swissbit®

Product Data Sheet

Industrial
USB Flash Drive

U-500k Series
USB 3.1 SuperSpeed, SLC

Commercial and Industrial
Temperature Grade

Date: June 11, 2019
Revision: 1.00

swissbit®

made in germany

Contents

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U-500k Series – Industrial USB Flash Drive
2 GBytes up to 32 GBytes

1. Product Summary

- **Capacities:** 2 GBytes, 4 GBytes, 8 GBytes, 16 GBytes, 32 GBytes
- **Form Factor:** USB3.1 solid state flash drive with USB Type-A connector (68 mm x 18 mm x 8.3 mm)
- **Compliance:** USB 3.1 Gen 1 SuperSpeed specification compatible (backward compliance with USB 2.0/1.1)
- **Performance:**
  - Read Performance: Sequential Read up to 180 MBytes/s, Random Read IOPS up to 3,700
  - Write Performance: Sequential Write up to 100 MBytes/s, Random Write IOPS up to 1,980
- **Operating Temperature Range [1]:**
  - Commercial: 0 °C to 70 °C
  - Industrial: -40 °C to 85 °C
- **Storage Temperature Range:** -40 °C to 85 °C
- **Operating Voltage:** 5.0 V ± 10%
- **Data Retention:** 10 Years @ Life Begin; 1 Year @ Life End
- **Endurance in TeraBytes Written (TBW) @ Max Capacity:** 3380 (seq. write 128KB); 198 (random write 4KB)
- **High-Performance 32-Bit Processor with Integrated, Parallel Flash Interface Engines:**
  - Single-Level Cell (SLC) NAND Flash
  - Hardware BCH Code ECC (up to 60bit correction per 1 KByte page)
- **High Reliability:**
  - Mean Time Between Failure (MTBF): > 3,000,000 hours
  - Data Reliability: < 1 non-recoverable error per 10^{17} bits read

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[1] Adequate airflow is required to ensure the drive temperature, as reported in the S.M.A.R.T. data, does not exceed the specified maximum operating temperature.

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2. Product Features

- Page based Flash management for increased endurance and random performance
- Optimized FW algorithms especially for high read access and long data retention applications
    - Proven power fail management for highest reliability
    - Near Miss ECC technology
      Minimize the risk of uncorrectable bit failure over the product life time. Each read command analyzes the ECC margin level and refreshes data if necessary.
    - Read Disturb Management
      The read commands are monitored and the content is refreshed when critical levels have occurred.
    - Wear Leveling technology
      Equal wear leveling of static and dynamic data. The wear leveling assures that dynamic data as well as static data is balanced evenly across the memory. This guarantees the maximum write endurance of the device.
    - Data Care Management
      The interruptible background process controls the user data for read disturb effects or high temperature related retention degradation and refreshes data if necessary.
- Detailed S.M.A.R.T. support and extended vendor information
- LED for operation indication
- In-field firmware update
- 30 µinch gold-plated USB 3.0 Type-A connector contacts
- Swissbit Life Time Monitoring (SBLTM) tool and SDK for SBLTM (on request)
- Controlled BOM & PCN process
- Customized options like removable or fixed drive configuration, customer specified strings and IDs, laser marking, FAT16, FAT32 or customer file system, preload service or customized logo on request

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3. Ordering Information

Table 1: Standard Product List

Capacity	Temperature	
	Commercial	Industrial
	Part Number	Part Number
2 GBytes	SFU32048ExAE1T0-C-QT-1y1-STD	SFU32048ExAE1T0-I-QT-1y1-STD
4 GBytes	SFU34096ExAE1T0-C-MS-1y1-STD	SFU34096ExAE1T0-I-MS-1y1-STD
8 GBytes	SFU3008GExAE1T0-C-DB-1y1-STD	SFU3008GExAE1T0-I-DB-1y1-STD
16 GBytes	SFU3016GExAE1T0-C-QC-1y1-STD	SFU3016GExAE1T0-I-QC-1y1-STD
32 GBytes	SFU3032GExAE1T0-C-NC-1y1-STD	SFU3032GExAE1T0-I-NC-1y1-STD

x = product generation and y = firmware revision

Table 2: Available Part Numbers

Capacity	Temperature	
	Commercial	Industrial
	Part Number	Part Number
2 GBytes	SFU32048E1AE1T0-C-QT-1A1-STD	SFU32048E1AE1T0-I-QT-1A1-STD
4 GBytes	SFU34096E1AE1T0-C-MS-1A1-STD	SFU34096E1AE1T0-I-MS-1A1-STD
8 GBytes	SFU3008GE1AE1T0-C-DB-1A1-STD	SFU3008GE1AE1T0-I-DB-1A1-STD
16 GBytes	SFU3016GE1AE1T0-C-QC-1A1-STD	SFU3016GE1AE1T0-I-QC-1A1-STD
32 GBytes	SFU3032GE1AE1T0-C-NC-1A1-STD	SFU3032GE1AE1T0-I-NC-1A1-STD

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4. Product Description

The Swissbit U-500k USB 3.1 embedded USB flash drive provides a robust, high performance, and reliable storage product with industry compatible interface and small form factor. The U-500k SLC technology both enables high NAND flash operation and excellent endurance. The use of page based Flash management and a global wear leveling extends the endurance to unprecedented values for USB products.

