

EMBEDDED MEMORY & STORAGE SOLUTIONS



AUTOMOTIVE • COMMUNICATIONS
INDUSTRIAL • NETWORKING • SECURITY

WHAT SEPERATES US FROM THE OTHERS

Data is the fuel of the future and is driving global growth and change. As a leader in industrial data storage, Swissbit recognizes the undeniable need for reliable and secure storage solutions as an integral part of the digital transformation age.

More than 5000 customers around the world including Fortune 500 companies and the world's leading OEM's already rely on Swissbit for their safety-critical data-storage requirements. With over 25 years of experience in the development of removable & embedded memory solutions for the most demanding markets coupled with a trusted global distribution & support network, Swissbit is firmly established as a global innovation leader in storage technology for high-reliability solutions.

Swissbit's state-of-the-art centralized and wholly owned manufacturing, testing and packing facility in Berlin ensures supply chain integrity that delivers fail-safe industrial strength flash memory solutions for safety-critical applications including industrial, medical, automotive and communication networking.

Swissbit's devices and proprietary firmware meet the highest technology & safety requirements so that customers can trust that their data is stored, protected and secured even in harsh environments and under the most difficult conditions. Whether flash memory solutions for extreme temperatures or tamper-proof secure data storage, all Swissbit products meet the highest quality criteria and performance benchmarks. When you need a reliable long-term source for your memory solutions, Swissbit is your partner you can trust to deliver.

CORPORATE PROFILE

Established

1992 – 2000 as SIEMENS AG
Swissbit AG was formed in 2001 through a management buyout

Financial Strength

Privately held company, equity ratio > 60%

CAGR 2009–2017

Double digit annual growth

Headquarters

Swissbit Group: Gais, Switzerland
Swissbit AG: Bronschhofen (St. Gallen, Lake Constance area)

Subsidiaries

Switzerland, Germany, USA, Japan, Taiwan

R & D sites

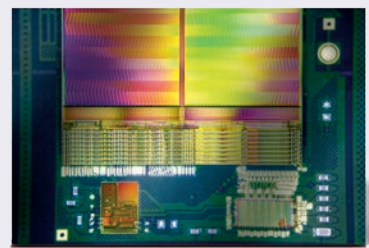
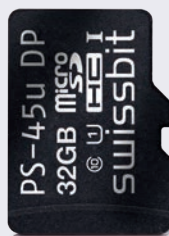
Switzerland, Germany and USA

Production Site

Berlin, Germany

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OUR PRODUCTS



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WHAT IS THE CUSTOMER BENEFIT?

HIGHEST ROBUSTNESS

WHAT MATTERS WHEN STORAGE NEEDS TO BE TOUGH

We assure that Swissbit storage products deliver best endurance at maximum performance and for lowest cost of ownership in our customers' applications. We combine reliable design and zero-defect manufacturing with world-class product qualification for highest quality and long service life: key factors that ensure highest productivity and efficiency in the tough applications that Swissbit serves.

01

Availability of a full portfolio of storage products with best fit to the customer use case

02

Fast and easy qualification of a mature product without risk of undetected issues

03

Long service life without need of frequent requalification

04

Reduced cost of maintenance and RMA handling

05

Fast and effective application engineering support

SAFE PROCESSES THROUGH RELIABLE DEVELOPMENT

- Product design and development with focus on embedded, NetCom and automotive market requirements
- Optimized for demanding applications
- Stringent hardware and firmware qualification verify design effort

SAVINGS THROUGH LONG SERVICE LIFE

- Swissbit products use components with long-term availability
- The service life of Swissbit products exceed industry practice by far
- Swissbit commits to frozen BOM and PCN process

MAXIMUM STABILITY

- Improved signal integrity
- In-house COB process for maximum mechanical robustness
- PCB design and soldering process withstand high thermal stress
- True industrial temperature support
- Firmware for highest endurance

APPLICATIONS

INDUSTRY



EMBEDDED PRODUCTS

Swissbit's embedded memory and storage solutions are the perfect fit for demanding embedded applications. They offer the highest reliability and quality. Swissbit's strategic cooperation with suppliers allows for long-term availability of products. To guarantee

high-quality standards, each product undergoes thorough functional testing before being released for shipment. The broad portfolio with different NAND technologies and industry-dedicated features guarantee the right solution for each embedded use case.



swissbit®

6GB

Industrial
Card™

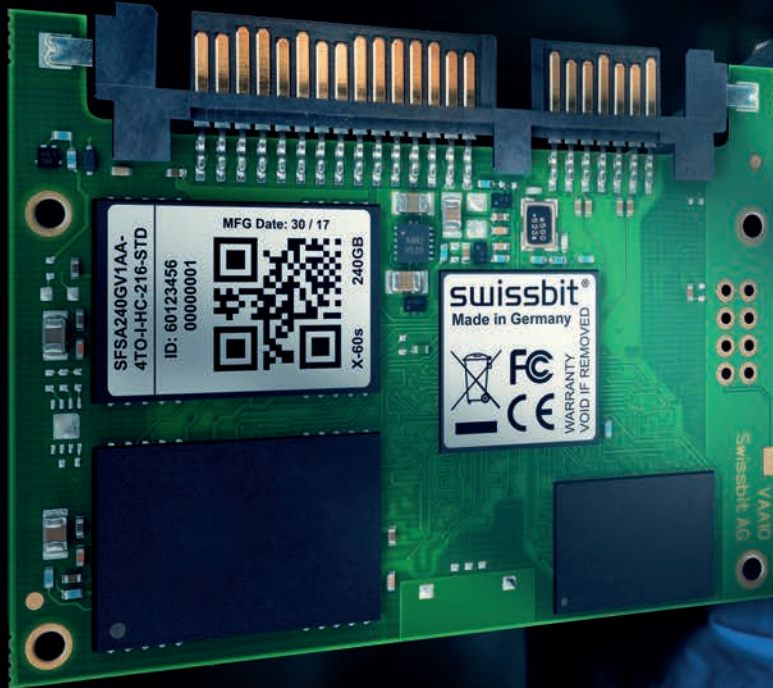
Memory and non-volatile storage solutions for embedded applications must provide reliable operation even in the most extreme conditions: temperature, shock, and vibration. As such, both the qualification cycle and the support life cycle needed for these products by far exceed those of devices designed for typical consumer applications.

TYPICAL APPLICATIONS:

- Industrial automation
- Energy distribution
- Energy consumption
- Smart grid
- Infotainment
- Healthcare
- Transportation
- Aerospace and defense
- Industrial IoT

APPLICATIONS

MEDICAL



MEDICAL PRODUCTS

There is a vast array of medical applications, ranging from diagnostic instruments as MRI and CT scanners, ultrasound systems, to blood testing and dialysis machines and infusion pumps. The amount of data stored can be small, as in heart rate monitoring equipment for example, or large as in X-Ray imaging. Nonetheless there is one common aspect: qualifying and certifying components for medical use is a lengthy, expensive task and the timeline from

the initial testing to volume production may extend over several years. Any requalification needs to be avoided as much as possible. This requires storage products that have a frozen BOM and long availability for many years. The portfolio of products for medical use range from SD memory cards or CF cards for handheld medical appliances, to 2.5" or M.2 SSDs with high bandwidth and capacity for medical imaging.



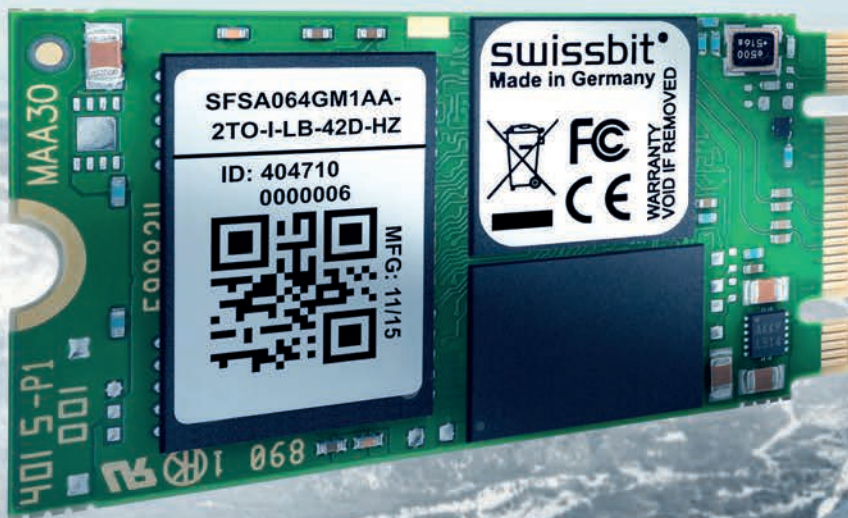
We rely on medical instruments in the most critical conditions of our lives. There is no tolerance for malfunctioning systems. Swissbit understands these requirements and serves the medical industry with storage products that fulfill the highest quality standards. Additionally, Swissbit's secure storage products protect the patients' medical data against unauthorized access. For more details on security products see page 42.

TYPICAL APPLICATIONS:

- Diagnostics
- Medical imaging
- Medical treatment
- Point-of-care testing
- Monitoring systems
- Augmented reality
- Medical vision

APPLICATIONS

NETWORKING & COMMUNICATION



NETCOM PRODUCTS

Swissbit supports the demanding field of NetCom applications with products that withstand a wide range of frequent temperature changes and operate between -40°C and $+85^{\circ}\text{C}$. It is mandatory that products perform for an extended life time in the field without the need for replacement or service. Swissbit's durabit™ range of SSDs fulfil this requirement.

For system boot purposes, a common frequently utilized device is the embedded USB module. With the U-4x and U-5x family, Swissbit offers a broad range of capacities and interface modes. Data care management with retention optimization maintains the boot image data over the complete service life and guarantees a safe and fast restart of the NetCom system.

The latest technologies and life changing developments rely on the Internet. The Internet of Things (IoT), the Industrial Internet of Things (IIoT) or Industry 4.0 (IND4.0) cannot be realized without a strong network of communication channels. Transmitting data to remote areas of the world is quite challenging and involves a high cost. Transceivers, routers and bridges which require uninterrupted, autonomous 24/7 operation, are often under extreme environmental conditions and may be installed in difficult to service areas.

TYPICAL APPLICATIONS:

- ATCA Blade
- Cable modem
- Content and video delivery
- Digital Subscriber Line access multiplexer
- Enterprise Media Gateway
- Switches and routers
- Optical network
- Radar / Sonar
- Radio network controller
- Security
- Tetra Base Station
- Wireless Base Station





APPLICATIONS

AUTOMOTIVE

AUTOMOTIVE PRODUCTS

All components used in automotive applications need to operate within a wide temperature range and withstand sudden power loss as well as shock and vibration. Additionally, very low failure rates are essential, because replacements of malfunctioning parts can incur high costs. Swissbit is the only indepen-

dent embedded memory and storage manufacturer with an IATF 16949 certified fab. Our S-45 SD and microSD memory card lineup caters to the demands of automotive applications, offering the highest reliability and quality at competitive prices.



