialty memory, storage and hybrid solutions serving the electronics industry for over 30 years. In addition to standard and ruggedized product lines, SMART Modular offers custom designs to various applications, including computing, networking, communications, storage, mobile, military, defense, aerospace and industrial markets. Focused on providing extensive customer-specific design capabilities, technical support and value-added testing services, SMART collaborates closely with their global OEM customers throughout their design process and across multiple projects to create reliable and efficient solutions for demanding applications with differentiated requirements.

## Why SMART Modular

- **Serving the Industry for Over 30 Years:** Dedicated in specialty memory, Flash storage and hybrid solutions for leading OEMs.
- **Advanced Products with Quality Assurance:** Taking innovations from the design stage through manufacturing and the supply chain.
- **Trusted Customer Relationships:** Customer-specific design capabilities, technical support and testing services.
- **Long-Term Partnerships with Suppliers:** Leveraging leading suppliers' pricing component availability to the customer's advantage.
- **Build-to-Order Manufacturing with Lifecycle Management:** Long-term, consistent support throughout all market and technology cycles.
- **Broad Customer Base in Diverse Industry Sectors:** Include Data center, storage server, HPC, edge computing, IIoT, networking, and industrial markets.

## SMART Modular Global Footprint





## Durable and Reliable Memory for Industrial Workloads

SMART's DuraMemory portfolio provides a superior level quality, durability and reliability to meet the needs of today's demanding industrial specifications and applications.

All DuraMemory products are backed by SMART's extensive expertise in design, manufacturing, testing and logistical support. The DuraMemory line provides an added level of confidence and security, knowing that these products will perform to the highest standards for durability and reliability, while meeting industrial workload requirements and exceeding performance expectations.

Enterprise Quality for High Reliability

Undergoes Triple Stress Testing and Burn-In

Encryption and Other Features Available



## DuraMemory Product Family

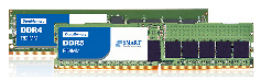
DDR5 / DDR4 / DDR3



NVDIMM



LRDIMM



RDIMM



UDIMM



SODIMM



Mini DIMM



MIP™

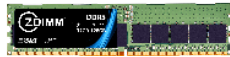
# Servers/Data Centers



DIMM Type	RDIMM		LRDIMM
Technology	DDR5	DDR4	DDR4
Density	16GB-128GB	4GB-256GB	128GB, 256GB
Height	31.25mm	31.25mm	31.25mm
Configuration	80bit	72bit	72bit
Speed (MT/s)	4800-5600	2666-3200	3200
Voltage	1.1V	1.2V	1.2V
Operating Temperature*	C/I Temp	C/I Temp	C Temp



## Registered ZDIMM



DIMM Type	RDIMM	
Technology	DDR5	DDR4
Density	32GB-128GB	16GB-128GB
Height	31.25mm	31.25mm
Configuration	80bit	72bit
Speed (MT/s)	5600	3200
Voltage	1.1V	1.2V
Operating Temperature*	C Temp	C Temp

\*C Temp (0 °C to +70 °C); I Temp (-40 °C to +85 °C); Ambient Temp (+40 °C to +70 °C)

## Blade/Compact Servers



DIMM Type	VLP RDIMM		VLP/ULP Mini RDIMM
Technology	DDR5	DDR4	DDR4
Density	32GB-48GB	4GB-64GB	8GB-32GB
Height	18.75mm	18.75mm	18.75/17.78mm
Configuration	80bit	72bit	72bit
Speed (MT/s)	4800-5600	2666-3200	2666-3200
Voltage	1.1V	1.2V	1.2V
Operating Temperature*	C/I Temp	C/I Temp	C/I Temp

## Networking



DIMM Type	UDIMM		ECC UDIMM	
Technology	DDR5	DDR4	DDR5	DDR4
Density	8GB-48GB	4GB-32GB	16GB-48GB	4GB-32GB
Height	31.25mm	31.25mm	31.25mm	31.25mm
Configuration	64bit	64bit	72bit	72bit
Speed (MT/s)	4800-5600	2666-3200	4800-5600	2666-3200
Voltage	1.1V	1.2V	1.1V	1.2V
Operating Temperature*	C/I Temp	C/I Temp	C/I Temp	C/I Temp