The standard USB3 Type-A connector allows easy operation with USB3 or USB2 Type-A sockets.

For outdoor use or in poorly ventilated systems the U-500k is available in industrial temperature grade from -40°C to +85°C. Each individual industrial temperature grade drive is tested at these corners to verify the temperature resistance.
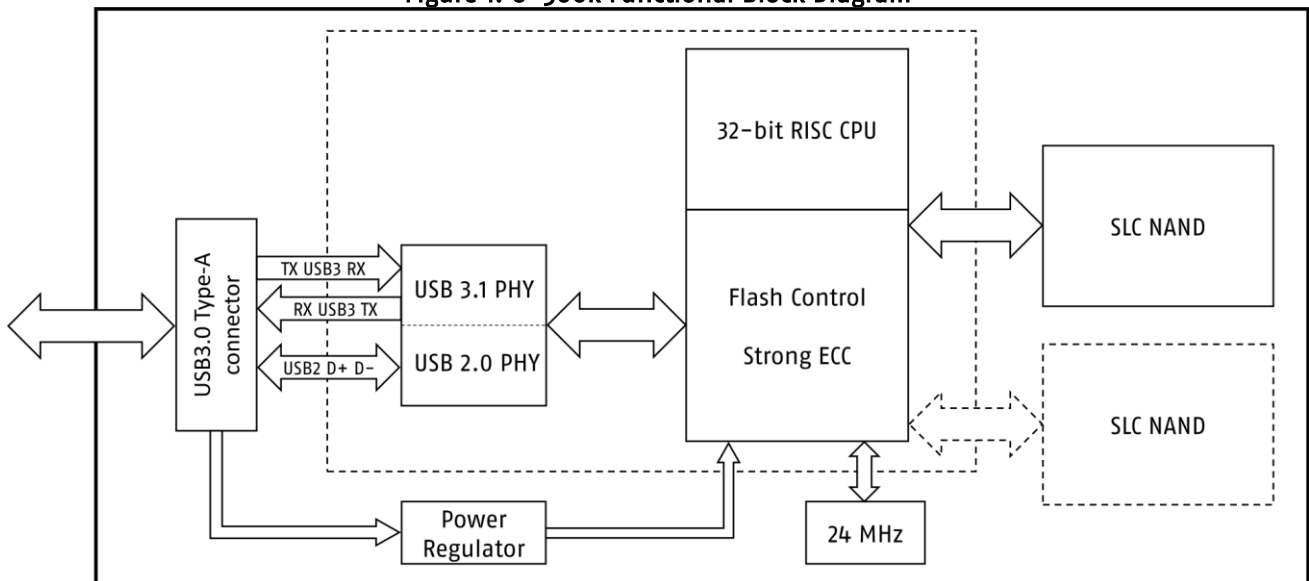
The U-500k firmware includes data care management features which refresh storage areas that are not or only infrequently read. At high temperature storage these areas are prone to retention loss. The firmware monitors the state of the NAND blocks and refreshes those that show a high level of degradation, thus preventing uncorrectable errors. This is an important feature for USB flash drives that are used as read only boot media.

The U-500k consists of a high performance 32bit RISC USB controller, the USB-A connector, power circuitry and different numbers of NAND dies. The U-500k 8/16/32GB keys use two flash channels for best performance.

The U-500k operates at 5V nominal with ±10% tolerance.

It supports USB 3.1 Gen 1 SuperSpeed and is fully backwards compatible to USB 2.0/1.1 High/Full Speed.

Figure 1: U-500k Functional Block Diagram

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4.1 Performance Specifications

The U-500k read/write sequential and random CDM performance benchmarks are detailed in the following Table 3 and Table 4.

