

Reliable Storage & Embedded IoT Solutions



**Industry • Automotive • Security
Networking & Communication • IoT**

About Swissbit

Store. Secure. Trust.

Data is the fuel of the future and is driving global growth and change. As trusted partner Swissbit empowers the digital and connected world by reliably storing and protecting data in industrial, security and IoT applications. As a leader in industrial storage and embedded IoT (Internet of Things) solutions, Swissbit develops and manufactures true industrial storage and security products "Made in Germany" with long-term availability, high reliability, custom optimization and low total cost of ownership.

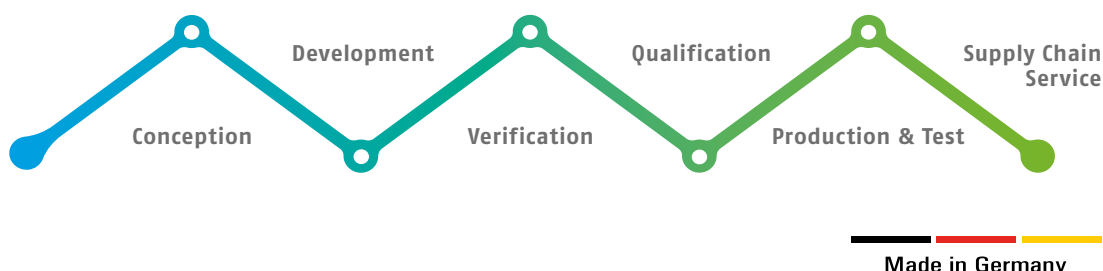
20 Years of Swissbit: a Unique Success Story ... and it Will Keep On Going !



More than 5,000 customers around the world including Fortune 500 companies and the world's leading OEM's already rely on Swissbit for their critical data storage and security requirements. With 20 years of experience in the development of removable & embedded storage and embedded IoT solutions for the most demanding markets, coupled with a trusted global distribution and support network, Swissbit is firmly established as a global innovation leader in storage and security products for high-reliability solutions.

Made in Germany

New technological trends are driving the demand for highly integrated solutions and advanced packaging technologies. Digitization will increase the demand for industrial memory products for industrial, telecommunications, automotive (e.g. autonomous driving), medical, and fiscal applications. In addition, the growing connectivity of devices in the Internet of Things means that the demands on the protection of data and devices, and thus the demand for smart security products, will increase massively. Swissbit has prepared for this with new state-of-the-art production capacities at the new plant in Berlin, Germany.



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A large orange industrial robotic arm is the central focus, positioned in a factory setting. The arm is mounted on a base and has a white protective cover on its upper section. It is surrounded by various cables and mechanical components. The background shows the interior of a large industrial building with a high ceiling and orange structural beams.

Applications

Industry

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.



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




Applications

Internet of Things

Memory and non-volatile storage solutions for edge computing must work uninterrupted and with a long service interval. Edge computing systems experience wide temperature ranges, shock, and vibration. Remotely installed sensors, actuators and communication channels need to have local storage for pre-processing of big data, temporary storage for optimized

network usage, and format conversion. Stored data as well as Internet of Things (IoT) devices must be protected against manipulation or theft. The storage product must provide a high bandwidth for small block write operations. The life time status of the storage device must be controllable by local maintenance routines.



Swissbit provides the perfect rugged and reliable small form factor storage products for edge computing systems. The Swissbit SD, microSD, eMMC, and USB products offer the right storage capacity, longevity, and operation temperature range for remotely installed systems. Swissbit security products can be used as a TPM-like, hardware-based root of trust to give IoT devices a unique ID and protect access, boot code, communication, and stored data.

Typical Applications:

- Industrial connectivity
- Manufacturing / IIoT
- Remote sensors
- Remote actuators
- Surveillance
- Point of Sale (POS)
- Smart infrastructure
- Mobility

Applications

Networking & Communication



Reliability: Storage solutions for Networking and Communication systems must provide reliable operation even in the most extreme conditions: wide temperature changes, sudden power interruptions, environmental influence.

Data integrity: Boot devices may be inactive for months and need to bring back the system after an unexpected power loss quickly and reliably. The storage data rate must remain high with fully utilized capacity.

Customized for NetCom: Small form factors with rather low densities and high endurance ask for specialized solutions while keeping the total cost of ownership low.

Longevity: Legacy interfaces still need to be supported, and qualification requirements of new products are among the most demanding in the storage industry.



Today's modern life can't be imagined without a wide and stable network for data access, distribution and storage. Exabytes of data travel daily through the internet, zettabytes are already stored. Millions of routers and bridges are spread out over the globe bringing internet access to even the most remote location. 5G technology requires a much higher number of small form factor edge devices to reach out to the end users and connected devices. Those networking and communication systems need to operate 24/7 and sometimes under extreme environmental conditions including poor power supply stability. Since many edge devices are positioned on high and prominent locations that are difficult to maintain, the service interval must be extended.

Typical Applications:

- ATCA blade
- Cable modem
- Content and video delivery
- Enterprise media gateway
- Switches and routers
- Optical network
- Radar / Sonar
- Radio network controller
- Security
- Tetra base station
- Wireless base station
- DSL access multiplexer

Applications

Medical



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 ranges from SD/microSD 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 patient's medical data against unauthorized access.

Typical Applications:

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

A man is shown from the side, sitting in the driver's seat of a car. He is looking at a futuristic digital dashboard. The dashboard displays a world map with various data points, a line graph, and other technical information. The background outside the car is blurred, suggesting motion. The overall theme is automotive technology and data.

Applications

Automotive

Reliability and temperature range:

Storage solutions for automotive applications must provide reliable operation even in the most extreme conditions: wide temperature changes, sudden power interruptions, environmental influence.

Customized for automotive applications:

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.

In-car cyber security: Increasingly networked systems and new developments such as autonomous driving require reliable protection of data and the integrity of devices.



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. Products built in Swissbit's IATF 16949 certified fab fulfill the quality requirements of the automotive industry.

Typical Applications:

- Infotainment systems
- Head unit / dashboard
- Black box / crash recorder
- Instrument cluster
- Dashcam

Applications

Security



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 security 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.



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.

Typical Applications:

- Surveillance
- Fiscal data logging
- E-charging
- Audit trails
- License and IP protection
- Secure update
- Secure boot
- 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 page-based firmware block management with a powerful card architecture and configuration settings.

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 life time prediction, thereby avoiding unexpected data loss.



Secure Erase (Sanitize / Purge) / Fast Erase

This feature uses an uninterrupted sequence of data erase commands.



Read-only optimized

For cases where 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 the life time.



Zone Protection

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

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 firmware 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

Digital signatures are very popular and indispensable 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 & E-purse

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.



Pre-sales

Your Future With Our Solution

Our experienced Business Development and Field Application Engineering 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 Life Time Monitor, hardware or firmware customization, middleware development, the provision of evaluation units and ultimately a joint qualification.

Sales

Your Trustworthy Partner

Our experienced Business Development and Field Application Engineering 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 Life Time Monitor, hardware or firmware customization, middleware development, the provision of evaluation units and ultimately a joint qualification.

After-sales

Local Support – Globally

Our engagement stretches far beyond the delivery of our products. Through sophisticated life cycle 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



What is the Customer Benefit?

Highest Robustness

What matters when storage needs to be tough?

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



01

Availability of a full portfolio of storage and security 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 industrial, 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 locked 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

NAND Flash Products

Our sophisticated flash handling algorithms optimize the performance and life of the 2D and 3D NAND flash used in our products.