The increasing varieties of infotainment and dashboard applications in cars today require significantly higher storage capacities than before. For autonomous driving the demand for fast and high capacity storage drives the development of embedded products. Swissbit participates in this trend with newly developed dedicated storage solutions.

TYPICAL APPLICATIONS:

- Entertainment systems
- Navigation systems
- Head unit / dashboard
- Black box / crash recorder
- Instrument cluster
- Dash cam

APPLICATIONS

SECURITY



SECURITY PRODUCTS

Governments, enterprises, banks, and industry demand high-end security to protect their assets. The growing number of IoT devices need to be secured against interception of data transfer and hacking of control systems.

But even trusted security solutions like Management Engines, Smartcard chips or secured CPUs prove to be imperfect. An upgradeable security solution based on exchangeable hardware cryptography and standard interfaces is the solution

to update systems to an always state-of-the-art security level. Swissbit's secure memory solutions offer smart card functionality coupled with NAND flash storage. Systems with SD card or USB interface can easily be updated to the protection level of a smart card chip. For efficient data protection of stored information, Swissbit offers SSDs as self-encrypted drives (SED) with TCG OPAL compliance or SD Cards with AES encryption.



Hardware based security offers the highest level of protection but needs a certain effort to be integrated in a system environment. Swissbit's middleware creates the standardized layer to offer security functionality to the system without the need to understand the underlying hardware interfaces. The Swissbit Security Interface supports all relevant mobile, portable, embedded, and PC platforms.

TYPICAL APPLICATIONS:

- Surveillance
- Audit trails
- License protection
- Secure update
- Secure voice communication
- Authentication and authorization
- Data encryption and protection

PRODUCT FEATURES

ROBUSTNESS FEATURES



SHOCK AND VIBRATION

The design, assembly, and use of selected materials guarantee extreme mechanical robustness.



CONFORMAL COATING

A thin polyurethane film protects against aggressive environmental conditions such as dust, moisture, or corrosive gas.



LONGEVITY

These products offer the lowest TCO in demanding applications with high requalification cost.

PERFORMANCE FEATURES



HIGH PERFORMANCE

Optimized for high sequential data rates and IOPS by use of SLC technology.



WAF REDUCTION

The WAF (write amplification factor) for MLC based products is reduced by combining a paged based FW block management with a powerful card architecture and configuration settings.

TEMPERATURE FEATURES



WIDE TEMPERATURE SUPPORT

The products are designed and approved for reliable operation over a wide temperature range.



TEMPERATURE SENSOR

The sensor allows the host hardware or software to monitor the storage device temperature.

DATA FEATURES



DATA CARE MANAGEMENT

Multiple routines inside the controller firmware improve data quality and eliminate degradation effects.



LIFE TIME MONITORING (LTM)

The Swissbit Life Time Monitoring feature enables users to access the memory device's detailed Life Time Status and allows remaining lifetime prediction thereby avoiding unexpected data loss.



SECURE ERASE (SANITIZE / PURGE) / FAST ERASE

This feature uses an uninterruptable sequence of data erase commands.



READ-ONLY OPTIMIZED

For such cases content is written to the NAND flash once, the firmware can be optimized to guarantee the highest possible data retention and read disturb.



TRIM SUPPORT

Expired data can be released and deleted in the Flash which reduces garbage collection and increases life time.



ZONE PROTECTION

The device allows the configuration of multiple zones with either no protection, write protection, or access protected settings.

ELECTRONIC FEATURES



ESD AND EMI SAFE

The product designs are in line with the latest regulations for electrostatic discharge and electromagnetic interference.



LOW POWER CONSUMPTION

Electronic devices with lower power consumption decrease energy cost, prolong battery life, and reduce heat generation in the device and hence require less cooling.



WEAR LEVELING

Sophisticated wear leveling and bad block management ensure that flash cells are sparingly and equally used to prolong the device's life.



IN FIELD FW UPDATE

The storage product can be upgraded with new FW in the field. The upgrade process is protected against power loss.



POWER FAIL PROTECTION & RECOVERY

During an unintentional shutdown, firmware routines and intelligent hardware architecture ensure that no corruption of user or system data will occur.

SECURITY FEATURES



TRUE HARDWARE RNG

True random numbers are generated inside the secure element to prevent brute force attacks.



DIGITAL SIGNATURE & VERIFICATION

Digital signatures are very popular and inevitable to protect against data or code manipulation.



HARDWARE BASED DATA ENCRYPTION

Hardware based security is key when it comes to replaceability, simple workflows, and trusted runtime environments.



MOBILE BANKING & EPURSE

Strong authentication and offline security for mobile banking and payment.



DEVICE PROTECTION BY DUAL FACTOR AUTHENTICATION

The user needs to have the card and know the PIN.



SECURE VOICE

The product is optimal for fast, encrypted, and user friendly secure voice solutions.



ELLIPTIC CURVE CRYPTOGRAPHY SUPPORT

Elliptic curves are faster and more efficient than RSA cryptography.



DATA PROTECTION & ENCRYPTION

The card offers a data safe function with strong AES encryption and PIN access protection.



SECURE LOGGING

Any data can be stored securely in write-once mode, queue mode, or random-access mode.



SECURE CD-ROM

Important data can be modified only after PIN authentication.



PRESALES

YOUR FUTURE WITH OUR SOLUTION

Our experienced BDM and FAE teams in Europe, North America, and Asia support you in the selection and qualification of the most suitable memory and storage solution for your applications.

This includes TCO analysis with the Swissbit Lifetime Monitor, hardware or firmware customization, middleware development, the provision of evaluation units and ultimately a joint qualification.

SALES

YOUR TRUSTWORTHY PARTNER

We understand the importance of providing local support in your language and time zone. For that reason, Swissbit has established sales offices in all major regions plus a strong network of partners that reaches even farther. Our experienced sales teams manage forecasting and order fulfillment, if desired also through third-party logistics or distribution networks.

AFTERSALES

LOCAL SUPPORT – GLOBALLY

Our engagement stretches far beyond the delivery of our products. Through sophisticated lifecycle management, we can ensure maximum longevity and smooth transitions in the event of product changes. And while we are proud of our best-in-class quality, we are still prepared to provide fast and solution-oriented RMA support at any time, including 4D and 8D reports whenever required.

SWISSBIT'S UNIQUE 360° CUSTOMER SERVICE



NAND FLASH PRODUCTS

SWISSBIT'S EMBEDDED STORAGE SOLUTIONS

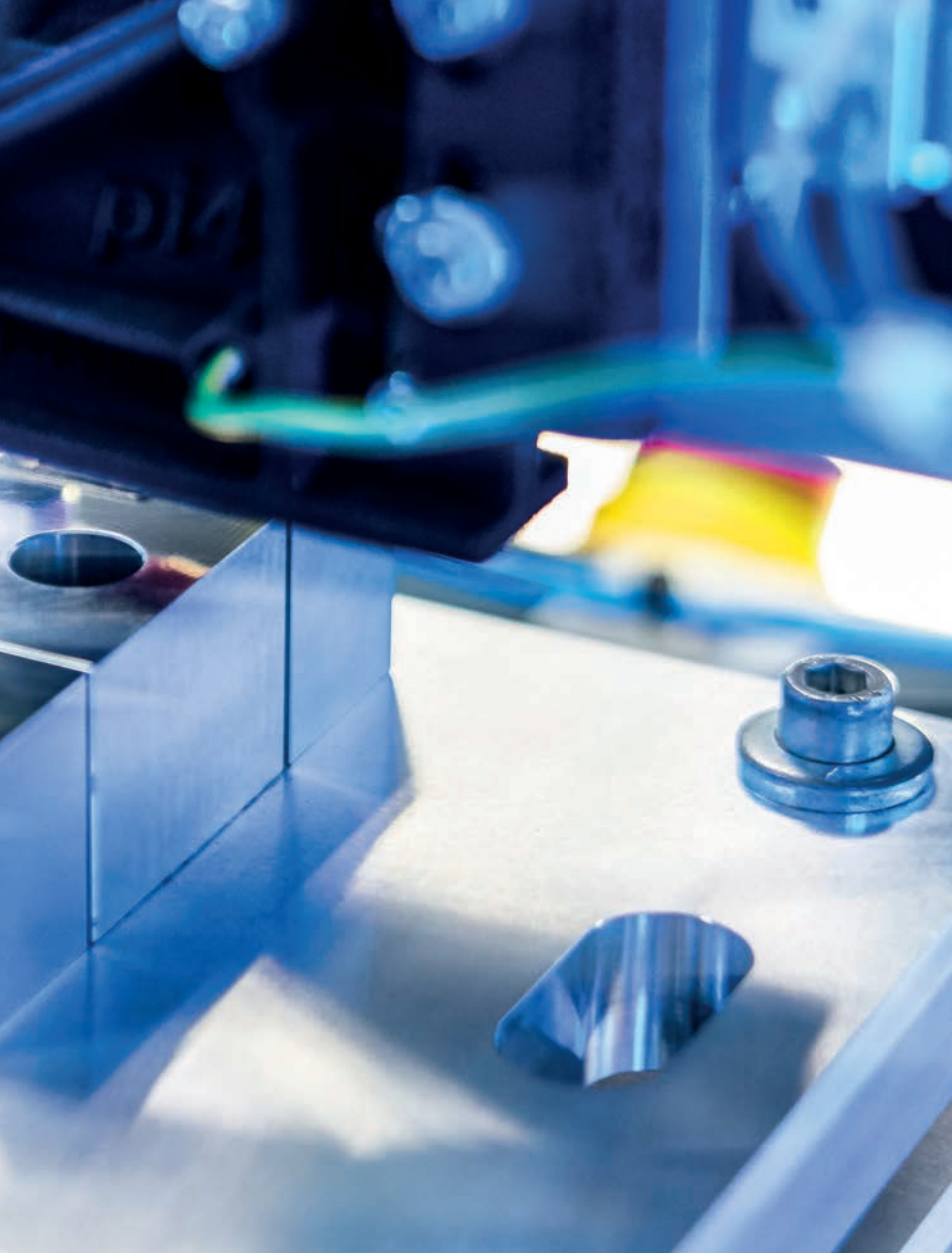
Our sophisticated flash handling algorithms optimize performance and life of the Single Level Cell (SLC) and Multi Level Cell (MLC) NAND flash used in our products.

OEM's of various industries require a variety of memory and storage solutions. In contrast to typical consumer devices, Swissbit's embedded memory and storage solutions are designed for highest reliability under extreme environmental conditions. They come with a large feature set tailored to the demands of the industrial, automotive, and NetCom markets and with our commitment to long-term availability. Swissbit's embedded

memory and storage solutions portfolio covers all relevant interfaces and form factors including SD and microSD memory cards, CompactFlash™ and CFast™ cards, 2.5" SATA SSDs, SLIM SATA and mSATA SSDs, M.2, USB Flash Drives (UFD) and modules. Our sophisticated flash handling algorithms optimize performance and life of the Single Level Cell (SLC) and Multi Level Cell (MLC) NAND flash used in our products.

