Industrial SSD and Memory
SQFlash and SQRAM for AIoT Applications
Advantech Industrial SSD & Memory Solutions

High-Performance Embedded Computing Solutions

High Speed SMT Machine
- SQR-UDSN
- SQF-CBM 930
- SQF-CU2 ER-1

Control Center
- SQF-CU2 ER-1

AOI Inspection Machines
- SQR-RD4N
- SQF-S25 840

Automated Boiler Welding
- SQR-S04E
- SQF-055 650

Cold Chain Logistics
- SQR-S04I
- SQF-C4M 720

Multiple Robotics Environment

- SQR-SD4N
- SQR-SD4I
- SQF-065 650

360-Degree Security
Security is at the heart of our solutions. Our SQFlash series offers a full spectrum of protection. These measures include data encryption (TCG-OPAL Compliant with FIPS Certification), data erase and protection, and built-in security via a user-friendly UI. In addition, our solutions feature Trellix and Acronis integration as security and backup solutions.

Ruggedized Design
Advantech’s SQFlash is equipped with advanced multi-stage power failure protection and is capable of operation in broad temperature environments. SQRAM features a conformal coating and sidefill to prevent corrosion by acid and/or water. These features remedy problems caused by high humidity or unexpected shock/vibration.

Industry-Leading Reliability
Advantech uses tier 1 chips from original IC vendors. The module assembly also passes in-house vibration and burn-in tests to ensure consistent quality. We leverage strict 100% screen testing and 3-year longevity to guarantee industrial grade stability and reliable 24/7 operation. We offer 3~5 years of extended longevity support.

Flexible Customization
To meet different application needs, Advantech provides 30-day design to order services such as security features through hardware jumper, thermal throttling setting, conformal coating/underfill, extend longevity, and SPD tuning with full hardware/software, and firmware support.

Self-Management
Device management is the foundation of industrial and IoT applications. Advantech industrial storage and memory solutions are equipped with DeviceOn/SQ Manager, a real-time self-management software, to enable lifetime prediction, remote device monitoring, and remote monitoring and management.

Advantech provides a wide range of memory products, including Industrial SSD, DDR, and I/O extension modules. We are committed to providing high-quality modules and security with corresponding software utilities and solutions. These include Advantech DeviceOn/SQ Manager, Trellix whitelisting and Acronis backup solutions — which simplifies real-time status and lifespan monitoring. Advantech delivers total solutions for a diverse range of embedded, automation, transportation, and networking applications. In addition, these solutions are compatible with all Advantech platforms. The SQFlash and SQRAM are your best peripheral choices for processing intensive data so as to accelerate IoT and AIoT transformations.
SQFlash

Leading Industrial SSD Solutions

We used our decades of embedded market experience to develop SQFlash, creating an excellent industrial storage solution with a full range of product support and value-added services. Advantech SQFlash SSDs are designed with industrial operation in mind, and provide highly-reliable storage with excellent compatibility, performance, and security. All our products are built with a TCG-OPAL self-encryption disk functionality powered by AES-256 internal encryption, and Advantech’s unique Flash Lock function for disk protection.

**Key Features**

**Comprehensive Security**
- FIPS certified SQFlash SSD
- TCG-OPAL compliant
- Cryptio Erase and Military Erase
- Trelilt & Acronis software integration

**High-Endurance Solutions**
- 10 x more durable SSD with 3D sTLC solution (P/E cycle: up to 100k)
- Industrial extended temperature support
- DeviceOn/SQ Manager delivers endurance and reliable monitoring

**Power Failure Protection**
- Comprehensive protection ensures data integrity
- Built-in voltage stabilizer for internal power supply
- Reliable startup power sequence

**Thermal Solution on NVMe SSD**
- Industrial heatsink cools SSD by up to 30 °C
- Flexible thermal grease prevents physical damage
- Smart thermal throttling against sudden performance drop
- Remote health and temperature monitoring

**Flexible Customization Service**
- 30-day time to market design-in service
- Extended longevity: 3 ~ 5 years
- Early access to the latest Storage technology
- System integration with FPGA and firmware support

The Advantech SQFlash series supports various interfaces — including SATA, PCIe/ NVMe, and PATA/ IDE — and multiple form factors — including 2.5” SSD, msATA, M.2, DOM, CFast, and half-slim SSD. SQFlash also features multiple temperature range customization. In addition, the SATA PCIe SSDs delivers superior performance, better durability, and high capacities to applications that handle sensitive data or required security.

