



The Global Leader in Specialized Storage and Memory Solutions

WE BUILD WITH YOU



About ATP

Since 1991, we have consistently distinguished ourselves as one of the world’s leading original equipment manufacturers (OEM) of high-performance, high-quality and high-endurance NAND flash products and DRAM modules. As a manufacturing leader, we provide memory and storage solutions trusted by diverse industries that require high levels of technical proficiency, manufacturing quality, and wide operating temperature ranges.

We reinforce our leadership by continuing to blaze the trail as:

The Global Leader in Specialized Storage and Memory Solutions

ATP-developed firmware and mass production infrastructure are fully capable of addressing any variety of embedded/ industrial usage cases. We can provide specialized configurations to support unique memory and storage requirements, all with the aim of delivering best total cost of ownership (TCO) for our customers.

The Thermal Experts in Storage and Memory Solutions

We are widely known as one of the first to develop industrial-temperature (I-Temp) 3D NAND flash storage for extreme operating conditions. This expertise continues to this day as customizable thermal solutions are made available for the latest NVMe modules that run at blistering speeds. Through constant collaboration with customers, as well as our top-notch firmware and hardware engineering capabilities, we make sure that optimal sustained performance is achieved despite freezing cold or blazing hot temperatures.

A True Manufacturer

We manage every stage of the manufacturing process to ensure quality and product longevity, offering in-house design, testing, and tuning from integrated circuits (ICs) to module and drive level. All products are meticulously tested and validated before leaving our manufacturing facilities to make sure that they comply with the strictest industry standards and that they will operate reliably under rugged conditions and workloads for a long time.



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President's Message

In now over 30 years in the memory business, we have maintained two key principles in how we work:

- 1) Deeply understand our value to you, our customers, partners, and suppliers.
- 2) Continuously adapt, learn, and improve while maintaining focus on core competencies.

These principles have been manifested into our team's execution over the years and are now finally expressed via our "We Build With You" mantra, which can be interpreted in the more literal sense as our strength in specialty product customization by project, or in the grander scheme as learning and growing collaboratively over the years with our customers, partners, and suppliers.

Today, we proudly state with confidence that we are ready for any specialty requirement that comes our way, and back that up with industry-leading quality and service.

Over the next several years, we will not only be continuing our journey to bring value to customers but will also endeavor to scale this to be more efficient and to span across every industry segment we touch. We will apply project-specific lessons learned and capabilities and scale these values segment wide. We will be more aggressive in sharing these values and improvements with all of you, and hope that you will see this speed up our collaborations.

You can expect to have more focused project proposals backed up with years of experience in the related product or application. You will see more application/segment-specific product roadmaps and data sheets specifically addressing the pain points and feature sets most relevant to your application area.

In this way, our over 30 years of experience are not only applied into our capability to customize to your requirements, but also into the collaborative process to be smoother and more efficient. We believe that through ongoing technology changes, increasing usage case diversity, and the many global macro influences these few years, we can continue to grow and succeed in our business together.

ATP has recently finalized plans and broken ground on a new manufacturing facility in southern Taiwan. Armed with the latest in energy, water, and air circulatory infrastructure, the new facility is designed from the ground up for industry-leading green sustainable manufacturing. In the coming months, you can expect to hear more about improvements in efficiency due to the application of the latest in automation and smart factory technologies.

Let me take this opportunity to thank all of you for your unwavering friendship, support, and partnership. The ATP team is looking forward to the next stage and our next project with you.

We Build With You.

Jeff Hsieh
President

THE GLOBAL LEADER IN SPECIALIZED STORAGE AND MEMORY SOLUTIONS

One size does not fit all. Providing Unique Solutions for Unique Challenges.

We at ATP recognize the uniqueness of each customer's requirements, so we go the extra mile to custom-configure our memory and storage solutions according to the needs of our customers.

Adding Value to Optimize TCO

We want to offer our customers an opportunity to stand out in the market, optimize investments, and add value without incurring huge costs.

Sustaining Competitiveness

Due to ATP's advanced manufacturing capabilities and control of the supply chain as a true manufacturer, we can provide specialized solutions for specific needs while maintaining competitiveness in unit cost.

Pillars of ATP Customization & Services



THERMAL

With a variety of customer host environments in terms of sustained temperature, cross temperature, and air flow, ATP custom-configures firmware and hardware to manage the best balance of performance and device life span.



ENDURANCE

ATP's experience dealing with a wide scope in workload models allow for custom set configurations, tailor-fitted to customer's requirements meeting the best compromise in terms of cost per GB, DWPD, and performance.

Collaboration Between ATP and Customers is Key to Meeting Diverse Usage Requirements with Specialized Services

Collaboration is Key

To help customers articulate their needs, we engage in constant dialog with them. Through such dialogs, we can define product configurations based on their endurance, thermal and other requirements.

Our Commitment: We Build With You.

This depicts our commitment to involve you, our customers, in the process of producing the memory and storage products you need. By empowering you in crafting the solution for your unique case, it becomes your solution, your product.



SECURITY

A wide range of optional custom security technologies provide extra layers of protection safeguarding data at rest and in transit.



LONGEVITY

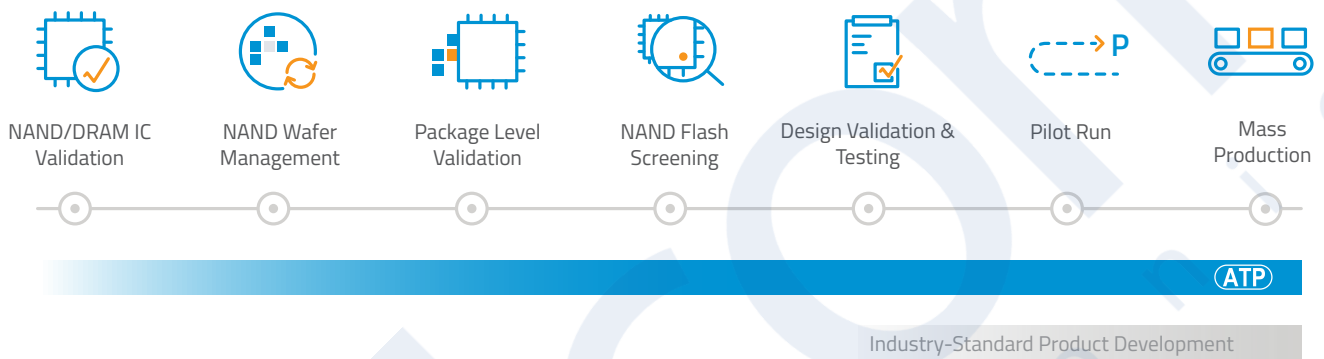
Long product cycles with a 5-year roadmap, support for legacy memory products, and controlled BOM with PCN/EOL notice typically 6 months in advance ensure consistent quality and supply availability.

ATP Delivers Specialized Storage and Memory Products with Own-Developed Firmware and Mass Production Infrastructure

As a true manufacturer, ATP is in charge of all the stages of the manufacturing process. This makes ATP totally capable of developing customizable firmware and mass production infrastructure to meet the thermal, security, endurance, and other requirements of customers. Such specialized configurations can address any variety of embedded and industrial use cases.

This once again demonstrates ATP’s commitment to deliver optimal total cost of ownership (TCO) value for its customers as storage demands of the Industrial Internet of Things (IIoT), edge computing, and other high-reliability applications continue on the upsurge.

The following figure shows ATP’s quality journey beginning with the very basic component level, the ICs, which serve as the building blocks of all ATP products.



Three Stages of ATP’s Complete Process Ownership

All DRAM and flash storage products go through a series of functional and reliability tests to ensure that they match the specifications agreed upon by ATP and the customer and to ensure that they are compatible with host environments.

1. NAND Flash IC Level

ATP ensures the reliability of the NAND flash via thorough meticulous IC-level validation for reliability and functionality.

3. Mass Production Level

100% Rapid Diagnostic Test (RDT) performed during the pilot run ensures proven reliability at mass production (MP) scale.

2. Module Level

To ensure complete module functionality and reliability, ATP performs:

- Module design/layout validation
- Controller hardware validation
- Controller firmware/FTL (flash translation layer) validation
- OEM customer joint validation: Compatibility testing for new device; module-level validation with host platform

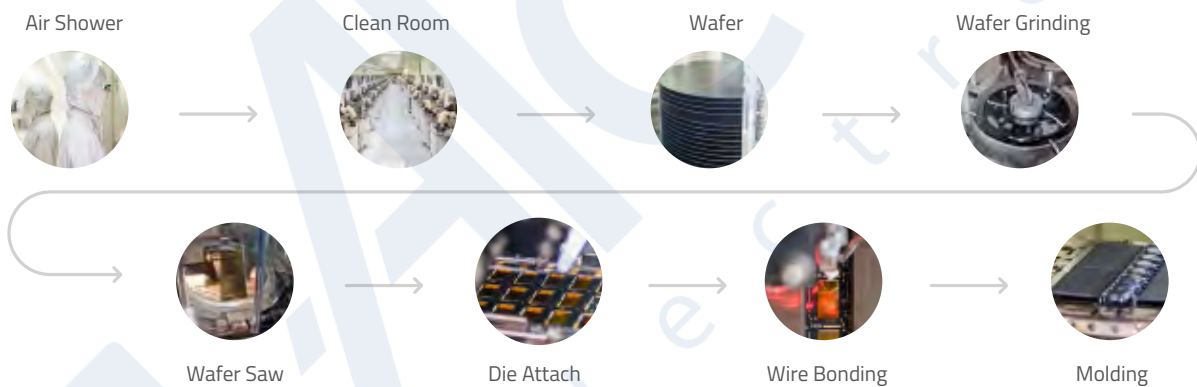
Key Manufacturing Processes

ATP demonstrates its extensive expertise in the use of NAND wafer through its own packaging capabilities to deliver IC/package-level field support and extended support for legacy products.



SiP Process

Integrates components within a single package. ATP's SiP process encapsulates all exposed components to provide protection and shielding.



Surface Mount Technology

ATP's SMT process includes mandatory 100% Solder Paste Inspection (SPI) In-Line System, which is optional for other manufacturers. ATP's N₂ Reflow effectively limits the amount of oxygen to prevent oxidation in components during the heating process by pumping nitrogen into the reflow chamber. It also improves solder wetting, which allows the metal in the solder (in the form of molten fluid) to adhere properly to the components for optimal solder joint.



