

P410m 2.5-Inch SAS NAND Flash SSD

MTFDEAK100MAS-1S1AA, MTFDEAK200MAS-1S1AA,
MTFDEAK400MAS-1S1AA

Features

- Micron® 25nm MLC NAND Flash
- RoHS-compliant package
- SAS 6 Gb/s interface
- Supported SAS speeds
 - 3 Gb/s
 - 6 Gb/s
 - Auto-speed negotiation
- Enterprise sector size support
 - 512-byte
- Hot-plug capable
- SAS-2, rev 16 support
- SAM-3-compliant
- 128-entry command queue depth
- Security erase command set: fast and secure erase
- 100GB performance (steady state)¹
 - Sequential read (64KB transfer): 400 MB/s
 - Sequential write (64KB transfer): 220 MB/s
 - Random read (4KB transfer): 50,000 IOPS
 - Random write (4KB transfer): 25,000 IOPS
 - READ latency (4KB transfer): 0.7ms
 - WRITE latency (4KB transfer): 1.5ms
- 200GB performance (steady state)¹
 - Sequential read (64KB transfer): 400 MB/s
 - Sequential write (64KB transfer): 340 MB/s
 - Random read (4KB transfer): 50,000 IOPS
 - Random write (4KB transfer): 30,000 IOPS
 - READ latency (4KB transfer): 0.7ms
 - WRITE latency (4KB transfer): 1.5ms
- 400GB performance (steady state)¹
 - Sequential read (64KB transfer): 400 MB/s
 - Sequential write (64KB transfer): 340 MB/s
 - Random read (4KB transfer): 50,000 IOPS
 - Random write (4KB transfer): 30,000 IOPS
 - READ latency (4KB transfer): 0.7ms
 - WRITE latency (4KB transfer): 1.5ms

- Reliability
 - MTTF: 2 million device hours²
 - Static and dynamic wear leveling
 - Uncorrectable bit error rate (UBER): <1 sector per 10¹⁶ bits read
- Capacity³ (unformatted): 100GB, 200GB, 400GB
- Endurance: Total bytes written (TBW)
 - 100GB: 1.75PB
 - 200GB: 3.50PB
 - 400GB: 7.00PB
- Mechanical – 7.0mm height
 - Supply voltage: 12V ±10%
 - 2.5-inch drive: 100.5mm x 69.85mm x 7.0mm
- Field-upgradeable firmware
- Power consumption: <9W (TYP)
- Operating temperature
 - Commercial (0°C to +70°C)⁴

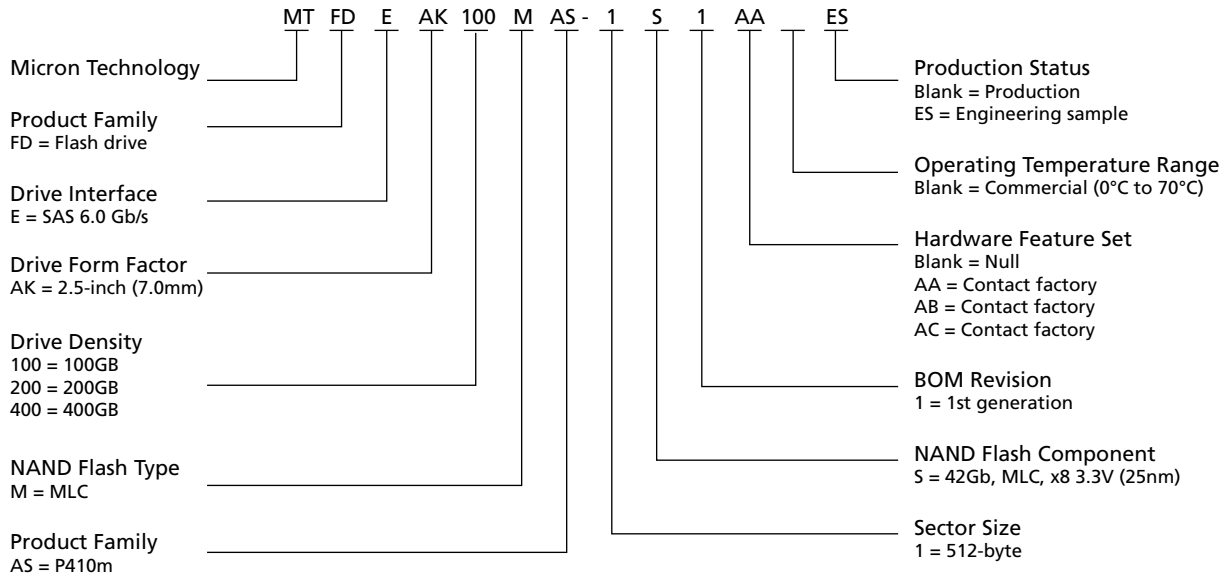
- Notes:
1. Typical I/O performance numbers as measured using Iometer with a queue depth of 32 and write cache disabled.
 2. The product achieves a mean time to failure (MTTF) based on population statistics not relevant to individual units.
 3. 1GB = 1 billion bytes; formatted capacity is less.
 4. Drive case temperature.

