viking
TECHNOLOGY

A RF, Optical, Microelectronics
and Memory Company

Datasheet for:

MO-300 mSATA SSD

PSFEM2xxxxCxxx

Embedded/Industrial Applications

Legal Information

Revision History

Date	Revision	Description	Checked by
3/12/18	A	Initial release based PSFEM2xxxxAxxx_A. Remove 3D NAND. Revise thickness to 4.85mm max	

Ordering Information for the MO-300 mSATA SSD

Part Number	SATA Interface	Application	Useable Capacity (GB)[1]	LBA[2]	NAND Type	Temperature Range	NAND Device
VRFEM2030GCCDMTL	6Gb/s	Client	30	58,626,288	MLC	(0 to +70'c)	Toshiba L-die
VRFEM2030GCIDMTL	6Gb/s	Client	30	58,626,288	MLC	(-40 to +85'c)	Toshiba L-die
VRFEM2030GCCBMTL	6Gb/s	Client	30	58,626,288	MLC	(0 to +70'c)	Toshiba L-die
VRFEM2030GCIBMTL	6Gb/s	Client	30	58,626,288	MLC	(-40 to +85'c)	Toshiba L-die
VRFEM2060GCCBMTL	6Gb/s	Client	60	117,231,408	MLC	(0 to +70'c)	Toshiba L-die
VRFEM2060GCIBMTL	6Gb/s	Client	60	117,231,408	MLC	(-40 to +85'c)	Toshiba L-die
VRFEM2120GCCBMTL	6Gb/s	Client	120	234,441,648	MLC	(0 to +70'c)	Toshiba L-die
VRFEM2120GCIBMTL	6Gb/s	Client	120	234,441,648	MLC	(-40 to +85'c)	Toshiba L-die
VRFEM2240GCCAMTL	6Gb/s	Client	240	468,862,128	MLC	(0 to +70'c)	Toshiba L-die
VRFEM2240GCIAMTL	6Gb/s	Client	240	468,862,128	MLC	(-40 to +85'c)	Toshiba L-die
VRFEM2480GCCZMTL	6Gb/s	Client	480	937,703,088	MLC	(0 to +70'c)	Toshiba L-die
VRFEM2480GCIZMTL	6Gb/s	Client	480	937,703,088	MLC	(-40 to +85'c)	Toshiba L-die

Notes:

1. User capacity is reported as a decimal count of bytes. The capacity is determined using the industry standard method as defined by the International Drive Equipment Manufacturers Association (IDEMA).
2. Logical Block Address (LBA) Configuration: The drive is set to report the number of logical block addresses (LBA) that will ensure sufficient storage space for the specified density. Standard LBA settings, based on the IDEMA standard (LBA1-03).
3. Contact Viking for availability dates
4. The lowercase letters x,y and z are wildcard characters that indicate product or customer specific information. Refer to the Viking part number coversheet or PN decoder for details.

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1   Introduction

The Viking MO-300 mSATA SSD combines performance and reliability with low power operation to make the ideal mobile drive. The high read and write performance will satisfy the most demanding power user. While the low power mode extends battery life for the road warrior.

Providing an industry-leading bandwidth, the Viking MO-300 mSATA can approach the limits of the SATA 6Gb/s interface on large transfers. I/O performance reaches enterprise class standards.

A robust LDPC algorithm and StaticDataRefresh technology protect the data. Efficient bad block management and reduced write amplification further bolster endurance. Drive health is monitored using an SSD-specific set of S.M.A.R.T. attributes. The combination of these techniques provides data protection unrivaled in the storage industry.

1.1   FEATURES

Reduced Power Requirements
• No moving parts
• Super-low operating and standby power needs
• Power requirements notably reduced over a typical HD

Fast Performance
• Virtually zero spin up or seek times
• Zero rotational latency
• High sustained data transfer rate

Reliable
• No volatile memory elements
• Improved resistance to shock & vibration
• Predictable and manageable failure modes reduce IT costs

Improved Operation
• Noise and vibration free
• Virtually no heat emissions

2 MO-300 mSATA Technical Specifications

Attributes
• Silicon Motion SM2246XT controller
• SLC caching accelerates burst performance
• Direct-to-MLC mode enhances sustained write performance
• Global wear leveling evens program/erase counts to extend drive lifespan
• StaticDataRefresh technology ensures data integrity
• Intelligent garbage collection routines for advanced free space management
• TRIM command support (OS dependent)
• S.M.A.R.T. support
• LDPC hard and soft decode ECC
• DEVSLP support
• Internal flash RAID-like parity scheme for an additional layer of error correction
• Field-upgradeable firmware
• SATA 3.1 Compliant SATA 6Gb/s – backwards compatible to SATA 3Gb/s and 1.5Gb/s
• ATA/ATAPI-8-ACS3 command set compliant
• Industry-standard 512 byte sector support
• Native Command Queuing (NCQ) support with 32 command queue depth
• RoHS-compliant package