Our Corporate Responsibility Commitment



Certifications

According to leading industry standards



ISO 9001:2015



ISO 14001:2015



ISO 45001:2018



ISO 14064-1:2018



ISO 17025



VDA 6.3



IATF 16949 (LOC)



Sony
Green Partner

ATP has extensive product validation experience in industry-specific standards, including:

- AEC-Q100
- IEC 60529
- JESD22-A110
- JESD78B
- SNIA
- IP6X
- MIL-STD-883
- UL94-v0
- JESD219
- ATIS
- IEC 61000-4-2:2008

Industry Associations and Compliances



All-Terrain Automotive Storage Solutions for the Road Ahead

ATP Electronics leverages 30 years of manufacturing experience and a decade of automotive expertise to provide best-in-class automotive-grade memory and storage solutions.

The world's leading OEM/Tier 1 suppliers, system developers and service providers trust ATP to deliver the highest levels of data accuracy, consistency and integrity for the most demanding automotive applications.

Up to Speed with EV & Vehicle Data Logging NAND Flash Storage Requirements

Next-generation electric vehicles require fast, reliable, and robust data storage media, not only for navigation and infotainment systems, but also for advanced applications to ensure riding safety and comfort. Vehicle data logging systems collect real-time sensor data from radar/lidar/telematic systems over long periods of time for prototype vehicles. ATP NAND flash storage products come in compact packages with high density, superior read/write performance, and customizable thermal management solutions, making them ideal solutions for constrained spaces and rugged operating environments.

Why the Automotive World Trusts ATP



Automotive Quality System Qualified, Certified and Recognized

Compliance with the most stringent international quality standards

International Automotive Task Force (IATF) 16949

Defines the quality management system requirements for the design, development, production and, when relevant, installation, and service of automotive-related products.

VDA 6.3

Defines a process-based audit standard for production parts and services to evaluate and improve controls in a manufacturing organization.

International Material Data System (IMDS)

A global archive of information on all materials found in finished automobile manufacturing.



Automotive Compliance and Standards

Always Ready for the Rough Road

AEC-Q100*

- **e.MMC:** -40°C to +105°C (Grade 2), -40°C to +85°C (Grade 3) ambient operating temperature range
- **SD/microSD:** Selected AEC-Q100 and AEC-Q104 test items; -40°C to +85°C (Grade 3) ambient operating temperature range

* Selected AEC-Q100 test items and conditions approved by customers. May vary by product and project support.

International Protection Marking*

- Waterproof (IPX7)
- Dustproof (IP6X/IP5X)

* For SD/microSD cards only.



Longevity Commitment

Your Partner for the Long Haul

Controlled BOM with PCN/EOL Notice*

- Long product cycles with buffer inventory
- Any changes affecting the process or product are communicated to customers
- 5-year roadmap
- PCN/EOL notice typically 6 months in advance

* May vary by product and project support.

Global and Local FAE Support

- Over 100 engineers and technical staff worldwide
- Global presence in five countries with support sales and service offices
- Global and regional franchised distributors

Applications

Vehicles typically traverse areas with little or no network connectivity, move between varied climates and temperatures, and constantly generate and record vast amounts of data. Automotive storage, therefore should be able to keep data accurate, secure, and available when needed.



Autonomous driving



IVI



Data Logger /
Measuring Systems



EV Infrastructure



Drive Recorder

Automotive Storage Portfolio

Form Factor	Product Line Naming	Interface	Recommended Capacity	NAND	Reliability TBW (max)*	Sequential Performance MB/s (up to)		Operating Temperature (°C)
						Read	Write	
M.2 2280	N600Si / Sc	PCIe G4 x4	240 GB to 3.84 TB	3D TLC	11,400	6,450	6,000	-40 to 85 / 0 to 70
	N600Si / Sc	PCIe G3x4	120 GB to 3.84 TB	3D TLC	10,600	3,420	3,050	-40 to 85 / 0 to 70
U.2	N600Si / Sc	PCIe G4 x4	960 GB to 7.68 TB	3D TLC	22,800	3,900	3,800	-40 to 85 / 0 to 70
	N600Si	PCIe G3x4	960 GB to 7.68 TB	3D TLC	21,000	3,100	1,400	-40 to 85
SD/ SDHC/ SDXC	S600Sia / Sca	UHS-I	8 GB to 16 GB	MLC	19	68	23	-40 to 85 / -25 to 85
	S600Sia / Sca	UHS-I	32 GB to 64GB	3D TLC (Longevity)	116	96	35	-40 to 85 / -25 to 85
	S650Sc / Si	UHS-I	32 GB to 64GB	3D TLC (High Endurance)	291	96	29	-40 to 85 / -25 to 85
	S600Sc / Si	UHS-I	64 GB to 256 GB	3D TLC (Low Latency)	698	96	65	-25 to 85 / -40 to 85
microSD/ microSDHC/ microSDXC	S600Si / Sc	UHS-I	32 GB to 64GB	3D TLC (Longevity)	116	96	35	-40 to 85 / -25 to 85
	S650Si / Sc	UHS-I	32 GB to 64GB	3D TLC (High Endurance)	291	96	29	-40 to 85 / -25 to 85
	S600Si / Sc	UHS-I	32 GB to 256 GB	3D TLC (Low Latency)	698	96	65	-40 to 85 / -25 to 85
e.MMC	E700Paa	v5.1, HS400	8 GB to 64 GB	3D MLC (pSLC mode)	1,213	300	240	-40 to 105 (AEC-Q100 Grade 2)
	E600Saa	v5.1, HS400	16 GB to 128 GB	3D MLC	309	300	170	-40 to 105 (AEC-Q100 Grade 2)
	E700Pia	v5.1, HS400	8 GB to 64 GB	3D MLC (pSLC mode)	1,320	300	240	-40 to 85 (AEC-Q100 Grade 3)
	E600Sia	v5.1, HS400	16 GB to 128 GB	3D MLC	824	300	170	-40 to 85 (AEC-Q100 Grade 3)

* Under highest Sequential write value. May vary by density, configuration and applications.

Networking / Telecom

High-speed networks provide the connectivity that feeds the growing appetite for digital communications. At the edge, requirements for higher memory and NAND flash storage specifications are growing to address environmental and performance challenges as 5G, Mobile Edge Computing (MEC) and Open Radio Access Network (O-RAN) transform the topology and architecture of communication networks.

Meanwhile, cybersecurity continues to pose numerous challenges, data centers are experiencing exponential expansions, and software-defined wireless area networking (SD-WAN) keeps evolving to offer benefits and capabilities.

With its growing memory and NAND flash storage requirements, the networking and telecommunications industry continues to trust ATP Electronics as it did over three decades ago. Today, over 70% of companies listed on Gartner's Magic Quadrant report for Primary Storage, Data Center and Cloud Computing, and WAN-Edge Infrastructure consider ATP as a strategic supplier.



5G/O-RAN/MEC



Cybersecurity/NGFW/
Networking



Data Center



SD-WAN

Unique Challenges	Solutions
Embedded form factors for boot/cache drives	SSDs with power loss protection: <ul style="list-style-type: none"> ▪ SATA: M.2 2280/2242, mSATA, 2.5", CFast ▪ NVMe: M.2 2280/2230, HSBGA
Need to maintain BOM consistency for long lifetime	5 years+ longevity and BOM control
Data integrity/reliability	End-to-end data path protection – CRC, SRAM/DRAM/NAND ECC, NAND RAID
Wide ambient temperature support	<ul style="list-style-type: none"> ▪ Industrial temperature operation ▪ High/Low temperature reliability validation ▪ Thermal cycling validation ▪ Thermal vs. Performance characterization & solutioning ▪ Heatsink solutions
High Read and Write endurance (TBW/DWPD)	High-endurance 3D TLC/pSLC/SLC series Capacity overprovisioning settings
Sustained write throughput	Configuration optimization - NAND mode selection, cache tuning, overprovisioning settings, firmware tuning
Surprise power loss or glitch	<ul style="list-style-type: none"> ▪ MCU-based power loss protection (PLP) ▪ Customized power cycling tests ▪ Sudden Power-Off Recovery (SPOR) by firmware
Data Security	<ul style="list-style-type: none"> ▪ AES, TCG-Opal 2.0, Self-Encrypting Drive ▪ Secure Erase ▪ Customized encryption security
Environmental and safety homologation	Global certifications: <ul style="list-style-type: none"> ▪ FCC, CE, UKCA, VCCI, BSMI, KCC, RCM, IC, UL, CB, CSA, Morocco, etc. (optional) ▪ ROHS, REACH
Customized validation	Collaboration on customer specific test, qualification, and validation that are beyond JEDEC standards Ex: Performance/Latency, Power consumption, Endurance, Data Retention, 4 Corner power cycling and thermal testing, Signal Integrity, system interoperability, reliability testing, etc.

Note: Listed ATP solutions are provided for reference only and may change without notice. Contact an ATP Distributor or Representative in your area to discuss how ATP can meet your specific requirements.

Industrial / Automation

As more industrial devices become interconnected, autonomous capabilities with less human control are also increasing. The resulting diverse and growing data and memory challenges require solutions offering robust performance, solid endurance, and maximum reliability to withstand rigid environments and rigid operations.

ATP offers a full spectrum of legacy and latest-generation memory and NAND flash storage solutions in a variety of form factors that meet the stringent requirements of industrial and automation systems. Built to deliver the longest uptime and least maintenance, these solutions operate reliably even under strenuous conditions and extreme temperatures.



Edge Computing/
Fanless PC



Automation/
Industrial 4.0/Drones



Energy



Gaming



Test & Measurement

Unique Challenges	Solutions
Embedded form factors for legacy platforms	<ul style="list-style-type: none"> 512 MB to 8 GB SLC/pSLC/MLC microSD, SD Industrial M.2 SATA3 or NVMe, mSATA, CF, CFast, eUSB, UFD, eMMC, BGA SSD DDR2/DDR3 VLP, 1.35V
Need to maintain BOM consistency for long lifetime	5 years+ longevity and BOM control
Wide ambient temperature Fanless platforms	<ul style="list-style-type: none"> Extreme temperature solution (-40°C to 105°C) High/low temperature reliability validation Thermal cycling validation Thermal vs. Performance characterization & solutioning Heatsink solutions I-Temp RCD
High endurance for least maintenance (low cost of ownership)	High-endurance SLC/pSLC/3D TLC series Capacity overprovisioning settings
Surprise power loss or glitch	<ul style="list-style-type: none"> MCU-based hardware power loss protection (PLP) Customized power cycling tests Sudden Power-Off Recovery (SPOR) by firmware
Environmental erosion prevention	<ul style="list-style-type: none"> 30 to 50µ" gold fingers by customization SIP package waterproof IP67 Anti-erosion, salt fog testing Conformal coating (optional)
Customized FW setting	<ul style="list-style-type: none"> Card speed mode Write capable, Read privilege control Boot-up mechanism tuning SMART ID attributes tuning
Customized validation/Label	Collaboration on customer specific test, qualification, and validation that are beyond JEDEC standards

Note: Listed ATP solutions are provided for reference only and may change without notice. Contact an ATP Distributor or Representative in your area to discuss how ATP can meet your specific requirements.