Warranty: Contact your Micron sales representative for further information regarding the product, including product warranties.

Part Numbering Information

Micron's P410m SSD is available in different configurations and densities. Visit www.micron.com for a list of valid part numbers.

Figure 1: Part Number Chart

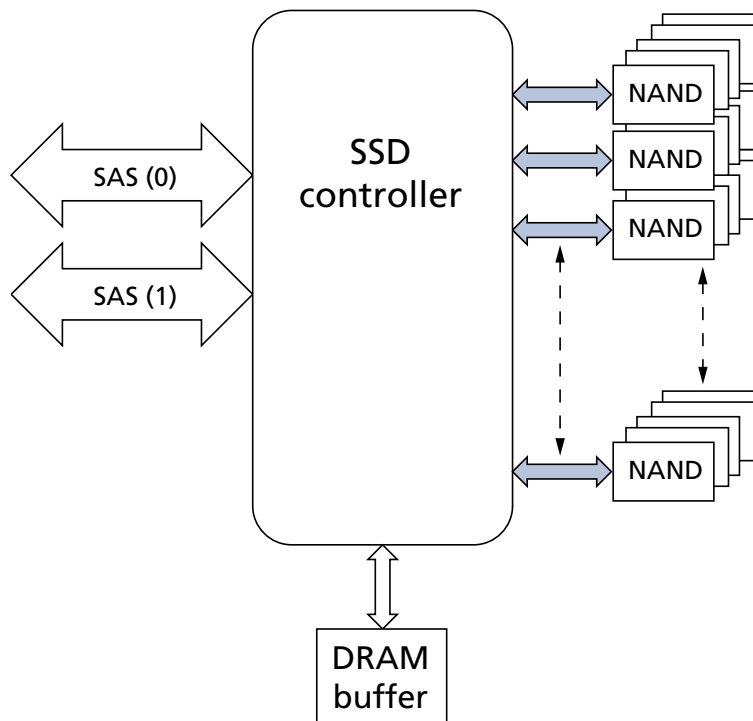


General Description

Micron's P410m solid state drive (SSD) uses a single-chip controller with a dual-port SAS interface on the system side and n-channels of Micron NAND Flash internally. Packaged in an HDD replacement enclosure, the SSD integrates easily in existing storage infrastructures.

The P410m is designed to support and manage the needs of highly available, high-performance platforms that utilize significant read/write mixed workloads. Optimized to support enterprise needs previously supported solely by single-level cell (SLC) solutions, the P410m provides the endurance and data integrity required by these growing environments.

Figure 2: Functional Block Diagram





Logical Block Address 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 (LBA1-02), are shown below.

Table 1: Standard LBA Settings – 512-Byte Sector Size

Drive Size	Total LBA		Max LBA		User Available Bytes
	Decimal	Hexadecimal	Decimal	Hexadecimal	(Unformatted)
100GB	195,371,568	BA52230	195,371,567	BA5222F	100,030,242,816
200GB	390,721,968	1749F1B0	390,721,967	1749F1AF	200,049,647,616
400GB	781,422,768	2E9390B0	781,422,767	2E9390AF	400,088,457,216

Physical Configuration

Table 2: 2.5-Inch Dimensions

Specification	Value		Unit
	Nom	Max	
Height	–	7.0	mm
Width	69.85	–	mm
Length	100.50	–	mm

Interface Connectors

The SAS signal segment interface cable has four conductors and three ground connections. As shown in Package Dimensions, the cable includes a 7-pin signal segment and a 15-pin power segment arranged in a single row with a 1.27mm (0.050in) pitch.

