SiliconMotion

Embedded Storage

FerriSSD® Module

PCIe/NVMe SSD Ax Series

Datasheet

(Simplified Edition)

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Revision History

Revision	Date	Description
0.1	Dec 4, 2018	Released the simplified edition
0.2	Feb 19, 2019	Updated the Endurance section (5.2)

Table of Contents

1. Overview

1.1 Product Description

Silicon Motion leverages the industry leading technologies and experiences to introduce the fully integrated FerriSSD® module in small and light form factors for enterprise/industrial applications such as node/blade server, navigation, thin-client, as well as a variety of embedded applications. The FerriSSD module series are designed optimally for a wide range of embedded applications that requires the highest reliability with blazing fast read/write performance.

FerriSSD can provide a shock-protected and quiet-operating environment for mobile storage requirements. The new generation PCIe NVMe FerriSSD Ax series with 3D NAND Flash equips Silicon Motion's advanced technologies including IntelligentScan, DataRefresh, high bandwidth LDPC code correction with proprietary RAID engine, and end-to-end data path protection — enabling unsurpassed data integrity in a non-volatile storage device designed for mission critical application.

With high reliability, industry-leading performance and programmable firmware, the FerriSSD is the ultimate storage solution for today's fast-moving consumer electronics and industrial level applications. The FerriSSD module is available in various densities for different storage needs.

1.2 Key Features

- Host Interface
    - PCIe Gen 3 x4/x2 Lane
    - Compliant with PCI 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)

■ Available Capacity
  – Supports unformatted capacity up to 256GB [1]

■ Small Form Factor
  – FerriSSD M.2:   M.2 SSD (type 2242 and type 2280)

■ Easy-to-Use
  – The Plug & Play device only requires format/fdisk prior to use

■ Temperature Range
  – Operating Temperature: 0°C ~ 70°C
  – Extended Operating Temperature: -40°C ~ +85°C
  – Non-Operating and Storage Temperature: -55°C ~ +85°C

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[1] 512GB will be available by Q1 2019.

1.3   Block Diagram

Figure 1: FerriSSD Block Diagram
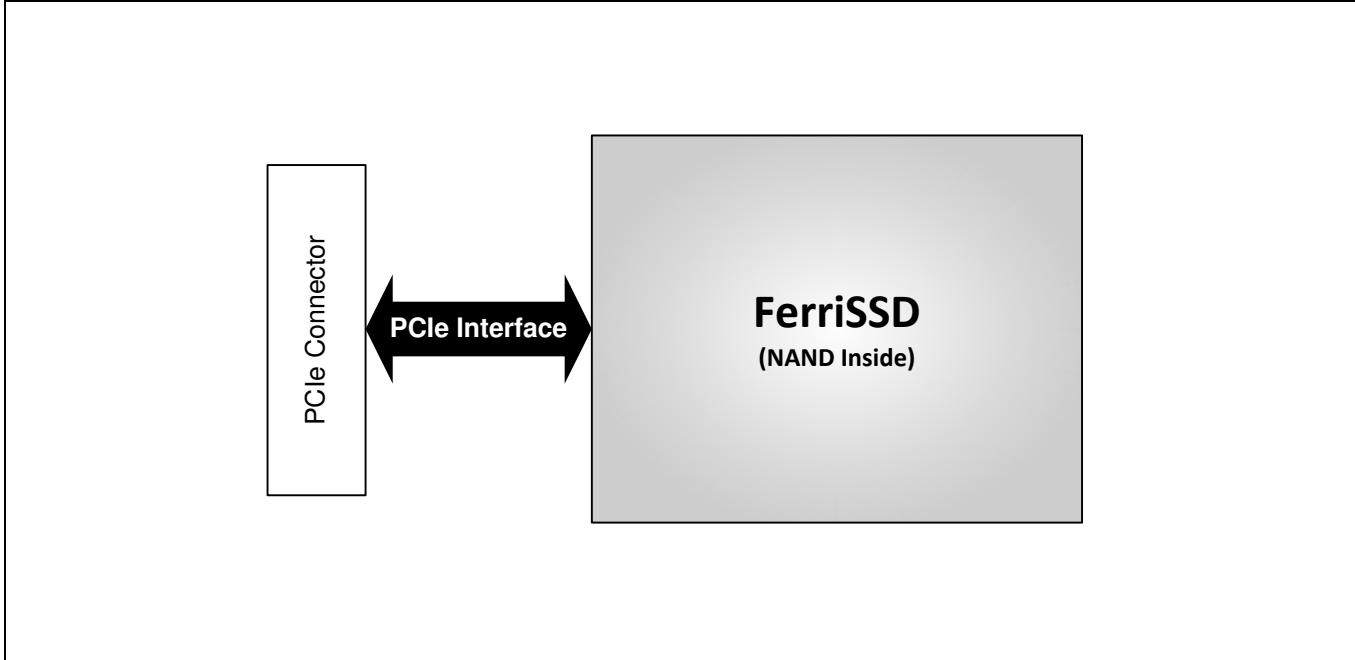
2.   Product Specifications

