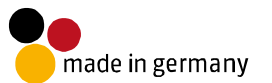


swissbit®

SD Memory Card Portfolio S-450 / S-455 / S-46 / S-45

REV. 4.0



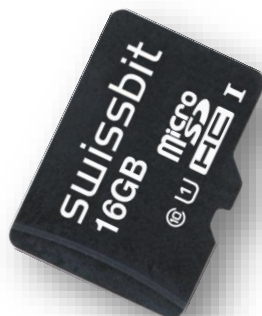
Best Service Memory Company

SD CARD PRODUCTS

durabit™
UHS-I MLC



S-45
durabit™

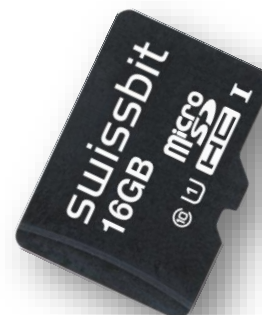


S-45u

everbit™
UHS-I pSLC



S-46
everbit™



S-46u

UHS-I SLC



S-450 / S-455



S-450u / S-455u

SD CARD HIGHLIGHTS



High Performance
High IOPS



Longevity
SLC 5+ years



Data Care Management



Industrial Temperature Grade



Corrosion resistant pads



WAF Reduction
High endurance
durabit™: *The better MLC*



Power fail safety



In Field FW Update



Detailed lifetime reporting



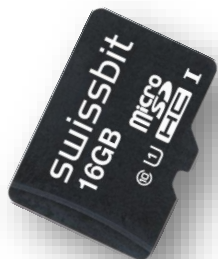
Exhaustive qualification process

SERIES COMPARISON



	S-45 durabit™	S-46 everbit™	S-450	S-455
Interface SD Spec	SD3.0 UHS-I	SD3.0 UHS-I	SD3.0 UHS-I	SD3.0 UHS-I
Speed class	Class 10, U1	Class 10, U1	Class 10, U1	Class 10, U1
Density	4 – 32GB (SDHC) 64 – 128GB (SDXC)	2GB (SD) 4 – 32GB (SDHC) 64GB (SDXC)	512MB – 2GB (SD) 4 – 32GB (SDHC)	512MB – 2GB (SD) 4 – 32GB (SDHC)
FLASH	MLC 15nm	pSLC 15nm	SLC 24nm	SLC 24nm
FW FTL Architecture	Page Based	Page Based	Block Based	Page Based
Flash Cell Endurance	3,000 PE cycles	20,000 PE cycles	60k / 100k PE cycles	60k / 100k PE cycles
Data Retention	10 years @ life begin, 1 year @ life end			
Seq. Read (MB/s)	Up to 40	Up to 50	Up to 90	Up to 44
Seq. Write (MB/s)	Up to 12	Up to 55	Up to 75	Up to 38
Target use case	Boot media / data logging	Boot media High end industry	Boot media High end industry / recording	Intensive small data logging
ECC	40bit / 1kB (96bit)	40bit / 1kB (96bit)	24bit / 1kB (96bit)	24bit / 1kB (96bit)

SERIES COMPARISON



	S-45u durabit™	S-46u everbit™	S-450u	S-455u
Interface SD Spec	SD3.0 UHS-I	SD3.0 UHS-I	SD3.0 UHS-I	SD3.0 UHS-I
Speed class	Class 10, U1	Class 10, U1	Class 10, U1	Class 10, U1
Density	4 – 32GB (SDHC)	2GB (SD) 4 – 16GB (SDHC)	512MB – 2GB (SD) 4 – 8GB (SDHC)	512MB – 2GB (SD) 4 – 8GB (SDHC)
FLASH	MLC 15nm	pSLC 15nm	SLC 24nm	SLC 24nm
FW FTL Architecture	Page Based	Page Based	Block Based	Page Based
Flash Cell Endurance	3,000 PE cycles	20,000 PE cycles	60k / 100k PE cycles	60k / 100k PE cycles
Data Retention	10 years @ life begin, 1 year @ life end			
Seq. Read (MB/s)	Up to 40	Up to 48	Up to 30	Up to 40
Seq. Write (MB/s)	Up to 12	Up to 48	Up to 24	Up to 28
Target use case	Boot media / data logging	Boot media High end industry	Boot media High end industry / recording	Intensive small data logging
ECC	40bit / 1kB (96bit)	40bit / 1kB (96bit)	24bit / 1kB (96bit)	24bit / 1kB (96bit)

SERIES IN DETAIL

S-450 / S-450u SLC

- 2xnm SLC NAND flash with long availability and highest reliability.
- Block based flash translation layer (FTL) for highest sequential operation mode.
- Highest endurance.

S-455 / S-455u SLC

- Page based FTL for highest random write operations.
- Maximum TBW for small data logging applications

S-46 / S-46u pSLC **everbit™**

- 15nm MLC in single bit/cell mode
- Page based FTL for highest random write operations.
- Endurance increased 6.7 times versus MLC.

