



Embedded Storage

FerriSSD[®] PCIe/NVMe BGA SSD

Ax Series

Datasheet

(Simplified Edition)

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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

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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 PCIe/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

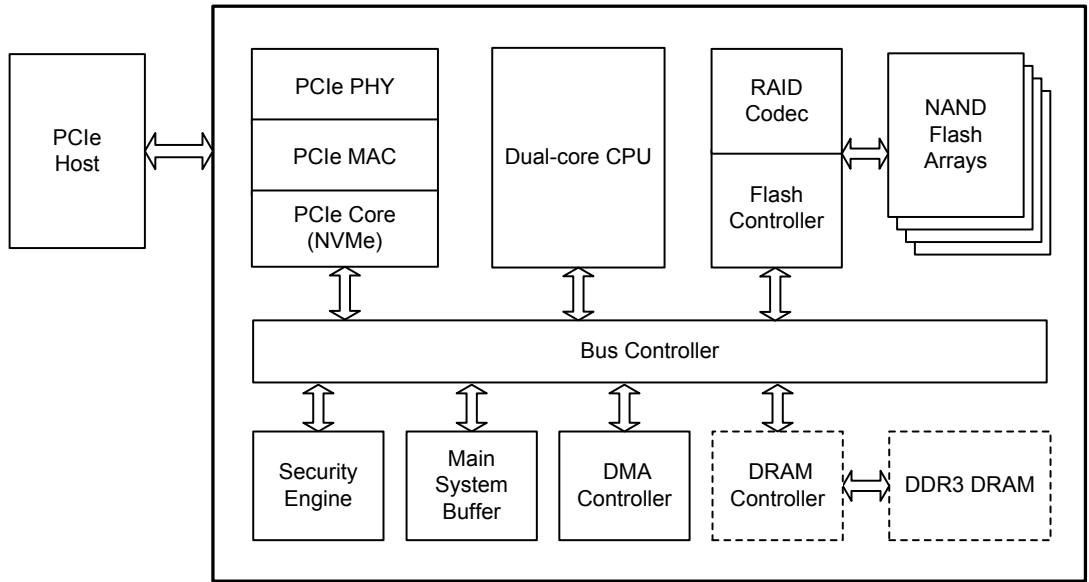
In case of uncorrectable errors occurring within a superblock (a pre-defined area which consists of a particular set of blocks across physical NAND units), the RAID engine recovers the uncorrectable error chunk by using a certain storage space of parity bits. Incorporated with LDPC, the RAID ensures 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 <ul style="list-style-type: none"> • 1 = DRAM-less • 9 = Embedded DRAM
G	Package: TFBGA 16 x 20 (mm)
E	Operating Temperature <ul style="list-style-type: none"> • X = 0°C ~ 70°C (C-temp) • E = -40°C ~ +85°C (I-temp)
D	Capacity <ul style="list-style-type: none"> • 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)