Table 3: Read/Write Performance in SuperSpeed mode[2]

Capacity	Sequential Read (MBPS)	Sequential Write (MBPS)	Random Read 4K (IOPS)	Random Write 4K (IOPS)
2 GBytes	30.8	14.2	2,410	1,670
4 GBytes	38.8	20.8	2,660	1,980
8 GBytes	167	79	3,720	1,300
16 GBytes	180	100	3,530	1,320
32 GBytes	177	95	3,500	1,310

Table 4: Read/Write Performance in High-Speed mode[2]

Capacity	Sequential Read (MBPS)	Sequential Write (MBPS)	Random Read 4K (IOPS)	Random Write 4K (IOPS)
2 GBytes	27.5	13.8	2,020	1,560
4 GBytes	33.2	20.8	2,210	1,720
8 GBytes	39.2	24.9	3,000	940
16 GBytes	38.3	26.5	2,890	950
32 GBytes	39.8	26.5	2,870	950

4.2 Current Consumption

The drive-level current consumption as a function of operating mode is shown in the following Table 5.

Table 5: Current Consumption[3]

Drive Capacity	Sequential Read	Sequential Write	Random Read 4K	Random Write 4K	Idle	Unit
2 GBytes	98	102	86	93	75	mA
4 GBytes	106	105	92	95	76	
8 GBytes	171	145	95	101	79	
16 GBytes	181	164	100	109	79	
32 GBytes	193	173	103	112	79	

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[2] The values are measured using CrystalDiskMark 5.1.2 x64 (CDM) with Seq Q1T1 and 4KiB Q8T8. Performance depends on flash type and number, file/cluster size, and burst speed.
[3] All values are the typical recorded at 25 °C, with 5V supply voltage at fastest CrystalDiskMark 5.1.2 x64 (CDM) in SuperSpeed mode.

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4.3 Environmental Specifications

4.3.1 Recommended Operating Conditions

The recommended operating conditions for the U-500k USB flash drives are provided in the following Table 6.

Table 6: Recommended Operating Conditions[4]

Parameter	Value
Commercial Operating Temperature	0 °C to 70 °C
Industrial Operating Temperature	-40 °C to 85 °C
Power Supply V_{CC} Voltage	5.0 V ± 10%

4.3.2 Recommended Storage Conditions

The recommended storage conditions are listed in the following Table 7.

Table 7: Recommended Storage Conditions

Parameter	Value
Commercial Storage Temperature	-40 °C to 85 °C[5]
Industrial Storage Temperature	-40 °C to 85 °C[5]

4.3.3 Shock, Vibration and Humidity

The maximum shock, vibration and humidity conditions are listed in the following Table 8.

Table 8: Shock, Vibration and Humidity

Parameter	Value
Non-Operating Shock	1,500 g (JESD22-B110, IEC 60068-2-27)
Non-Operating Vibration	20 g (IEC 60068-2-6, MIL-STD-883 M2007.3)
Humidity (Non-Condensing)	85% RH 85 °C, 1000 hrs (JESD22-A101)

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[4] Adequate airflow is required to ensure the drive temperature, as reported in the S.M.A.R.T. data, does not exceed the specified maximum operating temperature.

[5] The retention at high temperature is reduced. The acceleration factor at 85°C compared with 40°C is 170, i.e. the initial endurance at 10 years@40°C is reduced to 22 days@85°C.

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4.4 Regulatory Compliance

The U-500k devices comply with the standards listed in the following Table 9.

Table 9: Regulatory Compliance

Compliance	Country	Type	Standard(s)/Directive
CE	European Union	Compliance	2014/30/EU EN 55032:2015 EN 61000-6-4:2007 +A1:2011 EN 55035:2017 EN 61000-6-2:2005/AC:2015 EN 61000-4-2:2009
FCC	United States	Compliance	47 CFR Part 15, class B
RoHS	European Union	Compliance	2011/65/EU, 2015/863
WEEE	European Union	Compliance	2012/19/EU
REACH	European Union	Compliance	1907/2006
UL	United States	Compliance	Conformity by subparts

4.5 Mechanical Specifications

Physical dimensions (including cap) are detailed in the following Table 10. Figure 3 on page 13 illustrates the U-500k dimensions.

Table 10: Measured Physical Dimensions

Physical Dimensions		Unit
Length	67.8±0.4	mm
Width	18.0±0.2	
Thickness (Max)	8.3±0.2	
Weight (Max Capacity)	10	g

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4.6 Reliability and Endurance

The Mean Time Between Failure (MTBF) is specified to exceed the value listed in the following Table 11. Data reliability with effective error tolerance and data retention at the beginning and end of life is also provided.

Table 11: Reliability

Parameter	Value
MTBF (at 25 °C)	> 3,000,000 hours
Data Reliability	< 1 Non-Recoverable Error per 10^{17} Bits Read
Data Retention	10 Years at Start (JESD47), 1 Year at EOL

Endurance represented as TeraBytes Written (TBW) is provided in the following Table 12.