**FIPS 140-2 Level 2 certifications**

Advantech SQFlash SSD security design is verified by National Institute of Standards and Technology (NIST), an agency of US government. SQFlash 840F and 920F series meet FIPS 140-2 Level 2 certifications. The SQFlash has passed rigorous line-by-line review process, aimed at minimizing data leakage risks and protecting user data.
**Power Failure Protection**

- Voltage Stabilizer:
  - Stabilizing internal power supply

- Power Failure Saver:
  - Data integrity in Flash IC

- Flush Manager:
  - Valid data always kept in Flash IC

- Power Drop Catcher:
  - Reliable startup power sequence

**Robust Thermal Management**

- High Power Efficiency:
  - High Power Efficiency
  - High performance to power consumption ratio improves power efficiency

- Effective Hardware and Firmware Thermal Solution:
  - Effective heat dissipater and robust FW thermal throttling management with true wide temp. Flash, can reduces thermal energy up to 30%

### Flash Type

<table>
<thead>
<tr>
<th>Storage</th>
<th>SLC</th>
<th>Ultra MLC</th>
<th>3D sTLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE Cycles (3D sTLC/TLC with LDPC and RAID ECC)</td>
<td>1 bit / cell</td>
<td>60k +</td>
<td>30k +</td>
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<tr>
<td>C-temp.</td>
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<td>0-70 °C (Tc)</td>
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<tr>
<td>M-temp.</td>
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<td></td>
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<tr>
<td>I-temp.</td>
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<td>-40-85 °C (Tc)</td>
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<tr>
<td>Write Performance</td>
<td>Highest</td>
<td>High</td>
<td>High</td>
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<tr>
<td>Cost-per-bit</td>
<td>$555</td>
<td>$55</td>
<td>$5</td>
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<tr>
<td>Power Consumption</td>
<td>Lowest</td>
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### Flash Type

<table>
<thead>
<tr>
<th>MLC</th>
<th>BICS3 (64-layer)</th>
<th>BICS4 (96-layer)</th>
<th>BICS5 (112-layer)</th>
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<tr>
<td>2 bits / cell</td>
<td>3 bits / cell</td>
<td>3 bits / cell</td>
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<tr>
<td>3k +</td>
<td>3k +</td>
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<td>0-70 °C (Tc)</td>
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<tr>
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<td>Middle</td>
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<td>$</td>
<td>$</td>
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<td></td>
</tr>
</tbody>
</table>

### High Endurance Choices for Edge Server

- Up to 3 x DWPD high-endurance product selection for write intensive edge server application

### Large Capacity and RAID Support

- Large capacity support up to 12.8TB for U.2, U.3, and 3.2TB for M.2 2280. Hardware and software RAID support to reach even higher capacity and speed.

### Extreme High Performance

- Read/Write up to 6,900/5,700 MB/s and 750k/750k IOPS
SQRAM delivers a wide spectrum product portfolio for AI and industrial applications. All SQRAM memory modules use fixed die ICs to ensure quality and compatibility while providing a 3-year longevity guarantee & limited lifetime warranty. The series offers ruggedized wide temperature solutions with an extra sidefill and coating service for harsh environments. Our unique software solution helps you easily monitor SQRAM temperature and status.