2.1   Host Interface

The FerriSSD complies to the following industrial standards:

- PCIe Gen 3 Interface x4/x2 Lane
- Compliant with PCIe Express 3.1
- NVMe 1.3 register interface and command set

2.2   Supply Voltage

Table 1:   FerriSSD Module Supply Voltage

Model	Min	Typ	Max	Unit
FerriSSD M.2	3.135	3.3	3.465	V

3. Physical Specifications

3.1 FerriSSD M.2

3.1.1 FerriSSD M.2 Mechanical Drawing

Type	A (Nominal)	Tol
2242	42.0	± 0.15
2280	80.0	± 0.15
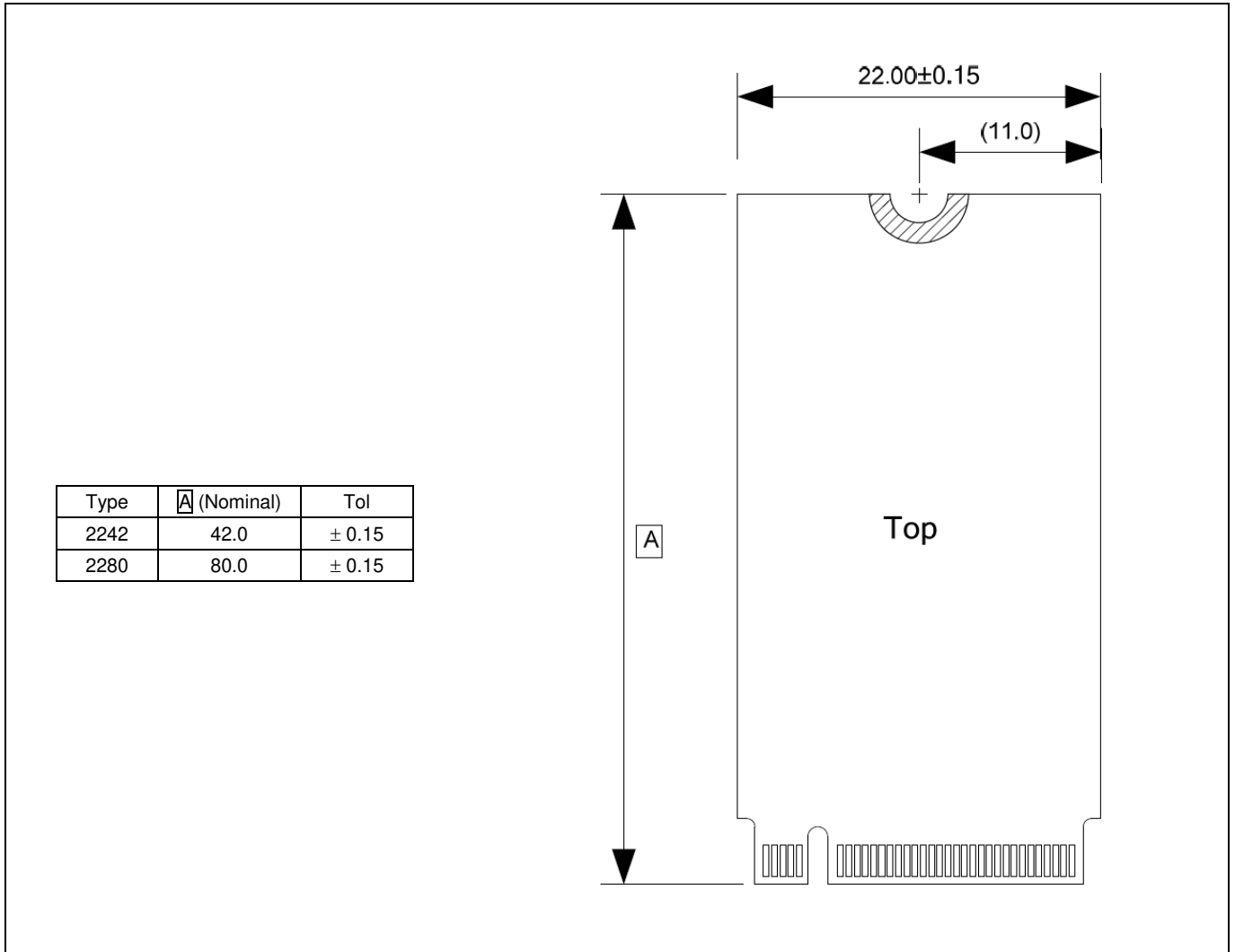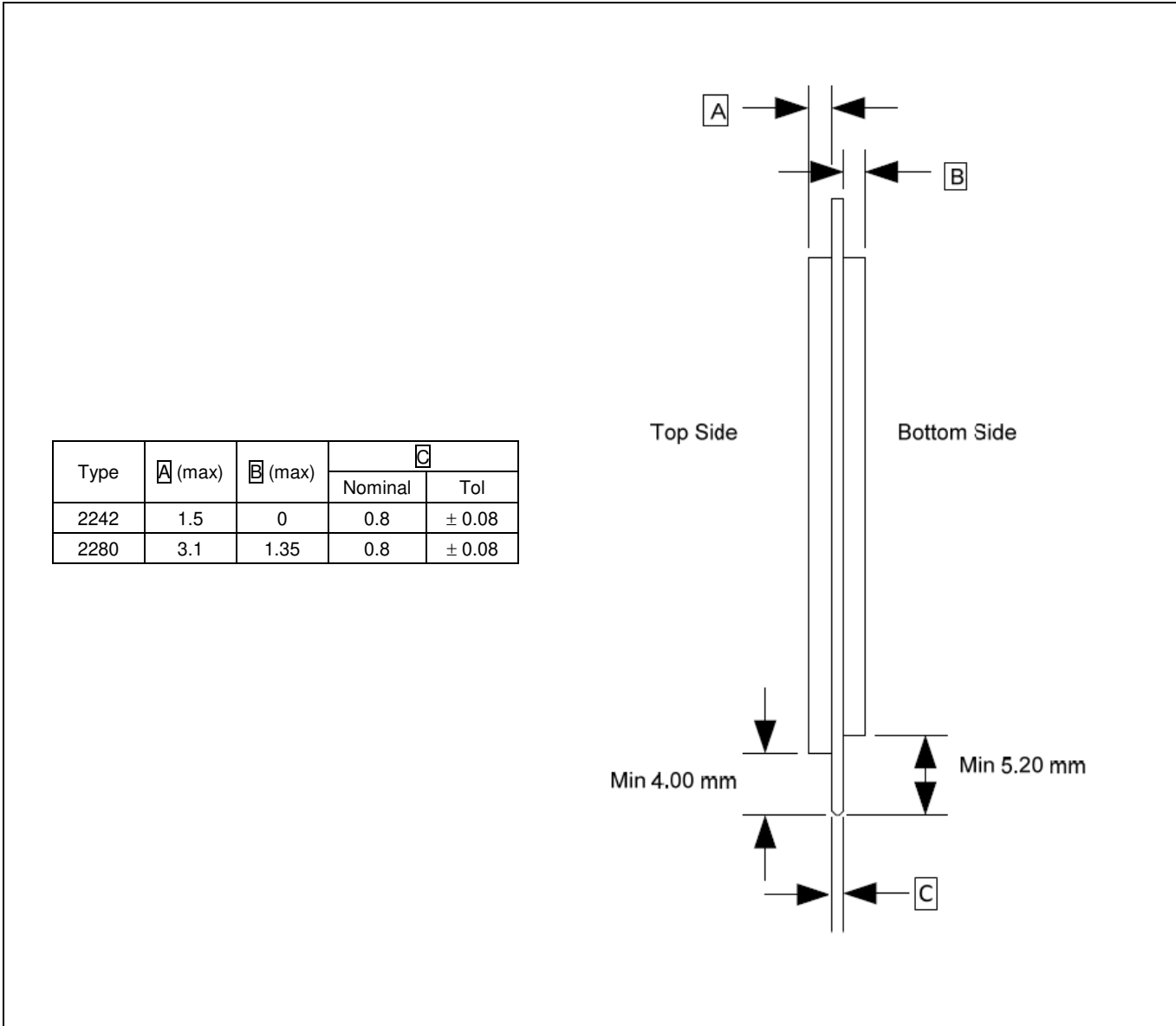
Unit: mm

