P300 2.5-Inch SATA NAND Flash SSD
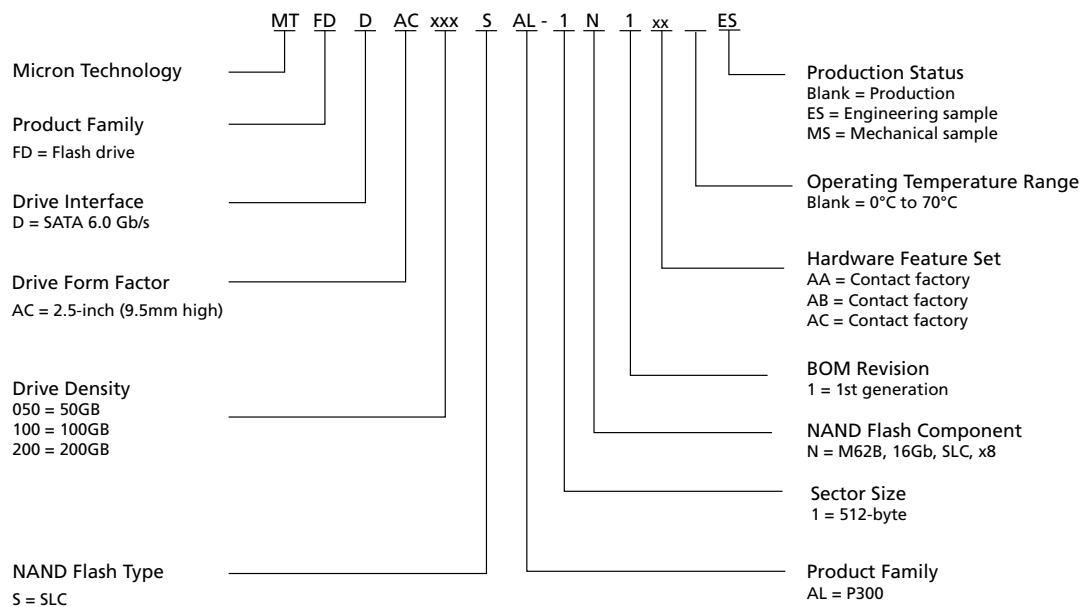
MTFDDACxxxSAL1x1

Features

- Micron® SLC NAND Flash
- RoHS-compliant package
- SATA 6 Gb/s interface
- ATA modes supported
  - PIO modes 3 and 4
  - Multiword DMA modes 0, 1, 2
  - Ultra DMA modes 0, 1, 2, 3, 4, 5, 6
- Industry-standard, 512-byte sector size support
- Hot-plug capable
- Native command queueing support with 32 command slot support
- ATA8-ACS2 command set support
- Secure erase (data page) command set
- Self-monitoring, analysis, and reporting technology (SMART) command set
- Performance (empty/steady state)[1, 2, 3, 4]
  - Sequential READ: up to 360/360 MB/s
  - Sequential WRITE: up to 275/255 MB/s
  - Random READ: up to 60,000/44,000 IOPs
  - Random WRITE: up to 45,200/16,000 IOPs
  - READ latency: 0.153/0.154ms (TYP)
  - WRITE latency: 0.118/0.424ms (TYP)

- Reliability
  - MTBF: 2 million hours
  - 3-year warranty
  - Static and dynamic wear leveling
  - Field-upgradable firmware
  - Uncorrectable bit error rate (UBER): <1 sector per 10^{16} bits read
  - Low power consumption: <7W (AVG)
- Endurance: Total bytes written (TBW) – 50GB (0.875PB); 100GB (1.75PB); 200GB (3.5PB)
- Mechanical/electrical
  - Standard SATA connector
  - 5V power (±10%)
  - Dimensions: 100.45mm x 69.85mm x 9.5mm
  - Weight: 100g
- Operating temperature: 0°C to 70°C
- Humidity (operating): 5% to 95% RH
- Shock and vibration
  - 1500G/0.5ms
  - 5–500Hz at 3.1G
- Capacity[5]: 50GB, 100GB, 200GB

Notes: 1. 128K transfers used for sequential READ/WRITE values.
2. 4K transfers used for random READ/WRITE latency values.
3. I/O performance numbers as measured using Iometer with a queue depth of 32 and write cache disabled.
4. Performance values apply to all drive capacities.
5. 1GB = 1 billion bytes; formatted capacity is less.

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

Part Numbering Information

The Micron® P300 SSD is available in different configurations and densities. Visit www.micron.com for a list of valid part numbers.

Figure 1: Part Number Chart

MT FD D AC xxx S AL - 1 N 1 xx   ES

Micron Technology

Product Family
FD = Flash drive

Drive Interface
D = SATA 6.0 Gb/s

Drive Form Factor
AC = 2.5-inch (9.5mm high)

Drive Density
050 = 50GB
100 = 100GB
200 = 200GB

NAND Flash Type
S = SLC

Production Status
Blank = Production
ES = Engineering sample
MS = Mechanical sample

Operating Temperature Range
Blank = 0°C to 70°C

Hardware Feature Set
AA = Contact factory
AB = Contact factory
AC = Contact factory

BOM Revision
1 = 1st generation

NAND Flash Component
N = M62B, 16Gb, SLC, x8

Sector Size
1 = 512-byte

Product Family
AL = P300

General Description

The Micron® P300 solid state drive (SSD) uses a single-chip controller with a SATA interface on the system side and n-channels of Micron NAND Flash internally. Packaged in an industry standard 2.5-inch drive enclosure, the SSD integrates easily in existing storage infrastructures.

The Micron® P300 SSD is targeted at applications that require a high percentage of random READ/WRITE operations; high performance in terms of IOPs or latency, high endurance, high data retention; or applications that are deployed in harsh environments.