\*C Temp (0 °C to +70 °C); I Temp (-40 °C to +85 °C); Ambient Temp (+40 °C to +70 °C)

## Telecommunication



DIMM Type	SODIMM		ECC SODIMM		
Technology	DDR5	DDR4	DDR5	DDR4	DDR3
Density	8GB-48GB	2GB-32GB	16GB-48GB	4GB-32GB	2GB-16GB
Height	30mm	30mm	30mm	30mm	30/25.4mm
Configuration	64bit	64bit	64bit	72bit	72bit
Speed (MT/s)	4800-5600	2400-3200	4800-5600	2666-3200	1600-1866
Voltage	1.1V	1.2V	1.1V	1.2V	1.35V/1.5V
Operating Temperature*	C/I Temp	C/I Temp	C/I Temp	C/I Temp	C/I Temp

## Compact Systems



DIMM Type	VLP UDIMM		VLP/ULP ECC UDIMM	
Technology	DDR3	DDR5	DDR4	DDR3
Density	4GB-8GB	32GB-48GB	16GB-32GB	4GB-8GB
Height	18.3mm	18.75mm	17.78mm	18.75/18.3mm
Configuration	64bit	72bit	72bit	72bit
Speed (MT/s)	1600	4800-5600	2666-3200	1600
Voltage	1.35V/1.5V	1.1V	1.2V	1.35V/1.5V
Operating Temperature*	C Temp	C/I Temp	C/I Temp	C Temp

## Aerospace/Military



DIMM Type	ECC SODIMM	
Technology	DDR4	DDR3
Density	4GB-32GB	2GB-16GB
Height	30mm	30/25.4mm
Configuration	72bit	72bit
Speed (MT/s)	2666-3200	1600-1866
Voltage	1.2V	1.35V/1.5V
Operating Temperature*	C/I Temp	C/I Temp

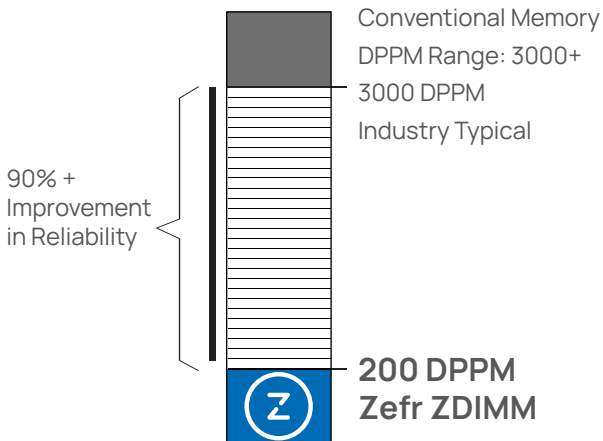
\*C Temp (0 °C to +70 °C); I Temp (-40 °C to +85 °C); Ambient Temp (+40 °C to +70 °C)



# Ultra-High Reliability Zefr™ ZDIMM Memory

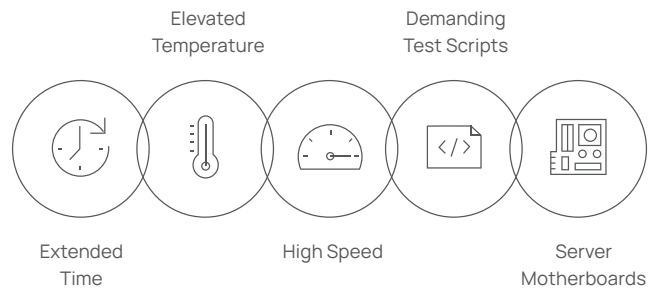
Eliminate over **90%** of Memory Reliability Failures

## Industry Standard Memory Reliability isn't Sufficient



## Zefr Screens Memory to Real-World Conditions

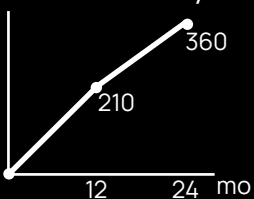
Zefr ZDIMM has been intensely processed to filter out weak memory modules. The Zefr Process combines five key testing ingredients.