OEMs 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 the 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 in SATA and PCIe NVMe, USB Flash Drives (UFD), and modules. Our sophisticated flash handling algorithms optimize the performance and life of the SLC, MLC and 3D NAND flash used in our products.

	SLC	everbit™ pSLC	durabit™ MLC	3D pSLC	3D TLC	3D QLC
Chip Capacity
Cost per Bit
Reliability & Endurance
High Temperature Support
Write Performance
Data Retention
Longevity

..... maximum; highest; ... high; .. medium; . low

Flash Life Time 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 and 3D NAND TLC is typically specified as 3,000 PE cycles.

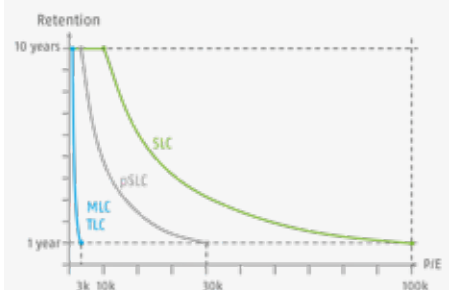
For each write that the host initiates, the flash controller has to perform internal management steps and may need to erase and write multiple blocks even at the smallest external write transfer size. The ratio between internal write data volume and the external request size is called WAF (write amplification factor) and varies strongly between different applications. For a trustworthy prediction of the expected life time the Swissbit Life Time Monitoring Tool (SBLTM) provides detailed information on Flash wear out. It allows an easy extrapolation of the results of a few days of real life testing to determine the expected field life of a Swissbit device.

Endurance specifies the amount of data that can be written to an SSD over the complete lifetime. The value is either given as the total sum in TBW (Terabytes Written) or in Drive Writes per Day (DWPD) over the warranty interval. Retention specifies the time data will still be readable after the SSD has been turned off. Both depend on each other and are separately listed in the Swissbit specifications. The endurance depends very much on the application that is running on the SSD. A mostly random write with small transfers wears out the

drive much more than the equivalent amount of data sequentially written. This is why Swissbit states the endurance for different application types:

- JEDEC Enterprise Workload
- JEDEC Client Workload
- Sequential Write

NAND Retention and 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.

Swissbit offers three different families for different purposes: The 2 lane version N-10m2 with a wide range of densities, the N-20m2 with HMB support and low power consumption and small form factors, and the new high performance 4 lane N-30m2. All versions are dedicated to industrial and NetCom application. They feature thermal and data care management and various security options. All series are also available in pSLC variants with highly increased endurance.

	Wide Temp. Support	ESD & EMI Safe	Shock & Vibration	Life Time Monitor	Secure Erase	Temp. Sensor	Power Loss Protected	Wear Leveling	Read-Only Improved	TRIM Support	Data Care Managed	WAF Reduction
N-10m2 / N-16m2	•	•	•	•	•	•	•	•	•	•	•	•
N-20m2 / N-26m2	•	•	•	•	•	•	•	•	•	•	•	•
N-30m2 / N-36m2	•	•	•	•	•	•	•	•	•	•	•	•

• default implemented



Coming soon

Information

Type	M.2 PCIe / NVMe		
Standard & Interface	PCIe 3.1 / NVMe 1.2	PCIe 3.1 / NVMe 1.3	PCIe 3.1 / NVMe 1.3
Form Factor	M.2 2280 B&M key, 2 lanes	M.2 2280, 2242, 2230 M key, 4 lanes	M.2 2280 M key, 4 lanes
Outline Dimensions	80 x 22 x 2.23 mm	80, 42, 30 x 22 x 3.5 mm	80 x 22 x 3.58 mm
Flash Type	3D NAND TLC / pSLC	3D NAND TLC / pSLC	3D NAND TLC / pSLC
Density Range	120 GB – 960 GB / 40 GB – 320 GB	15 GB – 480 GB / 5 GB – 160 GB	240 GB – 4 TB / 80 GB – 1,200 GB
Data Retention	10 years @ life begin 1 year @ life end		
Endurance [DWPD]*	max 2.17 / 23.9	max. 0.9 / 17.7	Target: 2 / 25

Temperature

Operating Temperature	Commercial: 0 °C to +70 °C Industrial: -40 °C to +85 °C
Storage Temperature	-40 °C to +85 °C

Performance

Sequential Read (MB/s)	up to 1,600 / 1,600	up to 1,770 / 1,750	Target: 3,900
Sequential Write (MB/s)	up to 1,000 / 1,050	up to 830 / 830	Target: 3,200
Random 4KB Read (IOPS)	up to 190,000 / 190,000	up to 140,000 / 140,000	Target: 400,000
Random 4KB Write (IOPS)	up to 190,000 / 190,000	up to 130,000 / 130,000	Target: 550,000

Robustness

MTBF	≥ 2,000,000 hours
Shock	1,500 G, 0.5 ms
Vibration	50 G, 80–2,000 Hz
Humidity	85 % RH 85 °C, 1,000 hrs

Electrical Data

VOLTAGE	3.3 V +- 5 %		
Power Consumption	Max. Read Active: 4.1 W Max. Write Active: 3.6 W Power State 3: < 500 mW	Max. Read Active: 2.7 W Max. Write Active: 2.4 W Power State 3: < 100 mW	Target Read: 5.0 W Target Write: 6.0 W Power State 3: < 100 mW

Feature List

Features & Tools	DRAM support	HMB support (Host Memory Buffer)	DRAM support HW Powerfail Protection Option
	Active and Passive Data Care Management AES 256 / E2E Data protection Power Fail Data Loss 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.) TCG OPAL 2.0 (on request for N-10m2 and N-20m2) Swissbit Life Time Monitoring (SBLTM) Tool and SDK for SBLTM (on request)		
More Information	For more details see www.swissbit.com/product-finder		

* DWPD values are according to JESD219 Client Endurance Workload based on a service life of 3 years

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

The new X-7x range is based on 3D NAND TLC with focus on best TCO. The X-76 is the flagship with 3D NAND pSLC offering best endurance per cost. 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.

	Wide Temp. Support	ESD & EMI Safe	Shock & Vibration	Life Time Monitor	Secure Erase	Conformal Coating	Temp. Sensor	Power Loss Protected	Wear Leveling	Read-Only Improved	TRIM Support	Data Care Managed	Longevity	WAF Reduction
X-600	●	●	●	●	●	○	●	●	●	●	●	★	●	●
X-60 / X-66	●	●	●	●	●	○	●	●	●	●	●	★	○	●
X-70	●	●	●	●	●	○	●	●	●	●	●	●	○	●
X-75 / X-73 / X-76	●	●	●	●	●	○	●	●	●	●	●	★	○	●

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

X-600 / X-66 / X-60



X-75



X-73 / X-76



X-70



Information

Type	2.5" SATA Gen3 SSD			
Interface	SATA Gen3 –6Gbit/s			
Data Transfer Mode	ATA8			
Connector	15 + 7 pin Serial ATA			
Outline Dimensions	100 x 70 x 7 mm			
Flash Type	SLC / pSLC / MLC	3D NAND TLC	3D NAND TLC / pSLC	3D NAND TLC
Density Range	SLC: X-600: 8 GB – 256 GB pSLC: X-66: 16 GB – 480 GB MLC: X-60: 30 GB – 960 GB	60 GB – 1920 GB	X-73: 30 GB – 960 GB X-76: 10 GB – 320 GB	60 GB – 480 GB
Data Retention	10 years @ life begin 1 year @ life end			
Endurance [DWPD]*	36.3 / 15.1 / 2.3	max 0.93	max 0.93 / 22.7	max 2.7