Figure 2: Functional Block Diagram
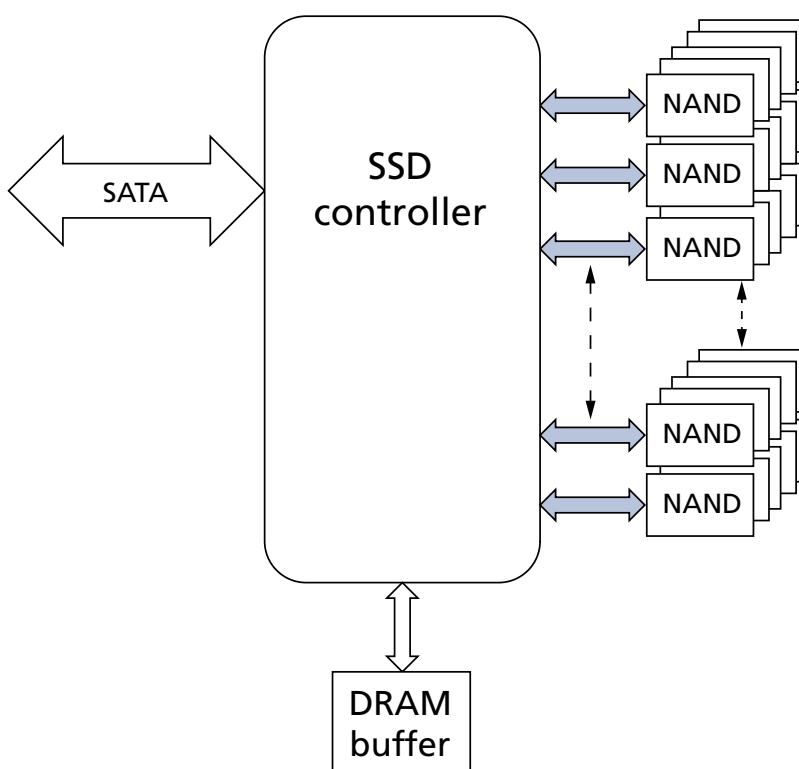
Architecture

The P300 SSD is a NAND Flash storage device. A SATA 6 Gb/s interface connects to the SSD externally and communicates with the controller. The controller manages data transfers to and from the NAND Flash array.

Table 1: P300 Configurations

Unformatted Disk Density	NAND Flash Process	NAND Flash Density	Package Count	Die per BGA Package
50GB	34nm	16Gb	16	2
100GB	34nm	16Gb	16	4
200GB	34nm	16Gb	16	8

Note: 1. Density is shown as user capacity (unformatted).

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 2: Standard LBA Settings

Drive Size[1]	Total LBAs		Max LBA		User Available Bytes
	Decimal	Hexadecimal	Decimal	Hexadecimal	(Unformatted)
50GB	97,696,368	5D2BA70	97,696,367	5D2BA6F	50,020,549,632
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

Note: 1. 1GB = 1,000,000,000 bytes.

Table 3: 2.5-Inch Nominal Dimensions and Weight

	Value	Unit
Height	9.5	mm
Width	69.85	mm
Length	100.50	mm
Unit weight	<100	g

Interface Connectors

The SATA 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 9-pin power segment arranged in a single row with a 1.27mm (0.050in) pitch.

Table 4: SATA Signal Segment Pin Assignments

Signal Name	Type	Description
S1	GND	Ground
S2	A	Differential signal pair A and A#
S3	A#	
S4	GND	Ground
S5	B#	Differential signal pair B and B#
S6	B	
S7	GND	Ground

Table 5: 2.5-Inch SATA 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	Grond
P6	GND	Ground
P7	V5	5V power, precharge
P8	V5	5V power
P9	V5	5V power
P10	GND	Ground
P11	DAS[1]	Device activity signal
P12	GND	Ground
P13	V12	No connect
P14	V12	No connect
P15	V12	No connect

Note: 1. Pin 11 (DAS) may be optionally connected to GND.

Figure 3: SSD Interface Connections

P1   S1

Power   Signal
segment   segment
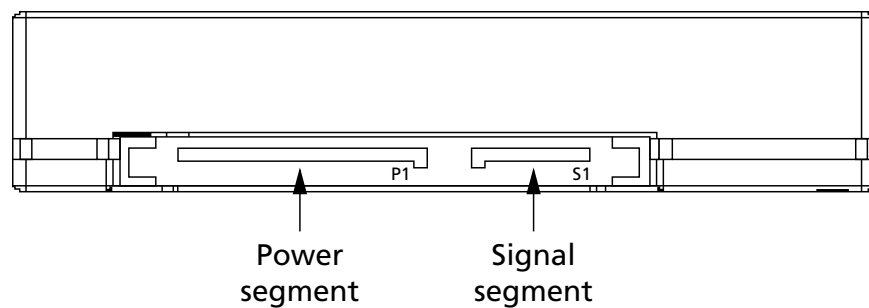
Device ID

Table 6: IDENTIFY Device ID

- F = The content of the word is fixed and does not change
- V = The content of the word is variable and may change depending on the state of the device or the commands executed by the device
- X = The fixed or variable type of this field is not defined in the governing standard
- R = The content of the word is reserved and shall be zero