**Key Features**

- **Anti-Sulfur Technology**
  - Special alloy materials used as passive components, which have passed the anti-sulfuration test to operate steadily in a harsh environments

- **30µ" Gold Finger**
  - Extra-thick gold-plated connectors ensure signal transmission and high stability
  - User-friendly Chamfer Golden finger

- **Wide-Temperature Support**
  - Diverse temperature range support
  - Extended temperature: -20-85 °C
  - Wide temperature: -40-105 °C
  - Ultra wide temperature: -40-125 °C

- **Industrial Heatsink Solution**
  - Ability to quickly disperse heat in high-temperature environments
  - Compatible with all form factors

- **Robust Design**
  - 48hr burn-in test program
  - Rugged DIMM with mounting holes resist shock and extreme vibration
  - Fixed BOM and 3-year longevity

- **Customization Services**
  - Conformal coating
  - SideFill

- **SPD Write Protect**
  - Secure DRAM parameter settings
  - Reversible Software Write Protection(RSWP)

- **Military Mechnical Certification**
  - MIL-810G verified
  - Passed test with 6 directions, 18 shocks

- **Smart DRAM Management Software**
  - Monitor operating temperatures and real-time system speeds
  - Overheating alerts
  - Background dynamic monitoring

Advantech SQRAM series offers a range of product lines including Unbuffered DIMM, ECC DIMM, Server DIMM, and Rugged DIMM with speeds of DDR4, DDR3, DDR2, and DDR1. The latest DDR5 is ready to give you a total upgrade in operating performance.

<table>
<thead>
<tr>
<th>Memory IC Quality Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original IC SQRAM</td>
</tr>
<tr>
<td>etTTC DRAM IC</td>
</tr>
<tr>
<td>100% Fully tested by Major IC Manufacturer</td>
</tr>
<tr>
<td>- Using the best quality wafers, and following the original factory’s testing procedures</td>
</tr>
<tr>
<td>- ICs will be printed with the manufacturer’s trademarks, such as Samsung, Micron</td>
</tr>
<tr>
<td>Effective Test DRAM IC</td>
</tr>
<tr>
<td>- DRAM ICs have been tested for effectiveness, but have not been fully tested</td>
</tr>
<tr>
<td>- ICs logo unmarked or only marked with partial IC part number</td>
</tr>
</tbody>
</table>

Advantech’s industrial-grade SQRAM memory modules are only selected original-grade IC chips which have passed through various rigorous internal tests to ensure the highest quality.

<table>
<thead>
<tr>
<th>DDR5</th>
<th>Embedded Series</th>
<th>Robust Series</th>
<th>Server Series</th>
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<tbody>
<tr>
<td>SODIMM</td>
<td>SQR-SD5N</td>
<td>SQR-SD5N/SQR-SD5U</td>
<td>RDIMM</td>
</tr>
<tr>
<td>UDIMM</td>
<td>SQR-UD5N</td>
<td>SQR-YD5N</td>
<td>SQR-UD5N</td>
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<td>ECC DIMM</td>
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<tr>
<td></td>
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<td>SQR-SD2(ECC)</td>
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<tr>
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<td>SQR-UD2(ECC)</td>
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<table>
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<td>SQR-SD4N/SQR-SD4U</td>
<td>RDIMM</td>
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<td>SQR-YD4N</td>
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<td></td>
<td>ECC DIMM</td>
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<td>SQR-SD4(ECC)</td>
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<tr>
<td></td>
<td></td>
<td>SQR-UD4(ECC)</td>
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<table>
<thead>
<tr>
<th>DDR3</th>
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<th>Server Series</th>
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<td>SQR-SD3N</td>
<td>SQR-SD3I</td>
<td>RDIMM</td>
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<td>UDIMM</td>
<td>SQR-UD3N</td>
<td>SQR-HS3I</td>
<td>SQR-UD3N</td>
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<td>ECC DIMM</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>SQR-SD3(ECC)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SQR-UD3(ECC)</td>
<td></td>
</tr>
</tbody>
</table>
SQRAM leverages next-gen technology to deliver excellent performance, compatibility, and efficient power management with a 2-fold increase in speed, and an innovative channel structure that empowers industrial, high-performance computing (HPC) and AI inference applications.

