

Embedded Storage

FerriSSD® PCIe/NVMe BGA SSD

Ax Series

Datasheet

(Simplified Edition)

Revision 0.3 Dec 2018



Document Confidentiality Statement

The information contained in these documents is confidential, privileged and only for the information of the intended recipient and should not be disclosed to any other person. It may not be used, published or redistributed in whole, or in part, nor many any of the information contained therein be disclosed without the prior written consent of Silicon Motion, Inc. and its affiliates (collectively "SMI").

The recipient hereby agrees that reading of this datasheet is strictly limited to her/him as authorized by SMI. If any statement, notice, requirement and/or disclaimer set forth hereunder is unacceptable, the recipient shall return this document to SMI's contact window without any delay or it is deemed to be agreed and accepted by the recipient and her/his representing companies, incorporations, or any legal entity of these statements, notices, requirements and/or disclaimers.

IMPORTANT NOTICE

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH PRODUCTS OF SILICON MOTION, INC. AND ITS AFFILIATES (COLLECTIVELY "SMI"). ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN SMI'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, SMI ASSUMES NO LIABILITY WHATSOEVER, AND SMI DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF SMI PRODUCTS INCLUDING LIABILITY OR WARRANTIES FOR FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

SMI, its agents, and employees, and all persons acting on its or their behalf, disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Statements regarding the suitability of products for certain types of applications are based on SMI's knowledge of typical requirements that are often placed on SMI's products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is customer's responsibility to validate that a particular product with the properties described in the product specification and/or datasheet is suitable for use in a particular application.

SMI products are not intended for use in medical, life saving, life sustaining, critical control or safety systems, or in nuclear facility applications. SMI may make changes to specifications and product descriptions at any time, without notice. SMI may have patents or pending patent applications, trademarks, copyrights, or other intellectual property rights that relate to the presented subject matter. The furnishing of documents and other materials and information does not constitute any license, express or implied, by estoppel or otherwise, to any such patents, trademarks, copyrights, or other intellectual property rights. The information in this document is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by SMI. SMI assumes no responsibility or liability for any errors or inaccuracies that may appear in this document or any software that may be provided in association with this document. Except as permitted by the permitted use abovementioned, no part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without the express written consent of SMI. Contact your local SMI sales office or your distributor to obtain the latest specifications and before placing your product order.

Silicon Motion and Silicon Motion logo are registered trademarks of SMI and/or its affiliates. Other brand names mentioned herein are for identification purposes only and may be trademarks and/or registered trademarks of their respective owners.

Copyright © 2018, SMI. All Rights Reserved.

www.siliconmotion.com



Revision History

Revision	Date	Description
0.1	Dec 8, 2017	Preliminary release
0.2	May 2, 2018	Minor text update
0.3	Dec 4, 2018	Released the simplified edition



Table of Contents

1.	Over	view	
	1.1	Product Description	5
	1.2	Key Features	5
	1.3	Functional Description	7
	1.4	Block Diagram	8
2.	Ordering Information		
	2.1	Product Coding Rule	9
	22	Top Marking	10



1. Overview

1.1 Product Description

The FerriSSD® is designed optimally for a wide range of embedded applications requiring faster access speed, small flexible form factor, and reliable PCle/NVMe storage. By combining industry proven controller technology, NAND flash and passive components into a small single BGA package, FerriSSD® simplifies design efforts, reduces time-to-market while protecting from NAND technology migration concerns.

The new generation FerriSSD Ax series with 3D NAND Flash leveraging Silicon Motion's advanced technologies, including IntelligentScan, DataRefresh, high bandwidth LDPC code correction with proprietary Page RAID engine, and end-to-end data path protection to provide unsurpassed data integrity in a non-volatile storage device. The FerriSSD stands for the ultimate storage solution for embedded computing devices such as navigation, thin-client, POS, MFP, telecommunications, factory automation, as well as varieties of server applications.