Word	Bit(s)	Setting	Default Value	Description
00	15	F	0b	0 = ATA device
	14–8	X	1000100b	Retired
	7–6	F	01b	Obsolete
	5–3	X	000b	Retired
	2	V	0b	Response incomplete
	1	X	0b	Retired
	0		0b	Reserved
01		X	3FFFh	Obsolete
02		V	C837h	Specific configuration
03		X	0010h	Obsolete
04		X	0000h 0000h	Retired
06		X	003Fh	Obsolete
07			0000h 0000h	Reserved for the CompactFlash® Association (CFA)
09		X	0000h	Retired
10		F	Varies	Serial number (20 ASCII characters)
20		X	0000h 0000h 0000h	Retired/Obsolete
23		F	Varies	Firmware revision (8 ASCII characters)
27		F	Varies	Model number (40 ASCII characters)
47	15–8	F	80h	80h
	7–0	F	10h	00h = Reserved 01h-FFh = Maximum number of logical sectors that shall be transferred per DRQ data block on READ/WRITE MULTIPLE commands
48	15	F	0b	Shall be cleared to 0
	14	F	1b	Shall be set to 1
	13–1		0000000000000b	Reserved for the trusted computing group
	0	F	0b	1 = Trusted computing feature set is supported

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Word	Bit(s)	Setting	Default Value	Description
49	15–14		00b	Reserved for IDENTIFY PACKET DEVICE command
	13	F	1b	1 = Standby timer values as specified in ATA-8 ACS-2 are supported 0 = Standby timer values shall be managed by the device
	12		0b	Reserved for IDENTIFY PACKET DEVICE command
	11	F	1b	1 = IORDY supported 0 = IORDY may be supported
	10	F	1b	1 = IORDY may be disabled
	9	F	1b	1 = Shall be set to 1 to indicate that LBA is supported
	8	F	1b	1 = DMA support
	7–2	X	00000000b	Reserved
	1–0		00b	Current long physical sector alignment setting
50	15	F	0b	Shall be cleared to 0
	14	F	1b	Shall be set to 1
	13–2		00000000b	Reserved
	1	X	0b	Obsolete
	0	F	1b	Shall be set to 1 to indicate vendor-specific standby timer value minimum
51		X	0000h 0000h	Obsolete
53	15–8	F	00000000b	Free-fall control sensitivity 00h = Vendor's recommended setting 01h-FFh = Sensitivity level; a larger number is a more sensitive setting
	7–3		00000b	Reserved
	2	F	1b	1 = The fields reported in word 88 are valid 0 = The fields reported in word 88 are not valid
	1	F	1b	1 = The fields reported in words (70:64) are valid 0 = The fields reported in words (70:64) are not valid
	0	X	1b	Obsolete
54		X	3FFh 0010h 003Fh FC10h 00FBh	Obsolete

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Word	Bit(s)	Setting	Default Value	Description
59	15	F	1b	1 = The BLOCK ERASE EXT command is supported
	14	F	0b	1 = The OVERWRITE EXT command is supported
	13	F	0b	1 = The CRYPTO SCRAMBLE EXT command is supported
	12	F	1b	1 = The sanitize feature set is supported
	11–9		000b	Reserved
	8	V	1b	1 = Multiple sector setting is valid
	7–0	V	00000001b	Current setting for number of logical sectors that shall be transferred per DRQ data block on READ/WRITE MULTIPLE commands
60		F	Sect	Total number of user addressable logical sectors for 28-bit commands
62		X	0000h	Obsolete
63	15–11		00000b	Reserved
	10	V	0b	1 = Multiword DMA mode 2 is selected 0 = Multiword DMA mode 2 is not selected
	9	V	0b	1 = Multiword DMA mode 1 is selected 0 = Multiword DMA mode 1 is not selected
	8	V	0b	1 = Multiword DMA mode 0 is selected 0 = Multiword DMA mode 0 is not selected
	7–3		0000b	Reserved
	2	F	1b	1 = Multiword DMA mode 2 and below is supported
	1	F	1b	1 = Multiword DMA mode 1 and below is supported
	0	F	1b	1 = Multiword DMA mode 0 is supported
64	15–8		00	Reserved
	7–0	F	03h	PIO modes support
65		F	0078h	Minimum multiword DMA transfer cycle time per word in nanoseconds (cycle time)
66		F	0078h	MFR's recommended multiword DMA transfer cycle time per word in nanoseconds (cycle time)
67		F	0078h	Minimum PIO transfer cycle time without flow control in nanoseconds (cycle time)
68	15–0	F	0078h	Minimum PIO transfer cycle time with IORDY flow control in nanoseconds (cycle time)

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Word	Bit(s)	Setting	Default Value	Description
69	15	F	0b	1 = CFast™ specification support
	14	F	0b	1 = Deterministic read after trim is supported
	13	F	0b	1 = Long physical sector alignment error reporting control is supported
	12	F	0b	1 = DEVICE CONFIGURATION IDENTIFY DMA and DEVICE CONFIGURATION SET DMA are supported
	11	F	0b	1 = READ BUFFER DMA is supported
	10	F	0b	1 = WRITE BUFFER DMA is supported
	9	F	0b	1 = SET MAX PASSWORD DMA and SET MAX UNLOCK DMA are supported
	8	F	0b	1 = DOWNLOAD MICROCODE DMA is supported
	7	F	0b	Reserved for IEEE-1667
	6	F	0b	1 = Optional ATA device 28-bit commands supported
	5	F	0b	1 = Read zero after trim is supported
	4–0		00000b	Reserved
70			0000h	Reserved
71			0000h 0000h 0000h 0000h	Reserved for the IDENTIFY PACKET DEVICE command
75	15–5		00000000000b	Reserved
	4–0	F	11111b	Maximum queue depth - 1
76	15–13		000b	Reserved for SATA
	12	F	1b	1 = Supports NCQueue priority information
	11	F	0b	1 - Supports unload while NCQ commands outstanding
	10	F	1b	1 = Supports PHY event counters
	9	F	1b	1 = Supports receipt of host-initiated partial interface power management
	8	F	1b	1 = Supports NCQ feature set
	7–3		0000b	Reserved for SATA
	2	F	1b	1 = Supports SATA Gen-2 signaling speed (3.0 Gb/s)
	1	F	1b	1 = Supports SATA Gen-1 signaling speed (1.5 Gb/s)
	0	F	0b	Shall be cleared to 0
77		V	0004h	Reserved for SATA