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	

Performance

Sequential Read (MB/s)	up to 520 / 520 / 525	up to 565	up to 565 / 560	up to 560
Sequential Write (MB/s)	up to 425 / 450 / 460	up to 495	up to 495 / 480	up to 465
Random 4KB Read (IOPS)	up to 79,000 / 80,000 / 74,300	up to 73,600	up to 73,600 / 74,000	up to 83,500
Random 4KB Write (IOPS)	up to 76,000 / 75,000 / 77,900	up to 79,400	up to 79,400 / 84,900	up to 66,900

Robustness

MTBF	≥ 2,000,000 hours		
Shock	1,500 G, 0.5 ms		
Vibration	50 G, 80–2,000 Hz		20 G, 80–2,000 Hz
Humidity	85 % RH 85 °C, 1,000 hrs		

Electrical Data

Voltage	5 V ± 10 % / 3.3 V ± 5 %	5 V ± 10 %		
Power Consumption	Read (Active): 2.45 W Write (Active): 3.8 W Idle: 550 mW Slumber: 125 mW	Read (Active): 2.5 W Write (Active): 3.6 W Idle: 500 mW Partial: 175 mW	Read (Active): 2.8 W Write (Active): 3.4 W Idle: 600 mW Partial: 150 mW	Read (Active): 3.0 W Write (Active): 3.1 W Idle: 600 mW Slumber: 200 mW

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 AES 256 Encryption optional	E2E Data Protection AES 256 Encryption optional TCG OPAL optional Proven Power Fail Safety NCQ, TRIM, Data Refresh In-Field Firmware Updates SBLTM Tool & SDK for detailed 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
More Information	For more details see www.swissbit.com/product-finder		

* DWPD values are according to JESD219 Client Endurance Workload based on a service life of 3 years

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 families X-86, X-80, X-75, X-76, 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. The latest additions X-80m2 and X-86m2 are targeting true industrial applications with a robust, reliable, low power module design, based on a dedicated industrial controller and firmware.



	Wide Temp. Support	ESD & EMI Safe	Shock & Vibration	Life Time Monitor	Secure Erase	Conformal Coating	Temp. Sensor	Power Loss Protected	Wear Leveling	Read-Only Improved	TRIM Support	Data Care Managed	Longevity	WAF Reduction
X-600m/s/m2	●	●	●	●	●	○	●	●	●	●	●	●	●	●
X-60 / X-66m/s/m2	●	●	●	●	●	○	●	●	●	●	●	●	○	●
X-75 / X-76m/s/m2	●	●	●	●	●	○	●	●	●	●	●	●	○	●
X-80 / X-86m2	●	●	●	●	●	○	●	●	●	●	●	★	○	●

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



Information

Type	M0-300 mSATA	M0-297 SLIM SATA	M.2 2242	M.2 2260 / 2280
Interface	SATA Gen3 -6Gbit/s			
Data Transfer Mode	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 (MAX)	3.8 mm	4.0 mm		3.58 mm
Flash Type	SLC			
Density Range	8 GB – 128 GB	16 GB – 128 GB	8 GB – 64 GB	16 GB – 128 GB
Data Retention	10 years @ life begin 1 year @ life end			
Endurance [DWPD]*	30.5			

Temperature

Operating Temperature	Commercial: 0 °C to +70 °C Industrial: -40 °C to +85 °C
Storage Temperature	-40 °C to +85 °C

Performance

Sequential Read (MB/s)	up to 520	up to 520	up to 520
Sequential Write (MB/s)	up to 405	up to 245	up to 405
Random 4KB Read (IOPS)	up to 76,000	up to 76,000	up to 76,000
Random 4KB Write (IOPS)	up to 73,000	up to 54,000	up to 73,000

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	Read (Active): 1.7 W Write (Active): 2.5 W Idle: 380 mW Slumber: 115 mW	Read (Active): 2.0 W Write (Active): 2.9 W Idle: 550 mW Slumber: 275 mW	Read (Active): 1.5 / 1.7 W Write (Active): 1.7 / 2.5 W Idle: 345 / 380 mW Slumber: 115 mW

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 AES 256 Encryption (optional)
More Information	For more details see www.swissbit.com/product-finder

* DWPD values are according to JESD219 Client Endurance Workload based on a service life of 3 years



Information

Type	M.2 2242	M.2 2260 / 2280	M0-297 SLIM SATA	M0-300 mSATA
Interface	SATA Gen3 –6Gbit/s			
Data Transfer Mode	ATA8			
Connector	75 pos. Edge Connector B & M key		15 + 7 pin Serial ATA Connector	52 pos. Edge Connector PCI Express (PCIe) mini
Outline Dimensions	22 x 42 mm	22 x 60 / 80 mm	54 x 39 mm	50.8 x 29.85 mm
Thickness (MAX)	3.58 mm	3.58 mm	4.0 mm	3.8 mm
Flash Type	MLC durabit™ pSLC everbit™			
Density Range	durabit 30 GB – 240 GB 16 GB – 120 GB	30 GB – 960 GB 16 GB – 480 GB	30 GB – 480 GB 16 GB – 240 GB	8 GB – 480 GB 16 GB – 240 GB
Data Retention	10 years @ life begin 1 year @ life end			
Endurance [DWPD]*	durabit™ : 2.0 everbit™ : 13.2			

Temperature

Operating Temperature	Commercial: 0 °C to +70 °C Industrial: –40 °C to +85 °C
Storage Temperature	–40 °C to +85 °C

Performance

Sequential Read (MB/s)	up to 520 / 520	up to 520 / 520
Sequential Write (MB/s)	up to 340 / 415	up to 450 / 450
Random 4KB Read (IOPS)	up to 72,000 / 80,000	up to 75,000 / 80,000
Random 4KB Write (IOPS)	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, 80–2,000 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	Read (Active): 1.3 W Write (Active): 1.6 W Idle: 360 mW Slumber: 115 mW	Read (Active): 1.6 W Write (Active): 3.4 W Idle: 415 mW Slumber: 115 mW	Read (Active): 1.7 W Write (Active): 3.7 W Idle: 550 mW Slumber: 275 mW	Read (Active): 1.5 W Write (Active): 3.2 W Idle: 380 mW Slumber: 115 mW

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 AES 256 Encryption (optional)
More Information	For more details see www.swissbit.com/product-finder

* DWPD values are according to JESD219 Client Endurance Workload based on a service life of 3 years



Information

Type	M.2 2242		M.2 2280	M0-297 SLIM SATA	M0-300 mSATA
Interface	SATA Gen3 –6Gbit/s				
Data Transfer Mode	ATA8				
Connector	75 pos. Edge Connector B & M key			15 + 7 pin Serial ATA	52 pos. PCI Express (PCIe) mini
Outline Dimensions	22 x 42 mm		22 x 80 mm	54 x 39 mm	50.8 x 29.85 mm
Thickness (MAX)	3.58 mm		3.58 mm	4.0 mm	3.8 mm
Flash Type	3D NAND TLC / pSLC		X-75*: 3D NAND TLC X-76*: 3D NAND pSLC		
Density Range	X-80m2: 30 GB – 480 GB X-86m2: 10 GB – 160 GB	X-75m2: 30 GB – 480 GB X-76m2: 10 GB – 160 GB	X-75m2: 30 GB – 960 GB X-76m2: 10 GB – 320 GB	X-75s: 30 GB – 960 GB X-76s: 10 GB – 320 GB	X-75m: 30 GB – 960 GB X-76m: 10 GB – 320 GB
Data Retention	10 years @ life begin 1 year @ life end				
Endurance [DWPD]*	X-86: 11.9 X-80: tbd		X-75*: max 0.98 X-76*: max 21.7		

