



**THE DATASHEET OF
SM651GEB BD**





Embedded Storage

FerriSSD[®] SATA BGA SSD

Bx Series

Datasheet

(Simplified Edition)

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Revision History

Revision	Date	Description
0.1	Jan 13, 2012	Initial release
0.2	Feb 14, 2012	<ul style="list-style-type: none">• Updated Key Features (1.2)• Added Product Coding Rule (2.1)
0.3	Mar 30, 2012	Minor text update
0.4	May 4, 2012	Minor text update
0.5	May 30, 2012	Updated Key Features (1.2)
0.6	Jun 13, 2012	Minor text update
0.7	Jul 5, 2012	Minor text update
1.0	Sep 6, 2012	Formal release
1.1	Mar 11, 2013	Minor text update
1.2	Jul 26, 2013	Minor text update
1.3	Sep 30, 2013	Minor text update
1.4	Apr 1, 2014	Minor text update
1.5	Aug 7, 2014	Minor text update
1.6	Aug 20, 2014	Minor text update
1.7	Nov 11, 2014	Minor text update
1.8	Mar 18, 2015	Minor text update
1.9	Jul 22, 2015	Minor text update
2.0	Jan 8, 2018	Minor text update
2.1	Dec 26, 2018	Released the simplified edition

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1. Overview

1.1 Product Description

Silicon Motion leverages the industry leading technologies and experiences introduce the fully integrated FerriSSD® single-chip Solid State Drive in small and light form factors for consumer applications such as tablets, navigation, thin-client, as well as a variety of embedded applications.

The FerriSSD SATA Series behaves like a SATA hard drive operating in a small multi-chip BGA form factor, featuring fast access time and enhanced endurance. Without any moving mechanical parts, the Solid State Drive provides a shock-protected and quiet-operating environment for mobile storage requirements. The combinations of Silicon Motion advanced technologies such as error correction, bad block management, and SSDLifeGuard® monitoring application enable the FerriSSD to deliver the most robust data integrity and protection in the market.

With high reliability, industry-leading performance and programmable firmware, the FerriSSD is the ultimate non-volatile storage solution that is easy to design and manufacture for today's fast-moving consumer and industrial applications.

1.2 Key Features

- Host Interface
 - Compliant with Serial ATA Revision 2.6 specification with 1.5Gbps/ 3.0Gbps interface rate
 - Compliant with ATA/ATAPI-8
 - Supports SATA Device Sleep (DevSleep)
 - Supports trim command with indeterminate pattern ¹
 - Supports partial/slumber power saving mode
 - Supports 48-bit Logical Block Addressing (LBA)
- Enhanced Data Reliability
 - Advanced Hardware BCH Error Correcting Code (ECC) Engine
 - StaticDataRefresh and EarlyRetirement technologies ensure the data reliability
- Robust Data Protection
 - Advanced system level protection against unstable power supply
 - Multiple data security zones
 - PowerShield and DataPhoenix technologies support power-down data protection and recovery
- SSD Status Monitoring
 - Supports Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.) commands

¹ The trim command is an option.

- 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
- Advanced Security
 - Supports ATA8 security feature set
 - Supports real time Full Disk Encryption (FDE) with Advanced Encryption Standard (AES) 128/256-bit strength²
 - Supports hardware SHA-256 and True Random Number Generator (TRNG)²
- Supports customization (security features, hidden partition, special capacity, etc)
- Easy-to-Use
 - The Plug & Play device only requires format/fdisk prior to use
- Power Management
 - Power supply: 3.3V
 - Prevents data corruption in case of sudden power-off
 - Automatic sleep and wake-up mechanism to save power
- Temperature Range
 - Operating Temperature - Commercial : 0°C ~ 70°C
 - Operating Temperature - Industrial: -40°C ~ +85°C
 - Non-Operating and Storage Temperature: -55°C ~ +85°C
- Package
 - Small Form Factor: 16mm x 20mm
 - Green Package
 - RoHS Compliant

² The encryption function is an option. Refer to 2.1 product coding rule and FerriSSD selection guide for details.

1.3 Functional Description

Host Interface

Compliant with Serial ATA Revision 2.6 and ATA-8 specifications, the SATA interface supports data transfer modes PIO 0 to 4, Multiword DMA modes 0 to 2, and Ultra DMA modes up to UDMA 6. In addition, the high-speed interface implements SATA DEVSLP to save SATA I/O power consumption.

Data Transfer

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 micro processor loading.

The flash controller enables multi-channel and interleaving for a multi-bank NAND flash connection to achieve optimal performance.

Error Correction

With multi-mode correction capability, the powerful ECC engine executes parity generation and error detection/correction features, and enhances decoding throughput and data reliability.

Data Security Option

Security commands can be used to lock and unlock the drive by password or through a hardware switch. For those users who require the highest level of security, the FerriSSD provides an option of full data encryption and secure erase within a short period of time. Incorporated various data encryption techniques, the FDE function eventually achieves confidential and secure data protection.