Performance
• Sequential Read: Up to 520MB/s
• Sequential Write: Up to 460MB/s
• Random Read: Up to 76K IOPS (4K block size)
• Random Write: Up to 64K IOPS (4K block size)

Endurance
• TBW: Up to 544
• DWPD: 0.80

Security
• User selectable ATA password support
• Secure Erase support

Reliability
• MTBF: 1.5 million device hours (per Telcordia SR-332 reliability prediction procedure)
• Low Density Parity Check (LDPC) ECC
• Static and dynamic wear leveling
• Uncorrectable Bit Error Rate: ≤1 sector per 10^{16} bits read

Electrical/Mechanical
• +3.3VDC (±5%) power supply
• Power Consumption: up to 1.55W (Active), 0.82W (Idle)
• Weight: 60g

Environmental
- Operating (Commercial Temperature):   0-70°C
- Operating (Industrial Temperature):   -40-85°C
- Non-Operating temperature: -40-85°C
- Operating humidity: 5-95% relative
- Shock: 1500G/0.5ms
- Vibration: 2-500Hz, 3.1G

3 Mechanical Dimensions
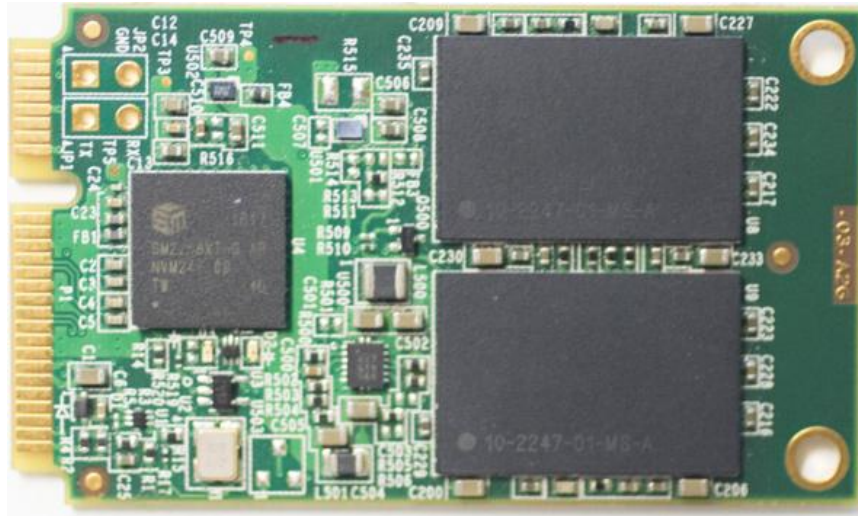
Figure 3-1: MO-300 mSATA SSD
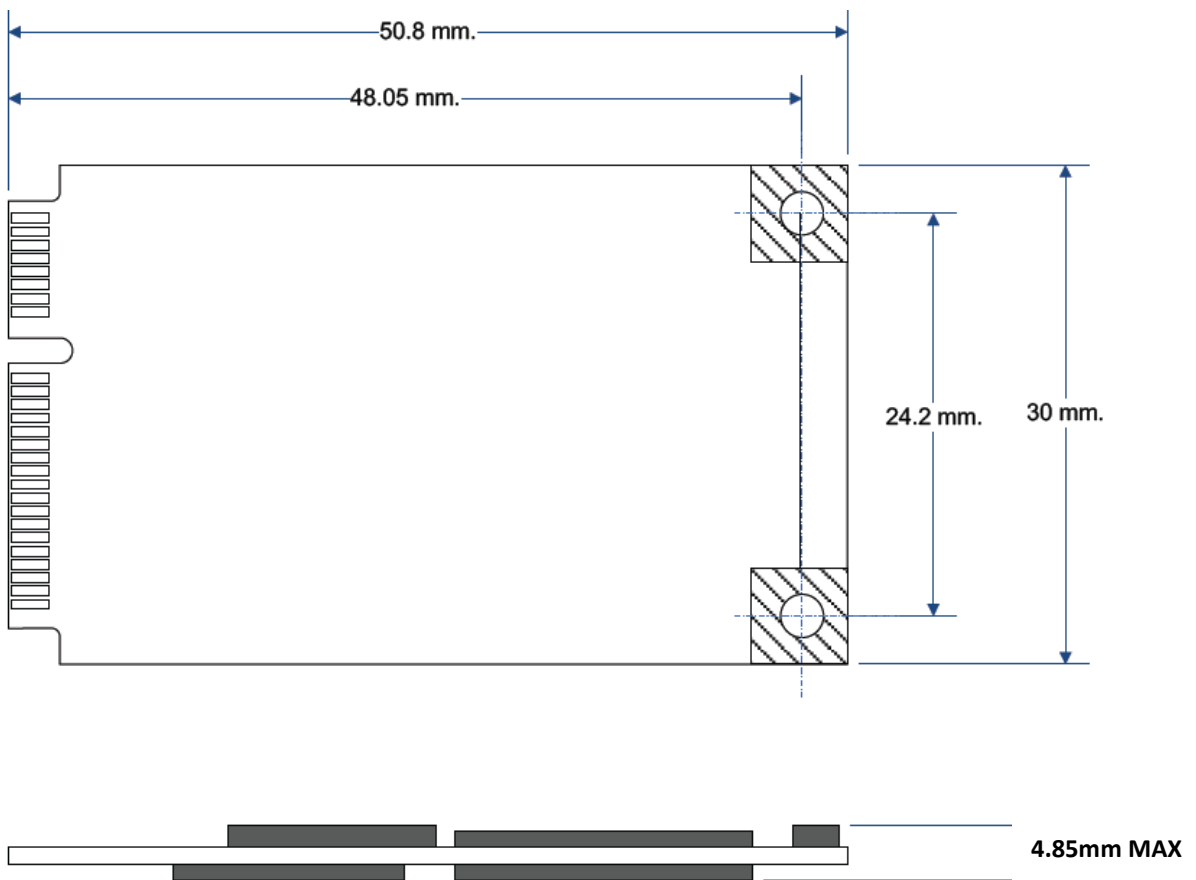
Figure 3-2: Dimension Details for MO-300 mSATA SSD