The ultra-wide temperature series is an innovative solution for critical markets, delivering industrial-grade stability with a wide range of operating temperature from -40-125 °C. The rugged design is an excellent choice for temperature-sensitive applications like transportation or mission critical markets.

DeviceOn/SQ Manager is an intelligent monitoring tool with cloud capabilities designed to keep your critical systems secure, healthy, and up-to-date. This software utility automates data collection, alerts, and provides real-time visibility into the health and performance of your memory and storage devices. Whether you are monitoring a single device or thousands, DeviceOn/SQ Manager streamlines the process with a user-friendly interface and cloud-based integration.

Advanced-Fast Performance
- Data rate 3200~6400MT/s,
- 50% faster compared to DDR4.

PMIC Adopted
- Make for better power supply and higher signal integrity.

On-Die ECC Support
- Detect and correct the error before sending data to the CPU to enhance system stability.

Independent Dual-channel Transfer
- 2 sub-channel per DIMM increase performance.

Exclusive Ultra-Wide Temperature Solution
The ultra-wide temperature series is an innovative solution for critical markets, delivering industrial-grade stability with a wide range of operating temperature from -40-125 °C. The rugged design is an excellent choice for temperature-sensitive applications like transportation or mission critical markets.

DeviceOn/SQ Manager
Intelligent Monitoring Tool With Cloud Capabilities

DeviceOn/SQ Manager is a smart software utility that secures data 24/7. Indeed, it allows users to access information on disk health, lifespan, device power-on time, temperature, power-cycle, and event logs in real-time for diagnostic purposes. Advantech’s solution enables users to execute predictive maintenance and budget for repair and replacement early. The software significantly reduces service times and cost by helping users monitor and diagnose systems remotely, as well as update mass edge devices over the air. Additionally, SQ Manager provides full spectrum of security protection in different OS and BIOS. Users can contact Advantech’s technical support for immediate action upon receiving alerts. Advantech also provides customized services such as conformal coating/underfill and SPD tuning with full hardware, software, and firmware aimed at supporting diverse applications.

SSD Health Performance Monitoring
- Disk status and endurance estimation
- Monitor SQFlash health status. Early-warning mechanism can be performed with API integration
- Real-time SSD endurance prediction based on user operation history

Disk security management and encryption
TFG OPAL compliant drive encryption and Crypto Erase

DRAM Dynamic Speed/Thermal Monitoring
- DRAM real-time status processing
- System speed monitoring
- Easily check system memory information include speed, capacity loading and operating temperature
- Memory SPD timing information
- Memory product record

Temperature Alerts
- Thermal alert will be trigger when memory operating temperature overheat.
- Alert temperature could be set up depends on user environment.

Upper Industrial 48HR Burn-in program
- Operating Environment Heat up to 125 °C

Automotive Grade IC

Sidefill Technology
Advantech’s embedded extension modules (EXM) are standard full-sized Mini PCIe modules equipped with a variety of I/O interfaces. EXM users can extend extra interface ports without customization or board modification. This eases EXM modules/adapter integration and delivers high flexibility to a diverse range of embedded, automation, transportation, and networking applications.

EXM modules provide standard full size Mini PCIe modules that support a variety of I/O for embedded boards and systems.