Table 3: SAS Signal Segment Pin Assignments

Signal Name	Type	Description
S1	GND	Second mate ground
S2	TX0+	Positive (Tx0 to target)
S3	TX0-	Negative Tx0 to target)
S4	GND	Second mate to ground
S5	RX0-	Negative (Rx0 to target)
S6	RX0+	Positive (Rx0 to target)
S7	GND	Second mate ground

Table 4: Back Side Signal Segment

Signal Name	Type	Description
S8	GND	Second mate ground
S9	TX1+	Positive (Tx1 to target)
S10	TX1-	Negative Tx1 to target)
S11	GND	Second mate to ground
S12	RX1-	Negative (Rx1 to target)
S13	RX1+	Negative (Rx1 to target)
S14	GND	Second mate ground

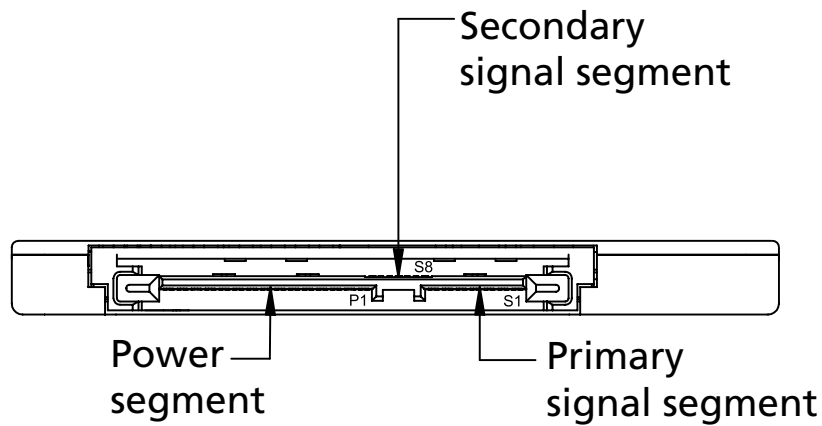
Table 5: 2.5-Inch SAS Power Segment Pin Assignments

Pin#	Signal Name	Description
P1	V33	No connect
P2	V33	No connect
P3	V33	No connect
P4	GND	Ground
P5	GND	Ground
P6	GND	No connect
P7	V5	No connect
P8	V5	No connect
P9	V5	No connect
P10	GND	Ground
P11	DAS	READY LED
P12	GND	Ground

Table 5: 2.5-Inch SAS Power Segment Pin Assignments (Continued)

Pin#	Signal Name	Description
P13	V12	12V power
P14	V12	12V power
P15	V12	12V power

Figure 3: SSD Interface Connections



Commands

Table 6: Supported ATA Command Set

Description	Command Code	Standard
ATA pass through (12)	A1	SAT-2
ATA pass through (6)	85	
Format unit	04	SBC-3
Inquiry	12	SPC-3
Log select	4C	SPC-4
Log sense	4D	
Mode select (6)	15	SPC-3
Mode select (12)	55	
Mode sense (6)	1A	
Mode sense (10)	5A	
Persistent reserve in	5E	SPC-4
Persistent reserve out	5F	
Pre-fetch (10)	34	SBC-3
Read (6)	08	
Read (10)	28	
Read (16)	88	
Read (32)	7F/0009	
Read buffer	3C	SPC-3
Read capacity (10)	25	SBC-3
Read capacity (16)	9E/10	
Read defect data (10)	37	
Read defect data (12)	B7	
Read long (10)	3E	
Read long (16)	9E	
Reassign blocks	07	
Receive diagnostic results	1C	
Release (6)	17	Obsolete (SPC-2)
Release (10)	57	
Report identifying information	A3/05	SPC-4
Report LUNs	A0	
Report supported operation codes	A3/0C	
Report supported task management functions	A3/0D	
Request sense	03	SPC-3
Reserve (6)	16	Obsolete (SBC-2)
Reserve (10)	56	
Security protocol in	A2	SPC-4/SAT-3
Security protocol out	B5	

Table 6: Supported ATA Command Set (Continued)

Description	Command Code	Standard	
Seek (10)	2B	Obsolete (SBC-2)	
Send diagnostic	1D	SPC-3	
Set identifying information	A4/06	SPC-4	
Start stop unit	1B	SBC-3	
Synchornize cache (10)	35		
Synchronize cache (16)	91		
Test unit ready	00	SPC-3	
Unmap	42	SBC-3	
Verify (10)	2F		
Verify (16)	8F		
Verify (32)	7F/000A		
Write (6)	0A		
Write (10)	2A		
Write (16)	8A		
Write (32)	7F/000B		
Write and verify (10)	2E		
Write and verify (16)	8E		
Write and verify (32)	7F/000C		
Write buffer	3B		SPC-3
Write long (10)	3F		SBC-3
Write long (16)	9F		
Write same (10)	41		
Write same (16)	93		
Write same (32)	7F/000D		



