RoHS Compliant

SATA Flash Drive Series

Datasheet for SFD 25L-E

September 16, 2025

Revision 1.0

This Specification Describes the Features and Capabilities of the Standard and Industrial Temperature SATA Flash Drives

Please Contact Fortasa Memory Systems Sales for any Custom Features Required For Your Specific Application

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Features:

- **Standard Serial SATA 3.2**
  - – SATA 3.1 command set compatible
  - – Serial SATA 6.0 Gbps Interface
  - – Backward compatible with SATA 1.5 and 3.0 Gbps interfaces
  - – ATA-8 compatible command set
- **Low power consumption (typical)**
  - – Supply voltage: 5V±5%
  - – Active mode: 275 mA
  - – Idle mode: 50 mA
- **Capacity**
  - – 120, 240, 480, 960, 1920GB
- **NAND flash type: 3D TLC**
- **MTBF (hours):** >3,000,000
- **Connector Type**
  - – 7-pin signal connector
  - – 15-pin power connector
- **Performance**
  - – Burst transfer rate: 600 MB/sec
  - – Sustained read: up to 555 MB/sec
  - – Sustained write: up to 500 MB/sec
  - – Random read (4K): up to 54,000 IOPS
  - – Random write (4K): up to 67,000 IOPS
- **Form factor**
  - – 2.5 inch
    - 7.0mm - 100.00 x 69.85 x 6.90, unit: mm
- **RoHS compliant**
- **Shock and Vibration**
  - – Shock: 1500g (approx.)
  - – Vibration: 15g (approx.)
- **Thermal Sensor for Temperature Management**
- **Intelligent endurance design**
  - – Low-Density Parity-Check (LDPC) Error Correction Code
  - – Global wear-leveling scheme together with dynamical block allocation to significantly increase the lifetime of a flash device and optimize the disk performance
  - – Flash bad-block management
  - *– Power Failure Management*
  - *– ATA Secure Erase*
  - *– SMART Command*
  - *– Trim Command*
- **Security**
  - – AES 256 Hardware Encryption
- **Temperature ranges**
  - – Operation:
    - Standard: 0°C to 70°C (32° ~ 158°F)
    - Industrial: -40°C to 85°C (-40° ~ 185°F)
  - – Storage: -40°C to 100°C (-40° ~ 212°F)
- **Endurance in Drive Writes Per Day (DWPD)**
  - – 120 GB: 2.27 DWPD
  - – 240 GB: 2.15 DWPD
  - – 480 GB: 2.16 DWPD
  - – 960 GB: 2.16 DWPD
  - – 1920 GB: 2.32 DWPD

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1 Product Description

1.1 General Description

Fortasa’s SFD25L is a high-performance, SATA interface, solid state drive (SSD) designed to replace a conventional SATA hard disk drive. SFD supports standard SATA protocol and can be plugged into a standard SATA connector commonly found in rugged laptops, military devices, thin clients, Point of Sale (POS) terminals, telecom, medical instruments, surveillance systems and industrial PCs. Fortasa SFD Series is the best drop-in replacement for high-maintenance HDD where reliability is of a major importance.

The SFD25L drive offers capacities of up to 2TB, providing full support for the SATA 6GBps high-speed interface standard. It can operate at sustained access rates of up to 520 megabytes per second, which is much faster than other solid-state or traditional HDD SATA drives currently available on the market. . **Manufactured using 3D BICS5 TLC NAND-flash, this SSD family offers cost effective solution to high capacity storage needs and withstand wide range of operating temperature from -40°C to +85°C.**

SFD25L offers high reliability global data wear-leveling scheme to allow uniform use of all storage blocks, increasing the lifetime of Flash media and optimizing drive performance. The SFD25L also offers Self-Monitoring Analysis and Reporting Technology (S.M.A.R.T.) feature that follows the ATA/ATAPI specifications and uses the standard SMART command B0h to read data from the drive. This capability monitors the drive accesses and provides the host with vital information about drive condition to schedule maintenance and service times.