Product Highlights

**EXM-CMPF1**
- A or E key
- M.2 (NGFF) to mPCIe (PCIe+USB) adapter
- Supports MiniPCIe thru PCIe and USB
- Full-size MiniPCIe with -40 ~ 85 °C

**EXM-520**
- Supports PCIe to 2-Ch SATA III port
- Mini PCIe thru PCIe interface
- Full-size Mini PCIe with -10 ~ 70 °C

**EXM-510**
- Supports PCIe to 1-Ch Giga LAN port
- Mini PCIe thru PCIe interface
- Full-size MiniPCIe with -40 ~ 85 °C

**EXM-523**
- Supports PCIe to 2-Ch Giga LAN port
- MiniPCIe thru PCIe interface
- Full-size MiniPCIe + Extension board with 0 ~ 70 °C

Applications

- **Elevator Communication**
  - Quickly extend CANBus interfaces
  - CANBus EXM-320
  - Fanless Box PC ARK-2121

- **Kiosk Applications**
  - Quickly extend USB 3.0 interfaces
  - USB 3.0 EXM-521
  - Embedded Box PC AIMB-B2274

- **HMI**
  - Quickly extend high-speed serial COM modules
  - Serial COM EXM-311
  - MIO Compact SBC MIO-5272

- **Railway NVR Applications**
  - Quickly extend serial ATA ports
  - SATA Port EXM-520
  - Fanless Compact System ITX-5710
Industrial automation applications require memory and storage solutions with excellent stability, longevity and endurance. Automation application high-frequency write functions accentuate the importance of high endurance design, and 3 years of longevity support. Advantech offers SLC flash technology for applications that require the absolute best endurance. Using sTLC delivers 10 x the endurance of standard TLC and is significantly more cost effective than comparable SLC.

**Automotive**
- 24/7 operation
- Extraordinary reliability and endurance
- Remote life monitoring

**Storage**
- Advanced thermal solution
- Large capacity
- Utility and AES-256-bit support

**Memory**
- Cost effective
- BOM fixed
- Longevity

**Networking**
- Advanced thermal solution
- Large capacity
- Utility and AES-256-bit support

**Memory**
- High speed
- High capacity
- Corrosion resistance

**Defense/Aerospace**
- 24/7 operation
- Extraordinary reliability and endurance
- Remote life monitoring

**Storage**
- Advanced thermal solution
- Large capacity
- Utility and AES-256-bit support

**Memory**
- Cost effective
- BOM fixed
- Longevity

**Networking**
- Advanced thermal solution
- Large capacity
- Utility and AES-256-bit support

**Memory**
- High speed
- High capacity
- Corrosion resistance

**Advantech provides ruggedized storage and memory solutions that meet the challenges presented by wide temperature and high humidity during 24/7 operation in military and aerospace applications. Advantech solutions are designed with an integrated suite of security features — including data encryption, emergency erase, and Trellix & Acronis security and backup solutions that keep data safe.**
**Case Studies**

### Multiple Temperature Support SATA & NVMe SSDs for EV Charger

**Region: North America**

**Project Introduction**
The widening adoption of EV, BEV, and HEV are increasing demands for charging stations at garages or in outdoor public parking lots. These charging stations need storage solutions that support efficient and reliable operation at a wide range of operating temperatures. The Advantech SQFlash 650 SATA and 720 NVMe SSD solutions are excellent choices for such applications.

**Project Requirements**
- Electric vehicles often have a limited charge capacity that runs out after several hours of driving. Fast, effective, and stable charging services are necessary for their successful operation. This makes system storage solutions capable of enduring wide operating temperatures and outdoor operation crucial.
- SSDs need to function stably in diverse environments.
- They need to endure constant, daily use for years on end.

**Project Description**
The Advantech SQFlash 650 SATA and 720 NVMe SSDs is an excellent solution for such applications. These SSD use KIOXIA’s BiCS 3D NAND Flash technology and support up to 2 TB per drive capacity at different temperature ranges (between -40 - 85 °C). Whether applied in private garages or outdoor parking lots, EV charging stations must be capable of enduring different environments. Advantech SQFlash 650 SATA and 720 NVMe SSDs are capable of robust operation in such situations.