Transportation

Transportation plays a vital role in supply chain management; hence, the timely delivery of goods and services can be a daunting challenge. Data technologies, artificial intelligence (AI), and other technological advancements are allowing transportation systems to operate more efficiently at optimal costs while also delivering better services. At the heart of these advancements are memory and data storage solutions that enable better fleet management, predictive analytics, and smart logistics.



In-Vehicle/Fleet Management



Railway



Transportation Infrastructure

Unique Challenges	Solutions
Legacy form factors required	<ul style="list-style-type: none"> CF/CFast cards, low-density micro/SD cards eUSB, UFD mSATA eMMC DDR3 DRAM
Lengthy development cycle	<ul style="list-style-type: none"> 5 years+ longevity and BOM/FW control Special extension support
High ambient temperature	<ul style="list-style-type: none"> Industrial/Automotive Grade temp (AG2 & 3) Tailored thermal solutions
Zero-failure safety standard	<ul style="list-style-type: none"> High-endurance SLC/pSLC/MLC/TLC series Customized spare block (OP) setting
Unstable power supply from the platform	<ul style="list-style-type: none"> Customized power cycling test Sudden Power-Off Recovery (SPOR) by firmware (FW) enhancement MCU-based power loss protection (PLP)
Environmental erosion prevention	<ul style="list-style-type: none"> 50μ" gold fingers by customization Waterproof system-in-package (SIP) Anti-erosion, salt fog testing
Host device power-on/off patterns	<ul style="list-style-type: none"> Firmware adjustment on CMD and cache behaviors

Note: Listed ATP solutions are provided for reference only and may change without notice. Contact an ATP Distributor or Representative in your area to discuss how ATP can meet your specific requirements.

ATP Customizable Thermal Management Solutions: Steady Wins the Race

In this increasingly data-centric era, industrial applications are constantly generating data requiring storage and quick access; however, we are in a constant race not only against time, but also against heat.

NVMe solid state drives (SSDs) deliver blazing-fast performance, running at four to six times the speed of Serial ATA (SATA), but their blistering speeds, exacerbated by extreme temperature variations and constricted embedded environments with little to no ventilation, can lead to heating issues that can compromise the stability of the storage device.



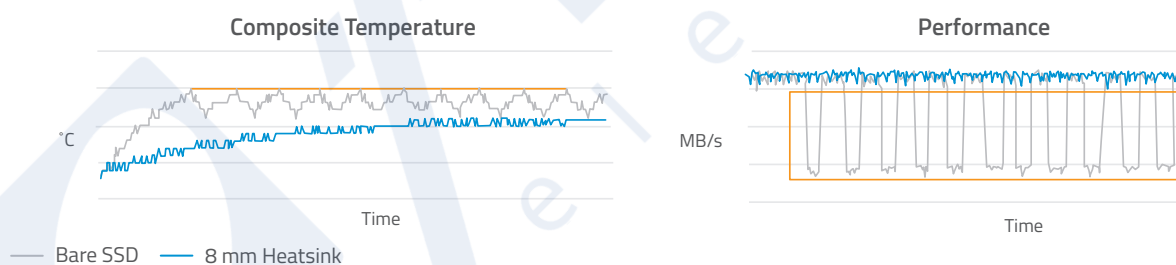
How can NVMe SSDs beat the heat?

While most of the storage world is saying, "The faster the better," ATP is taking the "Steady wins the race" stance, ensuring that blazing fast does not turn to blazing hot.

The ATP approach to thermal management may be likened to running a marathon. We consider the following aspects:

- **Environmental Assessment.** Similar to checking environmental factors, such as the weather and road conditions, we first check the airflow within the system. Is the airflow enough to provide cooling, especially for fan-less systems?
- **Physical Conditions.** Next, we assess heat dissipation by looking at the "racetrack" – which is the physical and mechanical design of the system. Considering the available space, what is the ideal heatsink solution and what material should be used? Will components on the printed circuit board (PCB) cause mechanical interference with the heatsink?
- **Ambient Simulation.** The ATP-built mini chamber is used to test the SSD within a controlled test environment, with a temperature test range from 25°C to 85°C. The mini chamber simulates and adjusts thermal environments based on customer's profile.
- **Suitable Gear/Equipment.** Selecting the suitable gear for a race can make a huge difference. What you wear keeps you cooler. The same is true in thermal management. Choosing a heatsink with excellent conductivity, reliability, design and hardness can help determine the success of the heatsink solution and may impact the total cost of ownership (TCO).
- **Pacing Strategy.** Managing heat while keeping performance optimized is a big challenge. The ATP Dynamic Thermal Throttling mechanism provides a delicate balance between performance and temperature by continuously detecting device temperature and adjusting the pace.

Steady wins the race!



When the composite temperature keeps increasing, the SSD repeatedly slows down to cool it. The 8 mm heatsink can dissipate heat complemented by airflow support.

The maximum composite temperature of NVMe SSD is reduced, and the performance is steady with optimized FW algorithm.

The ATP Solution

Simulation and Customization: One Scenario Does Not Fit All

Each customer faces a unique thermal challenge, which could be an interplay of all the factors mentioned.

As a global leader in customization, ATP recognizes the unique thermal challenges for different use cases and scenarios, and thus offers holistic and customizable solutions that combine firmware and hardware technologies to meet customers' specific thermal requirements.

ATP provides simulation and customization options depending on project and according to customers' request. The following table shows available heatsink solutions.

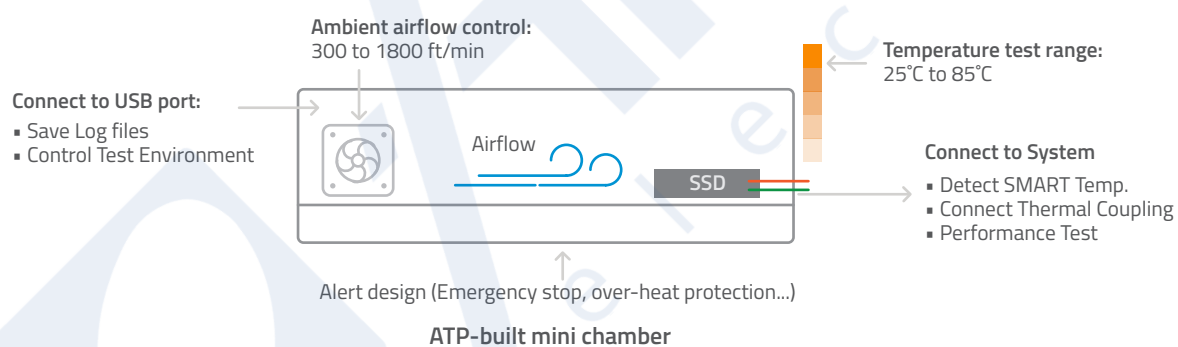
Heat Dissipation Solutions				
Form Factor supported	M.2 2280			U.2
Type	Copper Foil	4 mm Fin-Type Heatsink	8 mm Fin-Type Heatsink	15 mm Fin-Type Housing
Dimensions: L x W x H (mm)	80 x 22 x 3.9	80 x 24.4 x 8.3	80 x 24.4 x 12.3	100.5 x 69.85 x 15
Material	Copper	Upper: Aluminum alloy Bottom: Stainless steel	Upper: Aluminum alloy Bottom: Stainless steel	Aluminum alloy
Suitability	Limited space	Enough space for effective heat dissipation		
Fixedness	Stick	Clips design		Screwed

ATP Simulation Strategy: Testing Under Worst-Case Scenario to Determine Sufficient Cooling Solutions

Simulation is an important aspect of the manufacturing process. It allows ATP to test and validate its thermal solutions under different conditions and challenges in controlled environments.

ATP combines both hardware and software simulation in its three-pronged simulation testing strategy for thermal solutions:

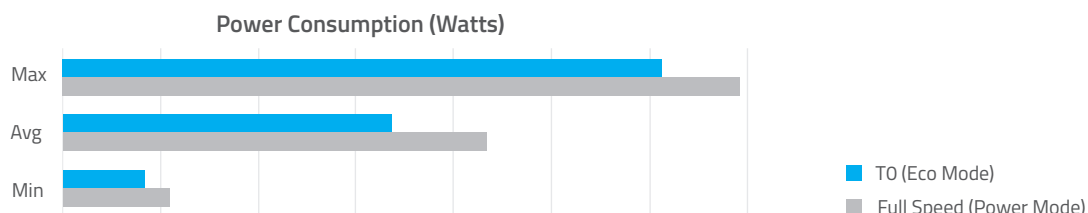
- Component-Level Simulation.** This is a pure hardware simulation based on full-speed operation, which is the worst-case scenario, to determine heat distribution in each PCB layer. Components using cooling solutions are subjected to high temperatures to test heat distribution efficiency considering various factors such as ambient temperature, airflow, thermal resistance, and power consumption of main components.
- System-Level Simulation.** The Cadence® simulation software can run system/module-level simulation. By providing contrasting results for scenarios with or without thermal solution, the simulation software demonstrates the efficiency of ATP heatsinks under worst-case ambient and airflow conditions.
- ATP-Built Mini Chamber.** The proprietary ATP-built mini chamber to simulates and adjusts thermal environments based on customer's profile. The mini chamber can run a real SSD test by simply connecting to a system's USB port.



ATP Optimization Strategy: Steady Wins the Race

The ATP Dynamic Thermal Throttling is a firmware-based mechanism that prevents extreme temperature increase by continuously detecting device temperature. As the mechanism balances performance and temperature, Eco Mode is triggered, resulting in lower power consumption.

The following figure shows that power consumption is significantly reduced under Eco Mode.