1.2 Key Features

- Host Interface
 - PCIe Gen 3 x2 Lane / x4 Lane
 - Compliant with PCIe Express 3.1
 - NVMe 1.3 register interface and command set
- Dual ARM Cortex R5 CPU
- Data Reliability
 - Performance-optimized LDPC engine provides maximum error correction capability
 - End-to-end data path protection with CRC parity
 - Embedded DRAM for added data protection capability (option)
 - SRAM and DRAM ECC error handling and prevention on major memory buffers
 - RAID engine provides multi-page protection for NAND flash data
- Robust Data Protection
 - Advanced system level protection against unstable power supply
 - RAID engine offers additional level of data protection
 - StaticDataRefresh and EarlyRetirement technologies ensure data integrity and prevent read disturbance
 - Early weak block retirement feature
 - PowerShield and DataPhoenix technologies support power-down data protection and recovery
- Data Integrity and Security
 - Built-in AES-128/256 Encryption
 - TCG Opal 2.0 compliant



- Built-in hardware SHA256 and True Random Number Generator (TRNG)
- SSD Status Monitoring
 - Supports Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.) commands
- Advanced Global Wear Leveling
 - Fully utilizes all memory blocks across management units/die(s)
 - Maximizes product lifespan with minimal wear leveling and write amplification overhead
- Digitally signed firmware with eFuse for enhanced security (option)
- Power Management
 - Supports different power states (PS0, PS1, PS2, PS3, PS4)
 - Thermal throttling supported with configurable temperatures
- Easy-to-Use
 - The Plug & Play device only requires format/fdisk prior to use
- Temperature Range
 - Commercial Operating Temperature: 0°C ~ 70°C
 - Extended Operating Temperature: -40°C ~ +85°C
 - Non-Operating and Storage Temperature: -55°C ~ +85°C
- Package
 - Small Form Factor: 16mm x 20mm
 - Green Package
 - RoHS Compliant



1.3 Functional Description

Data Transfer

The flash controller enables multi-way interleaving for multi-bank flash connection to obtain optimal performance. The FerriSSD uses a superior DMA technology to transfer data between the host and the NAND flash interface. The DMA technology transfers data at a very high rate in both directions (read and write) and in doing so, effectively decreases the loading of micro processor.

ECC Correction

The LDPC ECC engine executes parity generation and error detection/correction features, and enhances decoding throughput and data reliability. With LDPC correction capability, the hard and soft decoding mechanism provides powerful error correction to enhance the overall reliability of SSD.

RAID Protection

In case of uncorrectable errors occurring within a superblock (a pre-defined area which consists of a particular set of blocks across physical NAND units), the RAID engine recovers the uncorrectable error chunk by using a certain storage space of parity bits. Incorporated with LDPC, the RAID ensures a comprehensive level of data integrity while providing a broad range of RAID overhead protection.

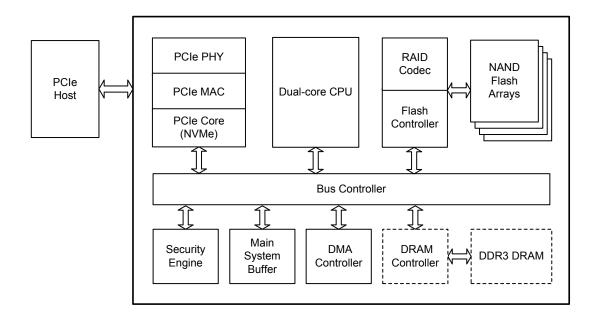
SMART Log and Telemetry Log

The FerriSSD supports get log commands that allow users to get SMART Log and Telemetry Log. The users can thus evaluate drive health at run time and receive an early warning before the flash drive lifespan ends.



1.4 Block Diagram

Figure 1: FerriSSD Block Diagram



Note: DRAM is an optional feature.



2. Ordering Information

2.1 Product Coding Rule

Table 1: Product Code Definitions

Example: SM 6 8 9 G E D □ AE □		
SM	Silicon Motion	
6	Ferri Family	
8	PCIe Interface	
9	DRAM option • 1 = DRAM-less • 9 = Embedded DRAM	
G	Package: TFBGA 16 x 20 (mm)	
E	Operating Temperature • X = 0°C ~ 70°C (C-temp) • E = -40°C ~ +85°C (I-temp)	
D	Capacity • A = 16GB • B = 32GB • C = 64GB • D = 128GB • E = 256GB • F = 512GB	
	Reserved	
AE	Product Revision	
	NAND Vendor Code ('T' or 'S')	

Note: See FerriSSD Product Selection Guide for specific ordering numbers.



2.2 Top Marking

Figure 2: FerriSSD Top Marking (Example)