1.2 Functional Block

The SFD25L drive includes a SATA 6.0 Gps Flash Controller and flash media. The Flash controller integrates the flash management unit to support multi-channel, multi-bank flash arrays.

1.3 Capacity Specification

Standard capacity specification of the SATA Flash Drive product is shown in Table 1-1. The table lists the specific capacity and the default numbers of heads, sectors and cylinders (CHS) for each product line.

Table 1-1: Capacity specifications

Capacity	Total Bytes	Cylinders	Heads	Sectors	Max LBA
120GB	120,034,123,776	16383[1]	16	63	234,441,648
240GB	240,057,409,536	16383[1]	16	63	468,862,128
480GB	480,103,981,056	16383[1]	16	63	937,703,088
960GB	960,197,124,096	16383[1]	16	63	1,875,385,008
1920GB	1,920,383,410,176	16383[1]	16	63	3,750,748,848

1. Cylinders, heads or sectors are not applicable for these capacities. Only LBA addressing applies.

Please contact factory for any non-listed SATA Flash Drive capacity or custom CHS requirement.

1.4 Performance Specification

Performances of the SATA Flash Drive are listed in Table 1-2.

Table 1-2: High Performance specifications

Performance \ Capacity	120GB	240GB	480GB	960GB	1920GB
Sustained read (MB/s)	540	555	555	555	555
Sustained write (MB/s)	475	495	500	500	500
Random Read IOPS (4K)	16,000	36,000	54,000	50,000	51,000
Random Write IOPS (4K)	67,000	67,000	64,000	62,000	64,000

Note: Performance varies from flash configurations or host system settings.
IOPS: measured on 8GB span (16777216 sectors Disk Size), 32 Outstanding I/Os (QD=32), Full Random Data pattern, 4KB Align I/Os and test durations 15minutes

1.5 Pin Assignments

Figure 1-2: Micro-SATA connectors

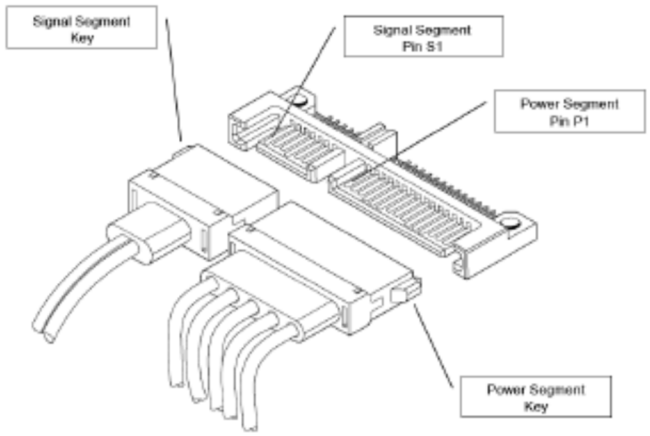


Table 1-3: Signal Segment

Pin	Signal	Description
S1	Ground	
S2	RxP	Serial Data Receiver
S3	RxN	
S4	Ground	
S5	TxN	Serial Data Transmitter
S6	TxP	
S7	Ground	

Table 1-4: Power Segment

Pin	Signal
P1	Not Used (3.3V)
P2	Not Used (3.3V)
P3	Device Sleep
P4	Ground
P5	Ground
P6	Ground
P7	5V
P8	5V
P9	5V
P10	Ground
P11	DAS
P12	Ground
P13	Not used (12V)
P14	Not Used (12V)
P15	Not Used (12V)

2. Software Interface

2.1 Command Set

Table 2-1 summarizes the command set with the paragraphs that follow describing the individual commands and the task file for each.