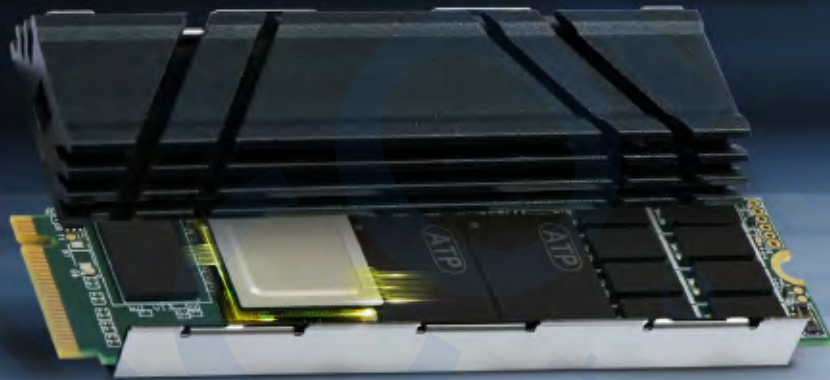


Flagship M.2, U.2 SSDs with PCIe Gen 4 x4 Interface Offer Excellent R/W Performance for High-Performance Applications

Fastest PCIe Generation Cuts Latency, Doubles Gen 3 Data Rate

ATP's latest flagship offerings, the new N600Si/Sc NVMe M.2 2280 and U.2 SSDs, sport the PCIe Gen 4 x4 interface to meet the growing need for high-speed data transfer in today's demanding applications. With twice the bandwidth of the previous generation (8 GT/s), PCIe Gen 4's 16 GT/s data rate translates to a bandwidth of 2 GB/s for every PCIe lane, enabling these SSDs to transfer data faster. ATP's PCIe Gen 4 SSDs use x4 lanes for a maximum bandwidth of 8 GB/s.

Top-class performance makes these SSDs suitable for both read/write-intensive, mission-critical applications such as data logging, surveillance, and imaging systems.



Please refer to page 37 for product specifications.

PCIe® Gen 4 NVMe M.2 2280 SSD

PRODUCT HIGHLIGHTS

- Capacities
 - 240 GB to 3.84 TB
- Operating Temp
 - I-Temp (-40°C to 85°C): N600Si
 - C-Temp (0°C to 70°C): N600Sc
- Thermal Management for Optimal Heat Dissipation
 - Nickel-coated copper heat spreader on controller
 - 4 mm or 8 mm fin-type heatsink design
- Security
 - AES 256-bit encryption
 - TCG Opal 2.0
- Data Integrity
 - End-to-End data path protection
- Performance
 - Read/Write up to : 6,450/6,000 MB/s



In keeping with its “We Build With You” motto, ATP develops these SSDs jointly with customers to meet special usage requirements and to ensure sustained and steady performance even for fanless systems without airflow. Optional features like anti-sulfur resistors are available depending on customer request.

Superior ATP-developed hardware and firmware thermal management solutions as well as power loss protection, AES-256 encryption, and TCG Opal 2.0 security make these SSDs secure and reliable for demanding industrial applications.

Accelerated I/O performance delivers ultra-low latency, improved Quality of Service (QoS), and optimal total cost of ownership (TCO).



Please refer to page 39 for product specifications.

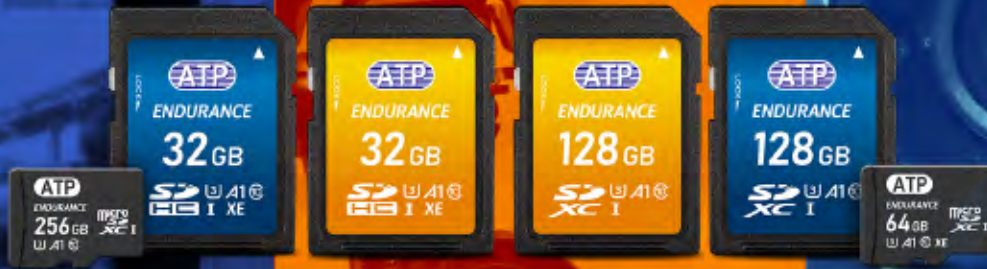
PCIe® Gen4 NVMe U.2 SSD

PRODUCT HIGHLIGHTS

- Capacities
 - 960 GB to 7.68 TB
- Operating Temp
 - I-Temp (-40°C to 85°C): N600Si
 - C-Temp (0°C to 70°C): N600Sc
- Thermal Management for Optimal Heat Dissipation
 - 15 mm fin-type heatsink design
- Security
 - AES 256-bit encryption
 - TCG Opal 2.0
- Data Integrity
 - End-to-End data path protection
- Performance
 - Read/Write up to: 3,900/3,800 MB/s
- Hot-swappable



High-Endurance, Low-Latency S750/S650 Series SD/microSD Cards: Non-Stop Dashcam Recording for Over 109K Hours



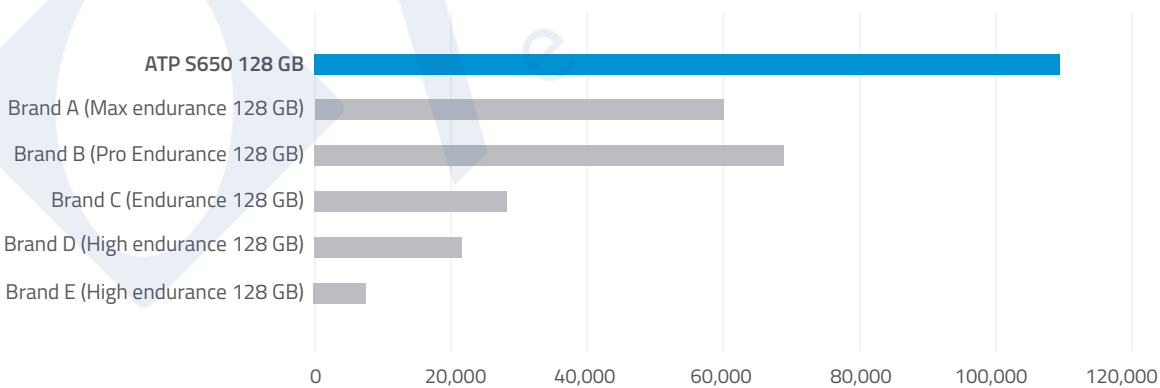
Please refer to page 47, 48 for product specifications.

The S750/S650 Series SD and microSD memory cards built with 3D triple level cell (TLC) are made for the rigors of non-stop video recording. They meet the high endurance, low latency, and built-to-last data storage requirements of dashcams and digital video recorders (DVRs), as well as surveillance systems, autonomous vehicles, and other write-intensive applications.

The S650 Series can record Full HD videos continuously up to 109,401 hours — far longer than similar cards marketed as “high endurance.” The S650 Series is based on 5K program/erase (P/E) cycles, which translate to 1.6X higher endurance than typical memory cards with 3K P/E cycles. The S750 Series, configured as pseudo single-level cell (pSLC) is based on 60K P/E cycles, while typical pSLC memory cards are rated for around 20K to 30K P/E cycles.

PRODUCT HIGHLIGHTS

- Capacities
 - S750 Series: 8 GB to 32 GB (SD); 8 GB to 64 GB (microSD)
 - S650 Series: 32 GB to 128 GB (SD); 32 GB to 256 GB (microSD)
- Operating Temp
 - I-Temp (-40 to 85 °C): S750Pi, S650Si
 - C-Temp (-25 to 85 °C): S750Sc, S650Sc
- Endurance
 - S750 Series: Up to 1,745 TB (SD); Up to 3,490 TB (microSD)
 - S650 Series: Up to 582 TB (SD); Up to 1,164 TB (microSD)
- ATP own-developed firmware
 - Read Retry, Auto Read Calibration
 - Read Disturb Protection
 - Back-up Mechanism and Sudden Power Off Recovery
- ATP own-developed advanced card analysis for System-in-Package (SiP) design
 - ATP-Developed Hardware Design - Substrate with reserved testing pin is available for future component analysis.
 - Solder Mask Removal by Laser – Precise and efficient method to remove solder mask so as to reach the reserved testing pins on the substrate.
 - ATP's Own Customized Debug Tool - This is connected to the Hardware reserved testing pin and then linked to the Software analysis system.



High Endurance Maximum Recording Hours: ATP S650 vs. Other High-Endurance Cards

Notes:

Tested using 128 GB ATP S650 TLC card based on 13 Mbps (lowest bitrate of HD recording) in best-case/ideal scenario, with no other influencing factors. Information sourced by ATP from publicly available data. To record new data, the oldest data will be overwritten when the card is full. 1Mbps=1,000,000 bps

A750/A650, N750/N650 Series: New-Generation 3D TLC SSDs Deliver Near-SLC/MLC Endurance

Endurance suited for write-intensive workloads —
66% higher than other SSDs in native TLC, at least 50% higher in pSLC

Please refer to page 38, 41, 42, 43 for product specifications.



Manufactured using a new die package, the new-generation 3D TLC SATA and NVMe embedded SSDs are breaking endurance records. The SATA A750 and A650 Series are available in M.2 2280/2242, 2.5" and mSATA form factors, while the N750 and N650 Series support the NVMe 1.3 protocol with PCIe Gen 3 x4 interface and are available as M.2 2280 modules.

Endurance enhancements compared with other SSDs:

- Near-MLC in native TLC mode: A650Si/Sc and N650Si/Sc — 66% higher
- Near-SLC in pSLC: A750Pi Series — 50% higher
N750Pi Series — 54% higher

Depending on drive capacity, N750Pi Series SSDs deliver maximum sustained sequential write performance of over 2000 MB/s, enabling them to run dependably for extended periods of time. This makes them highly suitable for write-intensive industrial/embedded applications that require reliable, uninterrupted operation.

N750Pi SSDs are configured entirely in pSLC mode, resulting in capacities lower than typical TLC drives but delivering higher reliability and longer service life.

ATP A750Pi Pseudo SLC Drives Yield 50 % Higher Endurance

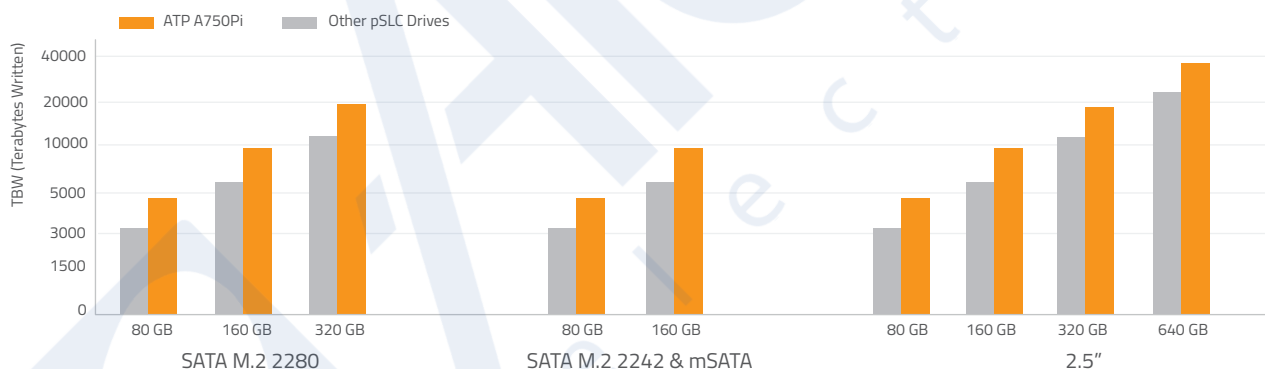


Figure 1. Comparison between ATP A750Pi and other 3D TLC drives in pseudo SLC (pSLC) mode. Endurance is expressed in terabytes written (TBW) in Sequential Write.