Temperature

Operating Temperature	Commercial: 0 °C to +70 °C Industrial: -40 °C to +85 °C
Storage Temperature	-40 °C to +85 °C

Performance

Sequential Read (MB/s)	up to 370	up to 565 / 560	up to 565 / 560	up to 565 / 565	up to 565 / 560
Sequential Write (MB/s)	up to 225	up to 490 / 480	up to 495 / 480	up to 495 / 490	up to 495 / 480
Random 4KB Read (IOPS)	up to 13,100	up to 73,200 / 72,900	up to 73,600 / 74,000	up to 73,600 / 77,400	up to 73,600 / 74,000
Random 4KB Write (IOPS)	up to 8,300	up to 79,400 / 84,900	up to 79,400 / 84,900	up to 79,400 / 84,900	up to 79,400 / 84,900

Robustness

MTBF	≥ 2,000,000 hours
Shock	1,500 G, 0.5 ms
Vibration	50 G, 80-2,000 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	Read (Active): 1.1 W Write (Active): 0.9 W Idle: 200 mW Partial: 80 mW	Read (Active): 2.2 W Write (Active): 2.9 W Idle: 395 mW Partial: 115 mW	Read (Active): 2.3 W Write (Active): 3.0 W Idle: 395 mW Partial: 115 mW	Read (Active): 2.7 W Write (Active): 3.4 W Idle: 475 mW Partial: 125 mW	Read (Active): 2.4 W Write (Active): 3.0 W Idle: 395 mW Partial: 100 mW

Feature List

Features & Tools	EzE Data Protection AES 256 Encryption (optional) / TCG OPAL 2.0 (optional) Advanced Wear Leveling, Bad Block Management Proven Power Fail Safety NCQ, TRIM Data Refresh In-Field Firmware Update SBLTM Tool & SDK for detailed S.M.A.R.T. based Life Time Monitoring
More Information	For more details see www.swissbit.com/product-finder

* DWPD values are according to JESD219 Client Endurance Workload based on a service life of 3 years

CFexpress™ Cards

CFexpress™ is hailed as the successor of the established Compact Flash and CFast-standards, created by the CompactFlash Association. Originally developed for high-end photography and other consumer applications, Swissbit has now applied the storage format to its latest products for use in demanding industrial applications. The CFexpress 2.0 Type B casing offers

excellent mechanical protection in harsh environments. The gold-plated pins are completely covered and shielded from any form of contact, therefore offering protection from dust or moisture penetration, and at the same time, making the cards resistant to any vibration. The G-20 series offers high data rates, low power consumption and wide temperature range.



	Wide Temp. Support	ESD & EMI Safe	Shock & Vibration	Life Time Monitor	Secure Erase	Conformal Coating	Temp. Sensor	Power Loss Protected	Wear Leveling	Read-Only Improved	TRIM Support	Data Care Managed	Longevity	WAF Reduction
G-20 / G-26	●	●	●	●	●	○	●	★	●	●	●	●	●	●

★ Industry Leading ● default implemented ○ on request





Information

Type	CFexpress™ Type B Card	
Standard and Interface	CFexpress v2.00 2 lanes PCIe 3.1 / NVMe 1.3	
Connector	CFexpress 30u" AU	
Outline Dimensions	38.5 × 29.6 × 3.8 mm	
Flash Type	3D NAND TLC	3D NAND pSLC
Density Range	15 GB – 480 GB	5 GB – 160 GB
Data Retention	10 years @ life begin 1 year @ life end	
Endurance [DWPD]*	Up to 0.9	Up to 17.7

Temperature

Operating Temperature	Commercial: 0 °C to +70 °C Industrial: -40 °C to +85 °C
Storage Temperature	-40 °C to +85 °C

Performance

Sequential Read (MB/s)	up to 1,610
Sequential Write (MB/s)	up to 830
Random 4KB Read (IOPS)	up to 115,000
Random 4KB Write (IOPS)	up to 130,000

Robustness

MTBF	≥ 2,000,000 hours
Shock	500 G, 1 ms
Vibration	20 G, 10–2,000 Hz
Humidity	90 % RH 85 °C, 96 hrs

Electrical Data

Voltage	3.3 V ± 5 %
Power Consumption	Read (Active): 2.6 W Write (Active): 2.4 W Idle: 400 mW PS4: 50 mW

Feature List

Features & Tools	HMB Support End to End Data Path protection Active and Passive Data Care Management AES 256 / E2E Data protection / TCG OPAL 2.0 Power Fail Data Loss 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.) Swissbit Life Time Monitoring (SBLTM) Tool and SDK for SBLTM (on request)
More Information	For more details see www.swissbit.com/product-finder

* DWPD values are according to JESD219 Client Endurance Workload based on a service life of 3 years

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 high performance F 600 to the cost/performance optimized 3D NAND F 80. The different product families are equipped with a rich feature set and are fulfilling the high Swissbit quality requirements.



	Wide Temp. Support	ESD & EMI Safe	Shock & Vibration	Life Time Monitor	Secure Erase	Conformal Coating	Temp. Sensor	Power Loss Protected	Wear Leveling	Read-Only Improved	TRIM Support	Data Care Managed	Longevity	WAF Reduction
F-600	●	●	●	★	●	○	●	★	●	●	●	●	●	●
F-60 / F-66	●	●	●	★	●	○	●	★	●	●	●	●	○	●
F-50 / F-56	●	●	●	★	●	○	●	★	●	○	●	●	○	○
F-800 / F-86 / F-80	●	●	●	★	●	○	●	★	●	●	●	★	●	○

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

F-800

F-80 / F-86

F-600

F-60 / F-66

F-50 / F-56



Information

Type	CFast™ Card				
Interface	CFast™ 2.0 – SATA Gen3				
Data Transfer Mode	6Gbit/s ATA8				
Connector	CFast™ Type I				
Outline Dimensions	36.4 x 42.8 x 3.6 mm				
Flash Type	SLC	3D NAND TLC / pSLC	SLC	MLC / pSLC	MLC / pSLC
Density Range	2 GB – 64 GB	F-80: 30 – 480 GB F-86: 10 – 160 GB	8 GB – 64 GB	MLC: 8 GB – 240 GB pSLC: 4 GB – 120 GB	MLC: 8 GB – 256 GB pSLC: 4 GB – 128 GB
Data Retention	10 years @ life begin 1 year @ life end				
Endurance [DWPD]*	29	tbd / 11.9	33.8	1.98 / 13.2	max 1.50 / 7.98

Temperature

Operating Temperature	Commercial: 0 °C to +70 °C Industrial: -40 °C to +85 °C				
Storage Temperature	-40 °C to +85 °C				

Performance

Sequential Read (MB/s)	up to 320	up to 375	up to 520	up to 520 / 520	up to 500 / 510
Sequential Write (MB/s)	up to 150	up to 320	up to 245	up to 180 / 415	up to 330 / 415
Random 4KB Read (IOPS)	up to 10,500	up to 13,100	up to 76,000	up to 72,000 / 80,000	up to 53,500 / 32,000
Random 4KB Write (IOPS)	up to 6,800	up to 8,300	up to 54,000	up to 43,000 / 75,000	up to 74,000 / 66,000

