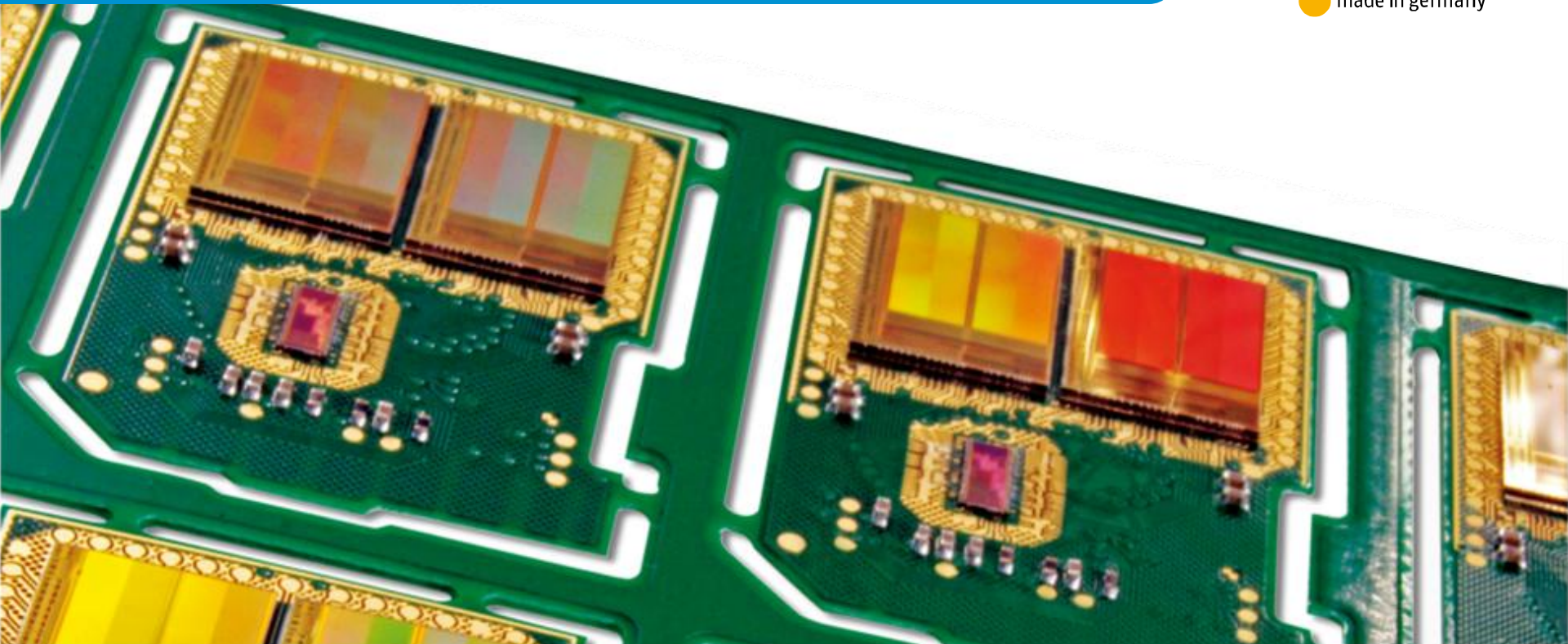
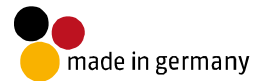