ATP A650Si/Sc 3D TLC Drives Yield 66% Higher Endurance

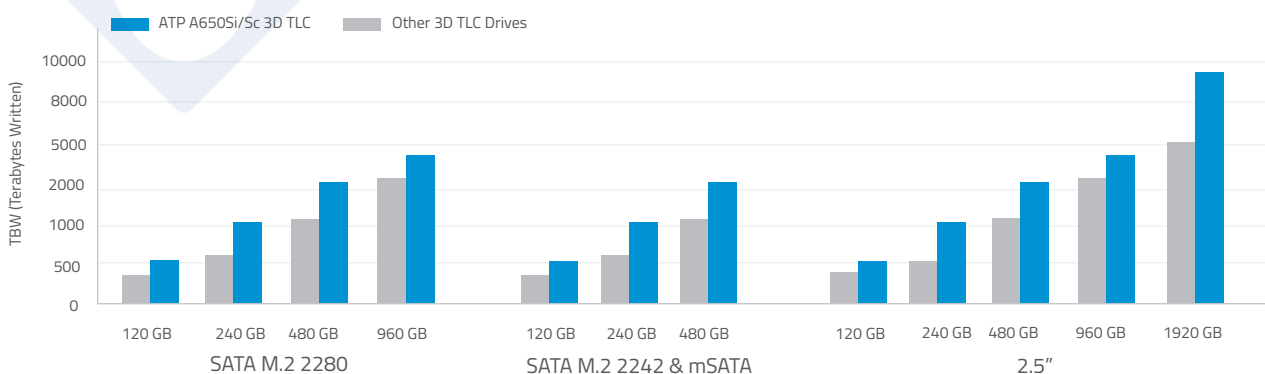


Figure 2. Comparison between ATP A650Si/Sc and other 3D TLC drives. Endurance is expressed in terabytes written (TBW) in Sequential Write.

E750Pi/Pc, E650Si/Sc Series e.MMC: New Die Package Extends Endurance to MLC/SLC Levels

Please refer to page 53 for product specifications.



Using a new die package, the E750Pi/Pc and E650Si/Sc Series offer long-life performance, optimized power consumption and customizable configuration options.

The E750Pi/Pc Series e.MMC offerings are built with 3D TLC NAND flash but are configured as pseudo SLC (pSLC) to offer endurance on par with SLC NAND, while E650Si/Sc Series in native TLC exceeds MLC endurance.

The E750Pi and E650Si Series are industrial temperature-operable (-40°C to 85°C), making them ideal for deployment in scenarios with extreme thermal challenges and harsh environments, while E750Pc and E650Sc support -25°C to 85°C operating temperatures for applications with non-critical thermal requirements.

PRODUCT HIGHLIGHTS

- Capacities
 - E750 Series: 10 GB to 21 GB
 - E650 Series: 32 GB to 64 GB
- Operating Temp
 - I-Temp (-40 to 85°C): E750Pi, E650Si
 - C-Temp (-25 to 85°C): E750Pc, E650Sc
- Endurance
 - E750 Series: Up to 1,034 TB
 - E650 Series: Up to 70 TB
- Shock/Vibration Proof
- Data Integrity Features:
 - Auto Refresh Technology
 - Dynamic Data Refresh Technology
 - SRAM Soft Error Detector and Recovery
 - Low-Density Parity-Check Error Correcting Code (LDPC ECC)
- Customizable Configuration (By project request)
 - 9 x 10 mm packaging option, for up to 40% space savings

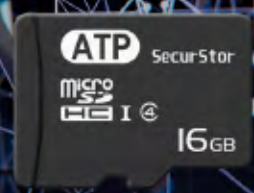
SecurStor microSD Cards Safeguard Data with Secure Boot, HW AES-256 XTS Encryption, and Customizable Security Features

As part of the ATP SecurStor product suite, the microSD cards come with integrated features that safeguard data-at-rest as well as a wide range of optional custom features tailored to an application's individual requirements.

They are well suited for the Internet of Things (IoT), education, automotive, defense, aerospace, and other applications requiring confidentiality and reliability.

As a customization option on a per-project basis, these cards may be specially built to comply with specific sanitization standards, such as the US Air Force System Security Instruction (AFSSI) 5020.

Please refer to page 51 for product specifications.



PRODUCT HIGHLIGHTS*

- **Multi-Layer Authentication:** Privilege control for up to 10 users offer high levels of protection.
- **SecurBoot:** Ensures the integrity and validity of the system's stored BIOS configuration.
- **Hardware AES-256 XTS Encryption (SecurEncrypt):** Protects the User Data area with the highest level of hardware encryption without performance trade-off.
- **Secure Erase:** Deletes the encryption key to prevent unauthorized retrieval or recovery of the user data. Compliance with US Air Force System Security Instruction (AFSSI) 5020 standard or alike is available on a per-request basis

PLATFORM/OS SUPPORT**

- x86 Windows 10 & Linux
- ARM Raspbian Linux



Customization Options

ATP is fully capable of customizing security policies, as well as hardware, firmware, and software. For special requests, please contact the ATP sales representative in your area.

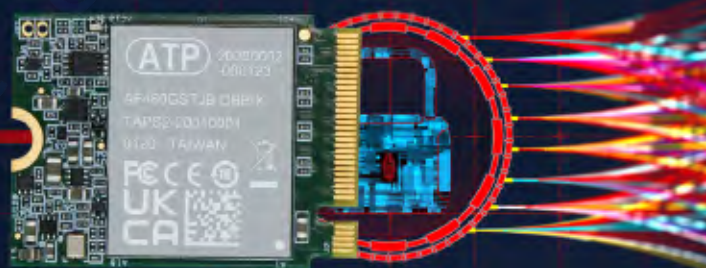
* Actual availability of specific features may vary by product and capacity. Please contact ATP for details.
 ** Support for other operating systems may be available on request.

N700 and N600 Series: High-Endurance M.2 2230, Type 1620 HSBGA SSDs Packed with Customizable Security Features

The N700 and N600 Series accommodate a heatsink ball-grid array (HSBGA) on the M.2 2230 form factor as well as M.2 Type 1620 HSBGA SSDs with the same firmware and NAND configuration for customers who prefer a soldered-down, vibration-proof solution.

They offer hardware-based security features, such as Write Protection and Quick Erase, by project and customer request.

Please refer to page 38, 54 for product specifications.



PRODUCT HIGHLIGHTS

- Form factors:
 - NVMe 1.3 PCIe Gen3x4 HSBGA on M.2 2230 module
 - NVMe 1.3 PCIe Gen3x4 HSBGA M.2 Type 1620 (soldered down)
- Capacities
 - N700 Series (pSLC): 40 GB to 160 GB
 - N600 Series (native TLC): 120 GB to 480 GB
- Maximum Endurance
 - N700 Series: 4,280 TB
 - N600 Series: 768 TB
- Sustainable performance with ATP Optimized Thermal Throttling firmware (FW)
- Low power consumption at just 5 mW under Power State 4 (Sleep Mode)
- Host Memory Buffer (HMB) support
- Operating Temperature
 - I-Temp (-40 to 85°C)
 - C-Temp (0 to 70°C)
- Customizable Security Options (by request and project support)
 - HW Write Protect
 - HW Erase
 - * Quick Erase
 - * Secure Erase (AFSSI-5020)
 - AES-256 Encryption
 - TCG Opal 2.0

ATP TSE Flash Solutions

Upgrade Modules Compliant with BSI TR-03153 Requirements
Offer Up to 8 Years of Tamper-Proof POS Transactions

Please refer to page 51 for product specifications.



ATP Electronics Technical Security Solutions (TSE) provide you with up to 8 years of secure, tamper-proof transaction storage following the TR-03153 guidelines of Bundesamt für Sicherheit in der Informationstechnik, BSI.

A TSE is an add-on to your current POS system that ensures tamper-proof recording of all fiscal transactions to prevent unauthorized manipulation for the purpose of tax fraud. ATP's solution consists of two basic elements:

PRODUCT HIGHLIGHTS

- TSE Requirements: Compliant with the requirements of the BSI TR-03153, Common Criteria PP-SMAERS, PP-CSP
- Projected Certificate Validity: Up to 8 years (also available with 5-year validity)
- Form Factors: microSD, SD, USB
- Capacities: 8 GB and 16 GB
- Data Retention: Up to 10 years (depending on test conditions)
- Lifetime: More than 20 million signatures*
- Signature time less than 150 ms
- OS Support: Windows, Android, Linux

*May vary depending on payload size(s).

ATP TSE Flash Solutions



Security Module Application for Electronic Record-keeping Systems (SMAERS)

Manages the transaction data flow from the cash register into the CSP and the NAND and prepares the data if requested by the tax authorities.



Cryptographic Service Provider (CSP)

Digitally signs transactions, which are then stored in the NAND media.



High-Speed Type B CFexpress Cards: PCIe 4.0 x2 Interface Delivers Next-Generation Performance

ATP CFexpress Type B memory cards utilize the PCIe 4.0 x2 interface, they deliver superior, high-speed performance compared with other cards using the PCIe 3.0 x2 interface. They are built with 3D TLC flash and offer big storage for IPC/embedded, automation, networking, test and measurement, and transportation systems as well as other applications that require excellent reliability, endurance, and performance.

The DRAM-less CFexpress card features Host Memory Buffer (HMB) support to improve random read performance, TCG-Opal and hardware write-protect security, and RAID 0, 1 compatibility. These features make them suitable storage media for entry-level data logging, high-end digital video cameras, and high-end digital and mirrorless cameras.

Please refer to page 49 for product specifications.



PRODUCT HIGHLIGHTS

- Capacities: 128 GB to 1 TB
- Operating Temp
 - I-Temp (-40°C to 85°C): N600Si
 - C-Temp (0°C to 70°C): N600Sc
- Endurance : Up to 1,000 TB
- Host Memory Buffer (HMB) support
- Security
 - TCG Opal 2.0
 - HW write protect (optional)
- RAID 0, 1 compatibility

ATP NANODURA Dual UFDs Comply with USB 3.2 Gen 1 Standard to Offer “SuperSpeed” Data Transfers

Effortlessly store, share, and access files with ATP’s new NANODURA Dual B600Sc Series universal flash drives (UFDs). Compliant with the Superspeed USB 3.2 Gen 1 specifications, these removable storage media can transfer data at speeds up to 5 Gb/s – a huge leap from USB 2.0 transfer speed of 480 Mb/s.