## Case Study

An HPC System Integrator built identical systems with standard and Zefr memory.

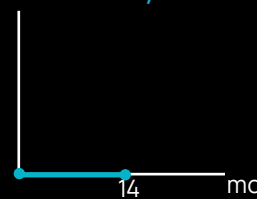
### Standard Memory



Purchase 18,384 Standard RDIMMs  
Build Cluster A:  
• 1,532 Nodes  
• Twelve 16GB RDIMMs per Node

Field Failures since Platform Bring up:  
360 Failures

### Zefr Memory



1Purchase 18,384 Standard RDIMMs  
Build Cluster B:  
• 1,532 Nodes  
• Twelve 16GB RDIMMs per Node

Field Failures since Platform Bring up:  
**0** Failures





# Generation DDR5

Advancing High Performance Computing

Onboard 12V integrated voltage regulators for better signal integrity and reduction of noise

On-die ECC provides further protection against single-bit errors inside the DDR5 memory arrays

Generates CRC checksum in READ data frames

Independent clocks for each channel improves signal integrity, lowers the noise margin

Dual 40-bit wide channel architecture for higher memory efficiency, lower latency



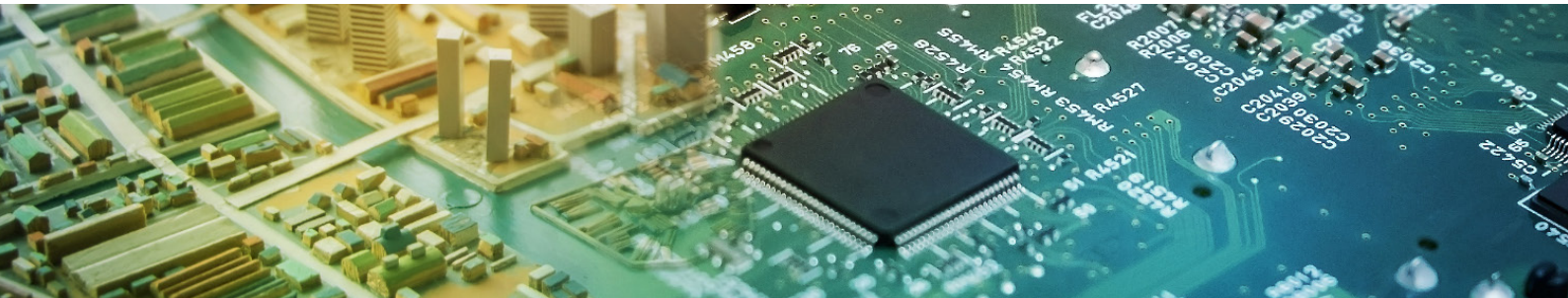


## Durable and Reliable Flash Solutions

With DuraFlash, SMART Modular is committed in offering a wide range of Flash storage form factors designed and manufactured to meet the heavy demands of accelerating embedded applications in the telecom, networking, storage, industrial control, medical, IIoT, transportation, and video surveillance market segments. SMART Modular's extensive capabilities and attention to detail integrate quality controls and stringent processes into all aspects of its design, procurement and manufacturing cycle. The process begins with the selection of specialized material and component suppliers that meet SMART Modular's strict requirements, to finished products, which are subjected to a rigorous design verification test (DVT) process requiring every unit to pass an extensive checklists of criteria, and final inspection for release.

### Value-Added Features:

- Optimized for Enterprise and Industrial Applications
- Available in C Temp (0°C to +70°C) and I Temp (-40°C to +85°C)
- Multiple NAND Options: TLC, eTLC, MLC, SLC, and pSLC
- Extensive Burn-In to Ensure Field Reliability
- Customized Options with Advanced Features Available
- SafeDATA™ Technology Safeguards In-Flight Data During Sudden Power Loss (SPL)
- Available in Broad Range of Capacities
- NVMSentry™ customized firmware support