Robustness

MTBF	≥ 2,000,000 hours				
Shock	500 G, 0.5 ms		1,500 G, 0.5 ms		500 G, 1 ms
Vibration	20 G, 80–2,000 Hz		50 G, 80–2,000 Hz		20 G, 80–2,000 Hz
Humidity	85 % RH 85 °C, 1,000 hrs				

Electrical Data

Voltage	3.3 V ± 5 %				
Power Consumption	Read (Active): 1.3 W Write (Active): 1.0 W Idle: 200 mW Slumber: 50 mW	Read (Active): 1.10 W Write (Active): 0.80 W Idle: 190 mW Slumber: 50 mW	Read (Active): 1.6 W Write (Active): 2.4 W Idle: 347 mW Slumber: 115 mW	Read (Active): 1.4 W Write (Active): 1.8 W Idle: 380 mW Slumber: 116 mW	Read (Active): 1.2 W Write (Active): 2.1 W Idle: 248 mW Slumber: 17 mW

Feature List

Features & Tools	E2E Data Path Protection	-
	Proven Power Fail Safety	
	NCQ, TRIM	
	Advanced Wear Leveling & Bad Block Management	
	In-Field Firmware Update	
More Information	SBLTM Tool & SDK for S.M.A.R.T. based Life Time Monitoring	
	F-6x: AES 256 Encryption (optional)	
	For more details see www.swissbit.com/product-finder	

* DWPD values are according to JESD219 Client Endurance Workload based on a service life of 3 years

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 recent launch of a new product family. Swissbit products are developed with a strong focus on quality, reliability, robustness, and longevity.

All Swissbit's CF Series are offered in both commercial (0°C to +70°C) and industrial (-40°C to +85°C) temperature ranges. Swissbit's most recent CF Card product families C-500 and C-56 are using page based Flash management and thus provide the highest write IOPS rate as well as outstanding endurance.

	Wide Temp. Support	ESD & EMI Safe	Shock & Vibration	Life Time Monitor	Secure Erase	Conformal Coating	Power Loss Protected	Wear Leveling	Read-Only Improved	TRIM Support	Data Care Managed	Longevity	WAF Reduction
C-300L	●	●	●	●	○	○	★	●	○	○	○	★	○
C-440	●	●	●	●	○	○	★	●	★	★	○	●	○
C-500	●	●	●	★	○	○	★	●	★	★	●	●	★
C-56	●	●	●	★	○	○	●	●	★	★	●	○	★

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

C-300L



C-440



UDMA6 CF

C-500



UDMA6 CF

C-56



UDMA6 CF

Information

Type	CompactFlash™ Card			
Interface Data Transfer Mode	CFA4.1	CFA5.0		
	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			pSLC everbit™
Density Range	128 MB – 1 GB	2 GB – 64 GB	128 MB – 64 GB	4 GB – 64 GB
Data Retention	10 years @ life begin 1 year @ life end			
Endurance [DWPD]*	max 3.40	max 2.15	max 3.50	max 1.35

Temperature

Operating Temperature	Commercial: 0 °C to +70 °C Industrial: -40 °C to +85 °C
Storage Temperature	-40 °C to +85 °C

Performance

Sequential Read (MB/s)	up to 22	up to 65	up to 64	up to 115
Sequential Write (MB/s)	up to 10	up to 35	up to 44	up to 66
Random 4KB Read (IOPS)	up to 3,000	up to 2,400	up to 3,200	up to 5,000
Random 4KB Write (IOPS)	up to 50	up to 300 (w. Trim)	up to 1,900	up to 3,300

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 70 mA @ 3.3 V DMA typ 70 mA @ 3.3 V DMA typ 70 mA @ 5 V	PIO typ 60 mA @ 3.3 V DMA typ 80 mA @ 3.3 V DMA typ 90 mA @ 5 V	max 120 mA Idle 4.5 mA	max 130 mA Idle 4.5 mA

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	Page based FTL for maximum Endurance 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
More Information	For more details see www.swissbit.com/product-finder		

* DWPD values are according to JESD219 Enterprise Endurance Workload based on a service life of 3 or 5 years

SD & microSD 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 is designed for high sustained performance and endurance and is manufactured and tested in Swissbit's own fab to withstand extreme

environmental conditions. The SLC based S-450/455 offers the best sequential performance and highest endurance, while the durabit™ S-45 and the everbit™ S-46 series rely on MLC NAND. The new S-30 and S-50 models feature 3D NAND, with S-30 targeting read-mostly applications and S-50 as a full featured device. The S-56 card offers best cost/ endurance ratio. All families are available as SD and microSD memory cards.

	Wide Temp. Support	ESD & EMI Safe	Shock & Vibration	Life Time Monitor	Conformal Coating	Power Loss Protected	Wear Leveling	Read-Only Improved	Data Care Managed	Longevity	WAF Reduction
											
S-200(u) / 220 / 300u	●	●	●	○	○	★	●	○	○	●	○
S-45(u)	●	●	●	★	●	●	●	★	★	○	★
S-46(u)	●	●	●	●	●	★	●	★	★	○	★
S-450(u)	●	●	●	★	●	★	●	★	★	●	○
S-455(u)	●	●	●	★	●	★	●	★	★	●	★
S-30(u)	○	●	●	○	●	●	●	●	○	○	●
S-50 / 55 / 56 / 58(u)	●	●	●	●	●	●	●	●	●	●	●
S-52	○	●	●	●	●	●	●	●	○	●	●

★ Industry Leading ● default implemented ○ not available



Information

Type	SD Memory Card (SD / SDHC / SDXC)		SD Memory Card (SDHC / SDXC)		
Interface Data Transfer Mode	SD 3.0, Class 10, UHS-I	SD 6.1, Class 10, UHS-I, V30, A1	SD 6.1, Class 10, UHS-I, A1, Automotive Type	SD 6.1, Class 10, UHS-I, A2, High reliability Type	
Connector	SD				
Outline Dimensions	32 x 24 x 2.1 mm				
Flash Type	MLC durabit™ pSLC everbit™	3D NAND TLC			3D NAND pSLC
Density Range	S-45: 4 GB – 128 GB S-46: 2 GB – 64 GB	32 GB – 256 GB	32 GB – 128 GB	S-50: 16 GB – 256 GB S-55: 64 GB – 512 GB	S-56: 4 GB – 64 GB S-58: 16 GB – 128 GB
Data Retention	10 years @ life begin 1 year @ life end				
Endurance	S-45: 3k P/E Cycles S-46: 20k P/E Cycles	1k P/E Cycles	3k P/E Cycles		S-55: 30k P/E Cycles S-58: 60k P/E Cycles

Temperature

Operating Temperature	Extended: -25 °C to +85 °C Industrial: -40 °C to +85 °C	Extended: -25 °C to +85 °C	Extended: -25 °C to +85 °C Industrial: -40 °C to +85 °C
Storage Temperature	-40 °C to +100 °C	-40°C to +100°C	

Performance

Sequential Read (MB/s)	up to 43 / 46	up to 95	up to 95	up to 91	up to 95
Sequential Write (MB/s)	up to 21 / 52	up to 95	up to 84	up to 38	up to 90
Random 4KB Read (IOPS)	up to 1,200 / 1,440	up to 1,650	up to 1,960	up to 2,010	up to 2,190
Random 4KB Write (IOPS)	up to 950 / 1,260	up to 930	up to 780	up to 1,360	up to 1360