Table 2-1: Command set

Command	Code	Command	Code
Check-Power-Mode	E5H	Security-Disable-Password	F6H
Execute-Drive-Diagnostic	90H	Security-Erase-Prepare	F3H
Flush-Cache	E7H	Security-Erase-Unit	F4H
Identify-Drive	ECH	Security-Freeze-Lock	F5H
Idle	E3H	Security-Set-Password	F1H
Idle-Immediate	E1H	Security-Unlock	F2H
Initialize-Drive-Parameters	91H	Seek	7XH
Read DMA	C8H	Set-Features	EFH
Read DMA EXT	25H	Set-Multiple-Mode	C6H
Read FPDMA Queued	60H	Set-Sleep-Mode	E6H
Read Log DMA EXT	47H	SMART	B0H
Read Log EXT	2FH	Stand-By	E2H
Read-Multiple	C4H	Stand-By-Immediate	E0H
Read-Sector	20H or 21H	Write DMA	CAH
Read-Verify-Sectors	40H or 41H	Write DMA EXT	35H
Recalibrate	10H	Write FPDMA Queued	61H
Write Log DMA EXT	57H	Write Log EXT	3FH
Write-Multiple	C5H	Write-Sector	30H or 31H

3. Flash Management

3.1 Error Correction/Detection

Fortasa SFD 25L implements a hardware ECC scheme, based on the Low Density Parity Check (LDPC). LDPC is a class of linear block error correcting code which has apparent coding gain over BCH code because LDPC code includes both hard decoding and soft decoding algorithms. With the error rate decreasing, LDPC can extend SSD endurance and increase data reliability while reading raw data inside a flash chip.

3.2 Wear Leveling

All NAND flash devices are limited by a finite number of write cycles. Under a standard file system, frequent file table updates are mandatory. As a painful side effect of OS file overhead, some areas of flash address space wear out faster than others. As these certain sections get a substantially higher write occurrence the whole SATA Flash Drive can wear out very quickly. This uneven wear would significantly reduce the lifetime of the whole device, even if majority of the Flash sectors are far from the write cycle limit. Fortasa’s SATA Flash Drive products offer advanced data wear leveling which distributes Flash writes evenly across the SATA Flash Drive memory space. By utilizing this advanced wear leveling feature, the lifetime of the media can be significantly extended.

3.3 Power Failure Management

The Low Power Detection on the Flash controller initiates cached data saving before the power supply to the device drops too low for operation. This feature prevents the device from system crash and ensures data integrity during an unexpected brownout. This feature makes sure that there are no catastrophic failures of the SATA Flash Drive due to system power glitches.

Note: The Flash controller unit of this product model is designed with an External DRAM as a write cache for improved performance and data efficiency. Though unlikely to happen in most cases, the data cached in the volatile DRAM might be potentially affected if a sudden power loss / brown-out condition takes place before the cached data is flushed into non-volatile NAND flash memory.

3.4 ATA Secure Erase

Accomplished by the Secure Erase (SE) command, which added to the open ANSI standards that control disk drives, “ATA Secure Erase” is built into the disk drive itself and thus far less susceptible to malicious software attacks than external software utilities. It is a positive easy-to-use data destroy command, amounting to electronic data shredding. Executing the command causes a drive to internally completely erase all possible user data. This command is carried out within disk drives, so no additional software is required. The erase process will not stop until it is completed. In case of power failure, the erase process will continue when the power is reapplied to the device.

3.5 S.M.A.R.T. Technology

S.M.A.R.T. is an acronym for Self-Monitoring, Analysis and Reporting Technology, an open standard allowing disk drives to automatically monitor their own health and report potential problems. It protects the user from unscheduled downtime by monitoring and storing critical drive performance and calibration parameters. Ideally, this should allow taking proactive actions to prevent impending drive failure.

Code	SMART Subcommand
D0h	READ DATA
D1h	READ ATTRIBUTE THRESHOLDS
D2h	Enable/Disable Attribute Autosave
D4h	Execute Off-line Immediate
D5h	Read Log (optional)
D6h	Write Log (optional)
D8h	Enable Operations
D9h	Disable operations
DAh	Return Status