4 Architecture

The Viking MO-300 mSATA SSD employs a single chip controller with a SATA Revision 3.1 interface on the host side and up to 16 NAND flash packages internally.
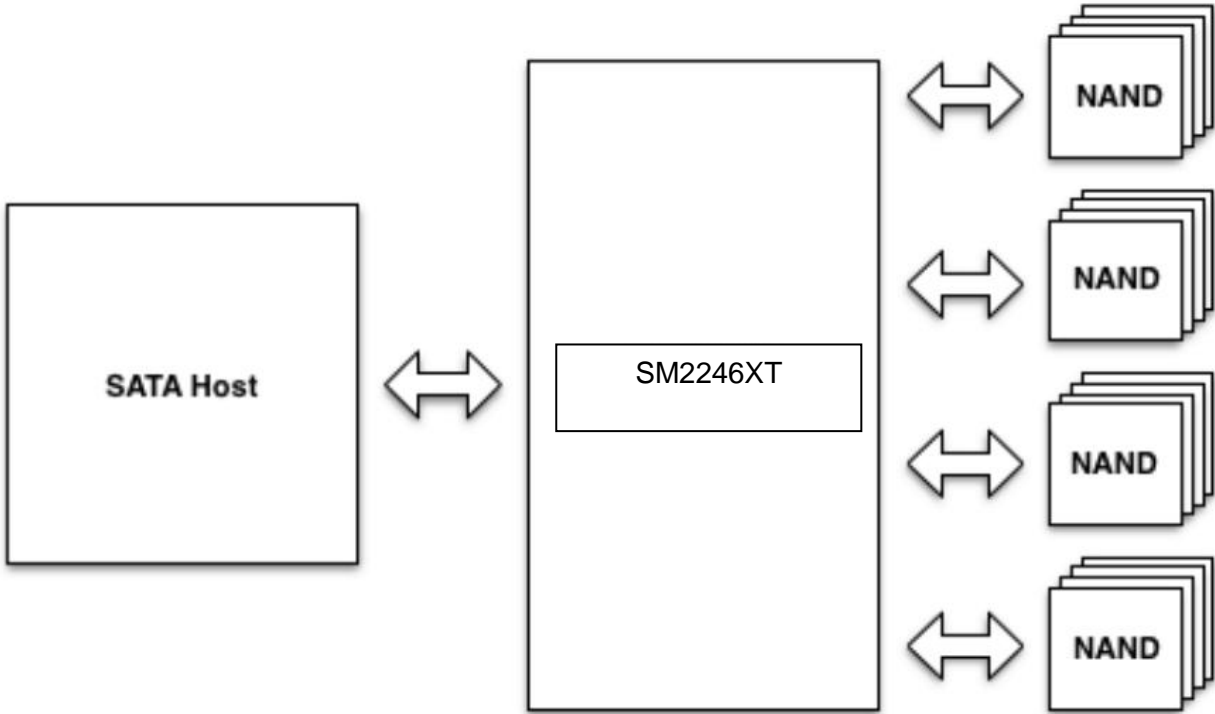
Figure 4-1: Block Diagram