	SLC	everbit™ pSLC	durabit™ The better MLC	MLC	TLC
Chip Capacity	•	••	•••	•••	••••
Cost per Bit	••••	•••	••	••	•
Reliability & Endurance	••••	••••	•••	••	•
Industrial Temperature	••••	•••	•••	•••	•
Write Performance	••••	••••	••••	•••	•
ECC Requirement	•	••	••	••	••••
Data Retention	••••	•••	•••	•••	•
Longevity	••••	••	••	••	•

•••• highest; ••• high; •• medium; • low



FLASH LIFETIME PREDICTION

The endurance of flash-based products is primarily defined by the maximum number of program / erase cycles of the flash components. SLC components normally allow 100,000 PE cycles per block while MLC is typically specified as 3,000 PE cycles.

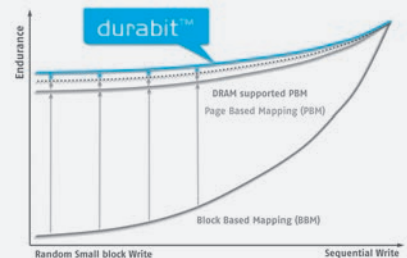
This transparency of NAND component endurance is no longer provided for integrated flash cards with controllers and firmware. For each write that the host initiates, the flash controller has to perform internal management steps and may need to erase and write multiple blocks even at the smallest external write transfer size. The ratio between internal write data volume and the external request size is called WAF (write amplification factor) and can vary between one (theoretical best case) and several hundred depending on card structure, flash components used, firmware architecture, and user-application write profile.

As explained in the box to the right, the endurance and performance of a FLASH product is massively defined by the internal write amplification (WAF). The way in which customer applications write to the storage device has a high impact on the WAF but is difficult to calculate analytically. Swissbit supports a realistic evaluation of the WAF and the endurance of their SSDs and storage cards with help of the Swissbit Life Time Monitoring Tool and statistical data stored into the flash by the firmware. This tool can read out the real usage

data such as number of writes and erase cycles, the bad block statistic, the successful ECC correction, and provides all the data necessary to extrapolate the lifetime of the device.

Swissbit durabit™ products use architectural improvements such as page based FTL, increased overprovisioning and DRAM supported flash management to significantly decrease the WAF for small writes. This enables unprecedented endurance and write performance in these critical use cases.

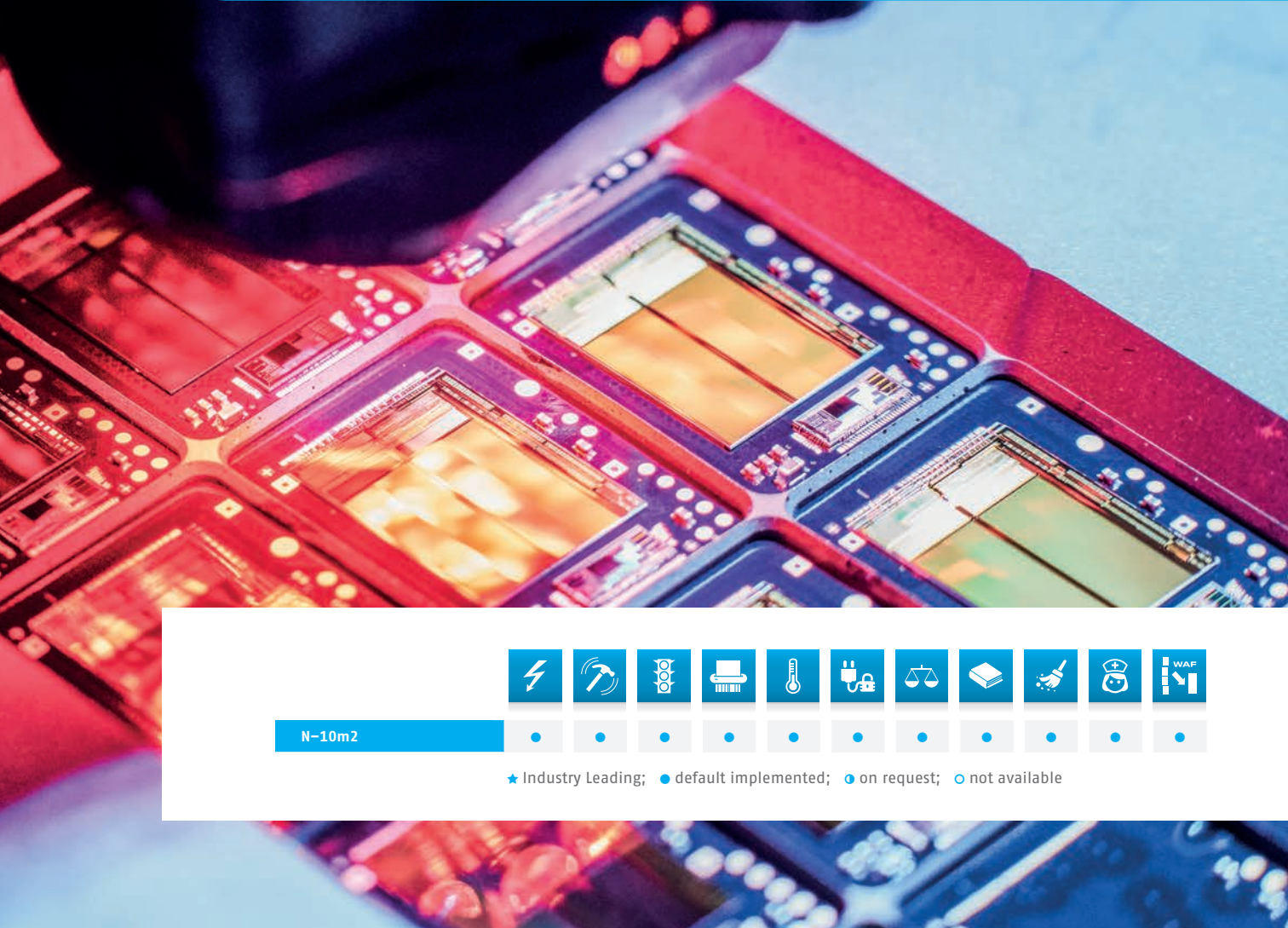
SSD ENDURANCE



PCIe SSD Modules

Although SATA is still a dominant interface in embedded and NetCom systems, the future belongs to PCIe. PCIe breaks the bandwidth limitations of SATA and offers flexible solutions with multiple lanes that can be combined. The second innovation to increase the performance is the new protocol NVMe, which has been designed specifically for Non Volatile Memory. The protocol significantly reduces the latency of read and

write requests. The higher performance also requires higher power consumption, especially with the common 4-lane configuration. The Swissbit N-10m2 module, a PCIe Gen3 / NVMe 1.2 module only uses 2 PCIe lanes and reduces the power consumption without sacrificing performance. Even if only operated with one PCIe lane, the performance still exceeds the SATA limits.



N-10m2	⚡	🔧	🚦	🖨️	🌡️	🔌	⚖️	📄	👉	🛡️	WAF
●	●	●	●	●	●	●	●	●	●	●	●
	★	●	●	●	●	●	●	●	●	●	●

★ Industry Leading; ● default implemented; ● on request; ○ not available

N-10m2



GENERAL INFORMATION

TYPE	m.2 PCIe / NVMe
STANDARD & INTERFACE	PCI Express (PCIe) Specification Revision 3.1 / NVMe 1.2
PACKAGE	PCI Express® M.2 (2280)
OUTLINE DIMENSIONS	80 x 22 x 3,6 mm
FLASH TYPE	3D NAND
DENSITY RANGE	120 GB – 960 GB
DATA RETENTION	10 years @ life begin 1 year @ life end
ENDURANCE	3,000 P/E cycles (Flash Cell Level)

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C
STORAGE TEMPERATURE	-40°C to +85°C

PERFORMANCE

SEQUENTIAL READ (MB/S)	up to 1,600
SEQUENTIAL WRITE (MB/S)	up to 1,100
RANDOM 4KB READ (IOPS)	up to 197,000
RANDOM 4KB WRITE (IOPS)	up to 199,000

ELECTRICAL DATA

VOLTAGE	2.70–3.60 V
POWER CONSUMPTION	Typ. Read Active: 3.1 W Typ. Write Active: 3.3 W Power State 3: < 50 mW

FEATURE LIST

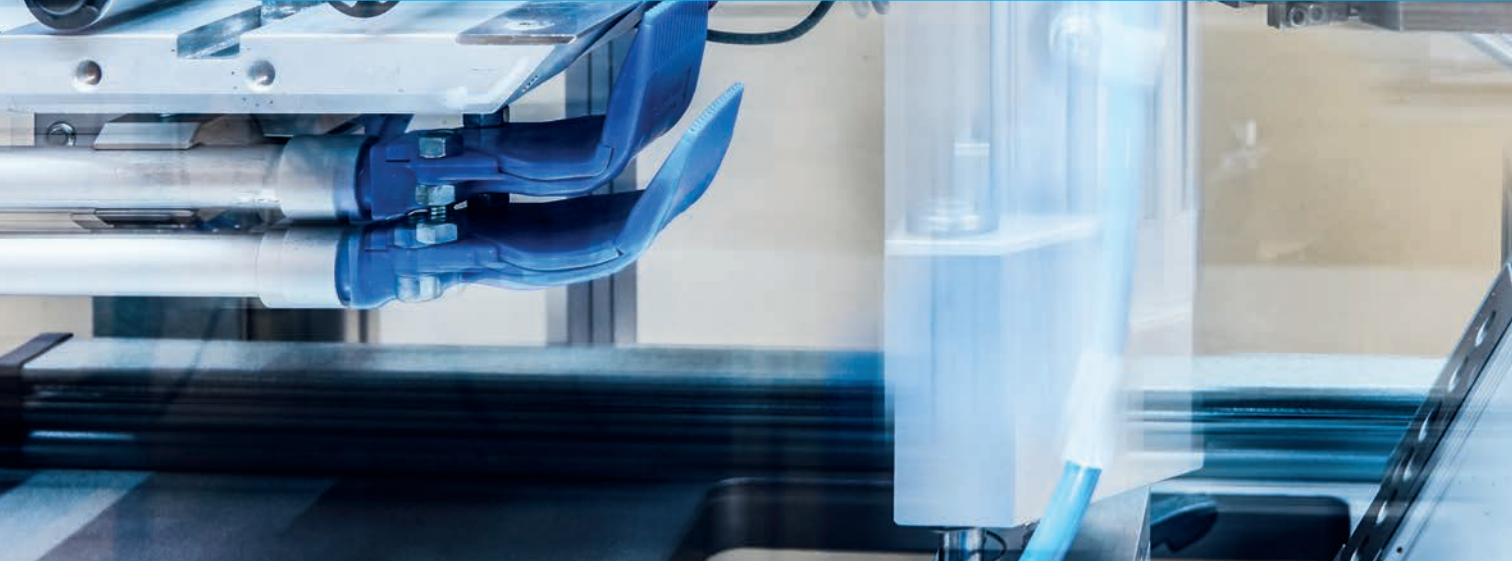
FEATURES & TOOLS	Best-in-Class Performance and Endurance with durabit™ Technology Dynamic and Static Wear Leveling, Dynamic Bad Block Remapping Active and Passive Data Care Management On-Board Power Fail Protection Active State Power Management (ASPM) Support NVMe Security Command Support In-Field Firmware Update Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.) AES256 Encryption (on request) Swissbit Life Time Monitoring (SBLTM) Tool and SDK for SBLTM (on request)
PART NUMBER	SFPCxxxGMxAGxss-C-dd-rrr-ccc

2.5" SATA SSDs

Swissbit's 2.5" SSDs are ideal solutions for embedded applications requiring reliable and long service life storage. The X-60 SATA 6Gb/s series is Swissbit's MLC based solution for high performance, cost sensitive, high capacity markets.