**Product Specifications**
- SQFlash 650 SATA and 720 NVMe SSDs
  - Up to 2TB (0 - 70 °C / -20 - 85 °C / -40 - 85 °C)
  - 100% burn in test at production line before shipment
  - SQFlash stress test for 24-hr high-low burn-in test with 100% full loading criteria; and low temperature boot up test with 1000cycles

### SQFlash Ultra-Speed Rugged NVMe PCIe Gen4 SSD for 5G Edge Computing in Data Logging Applications

**Region: Europe**

**Project Introduction**
5G edge servers used in Data Logging applications must provide low-latency, high-bandwidth computing resources at the network edge. This enables faster and more efficient data processing. These resources are particularly useful in surveillance, in-vehicle, and aviation applications.

**Project Requirements**
The demand for mission-critical data loggers is driven by the need for reliable and accurate data collection in extreme environments with high-stress conditions. The use of storage servers or Network Attached Storage (NAS) enables secure and efficient storage and retrieval of mission-critical data — including maps, images, and video footage. NAS for mission-critical data also enable real-time data processing and analysis to empower situational awareness, intelligence gathering, and decision-making.

**Product Specifications**
- SQF-CU2 ER-1 and SQF-C8M ER-1
  - SQFlash NVMe PCIe Gen4 SSD up to 15.3TB / 6.4TB (0 - 70 °C / -40 - 85 °C)
  - 100% burn in test at the production line before shipment
  - SQFlash stress test for 24-hr high-low burn-in test with 100% full loading criteria; and low temperature boot up test with 1000cycles
### Memory Solution for Highway Toll Stations

**Region:** Africa

**Project Introduction**
An SI in Morocco needed a memory solution for highway toll stations. Indeed, they needed to upgrade to faster DRAM solutions with larger capacity and better reliability to ensure efficient collection. After the upgrade, the machines at the station were able to process data faster. This resulted in reduced waiting times and improved efficiency.

**Problem Statement**
Tolling machines operate outdoors in environments with heavy vibration. They need to be reliable and vibration resistant, and to provide excellent longevity. In sum, they needed to endure daily use on the side of busy highways.

Advantech’s SQRAM solution with 30µ” chamfer edge gold finger solution enhances the vibration resistance and durability of memory modules. Gold finger connectors provide a reliable, high-speed interface between the DRAM modules and machines. The connector interface is more reliable and can withstand the harsh conditions presented by industrial applications.

**Project Description**
The SQRAM solutions in this case were tested in diverse traffic conditions to ensure performance and reliability. In the end, the machines with upgraded DRAM modules processed transactions faster with lower error rates, while demonstrating improved stability in heavy traffic conditions.

**Product Specifications**
- **SQR-UD4N**
  - Industrial-grade IC with high-quality Samsung original IC & fixed die
  - 100% reliability burn-in and vibration testing program
  - Anti-Sulfuration provide protection when used in harsh environments

**Why Advantech:**
- 30µ” Chamfer edge Gold Fingers
- 3yrs longevity fixed die
- Limited lifetime warranty
- Compatibility with motherboard AIMB-706

### Durable designed DDR4 memory against minus degree environment for Outdoor EV chargers

**Region:** Europe

**Project Introduction**
EV charging units are often installed in outdoor environments with extremely low temperatures. As the climates or seasons change, EV charger station devices face challenges created by unpredictable temperatures. Wide temperature DRAM memory peripherals avoid operational problems by stabilizing functionality in harsh environments.

**Customer Pain Points**
Our customers in Europe face critical cold weather challenges. Indeed, winter conditions cause system boot up problems and unstable operation in outdoor applications. Accordingly, wide temperature systems and robust DRAM memory is necessary for harsh environment operation.

- Unstable system operation and boot up problems in cold weather
- Challenges arise when the weather changes suddenly, during heavy rains, or after dusk

**Project Description**
The European customer in this case had a rugged motherboard but needed a memory solution capable of enduring cold temperatures. Accordingly, industrial DRAM memory was chosen to stabilize system operation.