Robustness

MTBR	≥ 3,000,000 hours		
Shock	1,500 G		
Vibration	50 G	20 G	50 G
Humidity	85 % RH 85 °C, 1,000 hrs		

Electrical Data

Voltage	2.7 – 3.6 V Normal				
Power Consumption	Read typ 60/75 mA Write typ 70/80 mA	Read typ 80 mA Write typ 100 mA	Read typ 110 mA Write typ 145 mA	Read typ 150 mA Write typ 150 mA	Read typ 110 mA Write typ 110 mA

Feature List

Features & Tools	Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block management Autonomous Data Care Management SBLTM Tool & SDK for detailed Life Time Monitoring	Support SD SPI mode Static and Dynamic Wear Leveling Bad Block Management Auto Read Refresh Embedded Mode	Support SD SPI mode Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block Management Autonomous Data Care Management SBLTM Tool & SDK for detailed Life Time Monitoring
More Information	For more details see www.swissbit.com/product-finder		



Information

Type	SD-Memory Card (SD / SDHC)		microSD Memory Card (SD / SDHC)	
Interface Data Transfer Mode	SD 2.0, Class 6	SD 3.0, Class 10, UHS-I	SD 2.0, Class 6	SD 3.0, Class 10, UHS-I
Connector	SD		microSD	
Outline Dimensions	32 x 24 x 2.1 mm		15 x 11 x 0.7 / 1 mm	
Flash Type	SLC			
Density Range	512 MB – 2 GB	512 MB – 32 GB	S-250u: 512 MB – 2 GB S-300u: 1 GB – 8 GB	512 MB – 8 GB
Data Retention	10 years @ life begin 1 year @ life end			
Endurance	100k P/E Cycles			

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	-40 °C to +85 °C	-40 °C to +100 °C

Performance

Sequential Read (MB/s)	up to 24	up to 88 / 44	up to 24 / 24	up to 30 / 40
Sequential Write (MB/s)	up to 13.5	up to 73 / 38	up to 13 / 22	up to 24 / 28
Random 4KB Read (IOPS)	up to 1,580	up to 1,430 / 1,250	up to 1,580 / 1,500	up to 1,200 / 1,280
Random 4KB Write (IOPS)	up to 29	up to 28 / 1,100	up to 29 / 28	up to 28 / 1,540

Robustness

MTBF	≥ 3,000,000 hours		
Shock	1,000 G		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 40 mA Write typ 50 mA	Read typ 60 mA Write typ 70 mA	Read typ 42 / 50 mA Write typ 50 / 60 mA	Read typ 50 mA Write typ 60 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	S-450 block based FTL S-455 page based FTL Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block Management Autonomous Data Care Management SBLTM Tool & SDK for detailed Life Time Monitoring	Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block Management Diagnostic features & Life Time Monitoring through SD / SPI command set	S-450u block based FTL S-455u page based FTL Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block Management Autonomous Data Care Management SBLTM Tool & SDK for detailed Life Time Monitoring
More Information	For more details see www.swissbit.com/product-finder			



Information

Type	microSD Memory Card (SD / SDHC / SDXC)	microSD Memory Card (SD / SDXC)		
Interface Data Transfer Mode	SD 3.0, Class 10, UHS-I	SD 6.1, Class 10, UHS-I, V30, A1	SD 6.1, Class 10, UHS-I, A2	
Connector	microSD			
Outline Dimensions	15 x 11 x 0.7 / 1 mm			
Flash Type	MLC durabit™ pSLC everbit™	3D NAND TLC		3D NAND pSLC
Density Range	S-45u: 4 GB – 128 GB S-46u: 2 GB – 64 GB	32 GB – 256 GB	16 GB – 128 GB 64 GB – 256 GB	4 GB – 32 GB 16 GB – 64 GB
Data Retention	10 years @ life begin 1 year @ life end			
Endurance	S-45: 3k P/E Cycles S-46: 20k P/E Cycles	1k P/E Cycles	3k P/E Cycles	30k / 60k P/E Cycles

Temperature

Operating Temperature	Extended: -25 °C to +85 °C Industrial: -40 °C to +85 °C	Extended: -25 °C to +85 °C	Extended: -25 °C to +85 °C Industrial: -40 °C to +85 °C
Storage Temperature	-40 °C to +100 °C	-40 °C to +85 °C	

Performance

Sequential Read (MB/s)	up to 44 / 42	up to 95	up to 91	up to 95
Sequential Write (MB/s)	up to 22 / 40	up to 95	up to 38	up to 83
Random 4KB Read (IOPS)	up to 1,350 / 1,430	up to 1,650	up to 2,010	up to 2,190
Random 4KB Write (IOPS)	up to 970 / 1,310	up to 930	up to 1,360	up to 1,360

Robustness

MTBR	≥ 3,000,000 hours		
Shock	1,500 G		
Vibration	50 G	20 G	50 G
Humidity	93 % RH 40 °C, 500 hrs	85 % RH 85 °C, 1,000 hrs	

Electrical Data

Voltage	2.7 - 3.6 V Normal			
Power Consumption	Read typ 75 mA Write typ 80 mA	Read typ 80 mA Write typ 100 mA	Read typ 110 mA Write typ 120 mA	Read typ 110 mA Write typ 110 mA

Feature List

Features & Tools	Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block Management Autonomous Data Care Management SBLTM Tool & SDK for detailed Life Time Monitoring	Support SD SPI mode Static and Dynamic Wear Leveling Bad Block Management Auto Read Refresh Embedded Mode	Support SD SPI mode Proven Power Fail Safety Sophisticated Wear Leveling & Bad Block Management Autonomous Data Care Management SBLTM Tool & SDK for detailed Life Time Monitoring
More Information	For more details see www.swissbit.com/product-finder		

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 the 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.

	Wide Temp. Support	ESD & EMI Safe	Shock & Vibration	Life Time Monitor	Power Loss Protected	Wear Leveling	Longevity	Data Care Managed	TRIM Support	WAF Reduction
U-56 / U-58 / U-48	●	○	●	●	●	●	●	●	●	●
U-56n / U-50n	●	●	●	●	●	●	●	●	●	●
U-500 / U-450	●	○	●	●	●	●	●	●	●	●
U-500k / U-56k / U-50k	●	●	●	●	●	●	●	●	●	●

● default implemented ○ not available

U-500
U-56 / U-58



U-450
U-48



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



U-56n
U-50n Nano



Information

Type	eUSB Flash Module		USB Flash Drive	
Interface	USB 3.1		USB 3.1	
Data Transfer Mode	Super Speed / High / Full		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 x 26.65 x 9.7 mm Low Profile: 36.8 x 26.65 x 6.0 mm		68.0 x 18.0 x 8.2 mm	24.0 x 12.1 x 4.5 mm
Flash Type	SLC / pSLC everbit™ / 3D pSLC / MLC durabit™			
Density Range	SLC: 4 GB – 32 GB pSLC: 4 GB – 32 GB 3D pSLC: 8 GB – 16 GB	SLC: 2 GB – 16 GB pSLC: 8 GB – 16 GB	SLC: 2 GB – 32 GB pSLC: 8 GB – 64 GB MLC: 16 GB – 128 GB	MLC: 8 – 64 GB pSLC: 4 – 32 GB
Data Retention	10 years @ life begin 1 year @ life end			
Endurance [DWPD]*	U-500: 4.0 / U-58: 4.1 / U-56: 1.8 / U-450: 4.2 / U-48: 6.2			