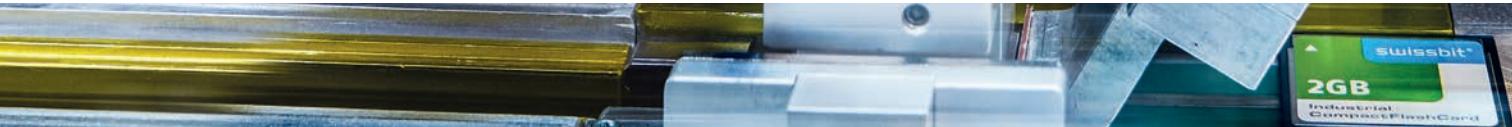
X-600 has best-in-class endurance, using SLC technology while X-66 is the perfect compromise with MLC NAND in pSLC mode.

ALL products feature Swissbit's proven Power Fail Safety, Data Care Management, a detailed S.M.A.R.T.-based Life Time Monitoring, NCQ, TRIM, advanced wear leveling, bad block management, and in-field firmware update functionality. The X-60P provides highest level of PFail protection by adding special circuitry and energy storing capacitors. The X-60 supports AES security and can be used as a self-encrypted drive (SED).



X-600	●	●	●	●	●	○	●	●	●	●	★	●	●
X-60 / X-66	●	●	●	●	●	○	●	●	●	●	★	○	●
X-60P	●	●	●	●	●	○	★	●	●	●	★	○	●
X-500	●	●	●	●	●	○	●	●	○	●	○	●	○
X-70	●	●	●	●	●	○	●	●	●	●	★	○	●

★ Industry Leading; ● default implemented; ○ on request; ○ not available



X-600 / X-66 / X-60 / X-60P

X-500

X-70



GENERAL INFORMATION

TYPE	2.5" SATA III SSD	2.5" SATA SSD	2.5" SATA IIISSD
INTERFACE DATA TRANSFER MODE	SATA III – 6 Gbit/s ATA8	SATA II – 3 Gbit/s up to PIO4, MDMA2, UDMA6	SATA III – 6 Gbit/s ATA8
CONNECTOR	15 + 7 pin Serial ATA	15 + 7 pin Serial ATA with latch protection / special feature connector	15 + 7 pin Serial ATA
OUTLINE DIMENSIONS	100.2 x 69.85 x 7.0 mm	100.2 x 69.85 x 9.3 mm	100.2 x 69.85 x 7.0 mm
FLASH TYPE	SLC / pSLC / MLC	SLC	3D NAND
DENSITY RANGE	SLC: X-600: 8 GB – 256 GB pSLC: X-66: 16 GB – 240 GB MLC: X-60: 30 GB – 960 GB	16 GB – 512 GB	240 GB – 2 TB
DATA RETENTION	10 years @ life begin 1 year @ life end		
ENDURANCE ENTERPRISE WL	8.7 / 3.8 / 0.6 TBW per GB drive capacity	5.8 TBW per GB drive capacity	tbd / 3,000 P/E cycles (Flash cell level)

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C		Commercial: 0°C to +70°C
STORAGE TEMPERATURE	-40°C to +85°C	-55°C to +95°C	-40°C to +85°C

PERFORMANCE

BURST RATE (MB/S)	up to 600	up to 300	up to 600
SEQUENTIAL READ (MB/S)	up to 520 / 520 / 520	up to 240	up to 560
SEQUENTIAL WRITE (MB/S)	up to 425 / 450 / 450	up to 220	up to 530
RANDOM 4KB READ (IOPS)	up to 79,000 / 80,000 / 74,000	up to 14,500	up to 81,000
RANDOM 4KB WRITE (IOPS)	up to 76,000 / 75,000 / 75,000	up to 5,300	up to 81,000

ROBUSTNESS

MTBF	≥2,000,000 hours
SHOCK	1,500 G, 0.5 ms
VIBRATION	50 G, 131–2,000 Hz
HUMIDITY	X-60/X-70: 85 % RH 85 °C, 1,000 hrs / X-60P: 65 % RH 85 °C, 1,000 hrs

ELECTRICAL DATA

VOLTAGE	5 V ± 10% / 3.3 V ± 5%	5 V ± 10 % / 3.3 V optional	5 V ± 10 %
POWER CONSUMPTION	typ 300 mA max 1,200 mA Idle 60 mA DEVS LP <5 mA	Slumber 140 mA max 700 mA Idle 200 mA	max 650 mA Idle 100 mA DEVS LP <1 mA

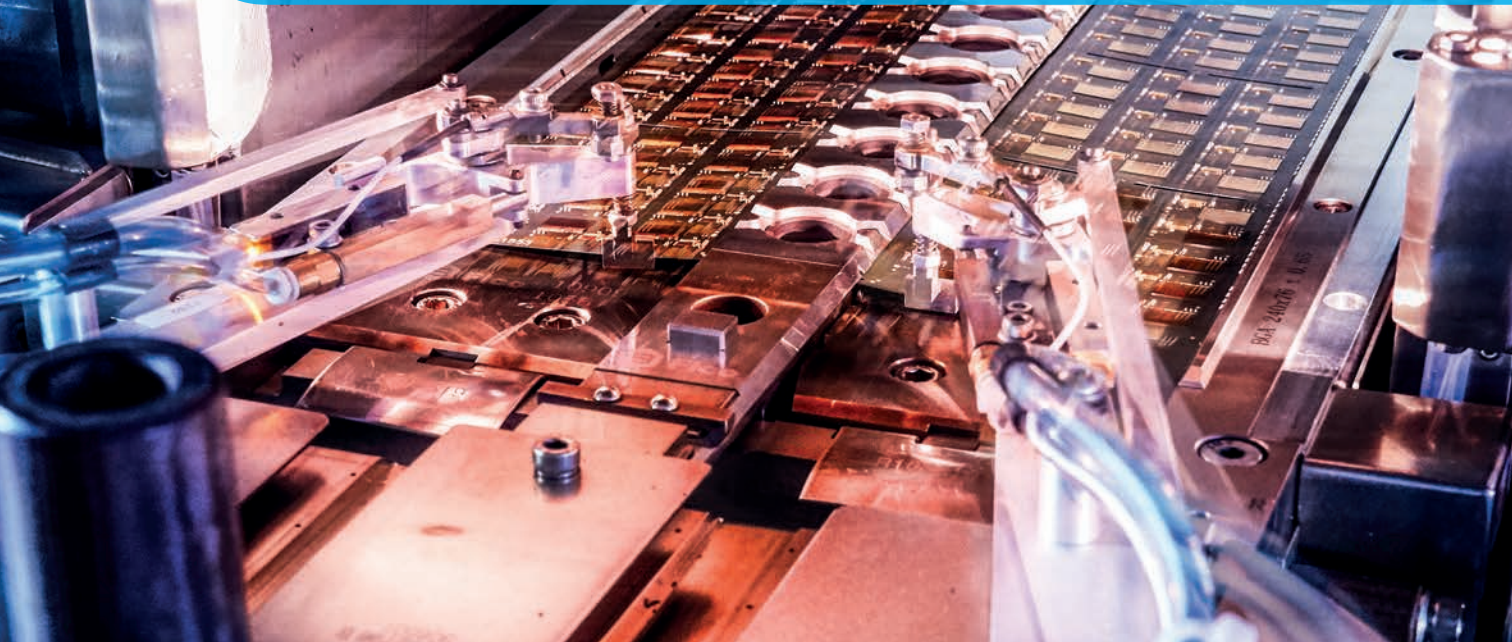
FEATURE LIST

FEATURES & TOOLS	X-60P: with Pfail Circuitry Proven Power Fail Safety NCQ, TRIM Advanced Wear Leveling & Bad Block management In-field firmware update SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring Self encrypted drive (SED) / TCG OPAL optional	Proven Power Fail Safety ATA security feature set Enhanced Secure Erase, Purge & Sanitize features (MIL STD) NCQ, TRIM Advanced Wear Leveling & Bad Block management In-field firmware update SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring	Proven Power Fail Safety NCQ, TRIM Advanced Wear Leveling & Bad Block management In-field firmware update SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring Self encrypted drive (SED) / TCG OPAL optional
PART NUMBER	SFSAxxxxQvAAxss-t-dd-rrr-ccc	SFSAxxxxQvBJxss-t-dd-rrr-ccc	SFSAxxxxQvAHxss-t-dd-rrr-ccc

SATA Modules

Equally to the 2.5" drives, the Swissbit mSATA (M0-300), SLIM SATA (M0-297) and the M.2 SSDs target embedded applications which require solid state storage in small, removable form factors. The SSD modules are designed for robustness against frequent temperature changes within the -40°C to 85°C range, withstand high shock and vibration and offer superior performance and endurance. The three families, X-60, X-66

and X-600 target different use cases including OS booting, data logging, surveillance recording or vaulting. The amount and type of write access defines the required endurance in TBW. Swissbit provides their detailed S.M.A.R.T based Life Time Monitor which helps to analyze the use case and identify the best fit between the Swissbit SSD product families and the user application.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
X-600m/s/m2	●	●	●	●	●	○	●	●	●	●	●	●	●	●	●
X-60 / X-66m/s/m2	●	●	●	●	●	○	●	●	●	●	●	●	★	○	●
X-200m/s	●	●	●	●	○	○	○	●	○	○	○	○	○	●	○

★ Industry Leading; ● default implemented; ○ on request; ○ not available

X-600m

X-600s

X-600m2

X-200m

X-200s



GENERAL INFORMATION

TYPE	M0-300 mSATA	M0-297 SLIM SATA	M.2 2242	M.2 2260 / 2280	M0-300 mSATA	M0-297 SLIM SATA
INTERFACE	SATA III – 6 Gbit/s				SATA II – 3 Gbit/s	
DATA TRANSFER MODE	ATA8				up to PIO4, MDMA2, UDMA6	
CONNECTOR	52 pos. Edge Connector PCI Express (PCIe) mini	15 + 7 pin Serial ATA Connector	75 pos. Edge Connector B & M key		52 pos. PCI Express (PCIe) mini	15 + 7 pin Serial ATA Connector
OUTLINE DIMENSIONS	50.8 x 29.85 mm	54 x 39 mm	22 x 42 mm	22 x 60 / 80 mm	50.8 x 29.85 mm	54 x 39 mm
THICKNESS	3.3 mm	4.0 mm	3.6 mm	DS: 3.6 mm SS: 2.0 mm	3.3 mm	4.0 mm
FLASH TYPE	SLC					
DENSITY RANGE	8 GB – 128 GB	16 GB – 128 GB	8 GB – 64 GB	16 GB – 128 GB	2 GB – 64 GB	
DATA RETENTION	10 years @ life begin 1 year @ life end					
ENDURANCE	max. 8.7 TBW per GB drive capacity (JEDEC Enterprise WL)				100,000 P/E cycles (Flash cell level)	

