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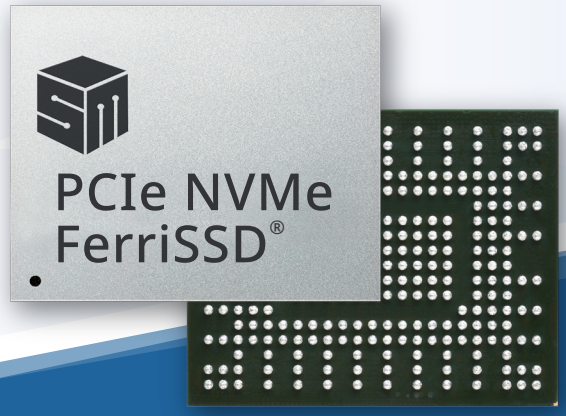
PCIe NVMe FerriSSD®

Single-Chip SSD



SM689 / SM681 Series Single-Chip SSD

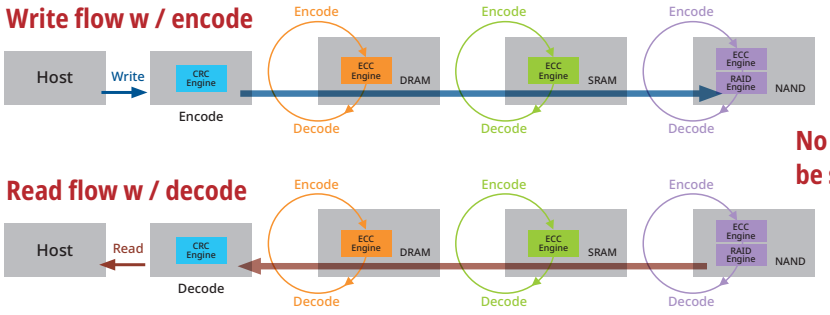
The PCIe NVMe FerriSSD® family consists of SM689 supporting PCIe Gen3 x4 NVMe 1.3 and SM681 supporting PCIe Gen3 x2 NVMe 1.3 designed optimally for high-performance mission critical applications. By combining industry proven controller technology, NAND flash and passive components into a small single BGA package, PCIe NVMe FerriSSD® simplifies design efforts, reduces time-to-market while protecting from NAND technology migration concerns.

The SM689 supports embedded DRAM with Data Redundancy with PCIe Gen3 x4 interface - exhibiting sequential read speed of up to 1.6 GB/s and sequential write speed of up to 650MB/s. The SM681 DRAM-Less series feature the best balance of saving/performance - cost saving from eliminating DRAM while maintaining DRAM-like performance via HMB (Host Memory Buffer). Both available in 3D TLC/MLC/SLC modes, the unique flexible design can support multiple capacity configurations ranging from 5GB to 480GB and include enterprise-grade advanced data integrity and reliability capabilities using Silicon Motion's proprietary end-to-end data protection, ECC and data caching technologies.

Key Features

End to End Data Path Protection

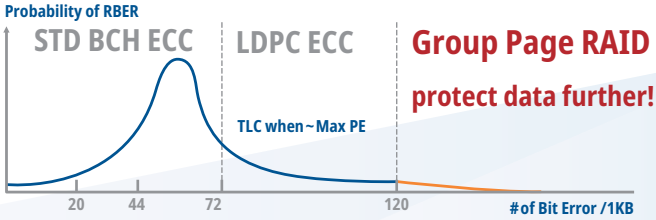
SMI's PCIe NVMe FerriSSDs incorporate full data error detection with recovery engines to provide enhanced data integrity throughout the entire Host-to-NAND-to-Host data path. The PCIe NVMe FerriSSD® data recovery algorithm can effectively detect any error in the SSD data path, including hardware (i.e. ASIC) errors, firmware errors and memory errors arising in SRAM, DRAM or NAND.



No error data will be sent to host!