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Word	Bit(s)	Setting	Default Value	Description
78	15–7		000000000b	Reserved for SATA
	6	F	1b	1 = Supports software settings preservation
	5		0b	Reserved for SATA
	4	F	0b	1 = Supports in-order data delivery
	3	F	1b	1 = Device supports initiating interface power management (DIPM)
	2	F	1b	1 = Supports DMA setup auto activation
	1	F	0b	1 = Supports nonzero buffer offsets
	0	F	0b	Shall be cleared to 0
79	15–7		000000000b	Reserved for SATA
	6	V	1b	1 = Software settings preservation enabled
	5		0b	Reserved for SATA
	4	V	0b	1 = In-order data delivery enabled
	3	V	0b	1 = Device initiated power management enabled
	2	V	0b	1 = DMA setup auto-activation enabled
	1	V	0b	1 = Nonzero buffer offsets enabled
	0	F	0b	Shall be cleared to 0
80	15–10		000000b	Reserved
	9	F	1b	1 = Supports ATA8-ACS2
	8	F	1b	1 = Supports ATA-8-ACS
	7	F	1b	1 = Supports ATA/ATAPI-7
	6	F	1b	1 = Supports ATA/ATAPI-6
	5	F	1b	1 = Supports ATA/ATAPI-5
	4	F	1b	1 = Supports ATA/ATAPI-4
	3	X	0b	Obsolete
	2	X	0b	Obsolete
	1	X	0b	Obsolete
	0		0b	Reserved
81				Minor version number
		F	0028h	0028h = ATA8-ACS version 6

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- R = The content of the word is reserved and shall be zero

Word	Bit(s)	Setting	Default Value	Description
82	15	X	0b	Obsolete
	14	F	1b	1 = NOP command support
	13	F	1b	1 = READ BUFFER command support
	12	F	1b	1 = WRITE BUFFER command support
	11	X	0b	Obsolete
	10	F	1b	1 = Host-protected area feature set support
	9	F	0b	Shall be cleared to 0 to indicate that the DEVICE RESET command is not supported
	8	F	0b	1 = Service interrupt support
	7	F	0b	1 = Release interrupt support
	6	F	1b	1 = READ look-ahead support
	5	F	1b	1 = Volatile write cache support
	4	F	0b	Shall be cleared to 0 to indicate that the PACKET feature set is not supported
	3	F	1b	Shall be set to 1 to indicate that mandatory power management feature set is supported
	2	X	0b	Obsolete
	1	F	1b	1 = Security feature set support
	0	F	1b	1 = SMART feature set support

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Word	Bit(s)	Setting	Default Value	Description
83	15	F	0b	Shall be cleared to 0
	14	F	1b	Shall be set to 1
	13	F	1b	1 = FLUSH CACHE EXT command support
	12	F	1b	Shall be set to 1 to indicate that the mandatory FLUSH CACHE command is supported
	11	F	1b	1 = Device configuration overlay feature set support
	10	F	1b	1 = 48-bit address feature set support
	9	F	0b	1 = Automatic acoustic management feature set support
	8	F	1b	1 = SET MAX security extension support
	7		0b	Reserved for address offset reserved area boot method
	6	F	0b	1 = SET FEATURES subcommand required to spin up after power up
	5	F	0b	1 = Power-up in standby feature set support
	4	X	0b	Obsolete
	3	F	1b	1 = Advanced power management feature set support
	2	F	0b	1 = CFA feature set support
	1	X	0b	Obsolete
	0	F	1b	1 = DOWNLOAD MICROCODE command support
84	15	F	0b	Shall be cleared to 0
	14	F	1b	Shall be set to 1
	13	F	1b	1 = The IDLE IMMEDIATE command with unload feature is supported
	12		0b	Reserved for TLC
	11		0b	Reserved for TLC
	10–9	X	00b	Obsolete
	8	F	1b	1 = 64-bit worldwide name support
	7	X	0b	Obsolete
	6	F	1b	1 = WRITE DMA FUA EXT (and) WRITE MULTIPLE FUA EXT commands are supported
	5	F	1b	1 = General purpose logging feature set support
	4	F	0b	1 = Streaming feature set support
	3	F	0b	1 = Media card passthrough command feature set support
	2	F	0b	1 = Media serial number support
	1	F	1b	1 = SMART self-test support
	0	F	1b	1 = SMART error logging support

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Word	Bit(s)	Setting	Default Value	Description
85	15	X	0b	Obsolete
	14	F	1b	1 = NOP command support
	13	F	1b	1 = READ BUFFER command support
	12	F	1b	1 = WRITE BUFFER command support
	11	X	0b	Obsolete
	10	V	1b	1 = Host-protected area feature set support
	9	F	0b	1 = DEVICE RESET command support
	8	V	0b	1 = Service interrupt enabled
	7	V	0b	1 = Release interrupt enabled
	6	V	1b	1 = Read look-ahead enabled
	5	V	1b	1 = Volatile write cache enabled
	4	F	0b	0 = Packet feature set is not supported
	3	F	1b	1 = Power management feature set is enabled
	2	X	0b	Obsolete
	1	V	0b	1 = Security feature set enabled
	0	V	1b	1 = SMART feature set enabled
86	15	F	1b	1 = Words 120 and 119 are valid
	14		0b	1 = Reserved
	13	F	1b	1 = FLUSH CACHE EXT command supported
	12	F	1b	1 = FLUSH CACHE command supported
	11	F	1b	1 = Device configuration overlay (DCO) feature set supported
	10	F	1b	1 = 48-bit address feature set support
	9	V	0b	1 = Automatic acoustic management feature set enabled
	8	F	0b	1 = SET MAX security extension enabled by SET MAX SET PASSWORD
	7		0b	Reserved for address offset reserved area boot method
	6	F	0b	1 = SET FEATURES subcommand required to spin up after power up
	5	V	0b	1 = Power-up in standby feature set enabled
	4	X	0b	Obsolete
	3	V	1b	1 = Advanced power management feature set enabled
	2	F	0b	1 = CFA feature set enabled
	1	X	0b	Obsolete
	0	F	1b	1 = DOWNLOAD MICROCODE command support