They come in capacities of 32/64/128 GB and are fitted with Type C connectors, which support reversible plug orientation.

Please refer to page 44 for product specifications.



PRODUCT HIGHLIGHTS

- Form Factor: USB flash drive (USB 3.2)
- Connector Type: Type C, supports reversible plug orientation
- Capacities
 - 32 GB to 128 GB
- Operating Temp
 - C-Temp (0 to 70°C)
- Endurance
 - Up to 84 TB
- True Plug and Play connection, supports hot swap function
- Advanced NAND management technology, global wear leveling algorithm

N600Vc/A600Vc Series: Value Line SSDs Built with 100+ Layer 3D TLC NAND

Please refer to page 38, 41, 42, 43 for product specifications.



The N600Vc/A600Vc Series SSDs are built with triple-level cell (TLC) NAND on leading 100+ layer 3D architecture. They are targeted for industrial/embedded applications requiring reliable performance, a wide range of capacity options, and long-term supply commitment at friendly price points.

The N600Vc Series is available in M.2 2242/2280 form factors and support the NVMe 1.3 protocol with PCIe Gen 3 x4 interface. The A600Vc Series is available in 2.5", M.2 2242/2280, and mSATA form factors and supports the Serial ATA (SATA) protocol and interface.

The Value Line is tailored for read-intensive applications, such as web server, box pc, kiosk/point-of-sale systems (POS), and other industrial/embedded boot drive requiring speed and reliability.

These SSDs offer lower cost per GB with a wide range of capacity offerings. They are DRAM-less, making them ideally suited for heavy random-read applications such as booting, which require minimal or even no write operations.

PRODUCT HIGHLIGHTS

- Capacities
 - N600Vc Series: 120 GB to 960 GB (M.2 2242/2280)
 - A600Vc Series: 32 GB to 1 TB (M.2 2242/2280, 2.5", mSATA)
- Operating Temp
 - C-Temp (0 to 70°C)
- Endurance
 - N600Vc Series: Up to 1,520 TB
 - A600Vc Series: Up to 1,530 TB
- Host Memory Buffer (HMB) support
- Firmware-based power-loss mechanism for data-at-rest protection

ATP's DDR5 Memory Feeds the Need for Speed, Higher Density, and Lower Power



Please refer to page 30 for product specifications.

ATP introduces DDR5, the next-generation DRAM specification memory that brings several significant improvements and advantages over its previous memory generation, DDR4. Here are some of the reasons why ATP's DDR5 delivers key performance gains.

2X the Speed



ATP DDR5 DIMMs debut with 4800/5600 MT/s memory bandwidth, which supersedes DDR4's maximum speed of 3200 MT/s. DDR5 is expected to scale up to 6400 MT/s channel speed, thus doubling DDR4's and translating to overall higher performance.



Up to 256 Gb Density with 8-Layer TSV

While DDR4 maxed out at 16 Gb in a single die package (SDP), a single DDR5 DRAM die package has up to 32 Gb, allowing a maximum of 256 Gb on an 8-layer through-silicon via (TSV) package.

Lower Power Consumption



From DDR4's 1.2V, DDR5 operating voltage is a mere 1.1V, resulting in lower power consumption and more energy savings.



Better Power Architecture with PMIC

DDR5 features a new power architecture that moves power management from the motherboard to the DIMM. An on-board Power Management Integrated Circuit (PMIC) regulates power for better distribution and signal integrity while reducing noise.

Precise Temperature Control



Targeted for DDR5 Registered DIMMs (RDIMMs), a temperature sensor on the DIMM provides accurate and real-time temperature monitoring and control.

Other Key Enhancements Over DDR4

- **On-Die ECC** detects and corrects errors before data is sent to the CPU.
- **Dual Subchannels on a DIMM.** Two 40-bit-wide channels (32 data bits and 8 ECC bits) improve memory access.
- **Burst length of 16.** Having twice the burst length of DDR4, DDR5 can access 64 Bytes of data with a single burst and using just one of two independent channels (half a DIMM), translating to better efficiency.
- **Dual Data Rate (DDR)** on command and address interface, as opposed to Single Data Rate (SDR) on command and address interface with DDR4, have freed up additional pins for isolation enhancements.

DRAM Solutions

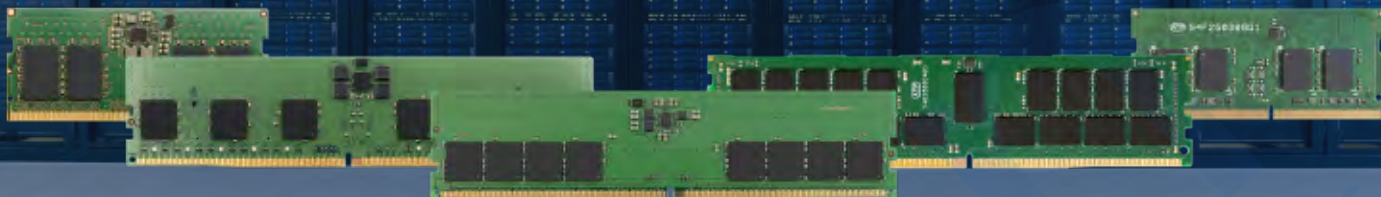
Intense Performance for Intense Workloads

ATP's industrial DRAM modules are built tough and can meet the exacting demands of the growing enterprise. On call 24/7, these hardworking modules are fast, can withstand harsh operating environments, and can handle large bandwidth requirements. ATP's DRAM lineup consists of legacy SDRAM, and a complete range of DDR1, DDR2, DDR3, DDR4, and DDR5 modules. They are available as RDIMM, RDIMM VLP, UDIMM/UDIMM ECC, SO-DIMM/SO-DIMM ECC, Mini-RDIMM, and Mini-UDIMM/Mini-UDIMM ECC.



DRAM Modules

Multi-Generational Accelerated Computing



ATP DRAM modules meet the growing need for accelerated performance in memory-intensive and high-performance computing applications to keep up with intensifying data processing requirements as the Internet of Things (IoT) and industrial IoT (IIoT) inevitably become more pervasive. Multi-generational solutions range from legacy DDR3/DDR2/DDR1 to the latest DDR4-3200 modules and DDR5 solutions, which deliver robust performance, durable build and the right density for the toughest workloads.

Key Differentiators*

■ Value-Added Customization Services

- **Conformal Coating.** ATP's conformal coating solution uses parylene coating technology via chemical vapor deposition (CVD), which is compliant with US Military Material MIL-I-46058C and Fire Safety UL94V-0 Certification standards. The coating completely penetrates spaces as narrow as 0.01 mm, making it totally pinhole-free and truly conformal to shield the DRAM module from dust, chemicals, moisture, and other harmful substances.
- **Chamfering PCB Design.** Chamfering refers to the process of "beveling or tapering" the connector edges for easier insertion into the memory slots. The bevel is done at specific angles, typically at around 40° to 50°.

■ Wide Temperature.

Wide-temperature ICs supporting -40°C to 85°C operating range offer the best solution to reach industrial grade performance at a lower cost.

■ Product Longevity Program.

Micron Technology, Inc. endorses ATP as a partner to support selected SDR/DDR/DDR2 modules. ATP will continue to manufacture legacy SDR/DDR/DDR2 DRAM modules for Micron's customers that are unable to migrate, including selected legacy DRAM modules specifically for customers using AMD Embedded/Geode platforms.

■ System-Level TDBI.

Test During Burn-In (TDBI) combines temperature, load, speed and time to stress test memory modules and expose weak modules. Even just 0.01% error on a 99.99% effective device can increase the failure rates at the module level and lead to failure in actual usage. ATP's system-level TDBI can detect and screen out the 0.01% error to ensure utmost reliability.

* May vary by product and project support.

ATP DRAM Modules: Tested Rigorously for Maximum Reliability

Dynamic Random Access Memory (DRAM) modules perform critical tasks for rigid workloads. Many of them are installed in systems that work non-stop in high-stress environments. They are constantly exposed to thermal, environmental as well as electro-mechanical challenges. Knowing that any vulnerability that can cause unstable system operation can also drastically impact business operations, ATP goes through extra lengths to make sure that its DRAM modules are extremely reliable.

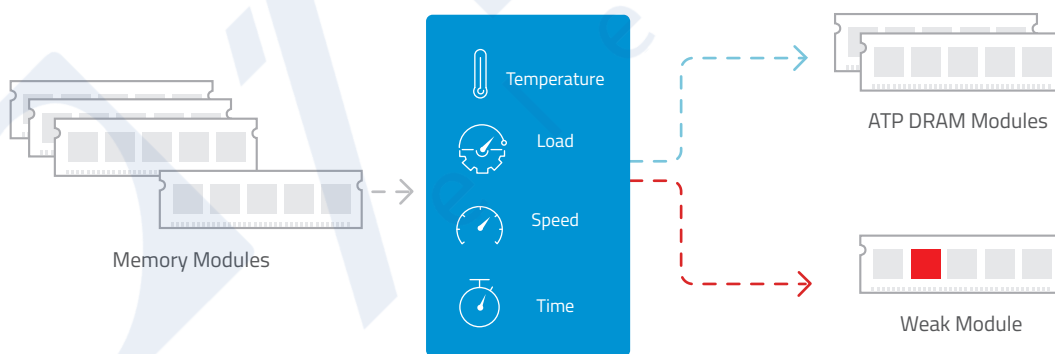
Automatic Test Equipment (ATE)

The ATE detects component defects and structural defects related to the DIMM assembly and screens out marginal timing and signal integrity (SI) sensitivities. ATE provides electrical testing patterns with various parameter settings, such as marginal voltage, signal frequency, clock, command timing and data timing under continuous thermal cycle.



Test During Burn-in (TDBI)

- TDBI at mass production level detects early life failures (ELF) and effectively screens out weak ICs that could fail during the early product life. It combines temperature, load, speed and time to stress test memory modules and expose the weak module.
- Even just 0.01% error on a 99.99% effective device can increase the failure rates at module level and lead to failure in actual usage.
- ATP TDBI can detect and screen out the 0.01% error to ensure utmost reliability.