## DuraFlash Product Family

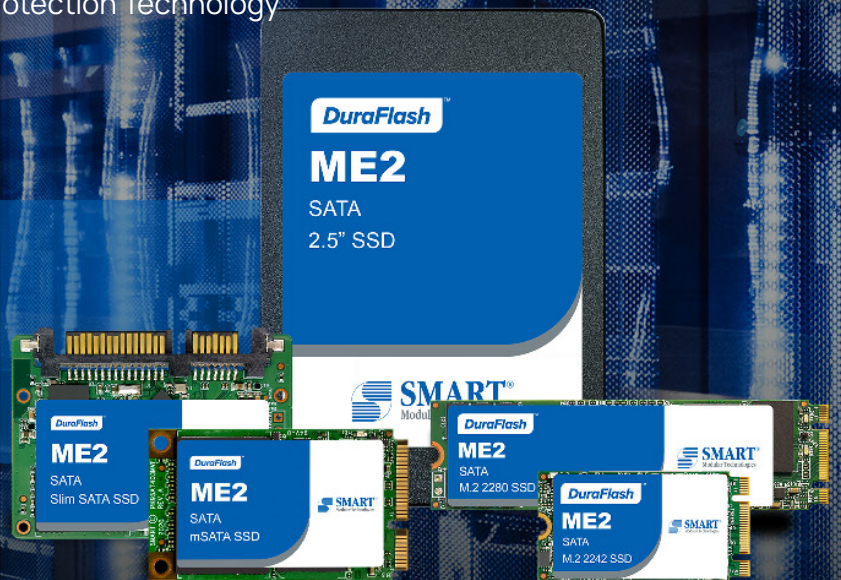
<p><b>DuraFlash SSDs</b></p>	<p><b>DuraFlash BGA</b></p>	<p><b>DuraFlash Cards</b></p>	<p><b>DuraFlash USB</b></p>	<p><b>Enterprise/ Data Center SSDs</b></p>
<ul style="list-style-type: none"> <li>• 2.5"</li> <li>• M.2 (2230/2242/ 2280/22110)</li> <li>• mSATA</li> <li>• Slim SATA</li> <li>• EDSFF E1.S</li> </ul>	<ul style="list-style-type: none"> <li>• eMMC</li> <li>• BGA NVMe</li> </ul>	<ul style="list-style-type: none"> <li>• SD Cards</li> <li>• microSD Cards</li> <li>• CF Cards</li> </ul>	<ul style="list-style-type: none"> <li>• eUSB</li> <li>• USB Flash Drives</li> </ul>	<ul style="list-style-type: none"> <li>• EDSFF E1.S, E3.S</li> <li>• U.2</li> </ul>



# The Ideal SSD Boot Drives for Embedded and Data Center

- The Latest Generation 3D NAND Technology
- 1 DWPD For Five Years
- SMART's Proprietary NVMSentry™ Firmware
- Optional SafeDATA™ Power Loss Data-Protection Technology
- TCG OPAL 2.0 and AES 256 Encryption
- Support I-Temp (-40°C to +85°C)

## ME2 SATA SSDs



## MP3000 PCIe NVMe SSDs



# ME2 SATA SSDs



## Specifications

Interface		SATA III 6Gb/s				
Form Factor		2.5"	M.2 2242-D3-B-M	M.2 2280-D3-B-M	mSATA (MO-300A)	Slim SATA (MO-297)
Max. Performance	Read	540MB/s	540MB/s	540MB/s	540MB/s	540MB/s
	Write	460MB/s	460MB/s	460MB/s	460MB/s	460MB/s
Capacity		240GB-1920GB	240GB-960GB	240GB-1920GB	240GB-1920GB	240GB-1920GB
DRAM		V	V	V	V	V
Input Voltage		5V ± 10%	3.3V ± 5%	3.3V ± 5%	3.3V ± 5%	3.3V ± 5%
Data Integrity	SafeDATA	Optional	-	Optional	-	-
	Advanced Error Detection & Correction	V	V	V	V	V
Security	AES 256 Encryption	V	V	V	V	V
	TCG OPAL 2.0	V	V	V	V	V
	Security Erase (ATA)	V	V	V	V	V
Reliability	MTBF	> 2,000,000 hours				
	Shock Operating	1500 g half-sine, 0.5 msec, 1 shock along each axis, X, Y, Z in each direction				
	Vibration Operating	20G 80-2000Hz, 1.52mm 20-80Hz, 3 axis				
Operating Temperature*		C/I Temp	C/I Temp	C/I Temp	C/I Temp	C/I Temp
Durability	DWPD (for 5 Years)	1 (Enterprise Workload)	1 (Enterprise Workload)	1 (Enterprise Workload)	1 (Enterprise Workload)	1 (Enterprise Workload)
	Pseudo-SLC	-	-	-	-	-
	Thermal Throttling	V	V	V	V	V
	Wear-Leveling / Garbage Collection / TRIM	V	V	V	V	V