**Product Specifications**
- **SQR-SD3I**
  - SQR is tested via a 24-hr high-low burn-in stress test (-40-85 °C) with 100% full loading criteria; and low temperature boot up with 1000 cycles
  - Qualified by 3rd party to ensure 30µ” thickness golden finger and provide stable data transfer quality even when used in outdoor applications
  - 100% inspection with customized criteria before shipment

**Why Advantech:**
- Reliable product quality
- 3yrs longevity stable supplying
- Customization service
- Prompt and professional technical team support
### SATA SSD

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Performance Series</th>
<th>Power Loss Protection</th>
<th>Enterprise Series</th>
<th>FIPS Certified</th>
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</thead>
<tbody>
<tr>
<td>SQF-S25 E300 series</td>
<td>2.5&quot; SATA SSD</td>
<td>0.2 - 0.3W</td>
<td>512GB</td>
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<tr>
<td>SQF-S25 E600 series</td>
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</tbody>
</table>

#### Form Factor
- 2.5" SATA SSD
- M.2 2280 SATA/SAS
- M.2 2280 SAS/SATA

#### Transfer Protocol
- SATA 6Gbps
- SATA 6Gbps
- SATA 6Gbps
- SATA 6Gbps
- SATA 6Gbps
- SATA 6Gbps
- SATA 6Gbps

#### Connector
- 7-pin SATA
- 7-pin SATA
- 7-pin SATA
- M.2 2280 with SATA pinout

#### Flash Type
- 30 TLC / 30 TLC
- 30 TLC / 30 TLC
- 30 TLC / 30 TLC
- 30 TLC / 30 TLC

#### Maximum Power Consumption
- 4.6W
- 3.0W
- 3.0W
- 3.0W

#### Capacity
- 2TB
- 2TB
- 2TB
- 2TB

#### Op. Temperature
- 0°C to 70°C
- 0°C to 70°C
- 0°C to 70°C
- 0°C to 70°C

#### Other Features
- 0.2 - 0.3W
- 512GB
- 512GB
- 512GB

### NVMe SSD

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Edge Server</th>
<th>Enterprise Series</th>
<th>Embedded Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQF-CU2 E2.1 series</td>
<td>2.5&quot; U.2/SAS</td>
<td>M.2 2280 NVMe</td>
<td>M.2 2280 NVMe</td>
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<tr>
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#### Form Factor
- 2.5" U.2/SAS
- M.2 2280 NVMe
- M.2 2280 NVMe

#### Transfer Protocol
- PCIe Gen 4 x4
- PCIe Gen 4 x4
- PCIe Gen 4 x4

#### Connector
- 3.2 M.2 with NVMe protocol
- 2.5 M.2 with PCIe protocol
- 2.5 M.2 with PCIe protocol

#### Flash Type
- 11.5W
- 7.0W
- 7.0W

#### Maximum Power Consumption
- 11.5W
- 7.0W
- 7.0W

#### Capacity
- 400GB
- 400GB
- 400GB

#### Op. Temperature
- 0°C to 70°C
- 0°C to 70°C
- 0°C to 70°C

#### Other Features
- 2.5" U.2/SAS
- M.2 2280 NVMe
- M.2 2280 NVMe

### Other Flash Product

<table>
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<tr>
<th>Model Name</th>
<th>Onboard BGA SSD</th>
<th>eMMC</th>
<th>High Speed Card</th>
<th>Pen Drive</th>
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#### Form Factor
- 281-ball BGA
- 150-ball BGA
- 150-ball BGA