Temperature

Operating Temperature	Commercial: 0 °C to +70 °C Industrial: –40 °C to +85 °C
Storage Temperature	–40 °C to +85 °C

Performance

Sequential Read (MB/s)	up to 174 / 175 / 180	up to 36 / 42	up to 180 / 190 / 150	up to 197 / 156
Sequential Write (MB/s)	up to 91 / 110 / 76	up to 26 / 38	up to 100 / 110 / 60	up to 126 / 64
Random 4KB Read (IOPS)	up to 2,980 / 3,200 / 4,100	up to 1,900 / 2,600	up to 3,700 / 4,000 / 3,200	up to 3,850 / 2,850
Random 4KB Write (IOPS)	up to 1,060 / 1,100 / 1,680	up to 1,400 / 2,000	up to 2,000 / 1,500 / 900	up to 2,600 / 1,800

Robustness

MTBF	≥ 3,000,000 hours		
Shock	1,500 G, 0.5 ms		
Vibration	50 G		20 G
Humidity	85 % RH 85 °C, 1,000 hrs		

Electrical Data

Voltage	3.3 V ±5 % / 5 V ±10 %	5 V ± 10 %
Power Consumption	Full Speed typ 80 mA High Speed typ 100 mA	

Feature List

Features & Tools	Page based FTL for best write performance and endurance 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
More Information	For more details see www.swissbit.com/product-finder

* DWPD values are according to JESD219 Enterprise Endurance Workload based on a service life of 3 or 5 years

Managed NAND

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

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

Swissbit's e.MMC EM-20 and EM-30 family covers multiple densities and interface speeds. Sophisticated NAND management makes the e.MMC ideal for applications like POS/POI, PLC, IoT, gaming, medical, or as a general boot medium for embedded applications. The EN-20 PCIe/NVMe BGA opens the door for high speed at small size.

	Wide Temp. Support	Life Time Monitor	Secure Erase	Power Loss Protected	Wear Leveling	TRIM Support	Data Care Managed	In-field FW Update	WAF Reduction	Low Power
EM-20 / EM-26	•	•	•	•	•	•	•	•	•	•
EM-30 / EM-36	•	•	•	•	•	•	•	•	•	•
EN-20 / EN-26	•	•	•	•	•	•	•	•	•	•

• default implemented



Information

Type	e.MMC		PCIe M.2 1620 BGA
Standard & Interface	e.MMC 5.0, 1-bit, 4-bit, 8-bit up to HS400	JEDEC e.MMC 5.1 1-bit, 4-bit, 8-bit up to HS400	PCIe Gen 3.1 / NVMe 1.3 4 PCIe lanes (up to 240 GB)
Package	153-ball BGA, 0.5mm pitch		BGA, 0.8mm pitch
Outline Dimensions	11.5 x 13 x 1 mm		16 x 20 x 1.8 mm
Flash Type	MLC / pSLC reliable mode	3D NAND TLC / pSLC	3D NAND TLC / pSLC
Density Range	4 GB – 64 GB MLC / 2 GB – 32 GB pSLC	16 GB – 256 GB TLC / 5 GB – 80 GB pSLC	15 GB – 480 GB / 5 GB – 160 GB
Data Retention	10 years @ life begin 1 year @ life end		
Endurance	3k / 20k P/E cycles	3k / 30k P/E cycles	3k / 30k P/E cycles

Temperature

Operating Temperature	Industrial: -40 °C to +85 °C		
Storage Temperature	-40 °C to +85 °C		

Performance

Sequential Read (MB/s)	up to 174 / 240	up to 300	up to 1,770
Sequential Write (MB/s)	up to 21 / 120	up to 230	up to 720
Random 4KB Read (IOPS)	up to 3,800 / 6,700	up to 39,500	up to 150,000
Random 4KB Write (IOPS)	up to 1,400 / 6,700	up to 41,500	up to 100,000

Electrical Data

Voltage	VCCQ: 1.70–1.95 V / 2.70–3.60 V ; VCC: 2.70–3.60		3.3 V ± 5 %, 1.8 V ± 5 %, 0.9 V ± 5 %
Power Consumption	Typ. Read Current: 180 mA @ 1.8V VCCQ, 38 mA @ 3.3V VCC Typ. Write Current: 105 mA @ 1.8V VCCQ, 80 mA @ 3.3V VCC Standby: 20 mA		Typ. Read Current: up to 2 W Typ. Write Current: up to 1.54 W Idle: 350mW

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	HMB support Dynamic and Static Wear Leveling Page Mode Flash Translation Layer Data Care Management Write Amplification Reduction Power Fail Data Loss Protection In Field Firmware Update Self Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.) AES256 Encryption
More Information	For more details see www.swissbit.com/product-finder	

Security Products















Unique Hardware Security for Reliably Protecting Data and Devices

Swissbit's modular security products are based on standard interfaces and offer system manufacturers a range of hardware-based cyber security solutions for the protection of data and devices. Security products are variations of storage products with various security features.

The security product series in USB, microSD, and SD form factors address the growing demand for mobile, portable and industrial security. They offer unique hardware security which is very suitable for retrofit and updates in the field.

Swissbit's security products are extremely robust and durable, which makes them ideal for challenging applications with long life time and maintenance cycles.

Valuable data such as sensitive files, videos, photos, licenses, OS images, firmware updates, log files, and audit trails can be protected by encryption, access protection, or made resistant to tampering by digital signature based on secure elements. Voice and video calls as well as data streams for M2M communication can be protected by the card in high speed.

	True Hardware RNG	Digitally Sign & Verify	Hardware based Encryption	2nd factor authentication	Retrofittable Secure Boot	Secure Voice	Elliptic Curve Crypto	Secure CD-ROM	Secure Storage	Secure Logging	FIPS 140-2 Mode	Host agnostic plug & play
												
Standard Edition (SE)	●	●	●	●	○	●	●	○	○	○	●	○
Premium Edition (PE)	●	●	●	●	○	●	●	●	★	★	●	○
Data Protection Edition (DP)	○	○	○	○	○	○	○	●	★	○	○	○
TSE	●	★	○	○	○	○	●	○	○	○	○	○
Raspberry Pi Edition	○	○	○	○	★	○	○	●	●	●	○	○
iShield Camera Edition	○	○	○	○	○	○	○	○	★	○	○	★

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



PS-45 / PS-45u



PS-46 / PS-46u



PS-450 / PS-450u



PU-50n / PU-56n



Information

Compliance	SD 3.0 SD, ASSD V1.1			USB 3.1
Data Transfer	UHS-1 Speed class 10			USB 3.1 SuperSpeed
Flash Type	MLC	pSLC	SLC	MLC / pSLC