Type	A (max)	B (max)	C	
			Nominal	Tol
2242	1.5	0	0.8	± 0.08
2280	3.1	1.35	0.8	± 0.08

Unit: mm

3.1.2 FerriSSD M.2 Pin Assignments

Pin	Type	Description
1	GND	Ground
2	3.3V	Supply pin, 3.3V
3	GND	Ground
4	3.3V	Supply pin, 3.3V
5	PETn3	PCIe Transmit data differential pair
6	NC	No connect
7	PETp3	PCIe Transmit data differential pair
8	PLP_INIT#	Power Loss Protection Initial signal
9	GND	Ground
10	LED_1#	Device Activity Signal
11	PERn3	PCIe Received data differential pair
12	3.3V	Supply pin, 3.3V
13	PERp3	PCIe Received data differential pair
14	3.3V	Supply pin, 3.3V
15	GND	Ground
16	3.3V	Supply pin, 3.3V
17	PETn2	PCIe Transmit data differential pair
18	3.3V	Supply pin, 3.3V
19	PETp2	PCIe Transmit data differential pair
20	NC	No connect
21	GND	Ground
22	NC	No connect
23	PERn2	PCIe Received data differential pair
24	NC	No connect
25	PERp2	PCIe Received data differential pair
26	NC	No connect
27	GND	Ground
28	NC	No connect
29	PETn1	PCIe Transmit data differential pair
30	PLP_FBCK#	Power Loss Protection Feedback signal
31	PETp1	PCIe Transmit data differential pair
32	NC	No connect
33	GND	Ground
34	NC	No connect
35	PERn1	PCIe Received data differential pair