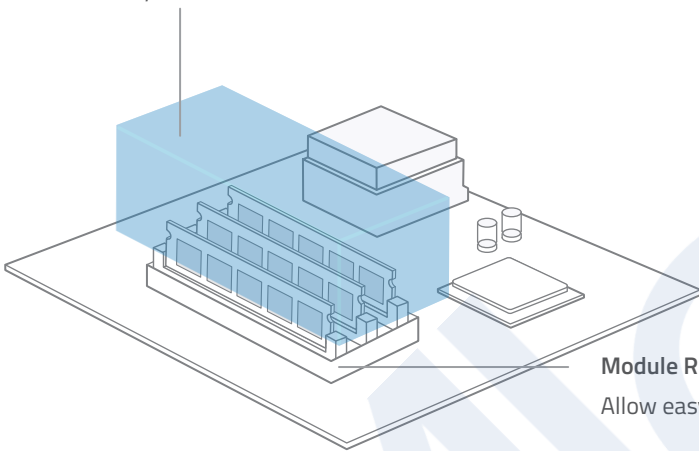


ATP TDBI: What Makes It Unique?

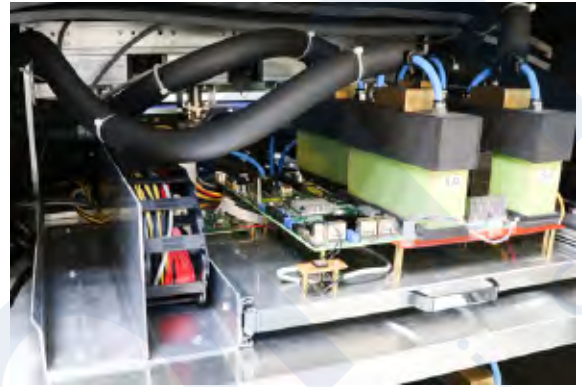
The ATP TDBI system applies extreme high/low temperature, high-low voltage, and pattern testing on DRAM modules. The system consists of:

The Mini Chamber

Isolates temperature cycling only to modules being tested so as not to thermally stress the rest of testing systems. This minimizes the failure of other testing components, such as the motherboards. It also allows faster debug for defects per million (DPM) fallout and reduced false failures. In conventional large thermal chambers, the failures of non-DRAM-related testing components are constant, given that the whole system is thermally stressed.

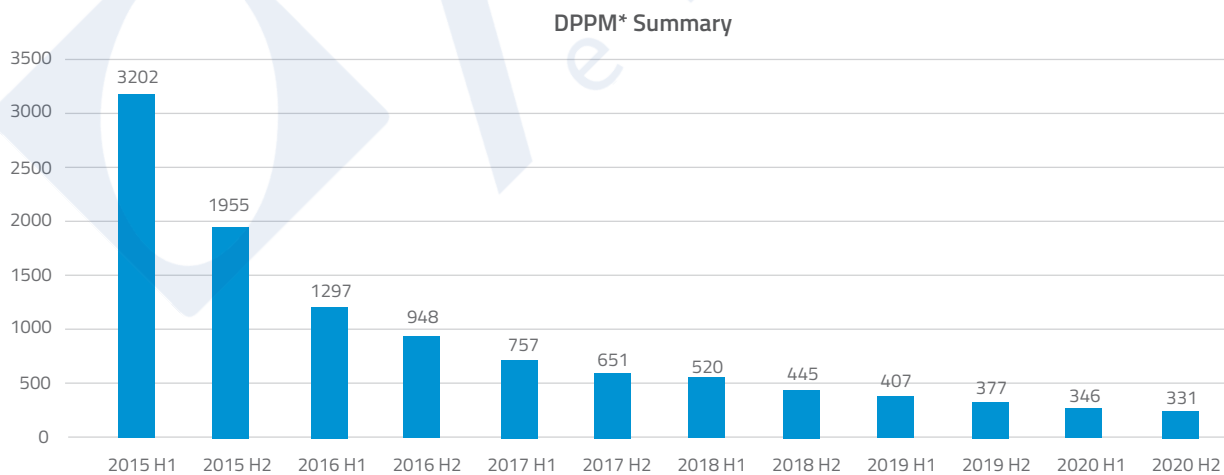


Module Riser Adapters from the Motherboard
Allow easy module insertions in production-level volumes.



Improvements After TDBI Adoption

The following graph shows that with ATP TDBI, the error rates decrease over time. The acceptable industry limit is 3,500 DPPM,* but with ATP TDBI, the error rate has gone down significantly over the years.



*DPPM = Defective Parts per Million

DDR5: Built to Meet Ever-Growing Memory Needs with 2X the Speed, 4X the Capacity and Greater Power Efficiency



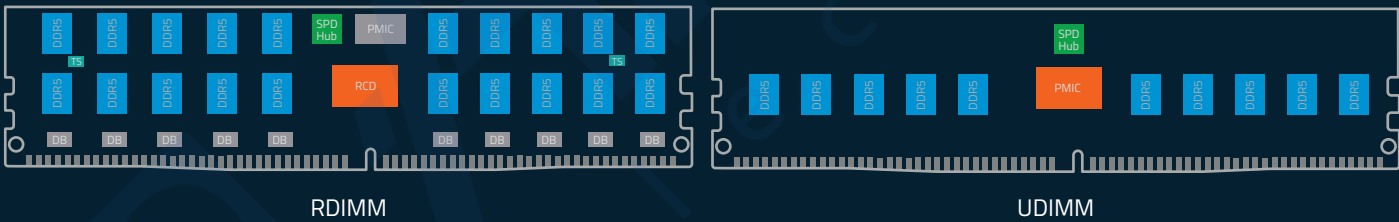
Up to 6.4 Gbps Memory Bandwidth	4800 to 6400 MHz Frequency / Transfer Rate	Per die Up to 64 Gb Memory Density	1.1_v Operating Voltage
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ATP's DDR5 solutions are expected to deliver performance and reliability improvements over the previous generation, especially for critical computing applications.

As the next-generation DRAM specification, DDR5 is poised to exceed DDR4 in every way. DDR5 promises faster performance, higher memory bandwidth, higher densities, and a new power management structure that delivers better power efficiency.

All of these advantages, and more, are expected to meet the ever-growing memory needs of present and future applications. Both DDR4 and DDR5 dual-inline memory modules (DIMMs) still have 288 pins, but with DDR5's higher bandwidth, this means it can transmit data faster. While the pin count is the same, DDR5 DIMMs will not fit in DDR4 sockets as the alignment key is located differently and the pinouts have been changed to accommodate the new features.

For more information on DDR5 and its advantages over DDR4, please go to page 25.



DDR5					
DIMM Type	RDIMM	ECC UDIMM	Non-ECC UDIMM	ECC SO-DIMM	Non-ECC SO-DIMM
Density	16 GB to 64 GB	16 GB to 32 GB	8 GB to 32 GB	16 GB to 32 GB	8 GB to 32 GB
Speed up to (MT/s)	4800/5600	4800/5600	4800/5600	4800/5600	4800/5600
PCB Height*	Low profile / VLP*	Low profile / VLP*	Low profile	Low profile	Low profile
Operating Temperature	0°C to 85°C / -40°C to 85°C				

* VLP: 0.74"

I-Temp Registered Clock Driver on Wide-Temp DDR4 RDIMMs Ensures Maximum Reliability in Extreme Temperatures



DRAM modules are typically installed in systems that operate in harsh environments and extreme temperatures that fluctuate during daytime and the nighttime, as well as in varying weather conditions; thus, memory with a broader range of temperature capabilities is becoming more necessary as most edge computing applications run 24/7, often in challenging environments.

ATP offers DDR4 wide-temp RDIMMs with industrial-temperature-rated registered clock driver (RCD) to ensure better endurance and redundancy in critical environments where commercial-grade DRAMs do not suffice.

The RCD's main function is to first receive the instructions or commands from the central processing unit (CPU) before sending them to the memory modules. This buffering reduces the strain on the CPU's memory controller, helps reduce impact on signal integrity, and maintains the same memory speed even in heavy workloads.

The following table provides a comparison between commercial grade and wide temperature RDIMMs with I-Temp RCD, which offer stability and reliability even in sub-zero temperatures.

	Commercial Grade RDIMM	Wide Temperature RDIMM
DRAM IC	Major IC	Wide-Temp IC ¹ (-40°C to 85°C)
RCD IC Temp Rating	Commercial Grade (0°C to 85°C)	Wide-Temp IC ¹ (-40°C to 85°C)
Module Operating Temp	0°C to 85°C	Industrial Grade (-40°C to 85°C)
Testing Features	ATE ² & TDBI ³ Module-Level Test (room temp.)	ATE ² & TDBI ³ 100% Module-Level Test (-40°C to 85°C)

¹ Wide-temperature ICs are ATP's best solution to reaching industrial-grade performance at lower cost through enhanced and more rigorous testing.

² ATE: Automatic Test Equipment

³ TDBI: Test During Burn-in

ATP Reaffirms Commitment to Long-Term Supply of Legacy DRAM Modules

ATP Meets Continued Demand for DDR3 Modules

With DDR4 as the current mainstream memory and companies preparing for DDR5, major memory makers are slowing down the production of DDR3 or phasing it out. However, systems that have been running for a long time supporting DDR3 remain widely in use for industrial, networking, and other embedded applications. Through its partnership with key suppliers, ATP is committed to supporting the continued demand for DDR3 SO-DIMM and UDIMM in the next 3 to 5 years.

Product Information

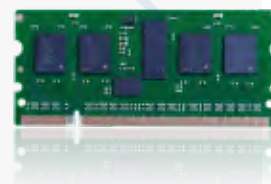
Module Type	DDR3 SO-DIMM	DDR3 UDIMM
Capacity	4 GB / 8 GB	4 GB / 8 GB
Function	ECC/NON-ECC	ECC/NON-ECC
Frequency	1866 MHz	1866 MHz

Micron-ATP Partnership and License Agreements: DDR2 Continuity Program

With DDR2 still widely deployed in the US, Japan and Europe, ATP and Micron are making sure that these markets will have a steady supply of Micron DDR2 SO-DIMMs and UDIMMs for industrial/embedded systems installed in high-reliability and mission-critical environments. All modules are manufactured, tested and validated by ATP, according to the equivalent specifications and testing/validation processes of the respective Micron part number.

“Micron is dedicated to maximizing customers' infrastructure investments by ensuring prolonged support for legacy systems and applications. Our proven partnership with ATP gives our customers the benefit of receiving similar Micron products and services to support their current platforms while ATP ensures the stability of their operations well into the future.”

- Kris Baxter, Corporate Vice President and General Manager, Embedded Business Unit, Micron Technology, Inc.