5 Performance

Table 5-1: MO-300 mSATA SSD Performance

Capacity (GB)		30	60	120	240	480
Max Sequential Read (up to)	(MB/s)	500	500	500	520	520
Max Sequential Write (up to)	(MB/s)	420	420	420	460	460
Max 4K Random Read (up to)	(IOPS)	50K	50K	50K	76K	76K
Max 4K Random Write (up to)	(IOPS)	44K	44K	44K	64K	64K

Notes:
1.estimated for 30Gto 120G

6 Endurance

Table 6-1: TBW

Capacity (GB)	TBW (TB)	DWPD (3yr)
30	48	0.8
60	90	0.8
120	181	0.8
240	262	0.8
480	544	0.8

Note:
1.estimated

7 Electrical Characteristics

Table 7-1: Power Consumption

Capacity (GB)	Idle	100% Read	100% Write	Unit
30	<0.820	<.95	<1.05	A
60	<0.820	<.95	<1.05	A
120	<0.820	<.95	<1.05	A
240	<0.820	<1.05	<1.55	A
480	<0.820	<1.05	<1.55	A

Notes
1 Idle power consumption measured with LPM enabled on host
2 Active power consumption measured with IOMeter 1.1x64-4KiB Aligned Random
3 estimated for 30Gto 120G

8 Interface

Viking MO-300 mSATA SSD uses the industry standard PCIe mini Card connector as defined by SATA-IO. The pin-out of the connector is shown in Figure 8-1.
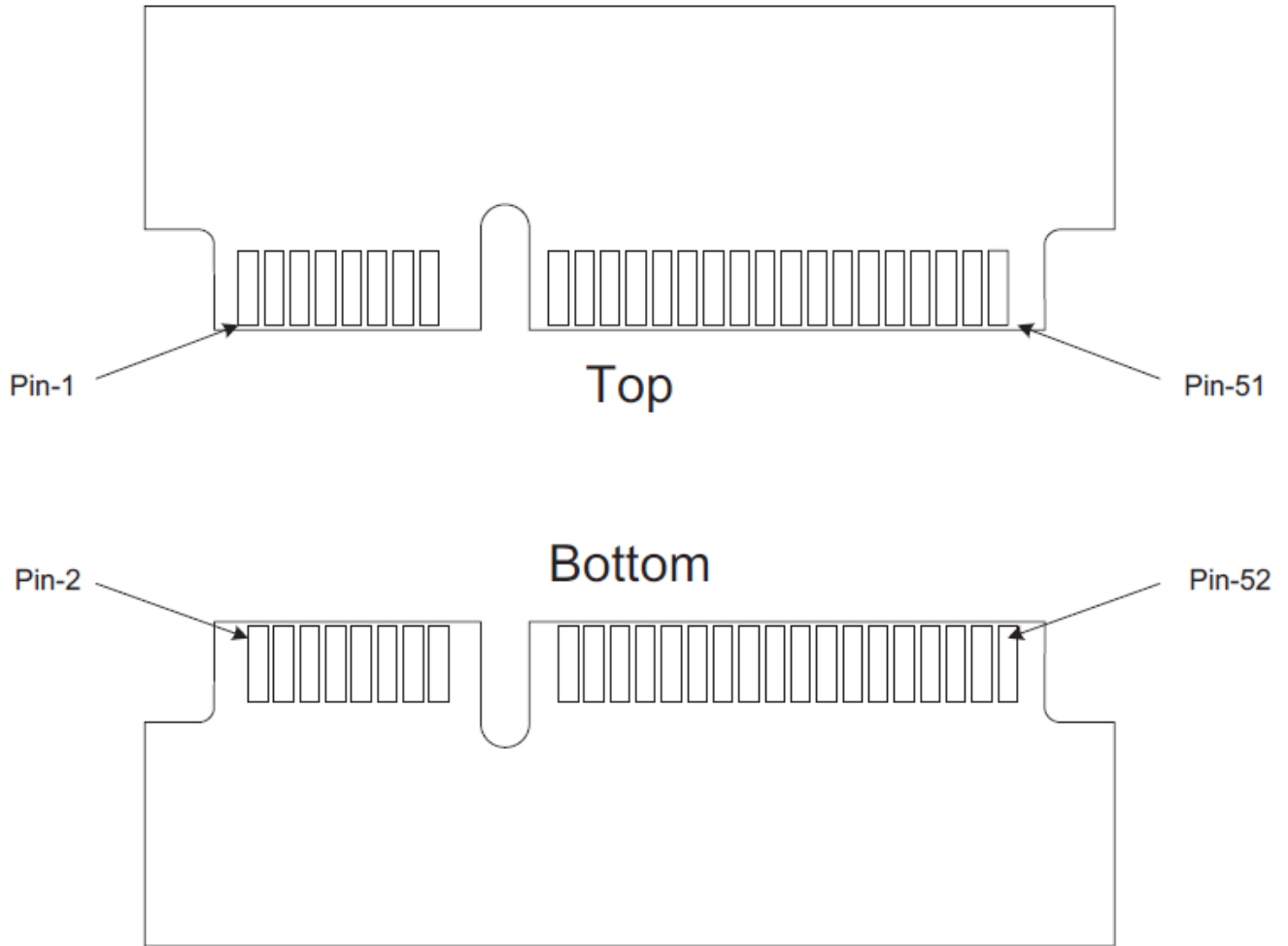
Figure 8-1: mSATA connector