Table 12: Endurance[6]

Drive Capacity	TeraBytes Written (TBW) @ Seq. Write 128kB Operation[7]	TeraBytes Written (TBW) @ Random Write 128kB Operation[7]	TeraBytes Written (TBW) @ Random Write 4kB Operation[7]
2 GBytes	204	83	32
4 GBytes	423	123	60
8 GBytes	808	232	52
16 GBytes	1691	414	101
32 GBytes	3380	858	198

4.7 Drive Geometry Specification

Table 13: Drive Geometry

Raw Capacity	Total LBA	User Addressable Bytes
	Decimal	(Unformatted)
2 GBytes	3,921,664	2,007,891,968
4 GBytes	7,843,328	4,015,783,936
8 GBytes	15,663,104	8,019,509,248
16 GBytes	31,326,208	16,039,018,496
32 GBytes	62,533,296	32,017,047,552

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[6] The Endurance values depend strongly on the use case, the preconditioning, the operation sequence, use of trim commands and usage level of the flash drive. The given values are for orientation only.

[7] Sequential Write 128kB simulates a continuous stream recording on a drive which has been preconditioned with a sequential write of the complete drive, Random Write 128KB or 4KB represent data logging applications with large or small block sizes.

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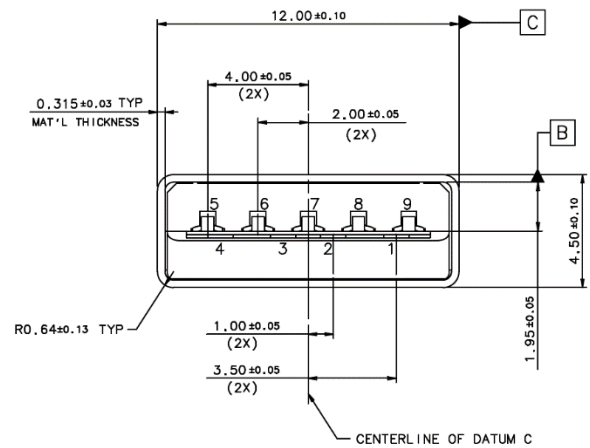
5. Electrical Interface

- USB3 Type-A connector, 9pin
- USB 3.1 Gen1 SuperSpeed interface, USB2.0 high-speed and 1.1 full-speed compatible

Table 14: Electrical pinout from device and host view.

Pin	Signal device view	Signal host view	Description host view
1	V_Bus	V_Bus	Operating voltage
2	D-	D-	Data signal pair
3	D+	D+	Data signal pair
4	GND	GND	Power Ground
5	SSTX-	SSRX-	Host receive -
6	SSTX+	SSRX+	Host receive +
7	GND	GND	Signal Ground
8	SSRX-	SSTX-	Host transmit -
9	SSRX+	SSTX+	Host transmit +
Shield			Connector shield

Figure 2: USB3 Type-A connector pinout

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6. Electrical Specification

Table 15: Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Power Supply Voltage	V_Bus	−0.5	6.0	V
Voltage at D+ and D−	V_Data	−0.5	5.0	
Voltage at USB3 pins	V_Data	−0.5	1.8	
Commercial Operating Temperature	T_A	0	70	°C
Industrial Operating Temperature		−40	85	

Table 16: DC characteristics for SuperSpeed operation (T=25°C, V_Bus=5V)

Parameter	Symbol	Density	Min	Typ	Max	Unit
Supply Voltage	V_Bus	all	4.5	5.0	5.50	V
Write current	I_WR	2GB		102	112	mA
		4GB		105	116	
		8GB		145	160	
		16GB		164	180	
		32GB		173	190	
Read current	I_RD	2GB		98	108	
		4GB		106	117	
		8GB		171	188	
		16GB		181	195	
		32GB		193	208	
Idle current	I_IDL	all		79[8]	85	
Suspend current	I_CCS	all		2.0	2.5	

Table 17: DC characteristics for High−Speed operation (T=25°C, V_Bus=5V)

Parameter	Symbol	Density	Min	Typ	Max	Unit
Supply Voltage	V_Bus	all	4.5	5.0	5.50	V
Write current	I_WR	2GB		63	72	mA
		4GB		67	77	
		8GB		68	78	
		16GB		72	83	
		32GB		74	85	
Read current	I_RD	2GB		63	72	
		4GB		71	82	
		8GB		77	89	
		16GB		76	87	
		32GB		80	92	
Idle current	I_IDL	all		44[8]	49	
Suspend current	I_CCS	all		2.1	2.5	
High Speed Idle Level	V_HSOI	all	−10		10	mV
High Speed Data Signaling LOW	V_HSOL	all	−10		10	
High Speed Data Signaling HIGH	V_HSOH	all	360		440	
Chirp J Level (differential)	V_CHIRPJ	all	360		440	
Chirp K Level (differential)	V_CHIRPK	all	−440		−360	

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[8] Typically 5 minutes after power on the device performs a background data care management, that needs up to 206mA in SuperSpeed and 165mA in High−Speed mode.