#### Transfer Protocol
- PCIe Gen 4 x4
- SATA 6Gbps
- SATA 6Gbps

#### Connector
- M.2 2280 with PCIe protocol
- M.2 2280 with PCIe protocol
- M.2 2280 with PCIe protocol

#### Flash Type
- 3.0 TLC / 3.0 TLC / 3.0 TLC
- 3.0 TLC / 3.0 TLC / 3.0 TLC
- 3.0 TLC / 3.0 TLC / 3.0 TLC

#### Maximum Power Consumption
- 2.2W
- 1.8W
- 1.8W

#### Capacity
- 16GB
- 32GB
- 64GB

#### Op. Temperature
- 0°C to 70°C
- 0°C to 70°C
- 0°C to 70°C

#### Other Features
- 2.7k (Up to V30)
- 2.7k (Up to V30)
- 2.7k (Up to V30)
### SQRAM Industrial Memory Modules

#### DDR5

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<th>SQR-DD5I</th>
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<th>SQR-DD50</th>
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### EXM Embedded Extension Modules

#### Adapter

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<thead>
<tr>
<th>Model Name</th>
<th>EXM-CMPF1 (A key)</th>
<th>EXM-CMPF2 (E key)</th>
<th>EXM-1100 (B key)</th>
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<tbody>
<tr>
<td>Type</td>
<td>PCIe to USB 2.0 port</td>
<td>PCIe to USB 2.0 port</td>
<td>PCIe to USB 2.0 port</td>
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<td>Communication Interface</td>
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<td>PCIe</td>
<td>PCIe</td>
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<tr>
<td>Interface Connector</td>
<td>PCIe</td>
<td>PCIe</td>
<td>PCIe</td>
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<tr>
<td>Channel Connector</td>
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<td>1</td>
<td>1</td>
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<tr>
<td>Operating Temperature</td>
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<td>-40~85°C</td>
<td>-40~85°C</td>
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<tr>
<td>Storage Temperature</td>
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<td>-40~85°C</td>
<td>-40~85°C</td>
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<tr>
<td>LED Status</td>
<td>Activated indicator</td>
<td>Activated indicator</td>
<td>Activated indicator</td>
</tr>
<tr>
<td>Dimensions (L x W x H)</td>
<td>50.5 x 19.6 x 0.4 in</td>
<td>50.5 x 19.6 x 0.4 in</td>
<td>50.5 x 19.6 x 0.4 in</td>
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#### PCIe Signal

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<thead>
<tr>
<th>Model Name</th>
<th>EXM-130-13009 (D key)</th>
<th>EXM-S33</th>
<th>EXM-320 (EMIO-200U3)</th>
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<tbody>
<tr>
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<td>PCIe to 2-Ch Giga LAN port</td>
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<td>Operating Temperature</td>
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<tr>
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<td>50.5 x 30 x 20 mm</td>
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#### USB Signal

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<td>USB to 2-Ch Giga LAN port</td>
<td>USB to 2-Ch USB 2.0 port</td>
<td>USB to 2-Ch USB 2.0 port</td>
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<td>Communication Interface</td>
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<td>50.5 x 19.6 x 0.4 in</td>
<td>50.5 x 19.6 x 0.4 in</td>
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</tbody>
</table>

Note: *- means Not Applicable (N/A)
## SQFlash Storage Modules

**Complete Form Factor Selection**
- 2.5" SSD, mSATA, M.2, DOM, CFast, and Half-slim solutions

## Advanced Thermal Solution

- Industrial heatsink on high-capacity NVMe SSDs

## SQRAM Memory Modules

**Smart-Management Memory**
- SODIMM, UDIMM, ECC DIMM, and RDIMM with monitoring software

**Exclusive Ultra Wide Temperature Solution**
- SQR-SD4E (-40 ~ 125 °C)
  - Original Micron Automotive Grade IC Adopted
  - Anti-Sulfur & Sidefill Technology Support
  - Limited lifetime warranty

---

## Regional Service and Customization Centers

### China
- Kunshan 86-512-5777-5666

### Taiwan
- Taipei 886-2-2792-7818

### Netherlands
- Eindhoven 31-40-267-7000

### Poland
- Warsaw 00800-2426-8080

### USA
- Milpitas, CA 1-408-519-3988

---

## Worldwide Offices

### Greater China

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