Category	Series	Interface	Standard / Premium Edition	TSE Type	Data Protection Type
Standard Editions	PS-45	SD	8 GB – 16 GB		8 GB – 64 GB
	PS-45u	microSD	8 GB – 16 GB		8 GB – 32 GB
	PS-46	SD	4 GB – 8 GB		4 GB – 32 GB
	PS-46u	microSD	4 GB – 8 GB		4 GB – 16 GB
	PS-450	SD	0.5 GB – 2 GB		0.5 GB – 2 GB
	PS-450u	microSD	0.5 GB – 2 GB		0.5 GB – 2 GB
	PU-50n	USB	8 GB – 16 GB		8 GB – 64 GB
TSE	PS-45 TSE	SD	–	8 GB	–
	PS-45u TSE	microSD	–	8 GB	–
	PU-50n TSE	SD	–	8 GB	–
Raspberry Pi Edition	PS-45u	microSD	–	–	8 GB, 32 GB
iShield Camera	PS-45u	microSD	–	–	16 GB, 32 GB
Security Features	<p>IFX / NXP smart card chip CC EAL 5+/6+ HW and OS Java card 3.0.1/ 3.0.4 Global Platform 2.2.1 / 2.2.2 Infineon JTOP/ NXP JCOP 3 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 • Cryptovision</p> <p>80 / 145 k EEPROM secure storage</p> <p>NXP smart card chip BSI TR-03153 certified TSE SMAERS:EAL2 CSP: EAL4</p> <p>384 bit encryption</p> <p>Validity of signature certificate: 5 or 7 years + 6 months for shelf storage</p> <p>Guaranteed 20 Mio signatures. Signature processing time < 250 ms. 10 years retention</p> <p>Common Features AES 256 bit flash encryption fast crypto wipe Unique ID</p> <p>Data Protection Edition: User and admin PIN with configurable retry counter Partitioning: • CD ROM • Private • Hidden/WORM</p> <p>Raspberry Pi Edition: Retrofittable secure boot Pre-boot authentication with PIN/NET/USB policies</p> <p>iShield Camera: Host-agnostic plug&play security Supports loop recording</p>				
More Information	For more details see www.swissbit.com/en/products/security-products/				

iShield Camera



Secure Video and Photo Recording

The microSD card Swissbit iShield Camera is a simple and retrofittable security solution especially for the encryption and access protection of video recordings. It is host-independent, i.e. plug-and-play, and can be used with a large number of

camera types. The solution also includes the "iShield Camera Card Tool" (iCCT) software.

Our Products



Swissbit TSE



Fiscal Solution for Germany

Swissbit is a complete provider of tamper-proof recording solutions for POS data in accordance with the German Cash Security Ordinance (KassenSichV). Whether single devices, networked POS systems in a LAN or online-capable POS systems with a cloud connection, Swissit provides

an easy-to-integrate, flexible and secure TSE connection for all scenarios. All TSE products have an optional connection to the fiscalization platform Mein Fiskal of DATEV with further additional services.

Our Products



Raspberry Pi Edition



Secure Boot Solution for Raspberry Pi

The Swissbit Secure Boot Solution for Raspberry Pi allows encryption and access protection of data stored on the microSD card by various configurable security policies. It protects the boot image and software installation against manipulation, unwanted

copying, or removal of a system from a defined network. The Swissbit Secure Boot Solution for Raspberry Pi consists of a Swissbit PS-45u DP microSD card "Raspberry Edition" and a Swissbit Secure Boot SDK for Raspberry Pi.

Our Products



Security Editions

Easy-to-integrate and Retrofittable Hardware-based Security Products

Swissbit provides easy-to-integrate and retrofittable hardware based security products together with software development kits (SDK) and customization services, enabling manufacturers to offer systems with secured devices, secure data storage, and secure data communication.

- **Standard Edition SE**
The Standard Edition SE fits best into authentication and PKI (Public Key Infrastructure) use cases.
- **Premium Edition PE**
The Premium Edition PE combines high end smartcard security with state of the art data protection.
- **Data Protection DP**
The Data Protection DP cards and USB drive offer AES encrypted data protection.

Our Products





Advanced Packaging, Assembly & Test Solutions

System-in-Package (SiP) is the umbrella term for using advanced packaging and assembly technologies to integrate and test sensitive bare silicon dies or chips (active circuits) and supporting components (passives) into robust finished modules or components. Together with integrated software or firmware this will create a fully functional system solution.

From the very beginning, Swissbit successfully uses advanced packaging technologies to achieve the smallest form factors and to build multi-chip-packages. Moreover, Swissbit develops unique test hard- and software solutions for dedicated applications and temperature ranges.

With this electronic integration and testing approach, our products provide more functionality inside one package, various functional blocks (RF, digital, sensors, security, and memory) and passive components are combined. Having all necessary capabilities in-house we have the best design for reliability, test and manufacturing.

For our highly-integrated SiPs (e.g. MicroSD Card) we developed processes for stacking multiple large dies, wire bonding the smallest bond pads, and molding the narrowest clearances.

Swissbit provides different assembly and packaging technologies (e.g SMT, CoB, FlipChip) in one single unit. The concentration of strong engineering and design knowhow and experience enables new, innovative electronic packages and devices for a wide range of applications.

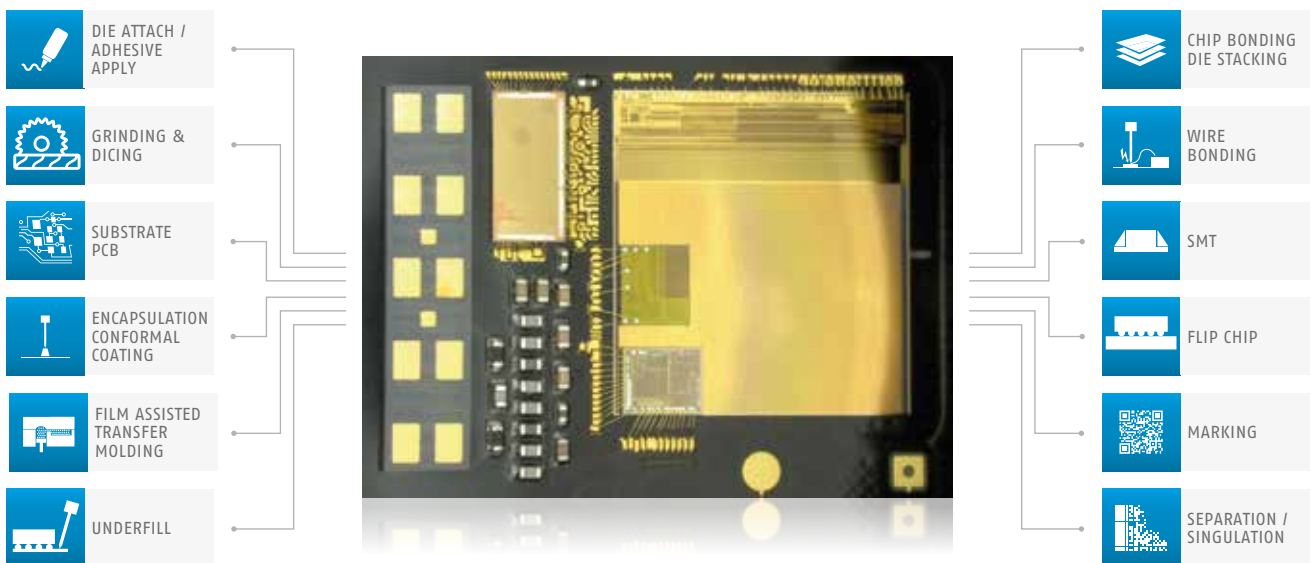
Our customers benefit from a reduced development cost and higher yields and reliability. We use smart production organizations, which allows the production of small volume series with short lead times and on-time delivery in high product variations.

Swissbit produces and develops in accordance with ISO 9001, IATF 16949, ISO 27001 and ISO 14001 approved processes and is an experienced partner for 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
- Mixed analog / digital design
- Reduced system board test complexity



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