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7. Package Mechanical

Figure 3: Mechanical Dimensions for U-500k
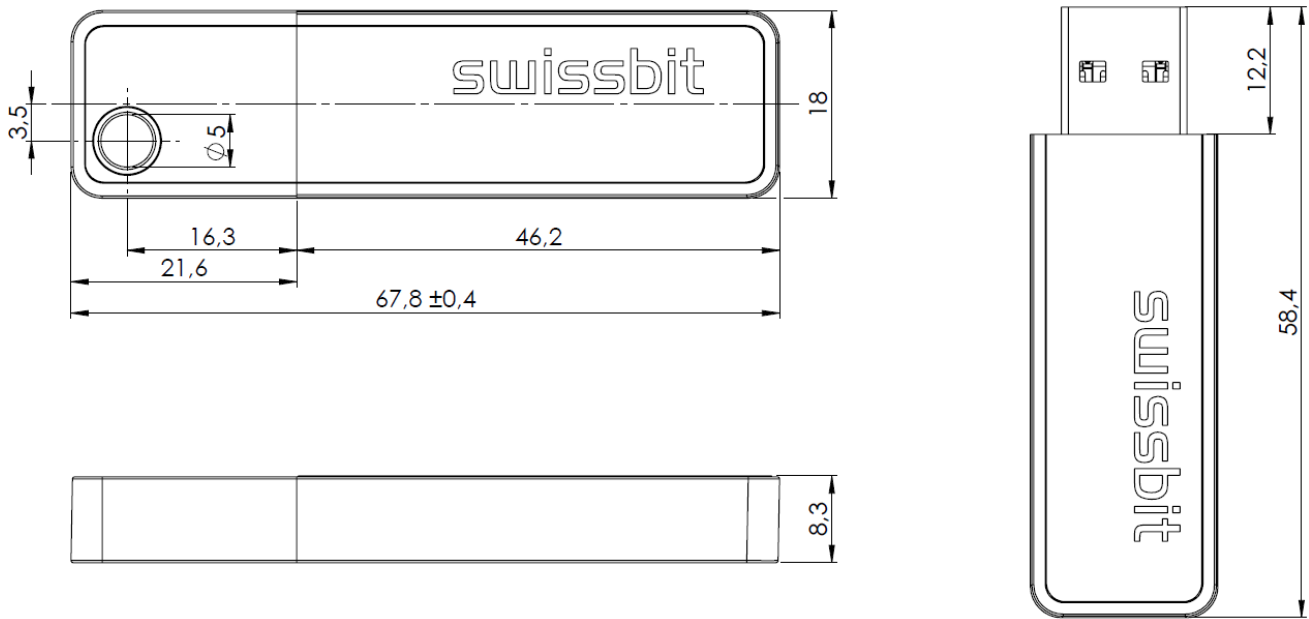
All dimensions are in millimeters, tolerance: ±0.2

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8. ATA Pass-Through commands (Identify Device and S.M.A.R.T.)

8.1 ATA Pass-Through commands

Additional to the standard SCSI commands the device also supports the ATA Pass-Through commands.

Table 18: ATA PASS-TRHOUGH(x) commands

SCSI command	OpCode	Description
ATA PASS-THROUGH(12)	A1h	Write and read ATA registers to send commands and read information
ATA PASS-THROUGH(16)	85h	

http://www.t10.org/ftp/t10/document.04/04-262r8.pdf

Table 19: ATA register addressing

Offset address	Input	Output	Type	Identify device	e.g. SMART commands
0	Data		Word		
1	Feature	Error	Byte	xx	yyh*
2	Sector count		Byte	xx	01h
3	LBA_Low		Byte	xx	xx
4	LBA_Mid		Byte	xx	4Fh
5	LBA_High		Byte	xx	C2h
6	Drive/head		Byte	E0h	E0h
7	Command	Status	Byte	ECh	B0h

* see below

8.2 Identify Device

The Identify Device returns a identify sector compatible to ATA and SATA devices.
Here an example of the interpretation of this sector.

Table 20: Identify Device Information

Word(s)	Default Value		Total Bytes	Data Field Type Information
0	0040h		2	Standard Configuration Fixed (optional 848Ah for removable)
...	...	...	...	...
10-19	aaaa*		20	Serial number in ASCII (right-justified)
...	...	...	...	...
23-26	XXXX*		8	Firmware revision in ASCII (big-endian byte order in Word)
27-46	XXXX*		40	Model number in ASCII (right-justified)
...	...	...	...	...
60-61	XXXXh		4	Total number of sectors addressable in LBA mode
...	...	...	...	...
82	0101h 7701h* 4063h*		2	Command set: SMART feature set, service interrupt
...	...	...	...	...
85	000Xh 0701h* 4063h*		2	Command set enabled: SMART feature set enabled/disabled
...	...	...	...	...
255	XXA5h		2	Integrity Word

* Values depend on device configuration.