Table 8-1: Signal Segment Pinout

Pin	Signal	Use	Pin	Signal	Use
1	Reserved	-	2	3.3V	PWR
3	Reserved	-	4	GND	GND
5	Reserved	-	6	1.5V	NC
7	Reserved	-	8	Reserved	-
9	GND	GND	10	Reserved	-
11	Reserved	-	12	Reserved	-
13	Reserved	-	14	Reserved	-
15	GND	GND	16	Reserved	-
17	Reserved	-	18	GND	GND
19	Reserved	-	20	Reserved	-

Pin	Signal	Use	Pin	Signal	Use
21	GND	GND	22	Reserved	-
23	A+	TXP	24	3.3V	PWR
25	A-	TXN	26	GND	GND
27	GND	GND	28	1.5V	NC
29	GND	GND	30	SMB-SCL	NC
31	B-	RNX	32	SMB-SDA	NC
33	B+	RXP	34	GND	GND
35	GND	GND	36	Reserved	-
37	GND	GND	38	Reserved	-
39	3.3V	PWR	40	GND	GND
41	3.3V	PWR	42	Reserved	-
43	Select	NC (mSATA Select)	44	Reserved	-
45	Vendor	RS232-TX	46	Reserved	-
47	Vendor	RS232-RX	48	1.5V	NC
49	DAS	DAS	50	GND	GND
51	Presence	GND	52	3.3V	PWR

9 Commands

Table 9-1: Supported ATA Commands

Command Name	Code	Subcode / Page
General Feature Set		
NOP	00h	
Data Set Management	06h	
Trim		01h
Recalibrate	1Xh	
Read Sectors	20h	
Read Sectors (w/o retry)	21h	
Read Sectors Ext	24h	
Read DMA Ext	25h	
Read Native Max Address Ext	27h	
Read Multiple Ext	29h	

Command Name	Code	Subcode / Page
Read Log Ext	2Fh	
Log Directory		00h
Extended Comprehensive SMART Error Log		03h
Device Statistics Logs		04h
List of supported log pages		00h
General Statistics		01h
General Errors Statistics		04h
Transport Statistics		06h
SSD Statistics		07h
Extended SMART Self-test Log		07h
NCQ Error Log		10h
SATA Phy Event Counters Log		11h
Identify Device Data Log		30h
List of Supported Pages		00h
Copy of IDENTIFY DEVICE Data		01h
Capacity		02h
Supported Capabilities		03h
Current Settings		04h
ATA Strings		05h
Security		06h
Serial ATA		08h
Write Sectors	30h	
Write Sectors Ext	34h	
Write DMA Ext	35h	
Set Max Address Ext	37h	
Write Multiple Ext	39h	
Write DMA FUA Ext	3Dh	
Write Log Ext	3Fh	
Selective Self-Test log(SMART)		09h
Host Specific(SMART)		80h-9Fh
SCT Command/Status(SCT)		E0h
SCT Data Transfer(SCT)		E1h
Read Verify Sectors	40h	
Read Verify Sectors (w/o retry)	41h	
Read Verify Sectors Ext	42h	
Write Uncorrectable Ext	45h	
Pseudo-UECC with logging		55h
Read FPDMA Queued	60h	
Write FPDMA Queued	61h	