## Recommended/Suggested Applications

- AI
- Data Center
- Industrial
- Networking
- Surveillance

\*C Temp (0 °C to +70 °C) ; E Temp (-25 °C to +85 °C) ; I Temp (-40 °C to +85 °C)

# MP3000 PCIe NVMe SSDs



## Specifications

Interface		PCIe Gen4 x4		
Form Factor		EDSFF E1.S	M.2 2280-D3-M	M.2 22110-D3-M
Max. Performance	Read	3500MB/s	3500MB/s	3500MB/s
	Write	2900MB/s	2900MB/s	2900MB/s
Capacity		240GB-1920GB	240GB-1920GB	240GB-1920GB
DRAM		V	V	V
Input Voltage		12V ± 10%	3.3V ± 5%	3.3V ± 5%
SafeDATA		Optional	Optional	Optional
Data Integrity	Advanced Error Detection & Correction	V	V	V
	AES 256 Encryption	V	V	V
Security	TCG OPAL 2.0	V	V	V
	Security Erase (ATA)	V	V	V
Reliability	MTBF	> 2,000,000 hours		
	Shock Operating	1500 g half-sine, 0.5 msec, 1 shock along each axis, X, Y, Z in each direction		
	Vibration Operating	20G 80-2000Hz, 1.52mm 20-80Hz, 3 axis		
Operating Temperature*		C/I Temp	C/I Temp	C/I Temp
Durability	DWPD (for 5 Years)	1 (Enterprise Workload)	1 (Enterprise Workload)	1 (Enterprise Workload)
	Pseudo-SLC	Optional	-	-
	Thermal Throttling	V	V	V
	Wear-Leveling / Garbage Collection / TRIM	V	V	V

## Recommended/Suggested Applications

- AI
- Data Center
- HPC
- Networking
- Storage
- Telecommunication

\*C Temp (0 °C to +70 °C) ; E Temp (-25 °C to +85 °C) ; I Temp (-40 °C to +85 °C)

# RP4000 PCIe NVMe SSDs



## Specifications

Interface	PCIe Gen4 x4	
Form Factor	M.2 2280-D3-M	
Max. Performance	Read	6000MB/s
	Write	2000MB/s
Capacity	480GB-1920GB	
DRAM	V	
Input Voltage	3.3V ± 5%	
Data Integrity	SafeDATA	Standard
	Advanced Error Detection & Correction	V
	AES 256 Encryption	V
Security	TCG OPAL 2.0	V
	Security Erase (ATA)	V
Reliability	MTBF	> 2,000,000 hours
	Shock Operating	1500 g half-sine, 0.5 msec, 1 shock along each axis, X, Y, Z in each direction
	Vibration Operating	20G 80-2000Hz, 1.52mm 20-80Hz, 3 axis
	Operating Temperature*	C Temp
Durability	DWPD (for 5 Years)	0.7 (Enterprise Workload)
	Pseudo-SLC	-
	Thermal Throttling	V
	Wear-Leveling / Garbage Collection / TRIM	V

## Recommended/Suggested Applications

- Data Center
- HPC
- Networking
- Storage Server
- Telecommunication

\*C Temp (0 °C to +70 °C) ; E Temp (-25 °C to +85 °C) ; I Temp (-40 °C to +85 °C)



# eUSB Flash Drives



Specifications	RU150e	HU250e
Interface	USB 2.0	USB 3.0
NAND Type	SLC	
Max. Performance	Read	150MB/s
	Write	90MB/s
Capacity	1GB-32GB	8GB-32GB
Operating Temperature*	C/I Temp	I Temp
Connector	Pin pitch 2.54mm, H: 7.50mm Pin pitch 2.54mm, H: 9.78mm Pin pitch 2.00mm, H: 3.68mm	Pin pitch 2.00mm, H: 3.68mm Pin pitch 2.54mm, H: 7.42mm