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8.3 S.M.A.R.T. commands

The intent of the SMART command feature set is to protect user data and minimize the likelihood of unscheduled system downtime that may be caused by predictable degradation and/or fault of the device. By monitoring and storing critical performance and calibration parameters, SMART feature set devices attempt to predict the likelihood of a near-term degradation or fault condition. Providing the host system the knowledge of a negative reliability condition allows the host system to warn the user of the impending risk of a data loss and advise the user of the appropriate action.

All S.M.A.R.T. commands have the command code Boh. The different commands are selected by the Feature register.

Table 21: S.M.A.R.T. Features Supported

Operation	Feature	Sect Count	LBA low	LBA mid	LBA high	DRV head	Com-mand
S.M.A.R.T. Read Data	D0h	01h	xx	4Fh	C2h	E0h	B0h
S.M.A.R.T. Read Attribute Thresholds	D1h	01h	xx	4Fh	C2h	E0h	B0h
S.M.A.R.T. Enable Operations	D8h	xx	xx	4Fh	C2h	E0h	B0h
S.M.A.R.T. Disable Operations	D9h	xx	xx	4Fh	C2h	E0h	B0h
S.M.A.R.T. Return Status	DAh	xx	xx	4Fh	C2h	E0h	B0h

All commands are aborted, if the LBA signature is invalid.

8.3.1 S.M.A.R.T. Read Data (D0h)

When the drive receives the S.M.A.R.T. Read Data subcommand, it returns one sector (512 bytes) of data. See the following table for the data structure of this sector.

Table 22: S.M.A.R.T. Data Structure

Byte(s)	Value	Description
0-1	0010h	S.M.A.R.T. structure version
2-361	XXh	Attribute entries 1 to 30 (see Table 23)
362	00h	Off-line data collection status (no off-line data collection started)
363	00h	Self-test execution status byte (self-test completed)
364-365	0000h	Total time, in seconds, to complete off-line data collection
366	00h	Vendor specific
367	00h	Off-line data collection capability (no off-line data collection)
368-369	0003h	S.M.A.R.T. capabilities
370	00h	No Error logging capability
371	00h	Vendor specific
372	00h	Short self-test routine recommended polling time, in minutes
373	00h	Extended self-test routine recommended polling time, in minutes
374-385	00h	Reserved
386-387	0004h	SMART Version
388-510	XXh	Vendor specific
511	XXh	Data structure checksum

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8.3.2 S.M.A.R.T. Attribute Entry Structure

Each attribute entry (Bytes 2-361) consists of 12 bytes. See the following table for the data structure of each entry.

Table 23: Attribute Entry

Offset Byte(s)	Value	Description
0	XXh	Attribute ID (see Table 24)
1-2	XXXXh	Flags (little-endian) Bit0: Advisory (0) or Prefailure (1) Bit1: Not used (0) or updated during normal operation (1)
3	XXh	Current value as a percentage 64h = 100%
4	XXh	Worst value as a percentage 64h = 100%
5-10	XXXXh	Raw value (little-endian)
11	00h	Reserved

8.3.3 S.M.A.R.T. Attributes

The drives support the S.M.A.R.T. attributes listed in the following table.
The Threshold values can be read out with the S.M.A.R.T. Read Attribute Thresholds command (D1h)
The first attributes (196, 213, 229) are "Pre-Fail" type, while all other are Advisory (Old Age).

Table 24: S.M.A.R.T. Attributes

ID dec	ID hex	Value	Worst	Thres-hold	Attribute	Description	RAW values Offset 5-10
196	C4h	X%	X%	25	Spare Block Count	Number of total available NAND spare blocks	Initial (offset 5-7) and current (offset 8-10) number of spare blocks
213	D5h	X%	X%	25	Spare Block Count worst channel	Spare block count for the NAND with the lowest number of remaining spare blocks	Initial (offset 5-7) and current (offset 8-10) number of spare blocks of the channel with the lowest current number of spare blocks
229	E5h	X%	X%	2	Total Erase Count	Estimated number of total NAND block erases	Estimated number of total NAND block erases
203	CBh	100	100	0	Total ECC Errors	All recorded ECC errors	Total number of ECC errors (correctable and uncorrectable) (offset 5-8)
204	CCh	100	100	0	Correctable ECC Errors	Total recorded ECC errors that were corrected during the life of the drive	Total number of correctable ECC errors (offset 5-8)
199	C7h	100	100	0	UDMA CRC Errors	Dummy attribute, included for legacy reasons	This value is fixed at 0.
232	E8h	100	100	0	Total Number of Reads	Total number of NAND READ commands	Total number of NAND READ commands
12	0Ch	100	100	0	Power-On Count	Count of power-on events	Number of power cycles (offset 5-8)
241	F1h	100	100	0	Total LBAs Written	Total amount of data written to the drive	Total number of LBAs written to the disk, divided by 65536
242	F2h	100	100	0	Total LBAs Read	Total amount of data read from the drive	Total number of LBAs read from the disk, divided by 65536
214	D6h	100	100	0	Management Block status	Total number of times the management block has been updated	Management block write count (offset 5-8)
194	C2h	X°C	Max °C	0	Temperature Status	Device temperature in Celsius (°C)	Current (offset 5) /Min (offset 6) / Max temperature (offset 7)