General SMART attribute structure

Byte	Description
0	ID (Hex)
1 – 2	Status flag
3	Value
4	Worst
5*-11	Raw Data

*Byte 5: LSB

SMART attribute ID list

ID (Hex)	Attribute Name
9 (0x09)	Power-on hours
12 (0x0C)	Power cycle count
163 (0xA3)	Maximum Erase Count
164 (0xA4)	Average Erase Count
166 (0xA6)	Total Later Block Count
167 (0xA7)	SSD Protect Mode (vendor specific)
168 (0xA8)	SATA PHY Error Count
175 (0xAF)	Bad Cluster Table Count
192 (0xC0)	Unexpected Power Loss Count
194 (0xC2)	Temperature
241 (0xF1)	Total sectors of write

3.6 TRIM Command Support

Over time the performance of SSD degrades as user continually writes and erases data. The ATA-TRIM command “formats” the SSD to optimize the drive performance. A TRIM enabled SSD running an OS with TRIM support will stay closer to its peak performance without much performance variance.

3.7 Thermal Sensor

SFD 25L contains a Thermal Sensor that measures module temperature. The module temperature can be obtained by polling SMART Command attribute ID 194 (0xC2). When the device temperature reaches a pre-set temperature threshold, the module performance will be reduced to limit the power draw and prevent the module from overheating.

3.8 AES 256-bit Encryption

SFD 25L incorporates Advanced Encryption Standard (AES) 256-bit which is an industry standard in data security and has been adopted by U.S. government and now widely used for symmetric-key data encrypting in order to meet higher level of data security requirements.

4. Environmental Specifications

4.1 Environments

Environmental specification of the SATA Flash Drive series follows the MIL-STD-810F standard as shown in Table 4-1.

Table 4-1: Environmental specifications

Environment		Specification
Temperature	Operation	0°C to 70°C (standard); -40°C to 85°C (industrial)
	Storage	-40°C to 100°C
Vibration		Sine wave: 5~55~5 Hz (X, Y, Z) Random: 10-2000 Hz, 16.3 G (X, Y, Z)
Shock-Operating		Acceleration: 1,500 G, 0.5 ms Peak acceleration: 50 G, 11 ms
Altitude		80,000 ft

4.2 Mean Time Between Failures (MTBF)

Mean Time Between Failures (MTBF) is predicted based on reliability data for the individual components in the SFD drive. Based on provided component data, SATA Flash Drive is rated at more than 3,000,000 hours.

Notes about the MTBF:

The MTBF is predicated and calculated based on “Telcordia Technologies Special Report, SR-332, Issue 2” method.

4.3 Certification and Compliance

The SFD25L complies with the following standards:

- CE
- FCC
- RoHS
- MIL-STD-810F

4.4 Endurance

The endurance of a storage device is predicted by Drive Writes Per Day (DWPD) based on several factors related to usage, such as the amount of data written into the drive, block management conditions, and daily workload for the drive. Thus, key factors, such as Write Amplifications and the number of P/E cycles, can influence the lifespan of the drive.

Capacity	Drive Wirtes Per Day (DWPD)
120 GB	2.57
240 GB	2.15
480 GB	2.16
960 GB	2.16
1920 GB	2.32

Notes:

This estimation complies with JEDEC JESD-219, Enterprise endurance workload of random data with payload size distribution.

- Flash vendor guaranteed 3D NAND TLC P/E cycles: 3K
- WAF may vary from capacity, flash configurations and writing behavior on each platform.
- 1 Terabyte = 1,024 GB
- DWPD (Drive Write Per Day) is calculated based on the number of times that user overwrites the entire capacity of an SSD per day of its lifetime during the warranty period. (3D NAND TLC warranty: 3 years

5. Electrical Specification

5.1 Operating Voltage

Caution: **Absolute Maximum Stress Ratings –** Applied conditions greater than those listed under “Absolute Maximum Stress Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions or conditions greater than those defined in the operational sections of this data sheet is not implied. Exposure to absolute maximum stress rating conditions may affect device reliability.

Table 5-1: Operating range

Range	Ambient Temperature	Conditions
Commercial	0°C to +70°C	5.0 V ±10% (4.5-5.5 V)
Industrial	-40°C to 85°C	5.0 V ±10% (4.5-5.5 V)

5.2 Power Consumption

Table 5-2 lists the SFD 25B power consumption.