Diagnostic, Log, and VPD Pages

Table 7: Supported Diagnostic Pages

Diagnostic Page Code	Diagnostic Page Name	Standard
00h	Supported Diagnostic Pages Diagnostic Page	SPC-4
3Fh	Protocol-Specific Diagnostic Page for SAS SSP	SPC-4/SAS-2
A0h	Fault LED Diagnostic Page	–

Table 8: Supported Log Pages

Diagnostic Page Code	Diagnostic Page Name	Standard
00h	Supported Log Pages Page	SPC-4
02h	Write Error Counter Log Page	SPC-4
03h	Read Error Counter Log Page	SPC-4
05h	Verify Error Counter Log Page	SPC-4
06h	Non-Medium Error Log Page	SPC-4
0Dh	Temperature Log Page	SPC-4
0Eh	Start-Stop Cycle Counter Log Page	SPC-4
0Fh	Application Client Log Page	SPC-4
10h	Self Test Results Log Page	SPC-4
15h	Background Scan Result Log Page	SPC-4
18h	Protocol-Specific Port Log Page	SPC-4
19h	General Statistics and Performance Log Page	SPC-4
2Fh	Informational Exceptions Log Page	SPC-4 /SAT-2
30h	Device SMART Read Data Log Page	–
31h	SATA IDENTIFY DEVICE Data Log Page	–
32h	SMART Read Error Log Page	–
33h	Impacted LBA List Log Page	–
34h	Device SMART Read Attribute Thresholds Log Page	–
35h	SATA Error Statistics Log Page	–
36h	SAS Error Statistics Log Page	–
37h	ELX-Bridge Error/Statistics Log Page	–

Table 9: Supported VPD Pages

Diagnostic Page Code	Diagnostic Page Name	Standard
00h	Supported VPD Pages VPD Page	SPC-4
80h	Unit Serial Number VPD Page	SPC-4

Table 9: Supported VPD Pages (Continued)

Diagnostic Page Code	Diagnostic Page Name	Standard
83h	Device Identification VPD Page (for SAS Target)	SPC-4 /SAS-2
86h	Extended Inquiry Data VPD Page	SPC-3 /SPC-4
87h	Mode Page Policy VPD Page	SPC-4
88h	SCSI Ports VPD Page	SPC-4
89h	ATA Information VPD Page	SPC-4 /SAT-2
8Ah	Power Condition VPD Page	SPC-4
90h	Protocol-Specific Logical Unit Information VPD Page	SAS-2
B0h	Block Limits VPD Page	SBC-3
B1h	Block Device Characteristics VPD Page	SBC-3
D0h	Drive Information VPD Page	–
D1h	Firmware Revision VPD Page	–
D2h	Hardware Revision VPD Page	–
D3h	Bridge Information VPD Page	–

Performance

Measured performance can vary for a number of reasons. The major factors affecting drive performance are the density of the drive and the interface of the host. Additionally, overall system performance can affect the measured drive performance. When comparing drives, it is recommended that all system variables are the same, and only the drive being tested varies.

Performance numbers will vary depending on the host system configuration.

Table 10: Drive Performance

Specification	100GB	200GB	400GB	Unit
Sequential read (64KB transfer)	400	400	400	MB/s
Sequential write (64KB transfer)	220	340	340	MB/s
Random read (4KB transfer)	50,000	50,000	50,000	IOPS
Random write (4KB transfer)	25,000	30,000	30,000	IOPS
READ latency (TYP)	0.7	0.7	0.7	ms
WRITE latency (TYP)	1.5	1.5	1.5	ms

- Notes:
1. Typical I/O performance numbers as measured using Iometer with a queue depth of 32 and write cache disabled.
 2. Iometer measurements are performed in the steady state region.
 3. 4KB transfers used for READ/WRITE latency values.
 4. System variations may affect measured results.

Reliability

Micron's SSDs incorporate advanced technology for defect and error management. They use various combinations of hardware-based error correction algorithms and firmware-based static and dynamic wear-leveling algorithms.

Over the life of the SSD, uncorrectable errors may occur. An uncorrectable error is defined as data that is reported as successfully programmed to the SSD but when it is read out of the SSD, the data differs from what was programmed.