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	-40°C to +85°C

PERFORMANCE

BURST RATE (MB/S)	up to 600	up to 600	up to 600	up to 300
SEQUENTIAL READ (MB/S)	up to 520	up to 520	up to 520	up to 120
SEQUENTIAL WRITE (MB/S)	up to 405	up to 245	up to 405	up to 95
RANDOM 4KB READ (IOPS)	up to 76,000	up to 76,000	up to 76,000	up to 3,100
RANDOM 4KB WRITE (IOPS)	up to 73,000	up to 54,000	up to 73,000	up to 25

ROBUSTNESS

MTBF	≥2,000,000 hours
SHOCK	1,500 G, 0.5 ms
VIBRATION	50 G, 131–2,000 Hz
HUMIDITY	85 % RH 85°C, 1,000 hrs

ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 %	5 V ± 10 %	3.3 V ± 5 %		3.3 V ± 5 %	5 V ± 10 %
POWER CONSUMPTION	typ 450 mA max 750 mA Idle 115 mA DEVSLP 35 mA	typ 450 mA max 750 mA Idle 110 mA DEVSLP 55 mA	typ 450 mA max 520 mA Idle 115 mA DEVSLP 35 mA	typ 450 mA max 750 mA Idle 115 mA DEVSLP 35 mA	typ 300 mA max 490 mA Idle 180 mA	typ 260 mA max 320 mA Idle 140 mA

FEATURE LIST

FEATURES & TOOLS	Proven Power Fail Safety NCQ, TRIM Advanced Wear Leveling & Bad Block management In-field firmware update SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring			Proven Power Fail Safety Advanced Wear Leveling & Bad Block management SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring	
PART NUMBER	SFSAxxxxUvAAxss-tdd-rrr-ccc	SFSAxxxxVvAAxss-tdd-rrr-ccc	SFSAxxxxMvAAxss-tdd-rrr-ccc	SFSAxxxxUvBRxss-tdd-rrr-ccc	SFSAxxxxVvBRxss-tdd-rrr-ccc

X-60m / X-66m

X-60s / X-66s

X-60m2 / X-66m2



GENERAL INFORMATION

TYPE	X-60m / X-66m	X-60s / X-66s	X-60m2 / X-66m2	
INTERFACE DATA TRANSFER MODE	SATA III – 6 Gbit/s ATA8			
CONNECTOR	52 pos. Edge Connector PCI Express (PCIe) mini	15 + 7 pin Serial ATA Connector	75 pos. Edge Connector B & M key	
OUTLINE DIMENSIONS	50.8 x 29.85 mm	54 x 39 mm	22 x 42 mm	22 x 60 / 80 mm
THICKNESS	3.3 mm	4.0 mm	3.6 mm	DS: 3.6 mm SS: 2.0 mm
FLASH TYPE	MLC durabit™ / pSLC everbit™			
DENSITY RANGE durabit everbit	8 GB – 480 GB 16 GB – 240 GB	30 GB – 480 GB 16 GB – 240 GB	30 GB – 240 GB 16 GB – 120 GB	30 GB – 480 GB 16 GB – 240 GB
DATA RETENTION	10 years @ life begin 1 year @ life end			
ENDURANCE ENTERPRISE WL	durabit: max 0.6 TBW / GB drive capacity everbit: max 3.8 TBW / GB drive capacity			

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	-40°C to +85°C

PERFORMANCE

BURST RATE (MB/S)	up to 600	up to 600	up to 600
SEQUENTIAL READ (MB/S)	up to 520 / 520	up to 520 / 520	up to 520 / 520
SEQUENTIAL WRITE (MB/S)	up to 450 / 450	up to 340 / 415	up to 450 / 450
RANDOM 4KB READ (IOPS)	up to 75,000 / 80,000	up to 72,000 / 80,000	up to 75,000 / 80,000
RANDOM 4KB WRITE (IOPS)	up to 75,000 / 75,000	up to 78,000 / 73,000	up to 75,000 / 75,000

ROBUSTNESS

MTBF	≥2,000,000 hours
SHOCK	1,500 G, 0.5 ms
VIBRATION	50 G, 131-2,000 Hz
HUMIDITY	85 % RH 85°C, 1,000 hrs

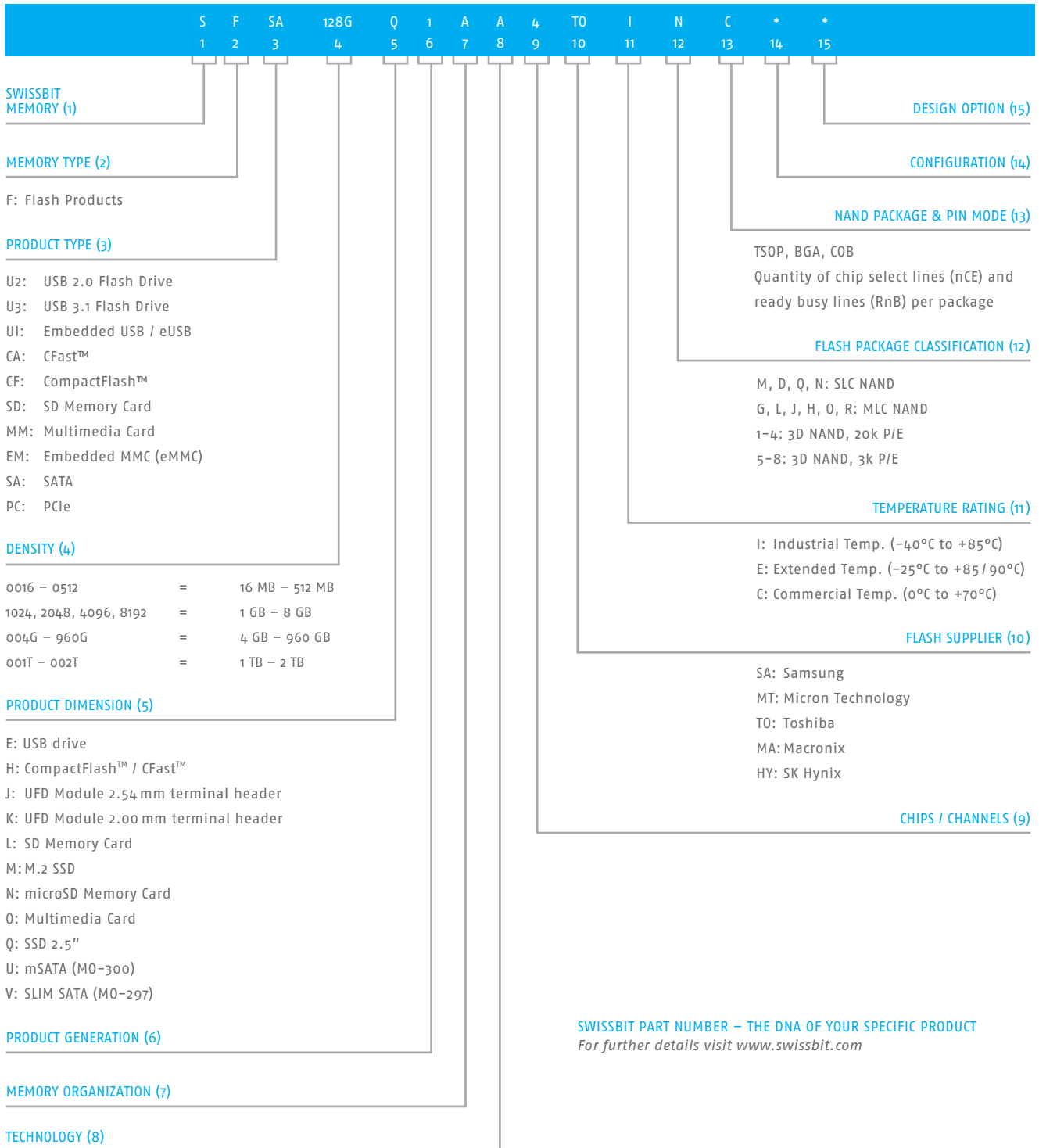
ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 %	5 V ± 10 %	3.3 V ± 5 %	
POWER CONSUMPTION	typ 500 mA max 960 mA Idle 115 mA DEVSLP 35 mA	typ 450 mA max 750 mA Idle 110 mA DEVSLP 55 mA	typ 420 mA max 480 mA Idle 110 mA DEVSLP 35 mA	typ 500 mA max 960 mA Idle 115 mA DEVSLP 35 mA

FEATURE LIST

FEATURES & TOOLS	Proven Power Fail Safety NCQ, TRIM Advanced Wear Leveling & Bad Block management In-field firmware update SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring		
PART NUMBER	SFSAxxxxUvAAxss-t-dd- rrr-ccc	SFSAxxxxVvAAxss-t-dd- rrr-ccc	SFSAxxxxMvAAxss-t-dd- rrr-ccc

SWISSBIT PART NUMBER – THE DNA OF YOUR SPECIFIC PRODUCT



CFast™ Cards

CFast™ cards combine the CompactFlash™ (CF) card form factor and the Serial ATA (SATA) interface into a single product. CFast™ cards can replace both HDDs and CompactFlash™ cards in applications requiring small form factors, high endurance and the ability to withstand shock, vibration, extreme temperatures (-40°C to +85°C), and rough environmental conditions. Swissbit's CFast™ cards provide

rugged and easy replaceable storage for embedded and industrial systems. The Swissbit CFast™ card portfolio covers the range from high end SLC based F-600 to the cost/performance optimized F-50. With an equal feature set as the 2.5" X-60 SSD, the F-60 MLC product and F-66 pSLC card are perfect devices for high performance and endurance and lowest total cost of ownership.