* These threshold values are changeable using the Write Attribute Thresholds command.

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8.3.4 S.M.A.R.T. Read Attribute Thresholds (D1h)

When the drive receives the S.M.A.R.T. Read Attribute Thresholds subcommand, it returns one sector (512 bytes) of data similar as S.M.A.R.T. Read data sector, but with the threshold value in offset 1 of each attribute (see Table 24).

8.3.5 S.M.A.R.T. Enable Operations (D8h)

This command enables access to the S.M.A.R.T. capabilities of the drive. The state of SMART (enabled or disabled) is preserved across power cycles.
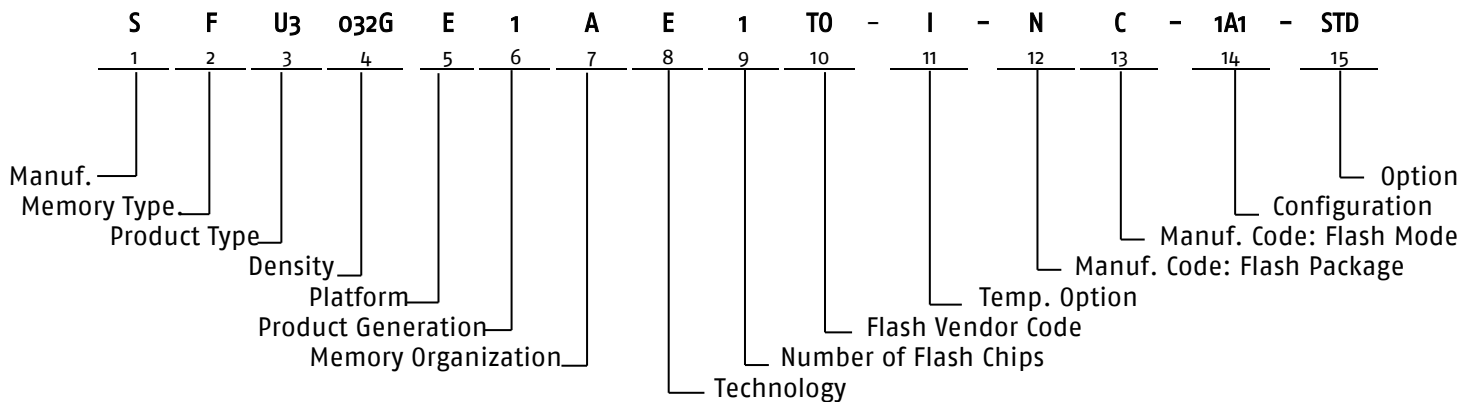
8.3.6 S.M.A.R.T. Disable Operations (D9h)

This command disables access to the S.M.A.R.T. capabilities of the drive. The state of SMART (enabled or disabled) is preserved across power cycles.

8.3.7 S.M.A.R.T. Return Status (DAh)

Table 25: S.M.A.R.T. Return Status

Operation	Feature	Sect Count	LBA low	LBA mid	LBA high	DRV head	Com-mand
Command S.M.A.R.T. Return Status	DAh	xx	xx	4Fh	C2h	E0h	B0h
Response							
S.M.A.R.T. Return Status OK	xx	xx	xx	4Fh	C2h	xx	xx
S.M.A.R.T. Return Status Pre-FAIL*	xx	xx	xx	F4h	2Ch	xx	xx

* If a threshold exceeded condition exists for either the Spare Block Count Worst Channel attribute or the Erase Count attribute, the device will set the Cylinder Low register to F4h and the Cylinder High register to 2Ch. In this case the drive should be replaced soon.