SMART Command

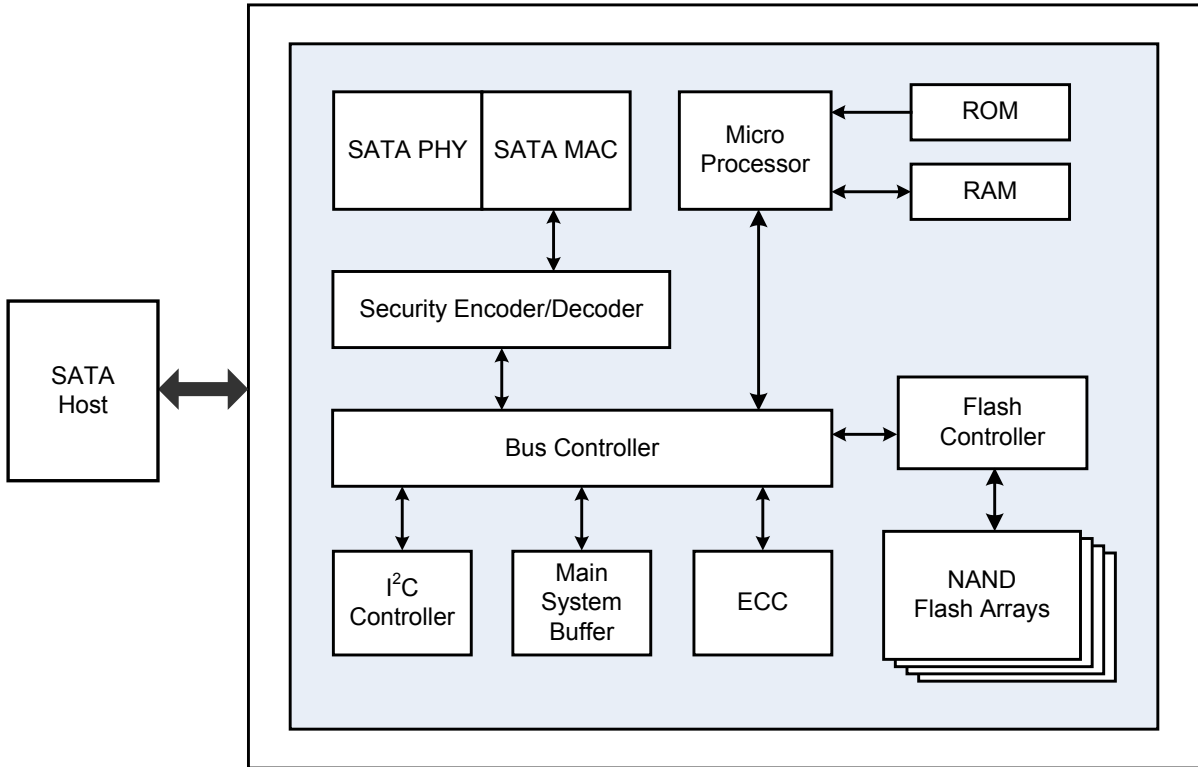
SMART commands allow users to read spare and bad block information. The users can thus evaluate drive health at run time and receive an early warning before the flash drive lifespan ends.

Power Management

The FerriSSD operates at 3.3V power supply with integrated voltage detectors for power fail protection. Utilizing a power-on reset (POR) circuit, the SSD provides a reset signal for the core logic after power on. Embedded PLL circuits run the system clock and the frequency can be programmed to fit different NAND flash timings.

1.4 Block Diagram

Figure 1: FerriSSD Single-Package SSD Block



2. Ordering Information

2.1 Product Coding Rule

Table 1: Product Code Definitions

Example: SM 6 5 1 G X 8 □ BD	
SM	Silicon Motion
6	Ferri Family
5	Type / Interface <ul style="list-style-type: none"> • 1 = CommercialFerri / SATA • 3 = EnterpriseFerri / SATA • 5 = XtendFerri / SATA
1	Encryption Function <ul style="list-style-type: none"> • 1 = Standard • 2 = Encryption Enabled
G	Package: MCM TFBGA
X	Operating Temperature <ul style="list-style-type: none"> • X: 0°C ~ 70°C (C-temp) • E: -40°C ~ +85°C (I-temp)
8	Capacity <ul style="list-style-type: none"> • 1 = 1GB • 2 = 2GB • 4 = 4GB • 8 = 8GB • A = 16GB • B = 32GB • C = 64GB
□	Space (for future use)
BA/BB/BC/BD	Product Revision
□	Blank (Indication for specified NAND vendor)

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

2.2 Top Marking

Figure 2: FerriSSD Single-Packaged SSD Top Marking – BA (Example)