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Word	Bit(s)	Setting	Default Value	Description
87	15	F	0b	Shall be cleared to 0
	14	F	1b	Shall be set to 1
	13	F	1b	1 = IDLE IMMEDIATE command with unload feature support
	12		0b	Reserved for TLC
	11		0b	Reserved for TLC
	10–9	X	00b	Obsolete
	8	F	1b	1 = 64-bit worldwide name support
	7	X	0b	Obsolete
	6	F	1b	1 = WRITE DMA FUA EXT (and) WRITE MULTIPLE FUA EXT commands are supported
	5	F	1b	1 = General purpose logging feature set support
	4	X	0b	Obsolete
	3	V	0b	1 = Media card passthrough command feature set support
	2	V	0b	1 = Media serial number is valid
	1	F	1b	1 = SMART self-test support
	0	F	1b	1 = SMART error logging support

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Word	Bit(s)	Setting	Default Value	Description
88	15		0b	Reserved
	14	V	0b	1 = Ultra DMA mode 6 is selected 0 = Ultra DMA mode 6 is not selected
	13	V	0b	1 = Ultra DMA mode 5 is selected 0 = Ultra DMA mode 5 is not selected
	12	V	0b	1 = Ultra DMA mode 4 is selected 0 = Ultra DMA mode 4 is not selected
	11	V	0b	1 = Ultra DMA mode 3 is selected 0 = Ultra DMA mode 3 is not selected
	10	V	0b	1 = Ultra DMA mode 2 is selected 0 = Ultra DMA mode 2 is not selected
	9	V	0b	1 = Ultra DMA mode 1 is selected 0 = Ultra DMA mode 1 is not selected
	8	V	0b	1 = Ultra DMA mode 0 is selected 0 = Ultra DMA mode 0 is not selected
	7		0b	Reserved
	6	F	1b	1 = Ultra DMA mode 6 and below supported
	5	F	1b	1 = Ultra DMA mode 5 and below supported
	4	F	1b	1 = Ultra DMA mode 4 and below supported
	3	F	1b	1 = Ultra DMA mode 3 and below supported
	2	F	1b	1 = Ultra DMA mode 2 and below supported
	1	F	1b	1 = Ultra DMA mode 1 and below supported
	0	F	1b	1 = Ultra DMA mode 0 support
89	15–8		00h	Reserved
	7–0	F	01h	Time required for normal erase mode SECURITY ERASE UNIT command
90	15–8		00h	Reserved
	7–0	F	01h	Time required for enhanced erase mode SECURITY ERASE UNIT command
91		V	00FEh	Current advanced power management value
92		V	0000h	Master password identifier

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Word	Bit(s)	Setting	Default Value	Description
93	15	F	0b	Shall be cleared to 0
	14	F	0b	Shall be set to 1
	13	V	0b	1 = Device detected CBLID above ViH 0 = Device detected CBLID below ViL
	12		0b	Reserved
	11	V	0b	0 = Device 1 did not assert PDIAG 1 = Device asserted PDIAG
	10–9	V	00b	These bits indicate how device 1 determined the device number: 00 = Reserved 01 = Jumper used 10 = CSEL signal used 11 = Other method used or method used unknown
	8		0b	Shall be set to 1
	7	F	0b	Reserved
	6	F	0b	0 = Device 0 does not respond when device 1 is selected 1 = Device 0 responds when device 1 is selected
	5	V	0b	0 = Device 0 did not detect the assertion of DASP 1 = Device 0 detected the assertion of DASP
	4	V	0b	0 = Device 0 does not detect the assertion of PDIAG 1 = Device 0 detected the assertion of PDIAG
	3	V	0b	0 = Device 0 failed diagnostics 1 = Device 0 passed diagnostics
	2–1	V	00b	These bits indicate how device 0 determined the device number: 00 = Reserved 01 = Jumper used 10 = CSEL signal used 11 = Other method used or method used unknown
	0	F	0b	Shall be set to 1
94	15–8	F	00h	Vendor's recommended auto acoustic management (AAM) value
	7–0	V	00h	Current auto acoustic management (AAM) value
95		F	0000h	Stream minimum request size
96		F	0000h	Streaming transfer time – DMA
97		F	0000h	Streaming access latency – DMA and PIO
98		F	0000h 0000h	Streaming performance granularity

Table 6: IDENTIFY Device ID (Continued)

- F = The content of the word is fixed and does not change
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- X = The fixed or variable type of this field is not defined in the governing standard
- R = The content of the word is reserved and shall be zero