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9. Part Number Decoder

S	F	U3	032G	E	1	A	E	1	T0	–	I	–	N	C	–	1A1	–	STD
1	2	3	4	5	6	7	8	9	10		11		12	13		14		15

- Manuf.
- Memory Type
- Product Type
- Density
- Platform
- Product Generation
- Memory Organization
- Technology
- Number of Flash Chips
- Flash Vendor Code
- Temp. Option
- Manuf. Code: Flash Package
- Manuf. Code: Flash Mode
- Configuration
- Option

9.1 Manufacturer

Swissbit code	S

9.2 Memory Type

Flash	F

9.3 Product Type

USB 3.1 Flash Drive	U3

9.4 Density

2 GBytes	2048
4 GBytes	4096
8 GBytes	008G
16 GBytes	016G
32 GBytes	032G

9.5 Platform

Full size USB drive	E

9.6 Product Generation

First generation	1

9.7 Memory Organization

x8	A

9.8 Technology

U-5xx platform UFD	E

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9.9 Number of Flash Chips

1 Flash	1
2 Flash	2

9.10 Flash Code

Toshiba	T0

9.11 Temperature Option

Industrial Temperature Range: –40 °C to 85 °C	I
Standard Temperature Range: 0 °C to 70 °C	C

9.12 Die Classification

SLC MONO (single die package)	M
SLC DDP (dual die package)	D
SLC QDP (quad die package)	Q
SLC ODP (octal die package)	N

9.13 Pin Mode

	BGA	TSOP
Single nCE and Single R/nB	A	S
Dual nCE and Dual R/nB	B	T
Quad nCE and Quad R/nB	C	U

9.14 Configuration XYZ

X = Configuration

Configuration	X
Removable	1

Y = Firmware Revision

FW Revision	Y
Revision 1	A

Z = Optional setting

Optional Setting	Z
Default (SLC)	1

9.15 Option

Swissbit / Standard	STD
Customized version	XXX

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10. Marking Specification

10.1 Top View

Figure 4: U-500k top view
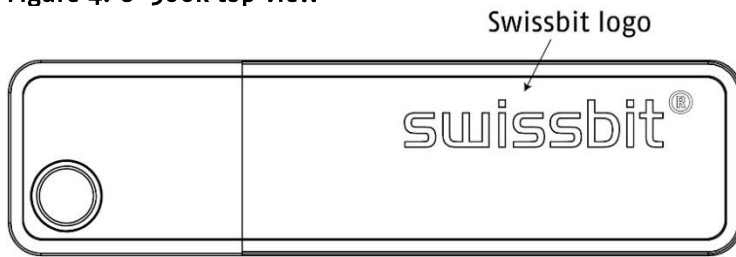
10.2 Bottom View

Figure 5: U-500k bottom view

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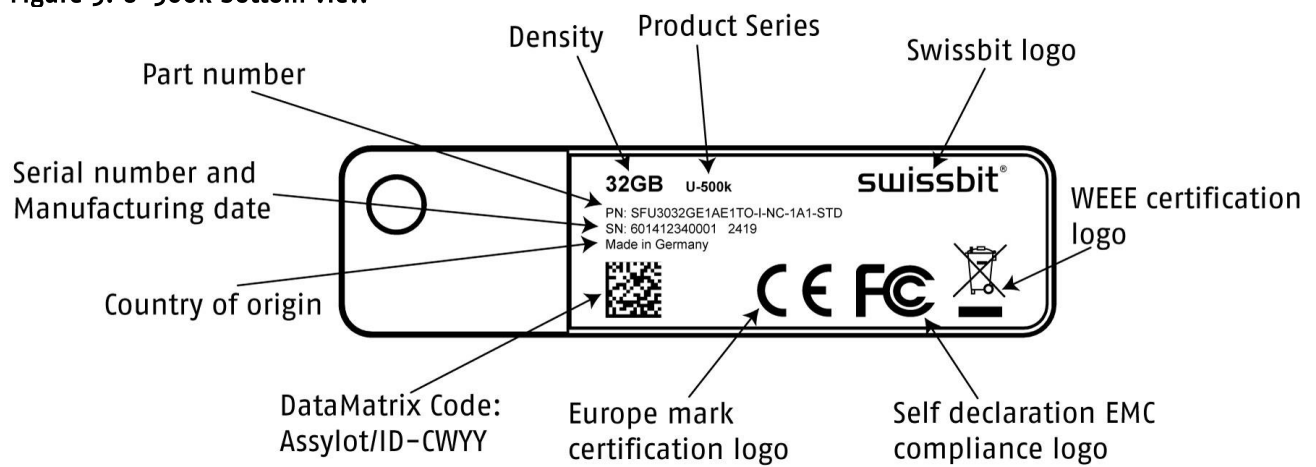
11. Revision History

Table 26: Document Revision History

Date	Revision	Description	Revision Details
27-Aug-2018	0.91	First preliminary release	
16-Oct-2018	0.92	Small adjustments in Table 8	
11-Jun-2019	1.00	Initial release	Doc. req. no. 2984

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