	Lightning Bolt	Hammer	Camera	Printer	Fan	Thermometer	Padlock	Scales	Book	Microscope	Crown	Infinity	WAF	
F-600	●	●	●	★	●	○	●	★	●	●	●	★	○	●
F-60 / F-66	●	●	●	★	●	○	●	★	●	●	●	★	○	●
F-50 / F-56	●	●	●	★	●	○	●	★	●	●	●	●	○	○
F-240	●	●	●	★	○	○	○	★	●	★	●	○	●	○

★ Industry Leading; ● default implemented; ○ on request; ○ not available

F-600

F-60 / F-66

F-50 / F-56

F-240



GENERAL INFORMATION

TYPE	CFast™ CARD			
INTERFACE	CFast™ 2.0 – SATA III – 6 Gbit/s			CFast™ 1.0 – SATA II – 3 Gbit/s
DATA TRANSFER MODE	ATA8			ATA7
CONNECTOR	CFast™ Type I			
OUTLINE DIMENSIONS	36.4 x 42.8 x 3.6 mm			
FLASH TYPE	SLC	MLC durabit™ / pSLC everbit™	MLC / pSLC	SLC
DENSITY RANGE	8 GB – 64 GB	MLC: 8 GB – 240 GB pSLC: 16 GB – 120 GB	MLC: 8 GB – 256 GB pSLC: 4 GB – 128 GB	2 GB – 64 GB
DATA RETENTION	10 years @ life begin 1 year @ life end			
ENDURANCE ENTERPRISE WL	8.7 TBW per GB drive capacity	0.6 TBW / 3.8 TBW per GB drive capacity	0.04 TBW / 0.32 TBW per GB drive capacity	100,000 P/E cycles (Flash cell level)

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C			
STORAGE TEMPERATURE	-40°C to +85°C			

PERFORMANCE

BURST RATE (MB/S)	up to 600	up to 600	up to 600	up to 300
SEQUENTIAL READ (MB/S)	up to 520	up to 520 / 520	up to 500 / 510	up to 120
SEQUENTIAL WRITE (MB/S)	up to 245	up to 180 / 415	up to 330 / 415	up to 120
RANDOM 4KB READ (IOPS)	up to 76,000	up to 72,000 / 80,000	up to 53,000 / 32,000	up to 3,200
RANDOM 4KB WRITE (IOPS)	up to 54,000	up to 43,000 / 75,000	up to 74,000 / 66,000	up to 75

ROBUSTNESS

MTBF	≥ 2,000,000 hours			≥ 2,500,000 hours
SHOCK	1,500 G, 0.5 ms			1,500 G
VIBRATION	50 G, 131-2,000 Hz			20 G
HUMIDITY	85 % RH 85°C, 1,000 hrs			

ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 %			
POWER CONSUMPTION	typ 450 mA max 715 mA Idle 105 mA DEVSLP 35 mA	typ 400 mA max 495 mA Idle 110 mA DEVSLP 35 mA	typ 290 mA max 420 mA Idle 75 mA DEVSLP 35 mA	typ 500 mA max 960 mA Idle 115 mA PHYSLP <25 mA

FEATURE LIST

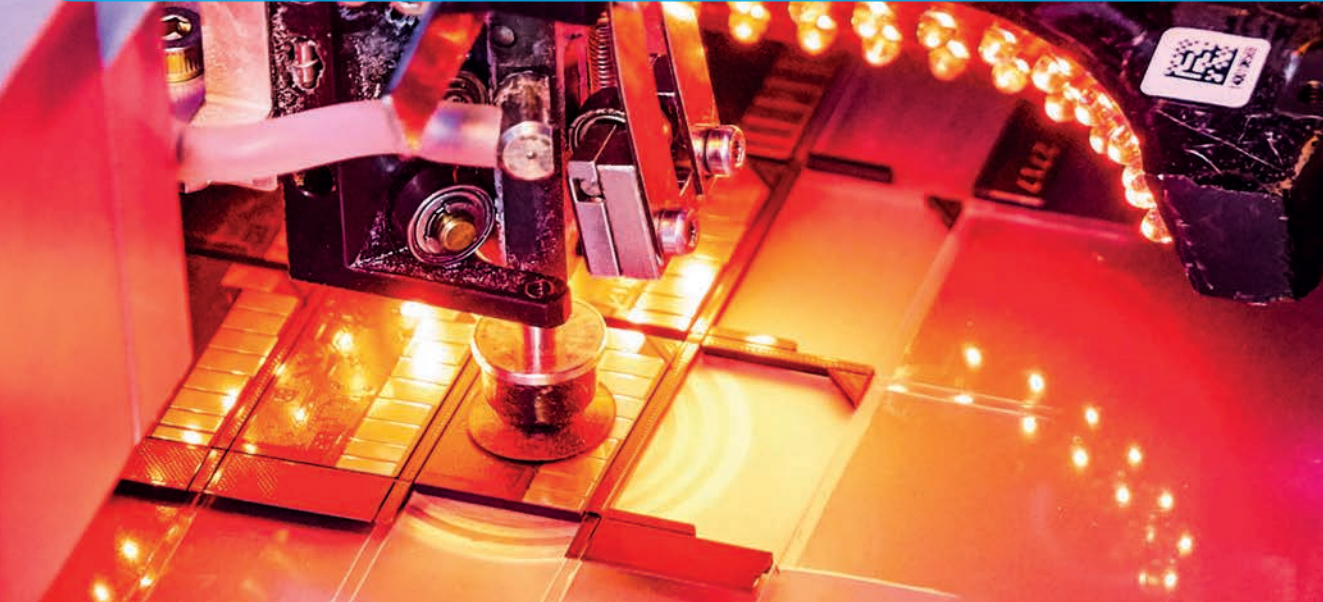
FEATURES & TOOLS	<p>Proven Power Fail Safety NCQ, TRIM</p> <p>Advanced Wear Leveling & Bad Block management In-field firmware update</p> <p>SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring</p>	<p>Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block management Read Disturb Management TRIM Low Power Consumption Security & SBZoneProtection features available SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring</p>	
PART NUMBER	SFCxxxxHvAAxss-t-dd-rrr-ccc		SFCxxxxHvBVxss-t-dd-rrr-ccc

CompactFlash™

To this day, CompactFlash™ (CF) cards are widely used as boot and data logging devices in many NetCom and industrial applications.

Swissbit's dedication to these markets is shown by the broad portfolio and continuing support of various CF cards. Swissbit products are developed with a strong focus on quality, reliability, robustness, and longevity.

Swissbit's CF Series C-3x0 and C-4x0 are offered in both commercial (0°C to +70°C) and industrial (-40°C to +85°C) temperature ranges. The most recent CF card product family is the C-300 Longevity series, which offers maximum long-term availability (until at least 2021). The impressive feature list and proven high quality has convinced many customers to rely on Swissbit solutions for their CompactFlash™ based applications.



C-300	●	●	●	●	○	○	★	●	○	○	●
C-300 LONGEVITY	●	●	●	★	○	○	★	●	●	○	★
C-320	●	●	●	●	○	○	★	●	○	○	●
C-440	●	●	●	★	○	○	★	●	★	★	●

★ Industry Leading; ● default implemented; ○ on request; ○ not available

C-300

C-300L

C-320

C-440



LONGEVITY



UDMA6 CF

GENERAL INFORMATION

TYPE	COMPACTFLASH™ CARD			
INTERFACE	CFA4.1			CFA5.0
DATA TRANSFER MODE	True IDE / PC card – Up to UDMA4, MDMA4 & PIO6			True IDE / PC card – Up to UDMA6, MDMA4 & PIO6
CONNECTOR	CFC Type I			
OUTLINE DIMENSIONS	36.4 x 42.8 x 3.3 mm			
FLASH TYPE	SLC			
DENSITY RANGE	128 MB – 8 GB	32 MB – 8 GB	2 GB – 32 GB	2 GB – 64 GB
DATA RETENTION	10 years @ life begin 1 year @ life end			
ENDURANCE	100,000 P/E Cycles (Flash Cell Level)			

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	-50°C to +100°C

PERFORMANCE

BURST RATE (MB/S)	up to 66	up to 66	up to 66	up to 133
SEQUENTIAL READ (MB/S)	up to 37	up to 37	up to 45	up to 65
SEQUENTIAL WRITE (MB/S)	up to 20	up to 20	up to 35	up to 40
RANDOM 4KB READ (IOPS)	up to 3,300	up to 3,300	up to 2,800	up to 2,400
RANDOM 4KB WRITE (IOPS)	up to 40	up to 50	up to 44	up to 300 (with TRIM)

ROBUSTNESS

MTBF	≥ 3,000,000 hours
SHOCK	1,500 G
VIBRATION	20 G
HUMIDITY	85 % RH 85°C, 1,000 hrs

ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 % 5 V ± 10 %			
POWER CONSUMPTION	PIO typ 50 mA @ 3.3 V DMA typ 70 mA @ 3.3 V DMA typ 110 mA @ 5 V	PIO typ 60 mA @ 3.3 V DMA typ 90 mA @ 3.3 V DMA typ 130 mA @ 5 V	PIO typ 60 mA @ 3.3 V DMA typ 80 mA @ 3.3 V DMA typ 90 mA @ 5 V	

FEATURE LIST

FEATURES & TOOLS	Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block management Security & SBZoneProtection features available SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring	Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block management Read Disturb Management TRIM Security & SBZoneProtection features available SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring		
PART NUMBER	SFCFxxxxHxBKxss-t-xx- rrr-ccc	SFCFxxxxHxBKxss-t-xx- rrr-ccc	SFCFxxxxHxB0xss-t-dd- rrr-ccc	SFCFxxxxHvBUxss-t-dd- rrr-ccc

SD Memory Cards

Secure Digital (SD) memory cards have a widespread use in industrial and automotive applications, ranging from read only applications as in navigation systems to utilization as boot media, for video recording or data logging. Swissbit's Industrial Secure Digital (SD) card series are designed for high sustained performance and endurance and are manufactured and tested in Swissbit's own fab to withstand extreme

environmental conditions. The SLC based S-450 offers best sequential performance and highest endurance, while the durabit™ S-45 and the everbit™ S-46 series rely on MLC NAND. They combine an industry leading controller with sub-page based firmware and achieve unprecedented random write performance. A long list of hardware and firmware features make these cards the best available choice.



	Lightbulb	Lightning Bolt	Hammer	Gear	Fan	Padlock	Scale	Book	Crown	Infinity	WAF
S-200 / 220	●	●	●	●	○	★	●	○	○	●	○
S-45	●	●	●	★	●	●	●	★	★	○	★
S-46	●	●	●	★	●	★	●	★	★	○	★
S-450	●	●	●	★	●	★	●	★	★	●	○

★ Industry Leading; ● default implemented; ○ on request; ○ not available

S-200 / 220

S-450

S-45

S-46



GENERAL INFORMATION

TYPE	SD MEMORY CARD (SD / SDHC)		SD MEMORY CARD (SDHC / SDXC)	SD MEMORY CARD (SD / SDHC / SDXC)
INTERFACE DATA TRANSFER MODE	SD 2.0, Class 6 / 10		SD 3.0, Class 10, UHS-I	
CONNECTOR	SD			
OUTLINE DIMENSIONS	32 x 24 x 2.1 mm			
FLASH TYPE	SLC		MLC durabit™	pSLC everbit™
DENSITY RANGE	512 MB – 2 GB (SD) 4 GB – 8 GB (SDHC)	512 MB – 2 GB (SD) 4 GB – 32 GB (SDHC)	4 GB – 32 GB (SDHC) 64 GB – 128 GB (SDXC)	2 GB (SD) 4 GB – 32 GB (SDHC) 64 GB (SDXC)
DATA RETENTION	10 years @ life begin 1 year @ life end			
ENDURANCE	100,000 P/E Cycles (Flash Cell Level)		3,000 P/E Cycles (Flash Cell Level)	20,000 P/E Cycles (Flash Cell Level)

TEMPERATURE

OPERATING TEMPERATURE	Extended: -25°C to +85°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	-40°C to +100°C

PERFORMANCE

BURST RATE (MB/S)	up to 25	up to 104	up to 104	up to 104
SEQUENTIAL READ (MB/S)	up to 24	up to 90	up to 40	up to 50
SEQUENTIAL WRITE (MB/S)	up to 19	up to 75	up to 12	up to 55
RANDOM 4KB READ (IOPS)	up to 1,400	up to 1,200	up to 750	up to 1,350
RANDOM 4KB WRITE (IOPS)	up to 90	up to 30	up to 650	up to 1,400

ROBUSTNESS

MTBF	≥ 3,000,000 hours		
SHOCK	1,000 G	1,500 G	
VIBRATION	15 G	50 G	
HUMIDITY	85 % RH 85°C, 1,000 hrs		

ELECTRICAL DATA

VOLTAGE	2.7 – 3.6 V Normal		
POWER CONSUMPTION	Read typ 40 mA Write typ 65 mA	Read typ 75 mA Write typ 75 mA	








FEATURE LIST

FEATURES & TOOLS	Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block management Diagnostic features & Life Time Monitoring through SD / SPI command set	Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block management Autonomous Data Care Management SBLTM Tool & SDK for detailed Life Time Monitoring
PART NUMBER	SFSDxxxxLVBNxss-t-dd-rrr-ccc	SFSDxxxxLxBMxss-t-dd-rrr-ccc

microSD Cards

Manufactured in Swissbit's own fab with chip on board technology and based on a dedicated industrial controller and reliable NAND flash, the microSD memory cards withstand extreme environmental conditions and provide the highest level of mechanical stability and enhanced ESD protection. Furthermore, the hard gold SD connectors endure a minimum of 20,000 insertion cycles.