S-45 MLC **durabit™**

- 15nm MLC technology.
- Page based FTL for best MLC endurance at lowest bit cost
- The **durabit™** products offer “the best of MLC”.

PERFORMANCE COMPARISON



	S-45 durabit™ MLC 32 GB	S-46 everbit™ pSLC 32 GB	S-450 SLC 32 GB	S-455 SLC 32 GB
Sequential Read [MB/s]	Up to 40	Up to 50	Up to 90	Up to 44
Sequential Write [MB/s]	Up to 12	Up to 55	Up to 75	Up to 38
Random Read 4K Q32 [IOPS]	Up to 750	Up to 1350	Up to 1200	Up to 1340
Random Write 4K Q32 [IOPS]	Up to 650	Up to 1400	Up to 30	Up to 1240



* Performance measured with Crystal DiskMark

ENDURANCE COMPARISON



	S-45 durabit™ MLC 32 GB	S-46 everbit™ pSLC 32 GB	S-450 SLC 32 GB	S-455 SLC 32 GB
Enterprise WL [TBW] ¹⁾	~ 5	~ 33	~ 34	~ 170
Filesystem WL [TBW] ²⁾	~ 15	~ 103	~ 134	~ 500

PAGE BASED FTL

SLC

BEST ENDURANCE

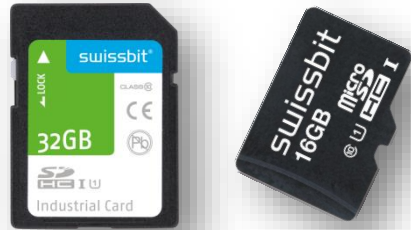
1) JEDEC Enterprise Work Load:

2) Swissbit Work Load:

high percentage of Random 4K writes

simulation of data logging application

FEATURE COMPARISON



	S-45 S-45u durabit™	S-46 S-46u everbit™	S-450 S-450u	S-455 S-455u
Industrial Temperature Range	✓	✓	✓	✓
Power Fail Safety (Operation / FW update)	✓/ ✓	✓/ ✓	✓/ ✓	✓/ ✓
Static & Dynamic Wear leveling	✓/ ✓	✓/ ✓	✓/ ✓	✓/ ✓
Bad Block Management	✓	✓	✓	✓
Read Retry	✓	✓	✓	✓
Autonomous auto refresh	✓	✓	✓	✓
Read disturb management	✓	✓	✓	✓
ECC monitoring	✓	✓	✓	✓
Life Time Monitoring	✓	✓	✓	✓
WAF reduction	✓	✓		✓
Short busy time	✓	✓	✓	✓
High speed sequential mode		✓	✓	
High IOPs rate	✓	✓		✓
Longevity			✓	✓

S-4X FEATURES IN DETAIL

POWER FAIL SAFETY, OPERATIONAL

S-450 SLC / S-455

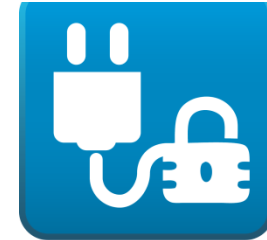
All Swissbit SLC cards offer highest possible power fail safety based on an internal transaction protocol. Sophisticated recovery algorithms reconstruct on power up the card content to an uncorrupted state. Static data is 100% protected against data loss.
The Swissbit power fail safety is verified by a thorough qualification process.

S-46 pSLC

The Swissbit pSLC technology has an equally efficient and robust power fail protection as the S-450.

S-45 MLC

Based on MLC architecture the power fail safety is reduced compared to SLC cards. Swissbit MLC cards are optimized for performance and endurance with a compromise of slightly higher risk of data loss at power fail.
The firmware area is fully protected against corruption.



S-4X FEATURES IN DETAIL

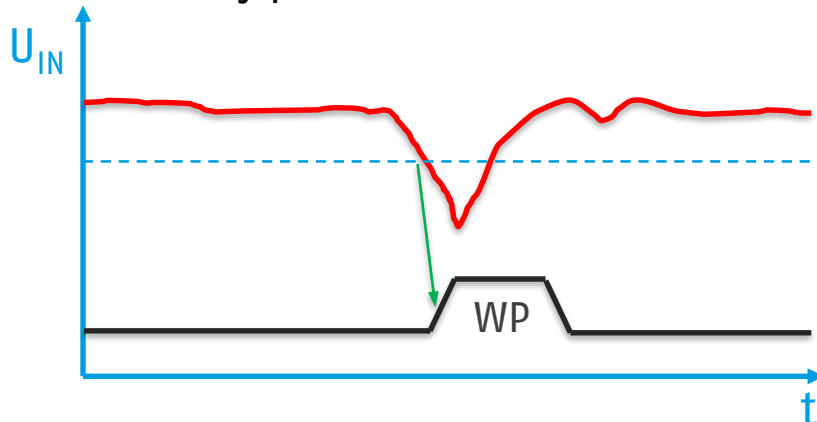
POWER FAIL SAFETY, FIRMWARE UPDATE

- All Swissbit S-4x cards can be upgraded with new firmware releases in the field.
- The complete upgrade process is fully protected against power loss. If the process is interrupted the firmware will reset to the last version and the process can start again.