Table 11: Uncorrectable Bit Error Rate

Uncorrectable Bit Error Rate	Operation
<1 sector per 10 ¹⁶ bits	READ

Mean Time To Failure

Mean time to failure (MTTF) for the SSD can be predicted based on the component reliability data using the methods referenced in the Telcordia SR-332 reliability prediction procedures for electronic equipment.

Table 12: MTTF

Density	MTTF (Operating Hours) ¹
100GB	2 million
200GB	2 million
400GB	2 million

Note: 1. The product achieves an MTTF of 2 million hours, based on population statistics not relevant to individual units.

Endurance

Endurance for the SSD can be predicted based on the usage conditions applied to the device, the internal NAND component cycles, the write amplification factor, and the wear-leveling efficiency of the drive. Total bytes written measured with 55°C case temperature within the total bytes written values listed in this document. The table below shows the drive lifetime for each SSD density based on predefined usage conditions.

Table 13: Drive Lifetime

Density	Drive Lifetime (Total Bytes Written)
100GB	1.75PB
200GB	3.50PB
400GB	7.00PB

Notes: 1. Total bytes written calculated with the drive 90% full.
2. Access patterns are 50% sequential and 50% random and consist of the following: 5% are 4KB; 5% are 8KB; 10% are 16KB; 10% are 32KB; 35% are 64KB; and 35% are 128KB.

Electrical Characteristics

Stresses greater than those listed may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Table 14: Power Consumption

Density	Sequential Write/Read (128KB transfer)	Unit
100GB, 200GB, 400GB	<10	watts

Table 15: Maximum Ratings

Parameter/Condition	Symbol	Min	Max	Unit
Voltage input	V12	10.8	13.2	V
Operating temperature	T _C	0	70	°C
Non-operating temperature		-40	85	°C
Rate of temperature change		-	20	°C/hour
Relative humidity (non-condensing)		5	95	%

Table 16: Shock and Vibration

Parameter/Condition	Specification
Operating shock	1000G (0.5ms duration)
Operating vibration	10-500Hz at 3.1G

Compliance

Micron SSDs comply with the following:

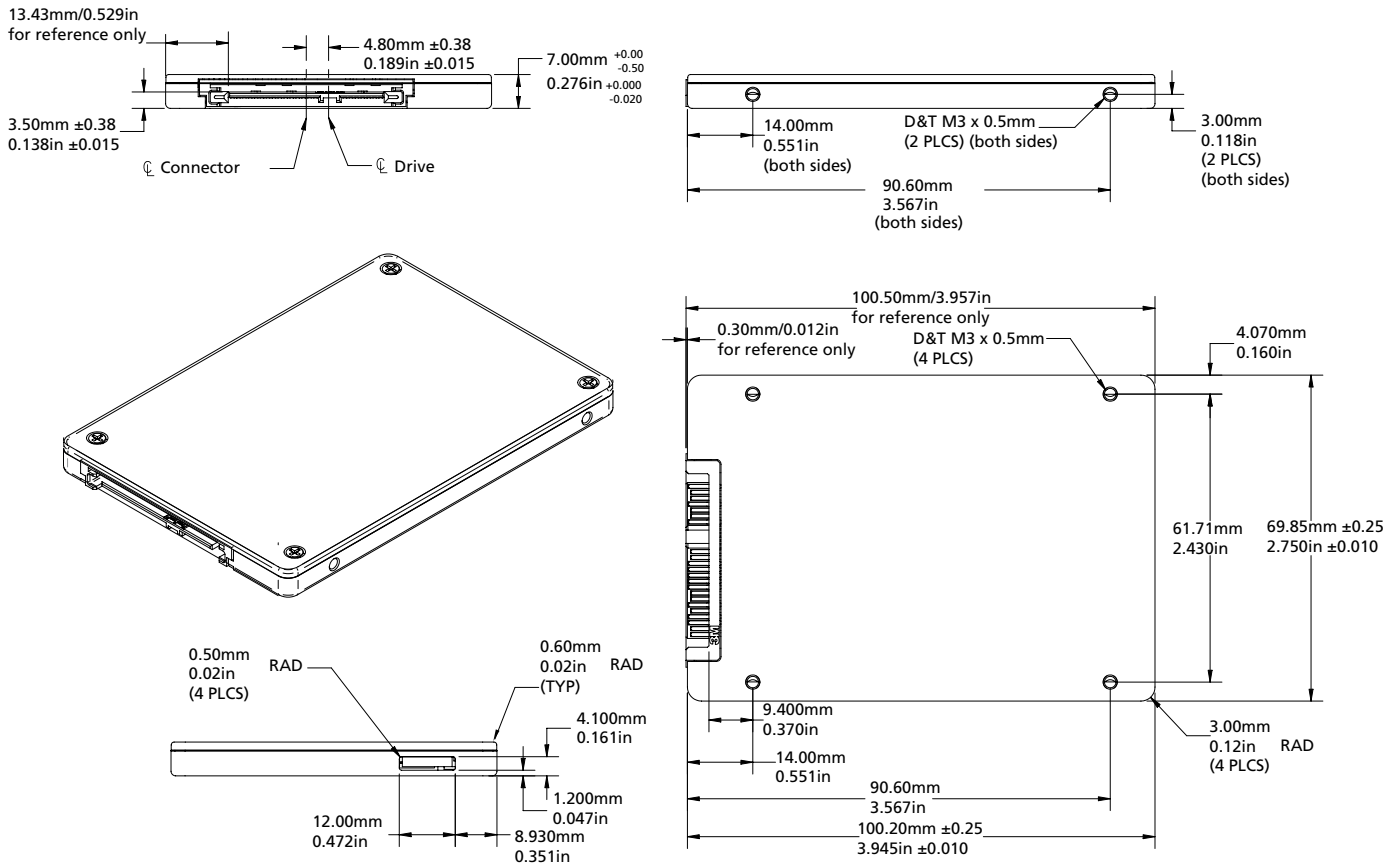
- RoHS
- CE (Europe): EN55022, 2006 Class A and EN55024, 1998 + A1: 2001 + A2:2003
- FCC: CFR Title 47, Part 15, ICES-003, all Class A
- UL (US): approval to UL-60950-1, 2nd Edition, 2007-03-27, IEC 60950-1:2005, 2nd Edition
- BSMI (Taiwan): approval to CNS 13438
- C-TICK (Australia, New Zealand): approval to AS/NZS CISPR22
- KCC RRL (Korea): approval to KCC-REM-MU2-P410m25 Class A
- W.E.E.E.: Compliance with EU WEEE directive 2002/96/EC. Additional obligations may apply to customers who place these products in the markets where WEEE is enforced
- TUV (Germany): approval to IEC60950/EN60950
- V_{CCI}
- IC (Canada):
 - This Class A digital apparatus complies with Canadian ICES-003.
 - Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada

FCC Rules

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Package Dimensions

Figure 4: 2.5-Inch Package – 7mm



References

- Serial Attached SCSI – 2, rev 16
- SAM – 3
- SCSI Primary Commands – 3
- SCSI Primary Commands – 4
- SAT – 2
- SCSI Block Commands – 3

Revision History

Rev. H – 03/14

- Updated performance specifications.
- Updated Power Segment Pin Assignment table.

Rev. G – 02/13

- Updated performance and power specifications.

Rev. F – 01/13

- Updated performance specifications.
- Updated endurance and sector size support.
- Changed status from Preliminary to Production.

Rev. E – 11/12

- Removed 9.5mm package drawing.
- Updated performance specifications.

Rev. D – 9/12

- Added part number for 9.5mm: MTFDEACxxxMAS-xS1AA
- Updated Figure 1 (page 2) to add AC (9.5mm) option.
- Added 9.5mm package drawing.

Rev. C – 6/12

- Removed part number for 15mm: MTFDEALxxxMAS-xS1AA
- Removed 15mm mechanical specs on page 1.
- Updated Figure 1 (page 2) to remove AL (15mm) option.
- Updated on page to remove 15mm height.
- Removed 15mm package drawing.

Rev. B – 6/12

- Added new part number for 7mm: MTFDEAKxxxMAS-xS1AA
- Updated mechanical specs on page 1 to add 7mm height.
- Updated Figure 1 (page 2) to add 7mm option.
- Updated on page to add 7mm height.
- Changed voltage input symbol in Table 15 (page 13) from V5 to V12.
- Updated operating vibration specification in Table 16 (page 13) to include the G level.
- Updated Compliance (page 14) to indicate that the P410m is a class A device.
- Added new Figure 4 (page 15) for 7mm height.

Rev. A – 5/12

- Initial version for certification



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This data sheet contains minimum and maximum limits specified over the power supply and temperature range set forth herein. Although considered final, these specifications are subject to change, as further product development and data characterization sometimes occur.