The different series in SLC technology (S-300u, S-200u and S-450u) as well as the MLC products S-45u and the pSLC configuration S-46u feature a long list of hardware and firmware improvements. Sub-page based firmware, known under the durabit™ and everbit™ brands, enables unprecedented endurance and random write performance for MLC based products. The Swissbit Life Time Monitor support allows you to choose the perfect product for your use case.

											
S-300u	●	●	●	○	●	●	●	●	○	●	○
S-200u	●	●	●	●	●	★	●	○	○	●	○
S-45u	●	●	●	★	●	●	●	★	★	○	★
S-46u	●	●	●	★	●	★	●	★	★	○	★
S-450u	●	●	●	★	●	★	●	★	★	●	○

★ Industry Leading; ● default implemented; ○ on request; ○ not available

S-300u

S-200u

S-450u

S-45u

S-46u



GENERAL INFORMATION

TYPE	microSD MEMORY CARD SD / SDHC	microSD MEMORY CARD SD	microSD MEMORY CARD SD / SDHC	microSD MEMORY CARD SDHC / SDXC	microSD MEMORY CARD SD / SDHC
INTERFACE DATA TRANSFER MODE	SD 2.0, Class 6 / 10	SD 2.0, Class 6		SD 3.0, Class 10, UHS-I	
CONNECTOR	microSD				
OUTLINE DIMENSIONS	15 x 11 x 0.7 / 1 mm				
FLASH TYPE	SLC			MLC durabit™	pSLC everbit™
DENSITY RANGE	1 GB - 2 GB (SD) 4 GB - 8 GB (SDHC)	512 MB - 2 GB (SD)	512 MB - 2 GB (SD) 4 GB - 8 GB (SDHC)	4 GB - 32 GB (SDHC) 64 GB (SDXC)	2 GB (SD) 4 GB - 16 GB (SDHC)
DATA RETENTION	10 years @ life begin 1 year @ life end				
ENDURANCE	100,000 P/E Cycles (Flash Cell Level)			3,000 P/E Cycles (Flash Cell Level)	20,000 P/E Cycles (Flash Cell Level)

TEMPERATURE

OPERATING TEMPERATURE	Extended: -25°C to +85°C Industrial: -40°C to +85°C				
STORAGE TEMPERATURE	-40°C to +85°C	-40°C to +100°C			

PERFORMANCE

BURST RATE (MB/S)	up to 25	up to 25	up to 104	up to 50	up to 104
SEQUENTIAL READ (MB/S)	up to 24	up to 21	up to 80	up to 40	up to 48
SEQUENTIAL WRITE (MB/S)	up to 22	up to 18	up to 75	up to 12	up to 48
RANDOM 4KB READ (IOPS)			up to 1200	up to 750	up to 1350
RANDOM 4KB WRITE (IOPS)			up to 30	up to 650	up to 1400

ROBUSTNESS

MTBF	≥ 3,000,000 hours				
SHOCK	1,500 G				
VIBRATION	50 G				
HUMIDITY	93 % RH 40°C, 500 hrs	85 % RH 85°C, 1,000 hrs			

ELECTRICAL DATA

VOLTAGE	2.7 - 3.6 V				
POWER CONSUMPTION	Read typ 50 mA Write typ 50 mA	Read typ 30 mA Write typ 40 mA		Read typ 100 mA Write typ 100 mA	

FEATURE LIST

FEATURES & TOOLS	Proven Power Fail Safety Advanced Wear Leveling & Bad Block management	Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block Management Diagnostic features Life Time Monitoring	Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block management Autonomous Data Care Management SBLTM Tool & SDK for detailed Life Time Monitoring		
PART NUMBER	SFSDxxxxNxBWxss-t-ddrrr-ccc	SFSDxxxxNxBNxss-t-ddrrr-ccc	SFSDxxxxNxBMxss-t-dd-rrr-ccc		

Managed NAND

Small form factor embedded systems have often used NAND components which were directly interfaced and managed by the host controller software. With increasing complexity of NAND devices and their management this task has become a challenge.

Managed NAND is the solution: a single small size BGA component incorporates multiple Flash dies, a NAND controller and the management firmware and eases the integration.

Swissbit's e.MMC EM-20 family covers multiple densities and interface speeds. It fulfills the JEDEC 5.0 standard and offers a reliable and stable storage product with true industrial operating temperature. Sophisticated NAND management makes the EM-20 ideal for applications like POS/POI, PLC, IoT, gaming, medical, or as a general boot medium for embedded applications.



EM-20 / EM-26



★ Industry Leading; ● default implemented; ● on request; ○ not available

EM-20 / EM-26



GENERAL INFORMATION

TYPE	E.MMC
STANDARD & INTERFACE	JEDEC e.MMC 5.0 Standard (JESD84-B50), 1-bit, 4-bit, 8-bit up to HS400
PACKAGE	153-ball BGA, 0.5mm pitch
OUTLINE DIMENSIONS	11.5 x 13 x 1 mm
FLASH TYPE	MLC / pSLC reliable mode
DENSITY RANGE	4 GB – 64 GB MLC / 2 GB – 32 GB pSLC
DATA RETENTION	10 years @ life begin 1 year @ life end
ENDURANCE	3,000 P/E cycles MLC mode / 20,000 P/E cycles reliable mode (Flash Cell Level)

TEMPERATURE

OPERATING TEMPERATURE	Industrial: -40°C to +85°C
STORAGE TEMPERATURE	-40°C to +85°C

PERFORMANCE

BURST RATE	up to 400
SEQUENTIAL READ (MB/S)	up to 270
SEQUENTIAL WRITE (MB/S)	up to 160
RANDOM 4KB READ (IOPS)	up to 5,900
RANDOM 4KB WRITE (IOPS)	up to 2,100

ELECTRICAL DATA

VOLTAGE	VCCQ: 1.70-1.95V / 2.70-3.60V ; VCC: 2.70-3.60
POWER CONSUMPTION	Typ. Read Current: 180 mA @ 1.8V VCCQ, 38mA @ 3.3V VCC Typ. Write Current: 105 mA @ 1.8V VCCQ, 80mA @ 3.3V VCC Standby: 20 mA

FEATURE LIST

FEATURES & TOOLS	High performance up to HS400 mode Sophisticated Wear Leveling & Read Disturb Management Page based FTL Management Production State Awareness Proven Power Fail Safety Security features – secure erase & RPMB
PART NUMBER	SFEMxxxGB1EAXss-l-dd-rrr-ccc

USB Products

The Universal Serial Bus (USB) is still a widely used interface for NetCom system booting or for update and licensing purposes. Swissbit offers USB 2 and USB 3 products in different form factors and in commercial and industrial operating temperature ranges. State-of-the-art NAND flash handling algorithms, stringent component selection, PCN control, and a 100% final system test at full temperature range (-40°C to 85°C)

qualify Swissbit's USB Flash Drive (UFDs) for embedded and NetCom markets.

All Swissbit USB solutions combine security features and Life Time Monitoring tools for product life control.

USB products are available in SLC, MLC and pSLC technology to meet the endurance and speed requirements of the different use cases.



	Temperature Control	High Speed	Shock Resistant	Secure Boot	USB Security	Secure Scales	Life Time Monitoring
U-50 / U-56 / U-45 / U-46	●	○	●	●	●	●	○
U-500 / U-400	●	○	●	●	●	●	●
U-500k / U-56k / U-50k	●	●	●	●	●	●	●

● default implemented; ● on request; ○ not available

U-500 / U-56 U-50



U-400 / U-46 U-45



U-500k / U-56k U-50k



GENERAL INFORMATION

TYPE	eUSB FLASH MODULE	eUSB FLASH MODULE	USB FLASH DRIVE
INTERFACE	USB 3.1	USB 2.0	USB 3.1
DATA TRANSFER MODE	Super Speed / High / Full	High / FullSpeed	Super Speed / High / Full
CONNECTOR	Standard: 2.54 mm –10 Pin (key option) Low Profile: 2.00 mm –10 Pin (key option)		USB 3.0 Type A-Plug
OUTLINE DIMENSIONS	Standard: 36.8 mm x 26.65 mm x 9.7mm Low Profile: 36.8 mm x 26.65 mm x 6.0mm		68.0 mm x 18.0 mm x 8.2 mm
FLASH TYPE	SLC / pSLC everbit™ / MLC durabit™		
DENSITY RANGE	SLC: 4 GB – 32 GB pSLC: 4 GB – 32 GB MLC: 8 GB – 64 GB	SLC: 1 GB – 32 GB pSLC: 2 GB – 16 GB MLC: 4 GB – 32 GB	SLC: 2 GB – 32 GB pSLC: 8 GB – 64 GB MLC: 16 GB – 128 GB
DATA RETENTION	10 years @ life begin 1 year @ life end		
ENDURANCE	100k / 20k / 3k P/E Cycles (Flash Cell Level)		

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	-40°C to +100°C

PERFORMANCE

BURST RATE (MB/S)	up to 625	up to 60	up to 625
SEQUENTIAL READ (MB/S)	up to 175 / 170 / 140	up to 36 / 39 / 23	up to 175 / 170 / 140
SEQUENTIAL WRITE (MB/S)	up to 95 / 90 / 60	up to 27 / 29 / 18	up to 95 / 90 / 60
RANDOM 4KB READ (IOPS)	up to 3,050 / 3,200 / 2,500	up to 1,600 / 1,800 / 1,400	up to 3,050 / 3,200 / 2,500
RANDOM 4KB WRITE (IOPS)	up to 1,000 / 1,050 / 700	up to 30 / 800 / 550	up to 1,000 / 1,050 / 700

ROBUSTNESS

MTBF	≥3,000,000 hours	
SHOCK	1,500 G	1,500 G
VIBRATION	50 G	20 G
HUMIDITY	85% RH 85°C, 500 hrs	

ELECTRICAL DATA

VOLTAGE	3.3 V ±5 % / 5 V ±10 %	5 V ± 10 %
POWER CONSUMPTION	Full Speed typ 70 mA High Speed typ 80 mA	

FEATURE LIST

FEATURES & TOOLS	Proven Power Fail Safety Windows / Linux – Spare block read out Bootable USB Drive Supports latest OS as Fixed Drive Connector pitch & key variations available Shock & vibration resistant	
	Support as Fixed Drive Connector pitch and key variations available	Hot pluggable removable drive
PART NUMBER	2.54 mm: SFU1xxxxJxAEExss-t-dd-rrr-ccc 2.00 mm: SFU1xxxxKxAEExss-t-dd-rrr-ccc	2.54 mm: SFU1xxxxJvABxss-t-dd-rrr-ccc 2.00 mm: SFU1xxxxKvABxss-t-dd-rrr-ccc SFU3xxxxEvAEExss-t-dd-rrr-ccc

SECURITY PRODUCTS

SECURITY SOLUTIONS

Security is becoming mandatory in diverse markets. Data breaches and compromised IT environments are becoming a reality.