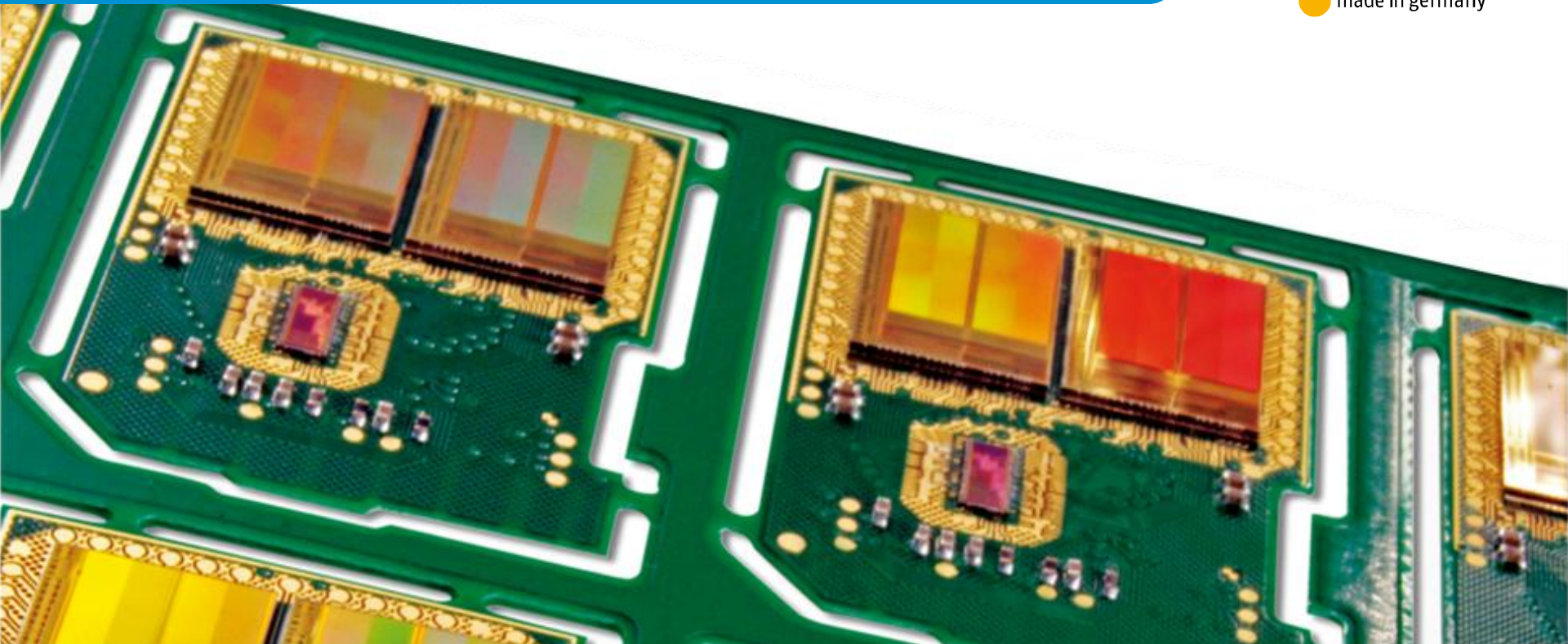
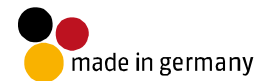
AUTOMOTIVE MEMORY MARKET OVERVIEW



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AUTOMOTIVE APPLICATIONS FOR FLASH STORAGE



APPLICATIONS

AUTOMOTIVE DEMANDS FOR FLASH STORAGE

Applications

- Head unit
- Dashboard
- Infotainment / car navigation
- "black box" / crash recorder

Range of Storage Products

- SD / Micro SD Card
- eMMC
- SSD (2.5" / mSATA)
- Security Products

Key Features Required

- Longevity
- Temperature range
- High quality standards
- Data integrity
- High capacities
- Specific certifications