Table 5-2 Typical power consumption

Capacity / Performance	1208GB	240GB	480GB	960GB	1920GB
Active Mode (mA)	240	265	275	270	275
Idle Mode (mA)	55	45	45	50	50

Notes:

- All values are typical and may vary depending on flash configurations or host system settings.
- Power consumption is measured using CrystalDiskMark 8.0.4 with file size 1,000MB.

6. Physical Characteristics

6.1 7.0 mm Dimensions

Figure 6-1 illustrates the overall dimensions of the 7.0mm Housing Thickness drive, as listed in Table 6-1.

Table 6-1 SFD 25L dimensions

Dimension	Millimeters (mm)
Height	6.90 + 0.10 / - 0.40
Width	69.85 ± 0.20
Length	100.00 ± 0.20

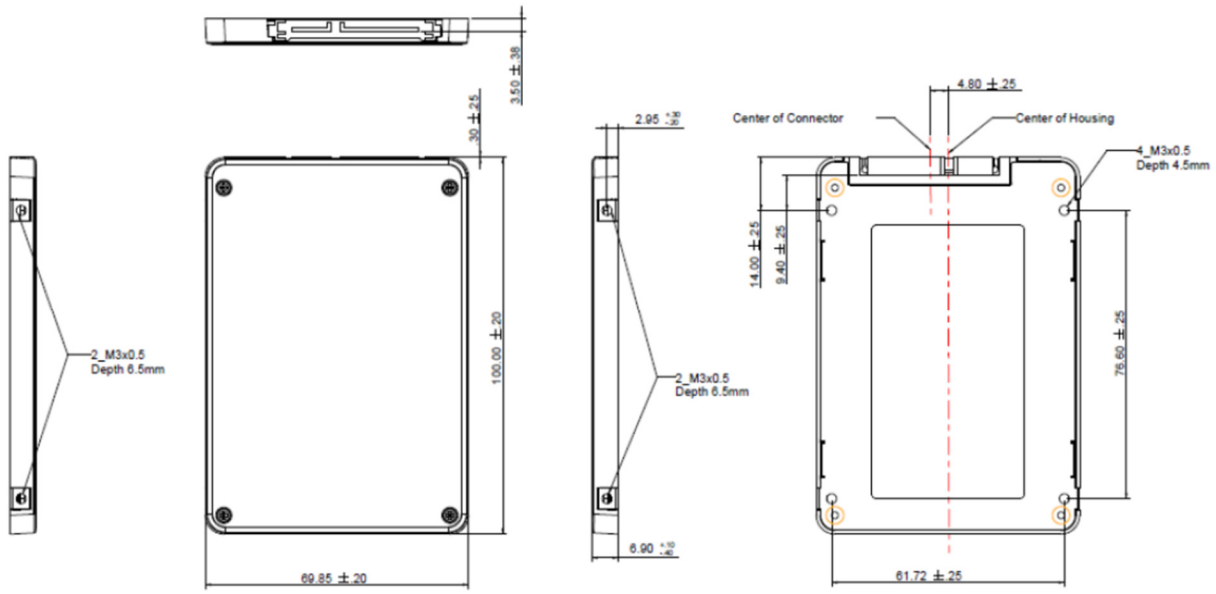
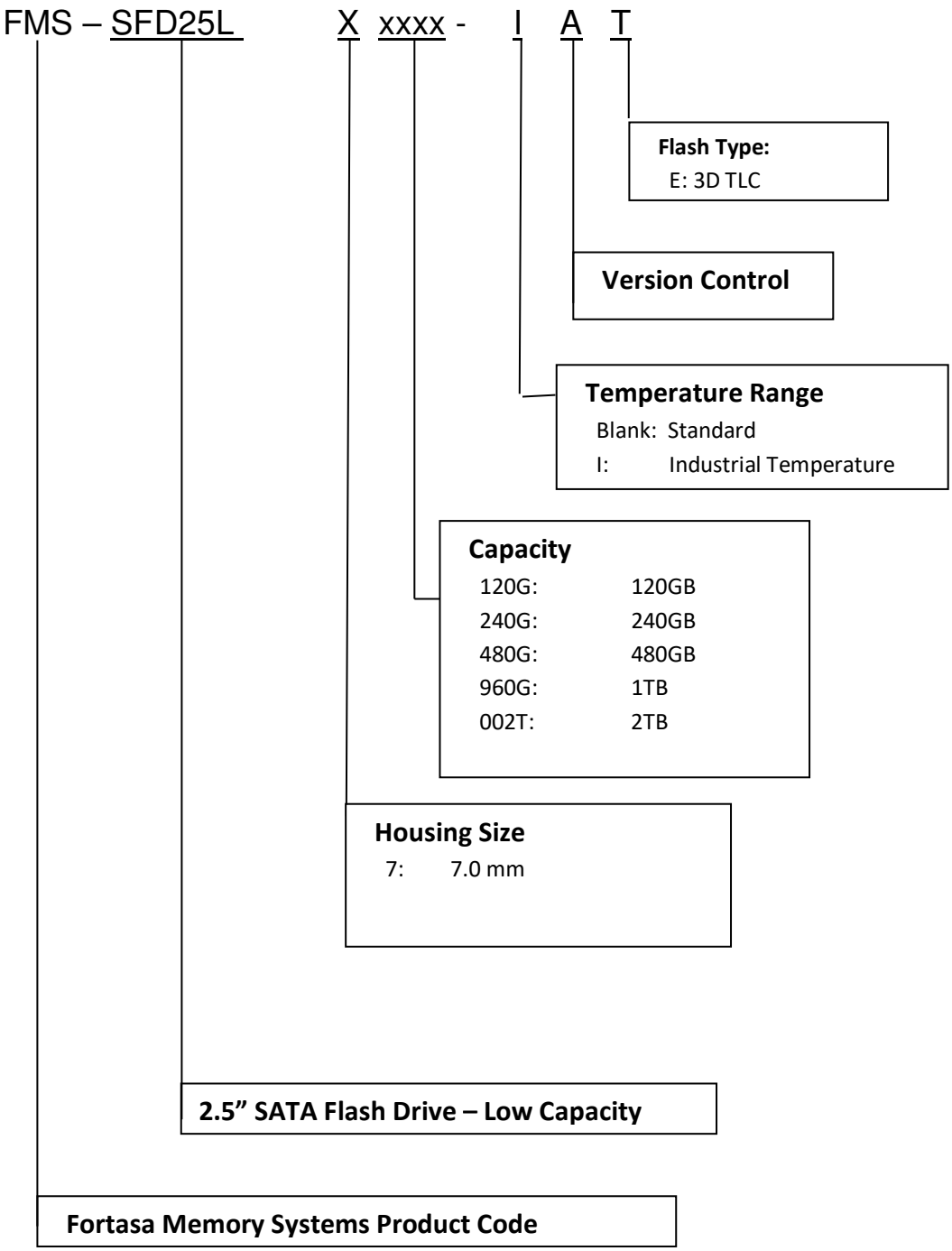


Figure 6-1 – Physical Dimensions

7. Product Ordering Information

7.1 Product Code Designations



7.2 Valid Combinations

7.2.1 7.0mm Housing

Capacity	Standard Temperature Model Numbers	Industrial Temperature Model Numbers
120GB	FMS-SFD25L7120G-AE	FMS-SFD25L7120G-IAE
240GB	FMS-SFD25L7240G-AE	FMS-SFD25L7240G-IAE
480GB	FMS-SFD25L7480G-AE	FMS-SFD25L7480G-IAE
960GB	FMS-SFD25L7960G-AE	FMS-SFD25L7960G-IAE
1920GB	FMS-SFD25L7002T-AE	FMS-SFD25L7002T-IAE

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Fortasa sales representative to confirm availability of valid combinations and to determine availability of new product combinations

8. Revision History

Revision	Date	Description	Comments
1.0	09/16/2025	Initial Release	