## Recommended/Suggested Applications

- Single-board computers for defense, gaming and industrial control applications
- ATCA compute blades
- Industry standard servers

\*C Temp (0°C to +70°C) ; E Temp (-25°C to +85°C) ; I Temp (-40°C to +85°C)

## SD Cards



Specifications	XL+	RD230
Interface	SD 3.01	SD 6.1
Form Factor	SD Card	
NAND Type	SLC	TLC
Max. Performance	Read	49MB/s
	Write	38MB/s
Capacity	4GB-32GB	128GB
Operating Temperature*	C/I Temp	I Temp

### Recommended/Suggested Applications

- Automotive telematics, navigation, and infotainment
- Digital commercial camcorders
- Telecom and communications
- Embedded computing
- Medical equipment

## MicroSD Cards



Specifications	RD130m	RD230m	RD530m
Interface	SD 3.01	SD 6.1	SD 6.1
Form Factor	microSD Card		
NAND Type	SLC	TLC	TLC
Max. Performance	Read	68MB/s	100MB/s
	Write	50MB/s	90MB/s
Capacity	1GB-4GB	32GB	64GB-128GB
Operating Temperature*	E/I temp	I Temp	C Temp

### Recommended/Suggested Applications

- Automotive telematics, navigation, and infotainment
- Telecom and communications
- Embedded computing
- Digital commercial camcorders
- Industrial meters and industrial control
- Medical equipment
- Gaming

\*C Temp (0°C to +70°C) ; E Temp (-25°C to +85°C) ; I Temp (-40°C to +85°C)

# CF Cards



Specifications	H9	XL
Interface	CF 6.1	CF 4.1
Form Factor	CompactFlash	
NAND Type	SLC	
Max. Performance	Read	30MB/s
	Write	12MB/s
Capacity	64MB-64GB	128MB-8GB
Operating Temperature*	C/I Temp	C/I Temp

## Recommended/Suggested Applications

- Gaming
- Communications
- Defense
- Industrial control equipment
- Networking
- Printers

\*C Temp (0 °C to +70 °C) ; E Temp (-25 °C to +85 °C) ; I Temp (-40 °C to +85 °C)



# Next-Generation Data Center SSDs

## Meet three major demands for data center applications

SMART Modular's next-generation SSD family is designed for demanding Applications and stringent SLA's. Today's compute applications place extraordinary demands on data center servers and continue to increase the need for consistent and reliable performance from the underlying hardware. The ability to meet Service Level Agreements (SLA's) that rely on frequent access to data is highly dependent on the SSD storage controller design.

### Architected for Low Power

SMART's DC SSD family uses a hardware-accelerated architecture that runs cooler while maintaining maximum performance. Low power operation helps achieve energy conservation standards and also increases server density per square foot. Save up to 200W per server in a standard 2U/24 configuration.



Peak Performance



Low Power



Enterprise Features

SMART's data center SSDs run full-throttle for maximum throughput.