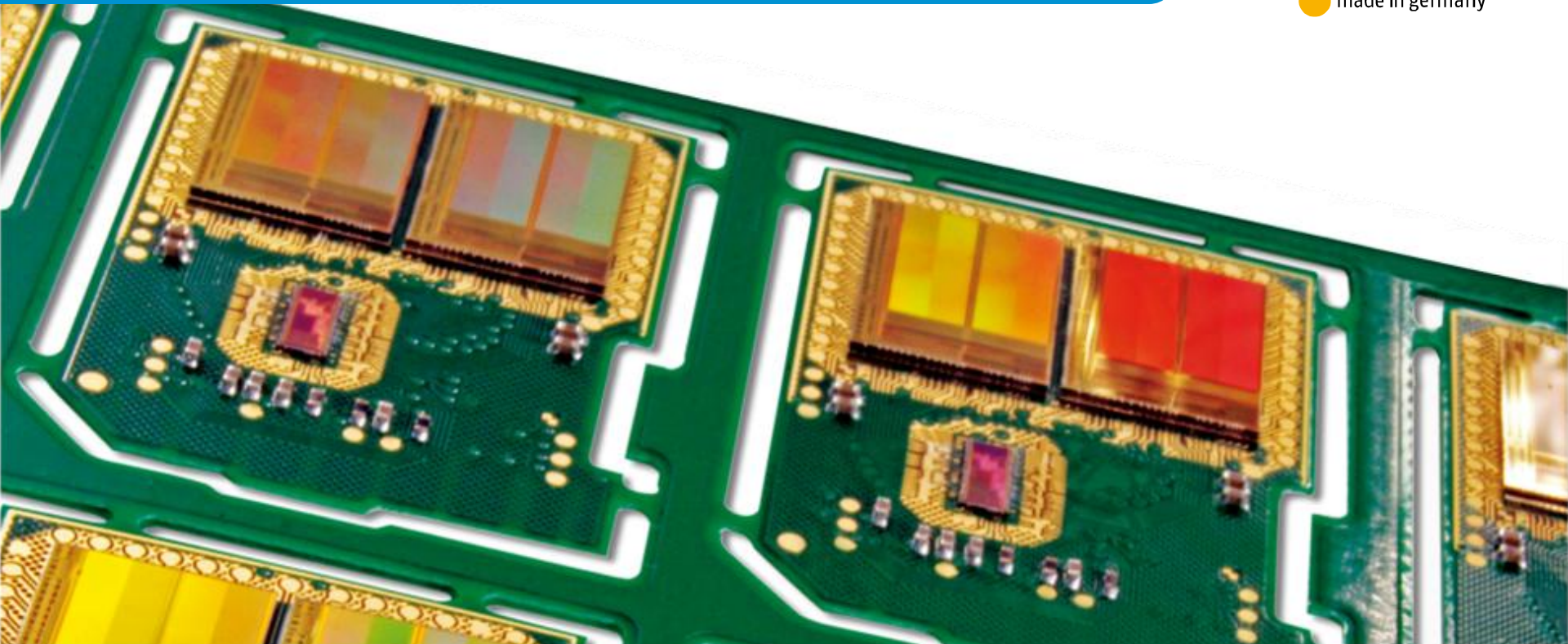
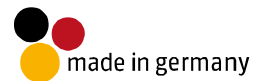


limited re-designs allowed – 8yrs life time, 5yrs service
industrial (-40/+85C)
lowest possible failure rate
long data retention, power fail protection, read disturb resistance
4~256GB today, almost entirely MLC
AEC-Q100, PPAP, TS16949

Swissbit SD & Micro SD cards have been approved various automotive infotainment and navigation systems

AUTOMOTIVE NAND STORAGE SUPPLIERS

COMPETITIVE ENVIRONMENT



AUTOMOTIVE NAND STORAGE SUPPLIERS


SWISSBIT'S UNIQUE STRATEGIC POSITION

There are two NAND Storage supplier groups, each of them with specific competitive advantages and disadvantages as an Automotive Supplier

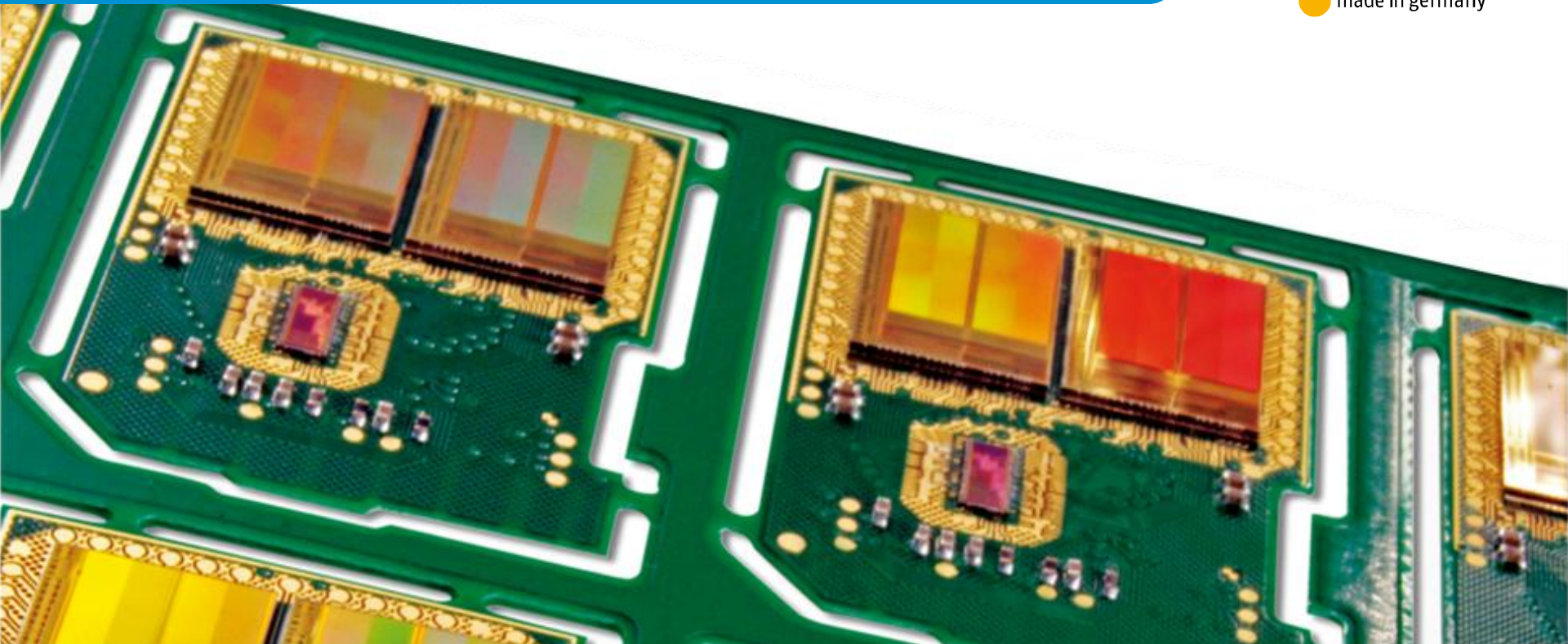
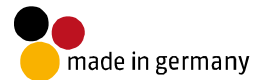
Swissbit is positioned in between those 2 which allows us to combine the benefits of both groups into our Automotive Market offering. On top of that, we have added further unique solutions such as:

- Product Features, e.g. Autonomous Data Care Management & Diagnostic Features
- Stringent internal validation processes that specifically test in extreme conditions
- 100% functional test at full temperature prior to shipment to customers

Our products are already used in several Automotive projects which proves that our offering is very competitive

	SUPPLIER GROUP 1	SUPPLIER GROUP 2
Strength	Brand recognition Good quality High economies of scale	 Wide range of products & features Customizations possible Focus on Industrial and/or Automotive Markets
Weakness	Core Market is Consumer → difficulty to adjust to automotive requirements high volumes & standardized products Very low flexibility with regards to product of feature adjustments	Not all Suppliers have experience in Automotive: <ul style="list-style-type: none"> • limited / no product offering that is proven to work in Automotive Applications • Challenge to meet certifications and quality requirements Several "Automotive Grade" products failed in Swissbit's validation test (e.g. Power fail protection)

SWISSBIT S-40(U) SD AND MICRO SD CARDS: FEATURES AND USPS



FEATURE OVERVIEW

SOLUTIONS FOR KEY ISSUES IN AUTOMOTIVE APPLICATIONS

		DESCRIPTION	SWISSBIT SOLUTION
Sudden Power Loss		System must be able to cope with sudden voltage drops or power loss	Proven Power Fail Protection*
Read Disturb Effect		Frequent read access to the same page can cause errors in neighboring pages	Autonomous Data Care Management (Read Disturb Management) *
Data Retention Guaranteed even at peak temperature levels		Data Retention reduces significantly with increasing temperature. Compared to 55°C , data retention is: 3.8% at 85°C / 0.6% at 105°C / 0.1% at 125°C	Autonomous Data Care Management (Auto Read Refresh) *
Reliability	<u>Diagnostic Features</u>	Sudden failure of the system will harm quality perception. Scheduled replacement based on system recommendation will not	Life Time Monitoring*
	<u>Very Low DPPM Rate</u>		100% full-temperature test & screening prior to release for shipment to customers
Support & Services	<u>Pre-Sales</u>	Consulting: system spec definition and component selection, SIP consulting Joint qualification, dedicated design-in support, Qualification reports, Customizations, Fast prototyping, Client specific testing, Custom labeling, Technology consulting and training, Validation support (CMTL, USB-IF, JEDEC, SDA etc.)	
	<u>Sales</u>	Global Key Accounting, Worldwide Channel service, Product Life Cycle Management, Active sampling process, Market information, Worldwide logistics services, Long-term and Service contracts	
	<u>After-Sales</u>	Responsive service, Solution driven, Failure analysis (4D & 8D reports), Reliability monitoring, Legacy support & longevity programs, PCN process, Firmware updates / upgrades	