Command Name	Code	Subcode / Page
Seek	7xh	
Execute Device Diagnostic	90h	
Initialize Drive Parameters	91h	
Download Microcode	92h	
Download with offsets and save microcode for immediate and future use.		03h
Download (without offsets) and save microcode		07h
Download with offsets and save microcode for future use / Activate downloaded microcode		0Eh/0Fh
SMART	B0h	
Read Data		D0h
Read Thresholds		D1h
Enable/Disable Attr Autosave		D2h
Save Attribute Values		D3h
Exec Off-line Immediate		D4h
Execute Off-Line routine		
Execute Short Self-test routine (Off-Line)		
Execute Extended Self-test routine (Off-Line)		
Abort Off-Line Self-test routine		
Execute Short Self-test routine (Captive)		
Execute Extended Self-test routine (Captive)		
Read Log Sector		
Write Log Sector		
Enable Operations		
Disable Operations		
Return Status		
Sanitize Device	B4h	
Sanitize Status Ext		00h
Crypto Scramble Ext		11h
Block Erase Ext		12h
Overwrite Ext		14h
Sanitize Freeze Lock Ext		20h
Read Multiple	C4h	
Write Multiple	C5h	
Set Multiple Mode	C6h	

Command Name	Code	Subcode / Page
Read DMA	C8h	
Read DMA (w/o retry)	C9h	
Write DMA	CAh	
Write DMA (w/o retry)	CBh	
Write Multiple FUA Ext	CEh	
Standby Immediate	E0h	
Idle Immediate	E1h	
Standby	E2h	
Idle	E3h	
Read Buffer	E4h	
Check Power Mode	E5h	
Sleep	E6h	
Flush Cache	E7h	
Write Buffer	E8h	
Flush Cache Ext	EAh	
Identify Device	ECh	
Set Features	EFh	
Security Set Password	F1h	
Security Unlock	F2h	
Security Erase Prepare	F3h	
Security Erase Unit	F4h	
Security Freeze Lock	F5h	
Security Disable Password	F6h	
Read Native Max Address	F8h	
Set Max Address	F9h	
Set Max Set Password		01h
Set Max Lock		02h
Set Max Unlock		03h
Set Max Freeze Lock		04h

10 SMART Attributes

Table 10-1: Supported S.M.A.R.T Attributes

ID	Item	Threshold
01	Read Error Rate	0
05	Physical Bad Block Count when run-time	0

ID	Item	Threshold
09	Power-On Hours	0
0C	Power-On Count	0
A0	Uncorrectable UNC Sector Count When Read/Write	0
A1	Number of Pure Spare Block	0
A3	Number of Initial Invalid Block	0
A4	Total Erase Count TLC	0
A5	Maximum Erase Count TLC	0
A6	Minimum Erase Count TLC	0
A7	Average Erase Count TLC	0
94	Total Erase Count SLC	0
95	Maximum Erase Count SLC	0
96	Minimum Erase Count SLC	0
97	Average Erase Count SLC	0
A9	Remain Life Percentage	0
B1	Total wearlevel count	50
B5	Total program fail count	0
B6	Total Erase fail count	0
C0	Sudden Power-off Count	0
C2	Temperature	0
C4	Uncorrectable Error Count	16
C7	UltraDMA CRC Error Count	50
E8	Remain free Space(%)	0
F1	Host Total LBAs Written (each write unit = 32MB)	0
F2	Host Total LBAs Read (each read unit = 32MB)	0
F5	Flash Total Units Written TLC (each write unit = 32MB)	0

11 Compliance

Viking Technology SSDs comply with the following:
- RoHS "green"
- CE (Europe): EN55022, 2006 Class B and EN55024, 1998 + A1: 2001 + A2:2003
- FCC: CFR Title 47, Part 15, ICES-003, all Class B
- BSMI (Taiwan): approval to CNS 13438 (testing in progress)
- C-TICK (Australia, New Zealand): approval to AS/NZS CISPR22 (testing in progress)
- TUV (Germany): approval to IEC60950/EN60950 (testing in progress)
- VCCI (testing in progress).