Pin	Type	Description
36	NC	No connect
37	PERp1	PCIe Received data differential pair
38	NC	No connect
39	GND	Ground
40	SMB_CLK	SMBus Clock
41	PETn0	PCIe Transmit data differential pair
42	SMB_DATA	SMBus Data
43	PETp0	PCIe Transmit data differential pair
44	ALERT#	Alert notification
45	GND	Ground
46	NC	No connect
47	PERn0	PCIe Received data differential pair
48	NC	No connect
49	PERp0	PCIe Received data differential pair
50	PERST#	PE-Reset is a functional reset to the card
51	GND	Ground
52	CLKREQ#	Clock Request is a reference clock request signal
53	REFCLKn	PCIe Reference Clock signals (100 MHz)
54	PEWAKE#	No connect
55	REFCLKp	PCIe Reference Clock signals (100 MHz)
56	Reserved for MFG_DATA	No connect
57	GND	Ground
58	Reserved for MFG_CLOCK	No connect
59	(removed for key)	Mechanical notch M
60	(removed for key)	Mechanical notch M
61	(removed for key)	Mechanical notch M
62	(removed for key)	Mechanical notch M
63	(removed for key)	Mechanical notch M
64	(removed for key)	Mechanical notch M
65	(removed for key)	Mechanical notch M
66	(removed for key)	Mechanical notch M
67	NC	No connect
68	SUSCLK	No connect
69	PEDET(NC-PCIE)	No connect
70	3.3V	Supply pin, 3.3V
71	GND	Ground
72	3.3V	Supply pin, 3.3V

Pin	Type	Description
73	GND	Ground
74	3.3V	Supply pin, 3.3V
75	GND	Ground

4. Environmental Conditions

4.1 Temperature

Table 2: Temperature Related Specifications

Parameter	Specifications
C-temp Operating Temperature	0°C ~ 70°C
I-temp Operating Temperature	-40°C ~ +85°C
Non-Operating Temperature	-55°C to +85°C
Storage Temperature	-55°C to +85°C

4.2 Humidity

Table 3: Humidity Related Specifications

Parameter	Specifications
Operating Humidity	
Humidity	5% to 95% (Non condensation)
Non-Operating Humidity	
Humidity (Non condensation)	5% to 95%
Maximum Relative Humidity Gradient	20% per hour

4.3 RoHS

Compliant to RoHS (Restriction of Hazardous Substances Directive) 2.0.

5. Reliability

5.1 Reliability Specifications

Table 4: Reliability Specifications

Type	UBER	MTBF
3D TLC	1 sector in 10^{16} bits read, max.	1,200,000 hours
3D SLCmode	1 sector in 10^{17} bits read, max.	2,000,000 hours

Notes:

1. UBER: Uncorrectable bit error rate will not exceed one sector in the specified number of bits read. Refer to the JEDEC SSD specifications for detailed definition.
2. Mean Time Between Failure is estimated based on FIT value. FIT (Failure in Time) test is conducted at SMI internal test lab with SMI RDT (Reliability Demonstration Test).

5.2 Endurance

Please contact SMI representative for the endurance information.

5.3 Preventive Maintenance

No preventive maintenance is required.

6.   Ordering Information

6.1   Product Coding Rule

Table 5:   Product Code Definitions

Example: MD 6 8 9 G X C H AE 3	
M	Ferri Module
D	Form Factor • D = FerriSSD M.2 (22 x 42 mm) • E = FerriSSD M.2 (22 x 80 mm)
6	Ferri Family
8	Type / Interface • 8 = PCIe/NVMe
9	• 9 = Embedded DRAM • 1 = DRAM-Less
G	BGA SSD Type • G = Default BGA • H = High-performance BGA
X	Operating Temperature • X = 0°C ~ 70°C (C-temp) • E = -40°C ~ +85°C (I-temp)
C	Density • A = 16GB • B = 32GB • C = 64GB • D = 128GB • E = 256GB
H	PCB Revision H = Revision H
AE	BGA SSD Product Revision
3	BOM Version 3 = Default setting 6 = With DataFlush option

Note: See the Selection Guide for detailed information on available product ordering numbers.