NANDXtend™ ECC Engine

Conventional SSDs employ standard BCH and RS ECC (error correction coding) engines for initiate first-level correction using NAND shift-read-retries. In addition to this first-level error correction, PCIe NVMe FerriSSDs also implement a highly efficient second-level correction scheme using an LDPC (low-density parity check) code and a Group page RAID algorithm (a highly efficient redundant backup) to reduce potential dPPM at customer site while extending the service life of SSD.



Group Page RAID protect data further!

Key Features

IntelligentScan and DataRefresh to Enhance Data Integrity

SMI's proprietary IntelligentScan function will activate automatically to scan recharge, repair or retire the cell block (DataRefresh) according to the host behavior and working environment (eg. ambient temperature). As a result of the combination of IntelligentScan and DataRefresh, PCIe NVMe FerriSSD® can effective prolong its service life much beyond typical NAND specifications.

Thermo impact on NAND Data Retention

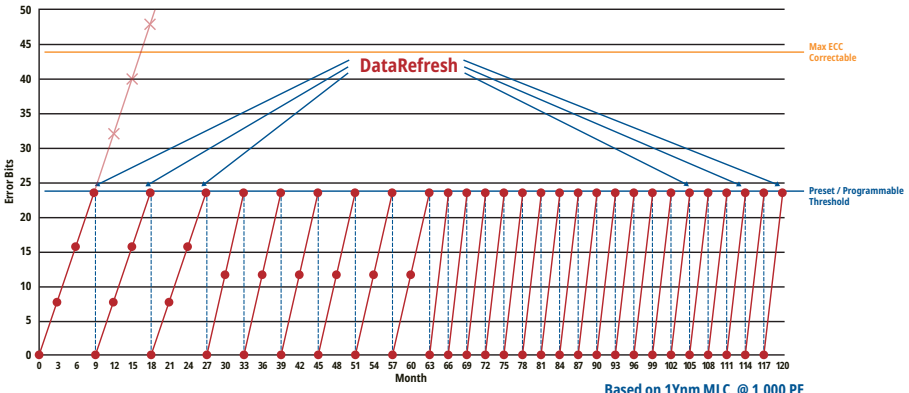
Temp	SLC @ max PE	MLC @ max PE
40	75.58 Mo	12 Mo
55	12 Mo	1.88 Mo
70	2.14 Mo	0.34 Mo
85	0.45 Mo	0.07 Mo

Based on Arrhenius Equation



Higher ambient temp to increase Scan frequency

85℃ data retention simulation



Based on 1Ynm MLC, @ 1,000 PE

IntelligentScan/DataRefresh to proactively extend Data Retention beyond the typical NAND flash limitation

Not to scale, for illustration purpose

Why PCIe NVMe FerriSSD®

Easy to use

- Plug & Play only requires format/fdisk prior to use
- Small footprint for space-limited design

Lower total cost of ownership

- Rugged & Reliable (no moving parts)
- Eliminate requalification cost from NAND generation change
- Cost saving with flexible TLC/MLC/SLC modes, configurable capacities.

Eliminate down time

- Support S.M.A.R.T. and advanced SSD Telemetry logging features
- IntelligentScan with DataRefresh for Data integrity enhancement
- Full End-to-End data path protection with recovery algorithms
- SMI's 4th generation LDPC ECC engine with Group Page RAID
- Remote firmware update available via secured digital signature

Specifications

	SM689	SM681
Host Interface	PCIe Gen3 x4	PCIe Gen3 x2
PCIe Protocal	NVMe 1.3	NVMe 1.3
Embedded DRAM	Yes	DRAM-less
Form Factor	20mm x 16mm BGA	
Green Product	Compliant to RoHS (Restriction to Hazardous Substances Directive) 2.0 / Halogen free	
Temperature Support	Commercial Temp (0°C to + 70°C) Industrial Temp (-40°C to + 85°C)	

Density

3D SLCmode	*5~160GB*
3D MLCmode	*10~320GB*
3D TLCmode	*15~480GB**

**1TB in Q3'2022*

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For more information about FerriSSD®, please go to **www.siliconmotion.com** or send e-mail to **ferri@siliconmotion.com**

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