POWER FAIL SAFETY, GLITCHES

- All Swissbit S-4x cards have a protection against supply voltage glitches that immediately puts the stored data in write protect mode to prevent data corruption



S-4X FEATURES IN DETAIL

DATA CARE MANAGEMENT

Swissbit S-4x cards introduced a read disturb management to improve data retention for read intensive applications.

Autonomous Read Refresh

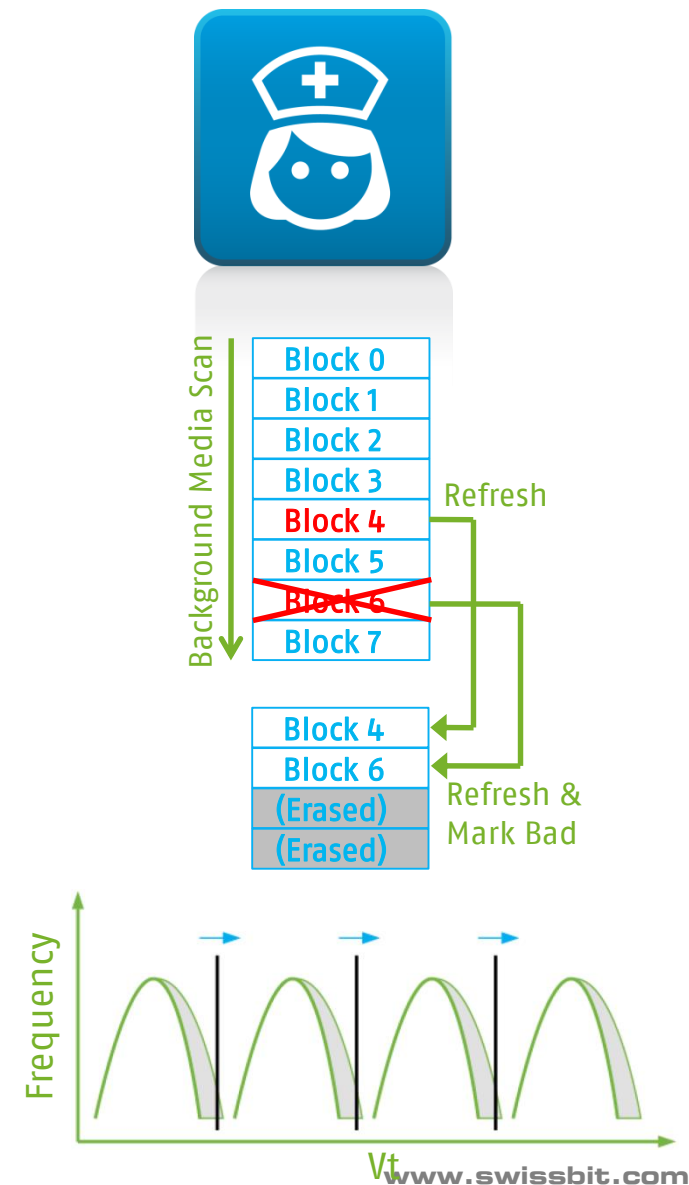
An independent background media scan process checks the health status of each block and rewrites the block if its data content shows signs of reduced retention.

Near Miss ECC Read/ Early Retirement

On each read operation the health status of the read block is evaluated and refreshed if necessary

Read Retry

If a read operation to a page shows uncorrectable errors then a sophisticated algorithm retries the read with different internal reference voltage levels. This eliminates typical fails that occur due to temperature changes between writes and reads.



S-4X FEATURES IN DETAIL

SWISSBIT LIFE TIME MONITOR

The Swissbit S-4x SD memory cards have a very detailed S.M.A.R.T. value analysis and reporting that goes way beyond market standards. That feature allows easy life time calculation, drive state monitoring and diagnostic.



Options:

- Windows or Linux Tool
- SDK / API

SBLTM FEATURES BY PRODUCT

	S-450 / S-450u S-455 / S-455u S-45 / S-45u S-46 / S-46u
S.M.A.R.T. support	✓
Overall health status (good / failure imminent)	✓
Spare & Bad Block status (total / free)	✓
Flash Erase Life Time status (e.g. percentage of remaining life)	✓ (high precision)
Power On Counter	✓
Flash read commands	✓
Flash ECC errors (total & correctable)	✓
Bus transfer error counter	✓
Power on data repair counter	✓
Host LBA counter	✓

swissbit®

Thank you for your attention