Legal requirements force solution providers to use state-of-the-art security concepts. In Germany DSGVO or pan-European GDPR are legally binding data protection laws that need to be fulfilled. If critical systems fail or sensitive data leak, severe fines and penalties are imminent. Recent security alerts like Spectre, Meltdown and other severe problems like vulnerability of the ubiquitous Intel Management Engine clearly demonstrate that security cannot just be placed somewhere in an appendix of a product specification but needs to be part of the DNA of each product. While PC systems are easily maintained by on-

line-distributed SW packages, industrial and automotive systems still suffer low maintenance cycles and therefore stay vulnerable over a longer period. The Industrial IoT has highest requirements on quality and security. Always-on devices taking over more and more responsibility in our everyday life offer huge attack surfaces that need highest security and at the same time ease of maintenance over the complete life cycle. Flexible and intuitive secure update concepts as well-trusted boot security are efficiently implemented based on the combination of security and storage by Swissbit products.

SWISSBIT OFFERS PRODUCT RELATED SERVICES:

- SECURITY FIRMWARE AND DRIVERS
- LOGO PRINTING
- OPTICAL AND ELECTRONIC PERSONALIZATION
- DESIGN-IN OF CONSIGNED SMART CARD CHIPS

AS WELL AS EXTENDED SERVICES:











- SECURITY CONSULTING
- SECURITY TRAINING
- CUSTOMER SUPPORT
- DESIGN-IN SUPPORT
- CONNECTION WITH ECO-SYSTEM PARTNER NETWORK FOR TURN KEY SOLUTIONS AND QUICK TIME TO MARKET



SECURITY PRODUCTS

The security product series in microSD and SD form factors addresses the growing demand for mobile, portable and industrial security. The products offer tangible hardware security in the same manner as the plug and play approach. For various markets, Swissbit offers a broad set of security use cases. The flash memory can be used by any host to store data on the cards at high speed. Additional security functions of the card can be activated to protect any data.

Valuable data such as sensitive files, emails, photos, OS images, firmware updates, log files and audit trails can be protected by encryption, access protection, or made resistant to tampering by digital signature. Voice and video calls as well as data streams for M2M communication can be protected by the card in high speed. The best fitting product can be chosen depending on the use case.

										
SE	●	●	●	●	●	○	○	○	○	○
VE	●	●	●	●	●	●	●	○	○	○
FE	●	●	●	●	●	●	●	○	○	○
PE	●	●	●	●	●	●	●	●	●	●
DP	○	○	○	○	○	○	○	●	●	●
WE	○	●	○	○	○	○	○	○	●	●

★ Industry Leading; ● default implemented; ○ on request; ○ not available

SECURITY EDITIONS



STANDARD EDITION SE

The Standard Edition SE fits best into authentication and PKI (Public Key Infrastructure) use cases. The card is supported by leading middleware vendors in mobile, desktop, and tablet use cases to ensure a seamless design-in into existing security infrastructures.



VOICE EDITION VE

The Voice Edition VE provides Elliptic Curve Cryptography. The enormous advantage of computation and security combined with small certificate sizes makes a VE card ideal for online key and certificate exchange.



PREMIUM EDITION PE

The Premium Edition PE combines high end smartcard security with state of the art data protection like CD-ROM, WORM, hidden storage. Data can be protected and digitally signed and fully AES encrypted in one device.



DATA PROTECTION DP

The Data Protection DP cards offer state of the art data protection. All data stored in the card is AES encrypted in high speed and can be protected by various options like CD-ROM, PIN protected data, hidden storage, WORM data area.



FE CARDS

FE cards provide a secure element according to FIPS 140-2 certification. US governmental organizations and enterprises that need to follow the FIPS 140-2 security standard.



WORM CARDS

WORM cards can be written once and read multiple times. Typical use cases for WORM are secure transaction logging as in cash registers or audit trails. All records are hash chained and can be digitally signed to prove origin. Once written, the individual records cannot be modified or deleted. The storage can be fully accessed with the administrator key provided to the respective authorities.

SE / VE / PE

FE

SECURITY	<p>Infineon SLE 78 smart card chip CC EAL 5+ HW and OS</p> <p>Java card 3.0.4 Global Platform 2.2.1</p> <p>RSA up to 2048 bit optional ECC up to 512 / 521 bit AES up to 256 bit SHA2 up to 512 bit RNG AIS31, FIPS-140</p> <p>Compatible Middleware: • AET SafeSign • Charismathics • Cryptovision</p>	<p>Infineon SLE 78 smart card chip FIPS 140-2 level 3</p> <p>Java card V2.2.x (ext. of V3.0) Global Platform 2.2.1 Gemalto ID Core 30</p> <p>RSA up to 2048 bit ECC up to 512 / 521 bit AES up to 256 bit SHA2 up to 512 bit</p> <p>Compatible Middleware: • Gemalto</p>
	80 k EEPROM secure storage	160 k EEPROM secure storage
DRIVERS / API	Windows, Mac, Linux, Android SDK available PKCS#11 Middleware	Windows, Mac, Linux, BlackBerry, Android SDK available

PS-100u PS-45 PS-45u PS-46 PS-46u PS-450 PS-450u

COMPLIANCE	SD 3.0 SD, ASSD V1.1							
DATA TRANSFER	SPI mode supported Speed class 10	UHS-1 Speed class 10						
TEMPERATURE	-25°C to 85°C							
COMPATIBLE TO	S-100u	S-45	S-45u	S-46	S-46u	S-450	S-450u	
FLASH TYPE	MLC	MLC		pSLC		SLC		
DENSITY	SE / VE / FE / PE	8 GB – 16 GB	8 GB – 16 GB	8 GB – 16 GB	4 GB – 8 GB	4 GB – 8 GB	4 GB – 32 GB	512 MB – 2 GB
	DP	8 GB – 32 GB	4 GB – 64 GB	4 GB – 32 GB	4 GB – 32 GB	4 GB – 16 GB	4 GB – 32 GB	512 MB – 8 GB

SECURITY PRODUCT MATRIX		SE Standard Edition	VE Voice Edition	FE FIPS Edition	PE Premium Edition	DP Data Protection
MOBILE / PC	PS-100u microSD	8 GB – 16 GB	8 GB – 16 GB	8 GB – 16 GB		8 GB – 32 GB
MEDICAL AUTOMOTIVE IoT	PS-45 SD	8 GB – 16 GB	8 GB – 16 GB	8 GB – 16 GB	8 GB – 16 GB	8 GB – 64 GB
	PS-45u microSD	8 GB – 16 GB	8 GB – 16 GB	8 GB – 16 GB	8 GB – 16 GB	8 GB – 32 GB
	PS-46 SD	4 GB – 8 GB	4 GB – 8 GB	4 GB – 8 GB	4 GB – 8 GB	4 GB – 32 GB
	PS-46u microSD	4 GB – 8 GB	4 GB – 8 GB	4 GB – 8 GB	4 GB – 8 GB	4 GB – 16 GB
INDUSTRIAL	PS-450 SD	4 GB – 32 GB	4 GB – 32 GB	4 GB – 32 GB	4 GB – 32 GB	4 GB – 32 GB
	PS-450u microSD	0.5 GB – 2 GB	0.5 GB – 2 GB	0.5 GB – 2 GB	0.5 GB – 2 GB	0.5 GB – 2 GB

SIP (SYSTEM-IN-PACKAGE)



DESCRIPTION

System-in-Package (SiP) is the processing of sensitive bare dies or chips into robust finished modules or components.

With 25 years of experience, Swissbit successfully uses advanced packaging technologies to achieve the smallest form factors and to build multi-chip-packages. With this electronic integration approach, our products provide more functionality inside one package, various functional blocks (RF, digital, sensors, security, and memory) as well as passive components are combined. Having all necessary capabilities in-house we have the best design for reliability, test and production.

For our memory products we developed processes for stacking multiple large dies and wire bonding the smallest bond pads. Swissbit's technology portfolio combined with its strong engineering knowhow and experience enables new,

innovative MCP (Multi Chip Packages) / SiP / COB configurations like stacked dies, side-by-side, sensors integration, and much more.

Our customers benefit from reduced development cost and higher yields and reliability. We use advanced packaging technology which allows production of small volume series (up to 50,000 pieces/month) with short lead-times and in-time delivery.

Swissbit produces and develops according to ISO 9001:2015, IATF 16949, ISO 5001:2011 and ISO 14001:2015 approved processes and is an experienced partner in global industrial and automotive accounts.



SYSTEM-IN-PACKAGE BENEFITS:

- REDUCED PROCESS COMPLEXITY
- LOWER TCO (TOTAL COST OF OWNERSHIP)
- REDUCED SYSTEM BOARD SPACE
- LAYER COUNT REDUCTION OF SYSTEM PCB
- REDUCED BOARD MOUNTED HEIGHT
- MIXED ANALOG / DIGITAL DESIGN
- REDUCED SYSTEM BOARD TEST COMPLEXITY



SUBSTRATE / PCB

- Fine etch
- Low overall thickness



DIE BONDING

- Multi & single chip
- Thin die (> 50um)
- Large die 15 x 15 mm



TRANSFER MOLDING

- Large area map
- Top-foil
- MicroSD, BGA, LGA



SMT

- 01005 passives
- Cleaning



WIRE BONDING

- Au, Ag-alloy, AL wire
- 17.5 – 32 um wire
- Chain bonding



SINGULATION

- Sawing
- Laser cutting



DIE ATTACH

- DAF tape
- Stencil print
- Dispensing



ENCAPSULATION

- Dam & Fill
- Underfill
- Glob top



MARKING

- Laser marking
- Tampon print
- Labelling

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