Word	Bit(s)	Setting	Default Value	Description
100		F	LBA	Maximum user LBA for 48-bit address feature set
104		F	0000h	Streaming transfer time – PIO
105		F	0008h	Maximum number of 512-byte blocks of LBA range entries per DATA SET MANAGEMENT command
106	15	F	0b	Shall be cleared to 0
	14	F	1b	Shall be set to 1
	13	F	0b	1 = Device has multiple logical sectors per physical sector
	12	F	0b	1 = Device logical sector size > 256 words
	11–4	F	00000000b	Reserved
	3–0	F	0000b	2^XP logical sectors per physical sector
107		F	0000h	Interseek delay for ISO-7779 standard acoustic testing
108	15–12	F	0101b	NAA (3–0)
	11–0	F	000000001010b	IEEE OUI (23–12)
109	15–4	F	Varies	IEEE OUI (11–0)
	3–0		Varies	Unique ID (35–32)
110		F	Varies	5–0 Unique ID (31–16)
111		F	Varies	Unique ID (15–0)
112			0000h 0000h 0000h 0000h	Reserved
116			0000h	Reserved for TLC
117		F	0000h 0000h	Logical sector size
119	15	F	0b	Shall be cleared to 0
	14	F	1b	Shall be set to 1
	13–8		000000b	Reserved
	7	F	0b	1 = Extended power conditions feature set supported
	6	F	1b	1 = Extended sense data reporting feature set supported
	5	F	1b	1 = Free-fall control feature set supported
	4	F	1b	1 = DOWNLOAD MICROCODE command with mode 3 supported
	3	F	1b	1 = READ LOG DMA EXT (and) WRITE LOG DMA EXT command support
	2	F	1b	1 = WRITE UNCORRECTABLE EXT support
	1	F	0b	1 = Write-read-verify feature set support
	0	F	0b	Reserved for DDT

Table 6: IDENTIFY Device ID (Continued)

- F = The content of the word is fixed and does not change
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- R = The content of the word is reserved and shall be zero

Word	Bit(s)	Setting	Default Value	Description
120	15	F	0b	Shall be cleared to 0
	14	F	1b	Shall be set to 1
	13–8		000000b	Reserved
	7	V	0b	1 = At least one extended power conditions idle timer is enabled
	6	V	0b	1 = Extended sense data reporting feature set enabled
	5	V	0b	1 = Free-fall control feature set enabled
	4	F	1b	1 = DOWNLOAD MICROCODE command with mode 3 supported
	3	F	1b	1 = READ LOG DMA EXT (and) WRITE LOG DMA EXT command support
	2	F	0b	1 = WRITE UNCORRECTABLE EXT support
	1	V	0b	1 = Write-read-verify feature set enabled
	0		0b	Reserved for DDT
121			0000h 0000h 0000h 0000h 0000h 0000h	Reserved for expanded support and enabled settings
127		X	0000h	Obsolete
128	15–9		0000000b	Reserved
	8	V	0b	Master password capability: 0 = High, 1 = Maximum
	7–6		00b	Reserved
	5	F	1b	1 = Enhanced security erase support
	4	V	0b	1 = Security count expired
	3	V	0b	1 = Security frozen
	2	V	0b	1 = Security locked
	1	V	0b	1 = Security enabled
	0	F	1b	1 = Security supported
129		X	Varies	Vendor specific
160	15	F	0b	CFA power mode
	14		0b	Word 160 supported
	13	F	0b	CFA power mode 1 is required for one or more commands implemented by the device
	12	V	0b	CFA power mode 1 disabled
	11–0	F	000000000000b	Maximum current in ma

Table 6: IDENTIFY Device ID (Continued)

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- R = The content of the word is reserved and shall be zero

Word	Bit(s)	Setting	Default Value	Description
161		F	0000h 0000h 0000h 0000h 0000h 0000h 0000h	Reserved for assignment by the CFA
168	15–4		000h	Reserved
	3–0	F	3h	Device nominal form factor (DNFF)
169	15–1	F	000000000000000b	Reserved
	0	F	1b	1 = Trim bit of the DATA SET MANAGEMENT command supported
170		F	0000h 0000h 0000h 0000h	Additional product identifier
174			0000h 0000h	Reserved
176		F	Varies	Current media serial number (60 ASCII characters; not supported)
206	15–12	X	0000b	Vendor specific
	11–6		000000b	Reserved
	5	F	1b	SCT data tables command support
	4	F	1b	SCT FEATURES CONTROL command support
	3	F	1b	SCT ERROR RECOVERY CONTROL command support
	2	F	1b	SCT WRITE SAME command support
	1	F	0b	Obsolete
	0	F	1b	SCT command transport support
207		F	0000h 0000h	Reserved FOR CE-ATA
209	15	F	0b	Shall be cleared to 0
	14	F	1b	Shall be set to 1
	13–0	F	00000000000000b	Logical sector offset within the first physical sector where the first logical sector is placed
210		V	0000h 0000h	Write-read-verify sector count mode 3
212		F	0000h 0001h	Write-read-verify sector count mode 2
214	15–12	F	0000b	NV cache feature set version
	11–8	F	0000b	NV cache power mode feature set version
	7–5		000b	Reserved
	4	V	0b	1 = NV cache feature set enabled
	3–2		00b	Reserved
	1	V	0b	1 = NV cache power mode feature set enabled
	0	F	0b	1 = NV cache power mode feature set support

Table 6: IDENTIFY Device ID (Continued)

- F = The content of the word is fixed and does not change
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- R = The content of the word is reserved and shall be zero

Word	Bit(s)	Setting	Default Value	Description
215		V	0000h	NV cache size in logical blocks (LSW)
216		V	0000h	NV cache size in logical blocks (MSW)
217		F	0001h	Nominal media rotation rate
218			0000h	Reserved
219	15–8		00h	Reserved
	7–0	F	00h	Device estimated time to spin up in seconds
220	15–8		00h	Reserved
	7–0	V	00h	Write-read-verify feature set current mode
221			0000h	Reserved
222	15–12	F	0001b	Transport type: 0 = Parallel; 1 = SATA; 2–15 = Reserved
	11–6		000000b	0 = Reserved 1 = Reserved
	5	F	1b	0 = Reserved 1 = SATA Rev. 3.0
	4	F	1b	0 = Reserved 1 = SATA Rev. 2.6
	3	F	1b	0 = Reserved 1 = SATA Rev. 2.5
	2	F	1b	0 = Reserved 1= SATA II: extensions
	1	F	1b	0 = ATA/ATAPI-7 1= SATA 1.0a
	0	F	1b	0 = ATA8-APT 1 = ATA8-AST
223		F	0000h	Transport minor revision number
224			0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h	Reserved
234		F	0001h	Minimum number of 512-byte units per DOWNLOAD MICROCODE command mode 3
235		F	00FFh	Maximum number of 512-byte units per DOWNLOAD MICROCODE command mode 3