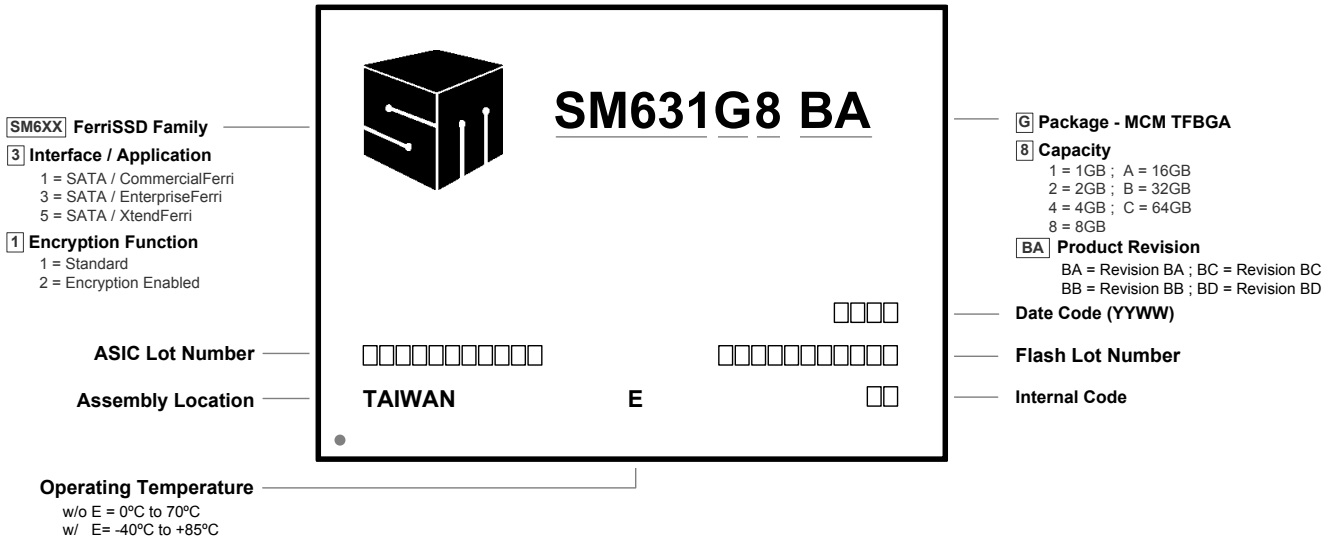
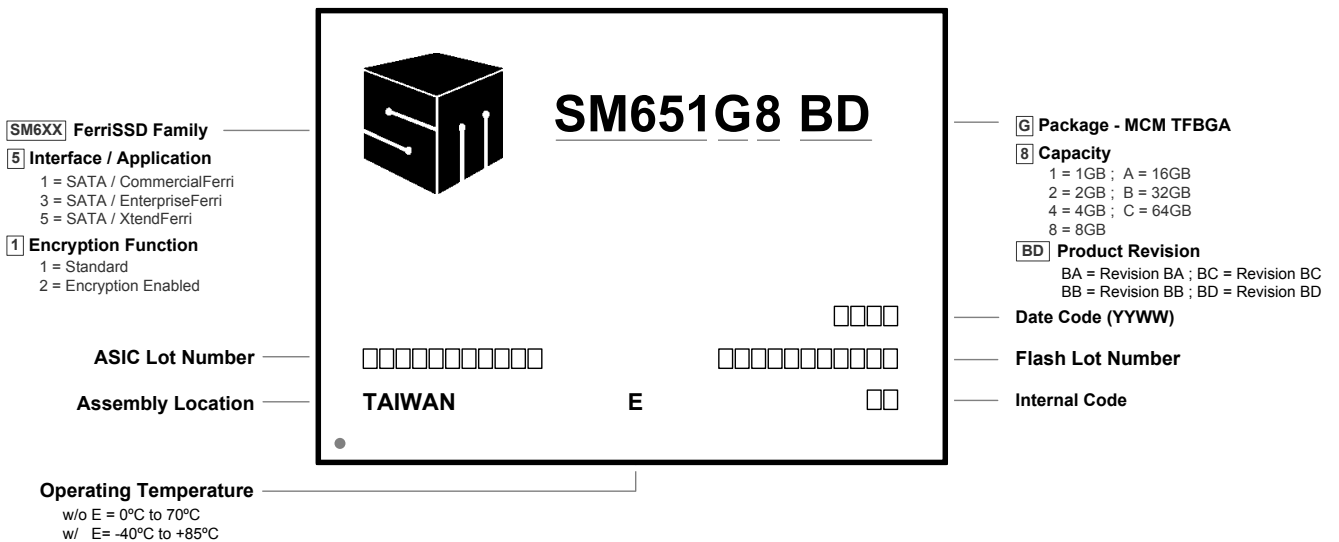


Figure 3: FerriSSD Single-Packaged SSD Top Marking – BD (Example)



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