* Please Refer to the following slides for more details

FEATURE OVERVIEW

KEY PRODUCT FEATURE OVERVIEW

FEATURE	CONSUMER CARD	INDUSTRIAL CARD	SWISSBIT S-40	ADVANTAGE
Power Fail Protection	Protection of data stored in NAND Generally no protection of data in process and Firmware	All industrial suppliers market "Power Fail Protection" But: significant differences among products on the market	Combination of <ul style="list-style-type: none"> • Firmware redundancy • Data Redundancy • voltage detector with access block at defined threshold 	High level of robustness to sudden power drops Verified and guaranteed in rigid internal tests
Autonomous Data Care Management	Not available	Not available	Available <ul style="list-style-type: none"> - Fully autonomous - Unique combination of features 	highest data integrity guaranteed No trigger required from host side Specifically tailored to read intensive applications in wide temperature ranges
Diagnose Functions Life Time Monitoring	Not available	Availability and feature range depending on manufacturer	Detailed System information available as Tool, SDK or API	Can be used for surveillance, diagnose or failure analysis. Allows host system to request exchange of card, avoiding unexpected failure
Certifications & Technical Support (8D etc)	Not available	Depends on supplier	Available / in progress	Compliant with the demanding requirements of the automotive industry

KEY FEATURES EXPLAINED

DIAGNOSE FUNCTIONS & LIFE TIME MONITORING

Each NAND Flash based storage product has a specific life time which largely depends on the Flash used (SLC, MLC, TLC), the controller and the firmware.

By reading out specific SD card registers or vendor commands, Swissbit's Life Time Monitoring Tool allows the host application to retrieve the current status and thus allows to predict when the card will reach its usage limit and needs to be replaced

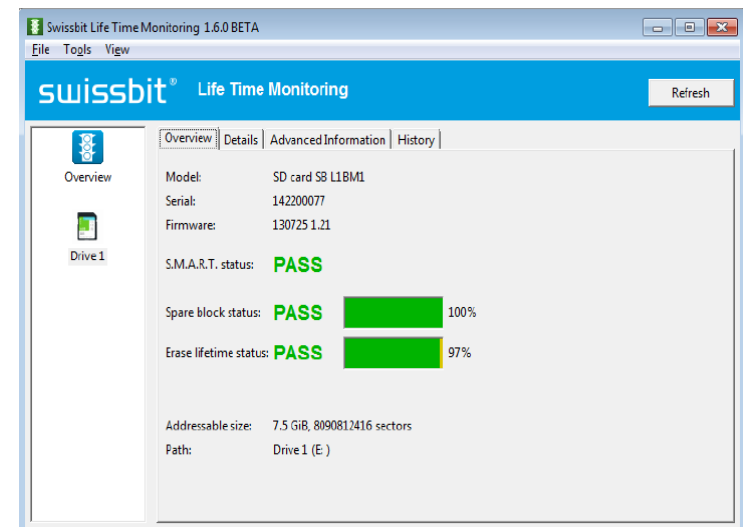


Benefit in Automotive Application

Real-Time, Detailed System information that can be used for surveillance, diagnose or failure analysis.

User can be informed and asked to exchange the card in the next service

No unexpected downtime of the system and hence no harm to quality perception



KEY FEATURES EXPLAINED

POWER FAIL PROTECTION

„Power Fail Protection“ is a rather broad definition, basically every supplier claims to have power fail safe products. But internal tests of various products on the market have shown significant differences.

Swissbit runs rigid Power Fail tests using scripts that were developed in-house and designed to guarantee the highest level of Power Fail Protection in various application environments.

Only cards with no failure at least 10'000 subsequent power loss cycles are qualified by Swissbit.



KEY FEATURES EXPLAINED

AUTONOMOUS DATA CARE MANAGEMENT

Autonomous Data Care Management is **exclusively available at Swissbit** in selected products including the S-40 Series and aims at avoiding data integrity issues due to read disturb or data retention effects.

The combination of various sophisticated algorithms allows the card to identify and manage data integrity issues that typically occur in hot environments or read intensive applications

While this task had to be taken care of by the host application previously, Swissbit's S-40 manages data integrity internally and fully independently from the host

Benefits

- burden of data management is taken off the host application
- More thorough management possible
- Significant reduction of data integrity issues
- Higher endurance and longer lifetime of the card and hence the host application



THANK YOU