Table 6: IDENTIFY Device ID (Continued)

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- R = The content of the word is reserved and shall be zero

Word	Bit(s)	Setting	Default Value	Description
236			0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h	Reserved
255	15–8	F	Varies	Checksum
	7–0	F	A5h	Signature

Commands

Table 7: Supported ATA Command Set

See ATA8-ACS2 standard for command details

Command Name	Command Code (Hex)
CHECK POWER MODE	98h
CHECK POWER MODE	E5h
DEVICE CONFIGURATION	B1h
DOWNLOAD MICROCODE	92h
FLUSH CACHE	E7h
FLUSH CACHE EXT	EAh
IDLE	E3h
IDLE	97h
IDLE IMMEDIATE	95h
IDLE IMMEDIATE	E1h
NOP	00h
READ BUFFER	E4h
READ BUFFER DMA	E9h
READ DMA	C8h
READ DMA EXT	25h
READ DMA (without retries)	C9h
READ FPDMA QUEUED	60h
READ LOG DMA EXT	47h
READ LOG EXT	2Fh
READ MULTIPLE	C4h
READ MULTIPLE EXT	29h
READ NATIVE MAX ADDRESS	F8h
READ NATIVE MAX ADDRESS EXT	27h
READ SECTORS	20h
READ SECTORS EXT	24h
READ SECTORS (without retry)	21h
READ VERIFY SECTORS	40h
READ VERIFY SECTORS EXT	42h
READ VERIFY SECTORS (without retry)	41h
RECALIBRATE	10h
REQUEST SENSE DATA EXT	0Bh
SECURITY DISABLE PASSWORD	F6h
SECURITY ERASE PREPARE	F3h
SECURITY ERASE UNIT	F4h
SECURITY FREEZE LOCK	F5h
SECURITY SET PASSWORD	F1h

Table 7: Supported ATA Command Set (Continued)

See ATA8-ACS2 standard for command details

Command Name	Command Code (Hex)
SECURITY UNLOCK	F2h
SEEK	70h
SET FEATURES	EFh
SET MAX ADDRESS	F9h
SET MULTIPLE MODE	C6h
SET NATIVE MAX ADDRESS EXT	37h
SLEEP	99h
SLEEP	E6h
SMART	B0h
STANDBY	E2h
STANDBY	96h
STANDBY IMMEDIATE	94h
STANDBY IMMEDIATE	E0h
WRITE BUFFER	E8h
WRITE BUFFER DMA	EBh
WRITE DMA	CAh
WRITE DMA EXT	35h
WRITE DMA FUA EXT	3Dh
WRITE DMA (without retries)	CBh
WRITE FPDMA QUEUED	61h
WRITE LOG DMA EXT	57h
WRITE LOG EXT	3Fh
WRITE MULTIPLE	C5h
WRITE MULTIPLE EXT	39h
WRITE MULTIPLE FUA EXT	CEh
WRITE SECTORS	30h
WRITE SECTORS EXT	34h
WRITE SECTORS (without retry)	31h

Reliability

Micron SSDs incorporate advanced technology for defect and error management. Micron uses 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 8: Uncorrectable Bit Error Rate

Uncorrectable Bit Error Rate	Operation
<1 sector per 10^{16} bits read	READ

Mean Time Between Failures

Mean time between failures (MTBFs) 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 9: MTBFs

Density	MTBF (Operating Hours)[1]
50GB	2 million
100GB	2 million
200GB	2 million

Note: 1. The product achieves a mean time between failure (MTBF) 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 conditons applied to the device, the internal NAND component cycles, the write amplification factor, and the wear-leveling efficency of the drive. The table below shows the drive lifetime for each SSD density based on predefined usage conditions.

Table 10: Drive Lifetime

Density	Drive Lifetime (Total Bytes Written)
50GB	.875PB
100GB	1.75PB
200GB	3.5PB

Notes: 1. Total bytes written calculated with the drive 100% full.
2. Access patterns are 50% sequential and 50% random. Random accesses: 10% are 512B; 50% are 4K; 15% are 32K; 15% are 64K; and 10% are 128K. Sequential accesses: 100% are 128K.

Data Retention

Micron SSD data retention at beginning of life: 10 years at 25°C

Micron SSD data retention at end of life: 1 year at 25°C

Electrical Characteristics

Table 11: SATA Typical Power Consumption

Density	Idle/Standby/Sleep	Secure Erase	SEQ Write/Read (128K XFR)	RND Write/Read (4K XFR)	Unit
50GB	125	1000	2500/1800	1900/1500	mW
100B	125	1200	3000/2000	2200/1700	mW
200GB	125	1400	3500/2200	2500/1900	mW

Table 12: Maximum Ratings

Parameter/Condition	Symbol	Min	Max	Unit
Voltage input	V5	4.5	5.5	V
Operating temperature	T_A	0	70	°C
Non-operating temperature		–40	85	°C
Rate of temperature change		–	20	°C/hour
Relative humidity (noncondensing)		5	95	%

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 13: Shock and Vibration

Parameter/Condition	Specification
Operating shock	1500G/0.5ms
Operating vibration	5–500Hz at 3.1G

Compliance

Micron SSDs comply with the following:

- RoHS compliant
- Halogen free
- SATA-IO
- WHQL
- CE (Europe): EN55022, 2006 Class B and EN55024, 1998 + A1: 2001 + A2:2003
- FCC: CFR Title 47, Part 15, ICES-003, all Class B
- 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 MU2-C30025, KCC MU2-C30018 Class B
- 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}

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.
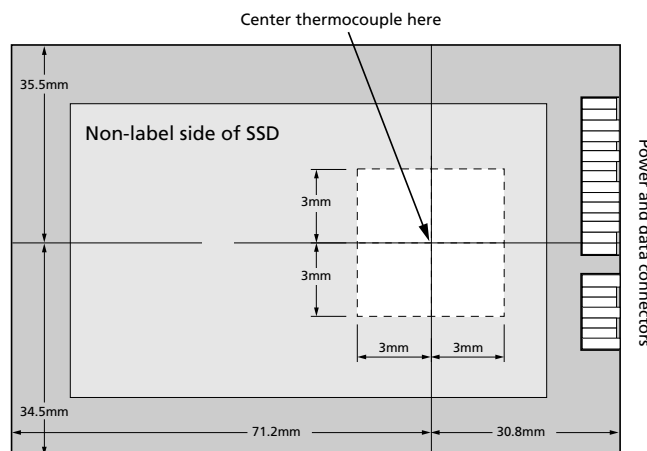
Package Dimensions

Figure 4: 2.5-Inch Package
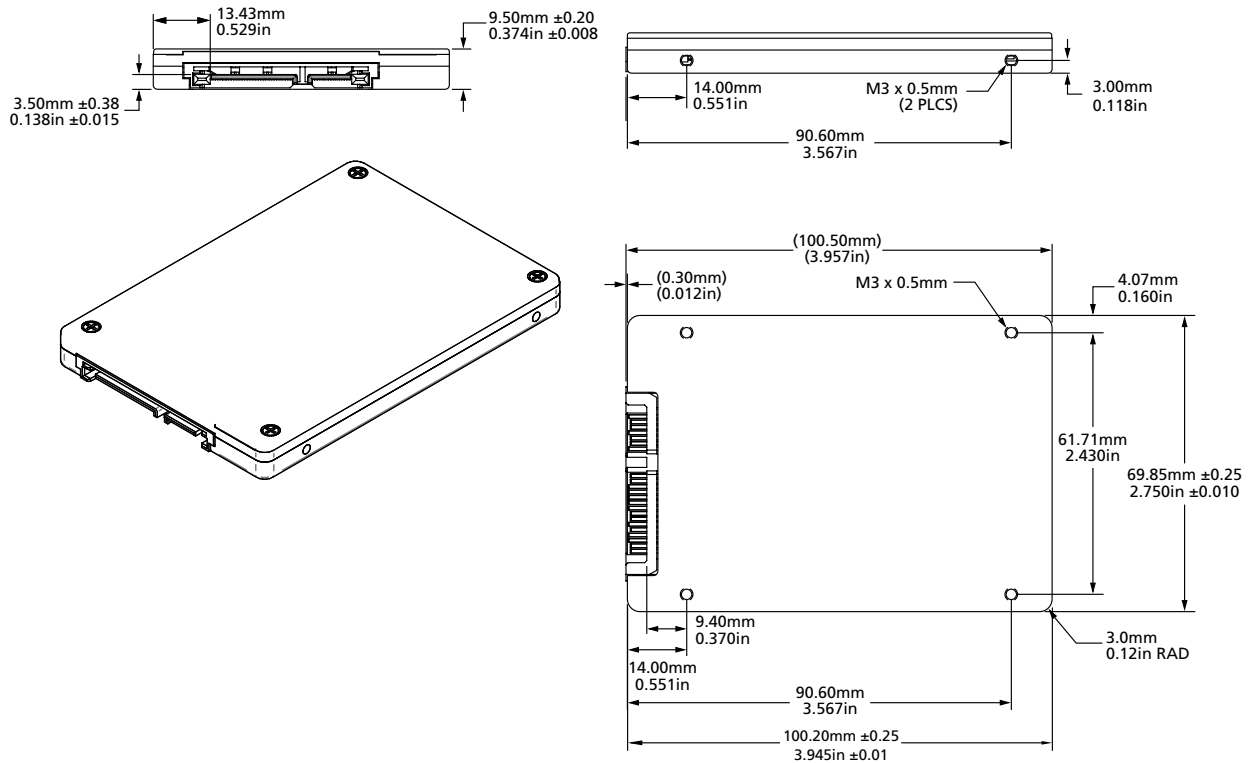
Notes: 1. Maximum mounting screw length: Bottom = M3 x 0.5 x 3; Side = M3 x 0.5 x 4
2. Maximum torque: 4.5 in-lb

Figure 5: Thermocouple Placement Guidelines for Temperature Measurement

References

- Serial ATA: High-speed serialized AT attachment, Serial ATA working group, available at www.sata-io.org
- Small Form Factor Specification SFF-8201, SFF-8223
- Electronic Industries Association Standard, EIA-720
- Telcordia SR-332 reliability prediction procedures for electronic equipment
- IDEMA Document LBA1-02

Revision History

Rev. K – 5/12

- Added center thermocouple graphic to package dimensions.

Rev. J – 4/12

- Added notes to package dimension graphic.

Rev. I – 10/11

- Added FCC rules to Compliance.

Rev. H – 5/11

- Added DOWNLOAD MICROCODE command to Table 7: Supported ATA Command Set; changed hex format of command codes.

Rev. G – 5/11

- Changed overall length of the enclosure + connector from absolute maximums to reference dimensions in packaging figure.

Rev. F – 4/11

- Removed references to altitude from Features section.

Rev. E – 4/11

- Removed references to green from Compliance section.