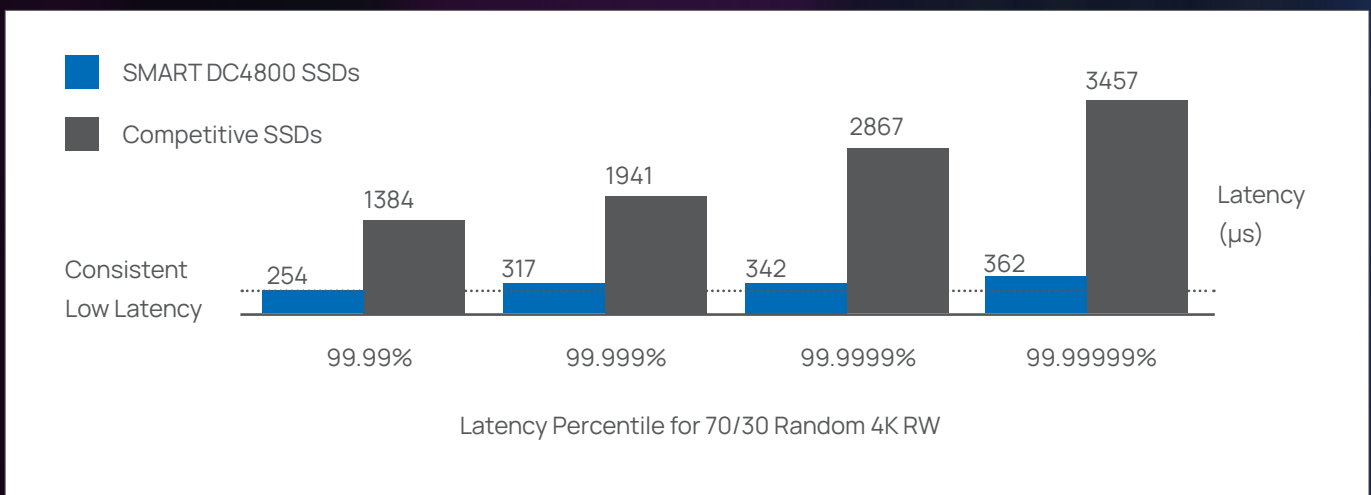
SMART's low power architecture keeps the SSDs running cool.

Our SSDs are designed for a diverse range of data center applications

	Read	Write
Sequential (GB/s)	7.1 GB/s	4.6 GB/s
Random (KIOP/s)	1,490	180

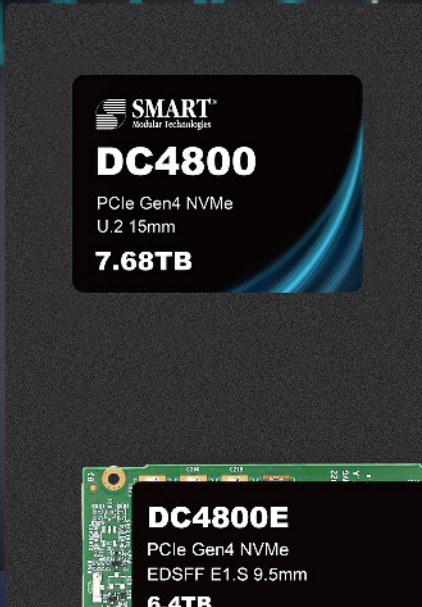
- Industry-leading low Idle and Active Power
- Less heat leaving more headroom for NAND to run fast
- Reduced OpEx costs for SSDs and cooling

- E2E Data protection, TCG, OPAL, eDrive
- Secure Platform Boot
- Multiple Namespaces
- 1 and 3 DWPD
- SMART/Health Log Telemetry
- External Power Loss Protection



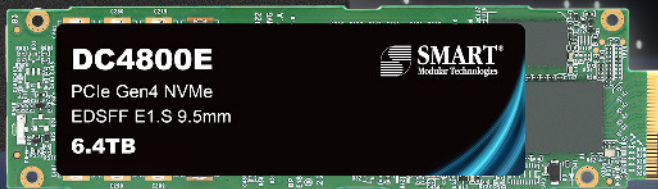


**OPEN**  
Compute Project  
SOLUCIÓN PROVIDER®



	Read (GB/s)
Competitor M	4,026
Competitor T	3,194
Competitor W	3,300

	Write (GB/s)
Competitor M	2,180
Competitor T	1,253
Competitor W	3,196



# DC4800/E PCIe NVMe Data Center SSDs

## Fast, Cool and Consistent

Designed for data center, hyperscaler and cloud server applications

Maximum sustained performance capable of fully saturating the server's PCIe Gen 3/4/5

Superior Quality of Service (QoS) with 7-nines (99.99999%) of latency consistency

Hardware-accelerated SSD design to significantly reduce thermal throttling

### Product Family

Form Factor	Form Factor	Capacity	DWPD
DC4800	U.2 EDSFF E1.S	1.92TB, 3.84TB, 7.68TB	1
DC4800E	U.2 EDSFF E1.S	0.8TB, 1.6TB, 3.2TB, 6.4TB	3



# Think Memory. Think SMART.

For more product details, please contact the SMART sales team or visit our website.

*\*Product images are for promotional purposes only.  
Labels may not be representative of the actual product.*

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