Legacy (SDR/DDR) DRAM Modules

The license agreement stipulates the following conditions for ATP:

- 100% follow Micron’s design. Offer extended support for these legacy products to minimize the customer’s (re)qualification efforts.
- 100% follow Micron’s BOM selection. Implement the same specifications for key components (such as IC configuration and Register/PLL type), as well as passive components (such as resistors, capacitors and EEPROM) to meet the specifications of Micron’s BOM.
- 100% follow Micron’s firmware settings. Implement SPD in addition to the manufacturer’s information.
- 100% follow Micron’s specifications. Each module will be manufactured to the equivalent specifications and test processes of the corresponding Micron part number.

Product Information

Module Type	Capacity	Function	Frequency	Number of Pins	PCB Height
DDR SO-DIMM	128 MB / 256 MB / 512 MB / 1 GB	Unbuffered Non-ECC	400 MHz	200	1.25"
DDR SO-DIMM (Industrial Grade)	256 MB / 512 MB	Unbuffered Non-ECC	400 MHz	200	1.25"
Build To Order (BTO)					
Module Type	Capacity	Function	Frequency	Number of Pins	PCB Height
DDR UDIMM	256 MB / 512 MB	Unbuffered Non ECC	400 MHz	184	1.25"
SDRAM SO-DIMM	64 MB / 128 MB / 256 MB	Unbuffered Non ECC	133 MHz	144	1.0" / 1.25"

Complete DRAM Portfolio

Product	DIMM Type	Capacity	Speed (MT/s, up to)	VLP/ULP*	30µ" Golden Finger	ATP TDBI	Wide Temperature	Anti-Sulfur Resistors	Conformal Coating	PCB Chamfer
DDR5	RDIMM	16 GB to 64 GB	4800/5600	●	●	●	▲	▲	-	▲
	ECC UDIMM	16 GB to 32 GB	4800/5600	●	●	●	▲	▲	▲	▲
	Non-ECC UDIMM	8 GB to 32 GB	4800/5600	-	●	●	▲	▲	▲	▲
	ECC SO-DIMM	16 GB to 32 GB	4800/5600	-	●	●	▲	▲	▲	▲
	Non-ECC SO-DIMM	8 GB to 32 GB	4800/5600	-	●	●	▲	▲	▲	▲
DDR4	RDIMM	4 GB to 128 GB	3200	●	●	●	▲	▲	-	▲
	ECC UDIMM	4 GB to 32 GB	3200	●	●	●	▲	▲	▲	▲
	Non-ECC UDIMM	4 GB to 32 GB	3200	●	●	●	▲	▲	▲	▲
	ECC SO-DIMM	4 GB to 32 GB	3200	-	●	●	▲	▲	▲	▲
	Non-ECC SO-DIMM	4 GB to 32 GB	3200	-	●	●	▲	▲	▲	▲
	Mini-RDIMM	4 GB to 16 GB	2400	●	●	●	▲	▲	-	-
	Mini-UDIMM	4 GB to 16 GB	2400	●	●	●	▲	▲	-	-
DDR3	RDIMM	1 GB to 32 GB	1866	●	●	●	▲	▲	-	▲
	ECC UDIMM	1 GB to 16 GB	1866	●	●	●	▲	▲	▲	▲
	Non-ECC UDIMM	1 GB to 16 GB	1866	●	●	●	▲	▲	▲	▲
	ECC SO-DIMM	1 GB to 16 GB	1866	-	●	●	▲	▲	▲	▲
	Non-ECC SO-DIMM	1 GB to 16 GB	1866	-	●	●	▲	▲	▲	▲
	Mini-RDIMM	1 GB to 8 GB	1600	●	●	●	▲	▲	-	-
	Mini-UDIMM	1 GB to 8 GB	1600	●	●	●	▲	▲	-	-
DDR2	ECC UDIMM	1 GB to 2 GB	800	-	●	●	▲	-	-	-
	Non-ECC UDIMM	1 GB to 2 GB	800	-	●	●	▲	-	-	-
	Non-ECC SO-DIMM	256 MB / 1 GB to 4 GB	800	-	●	●	▲	-	-	-
DDR1	Non-ECC UDIMM	256 MB	400	-	●	●	-	-	-	-
	Non-ECC SO-DIMM	128 MB to 512 MB / 1 GB	400	-	●	●	▲	-	-	-
SDRAM	Non-ECC SO-DIMM	64 MB to 256 MB	PC 133	-	●	●	-	-	-	-

▲: Optional
 * VLP: height = 0.74"
 ULP: height below 0.74"

Flash Solutions

Specialized Storage Solutions for Mission-Critical Applications

ATP's industrial flash products deliver dependable performance, efficient responsiveness, and long usage life to accomplish mission-critical tasks. Customizable* to customers' configurations, they come in different form factors, such as U.2, 2.5" SSDs, M.2 embedded modules, mSATA, CFexpress, CFast, CompactFlash, SD/microSD memory cards, and USB drives for enterprise and industrial applications.

They support high-speed interfaces such as SATA 6 Gb/s and the latest NVMe™ protocol on PCIe® interface for reliable, blazing-fast, and future-ready performance. Managed NAND offerings include the automotive/industrial grade e.MMC and NVMe HSBGA SSD, which integrate flash memory and controller into a single package.

* By project support.



Solid State Drives and Modules

Reliable Storage Solutions for the Data Era



ATP flash storage products are built for different workloads, usage scenarios, operating environments and platforms. Hard-wired for sustained operation in wide temperatures (-40°C to 85°C) and other environmental challenges, they may also be customized according to customers' requirements. They undergo stringent reliability testing to ensure reliable performance even at extreme temperatures and voltages at sudden power off and unstable power supply. Four-Corner, Temperature Cycling, and Power Cycling are just some of the reliability tests performed to guarantee that ATP SSDs deliver outstanding performance, rugged durability, and many years of reliable performance. They support the latest high-speed NVMe™ protocol on a PCIe®Gen4 x4 interface as well as proven interfaces such as SATA 6 Gb/s and USB. Various form factors include U.2, 2.5" SSDs, M.2, mSATA and eUSB modules.

Key Differentiators*

- **MLC/SLC-Level Endurance for 3D TLC Flash.** ATP's latest-generation industrial/embedded SSDs built on 3D TLC NAND flash deliver exceptional endurance. SSDs in native TLC match MLC endurance, while those configured in pSLC mode are nearly on par with SLC drives.
- **Thermal Management Solutions.** Available for NVMe SSDs, customizable solutions combine firmware and hardware technologies to overcome overheating challenges in high-speed and high-performance storage. By understanding the performance criteria, user application and system specifications, ATP can offer tailor-fitted solutions to deliver improved sustained performance.
- **High-Performance, High-Density Storage in Compact Form Factors.** ATP M.2 and mSATA modules deliver power-packed performance and massive storage capacity in lean footprints, making them ideal for space-restricted systems such as embedded/IPCs, point-of-sale (POS), and networking systems.
- **MCU-Based Power Loss Protection (PLP).*** Selected NVMe and SATA SSDs feature a completely new design of the PLP array, which utilizes a new power management IC (PMIC) and new firmware-programmable MCU (microcontroller unit). Integrated into its latest PLP technology, the new MCU design allows the PLP array to perform intelligently in various temperatures, power glitches and charge states.
- **End-to-End Data Path Protection.** ATP industrial SSDs incorporate End-to-End Data Path Protection technology to ensure the integrity of data during transfers from the host system to the storage device and back by detecting and correcting errors on multiple transfer points.

* May vary by product and project support.

Reliability Testing and Validation: Setting ATP SSDs a Cut Above the Rest

Reliability testing is an important cornerstone in the ATP manufacturing process. ATP's embedded SSDs go through standard as well as customizable testing depending on customer requests and application-specific requirements.



Reliability Demonstration Test (RDT)

Validates the mean time between failures (MTBF) rating of the drive through actual drive-level testing instead of relying on reliability prediction systems.



End-of-Life Validation Test

Makes sure that ATP SSDs perform reliably and maintain data integrity over their life span (and even beyond) as required.



PCBA Solderability Validation

Ensures effective bonding of components on the printed circuit board assembly (PCBA) for reliable electro-mechanical connections.



Four-Corner, Temperature Cycling, and Power Cycling Tests

Demonstrate reliable performance and stored data handling without data miscompare even under harsh conditions.

Compliance Testing. Uses the following ULINK DriveMaster Test Suites to test and validate compliance:



NVMe Protocol

NVM Express Compliance



Regression

Power cycle tests and JEDEC Workload Client/Enterprise Compliance



TCG Opal 2.0 Compliance

Verifies the correct behavior of storage devices implementing one or more of the Opal family SSC Specifications. Compliance is tested according to the requirements of the "TCG Storage Opal Family Test Cases Specification Version 1.00, Revision 1.00."



Proprietary Firmware Customization

Specialized solutions to enhance performance and features according to customers' unique usage/application-specific needs.

PCIe® Gen 4 NVMe M.2 2280 SSD

PCIe® Gen 4 NVMe M.2 2280 SSD		
Product Line	Superior	
	N600Si ³	N600Sc ³
Interface	PCIe G4 x4	
Flash Type	3D TLC	
Form Factor	M.2 2280-D6-M	M.2 2280-D2-M
Operating Temperature (Tcase) ¹	-40°C to 85°C	0°C to 70°C
Power Loss Protection Options	Hardware + Firmware Based	Firmware Based
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0	
Capacity	240 GB to 1,920 GB	
Performance		
Sequential Read (MB/s) up to	6,450	
Sequential Write (MB/s) up to	6,000	
Random Reads IOPS up to	1,095,000	
Random Writes IOPS up to	1,251,000	
Endurance and Reliability		
Endurance (TBW) ² up to	5,700 TB	
Reliability MTBF @ 25°C	>2,000,000 hours	
Others		
Dimensions (mm)	80.0 x 22.0 x 3.85	80.0 x 22.0 x 3.6
Certifications	CE, FCC, BSMI, UKCA, RoHS, REACH	
Warranty	2 years	

KEY FEATURES

- Superior Read/Write performance
- MCU-based Power Loss Protection Design with Level 4 (data-in-flight) protection*
- Self-Encrypting Drive (SED) with AES 256-bit Encryption, TCG Opal 2.0 *
- Thermal Heatsink Solutions**
- End-to-End Data Path Protection
- Anti-sulfuric resistor support*

* May vary by product and project support
 ** Customization available on a project basis.



Technologies & Add-On Services ⁴													
Superior	○	○	○	○	○	○	○	○	▲	▲	○	▲	▲

1 Case Temperature, the composite temperature as indicated by SMART temperature attributes.
 2 Under highest Sequential write value. May vary by density, configuration and applications.
 3 Data subject to change.
 4 Please refer to pages 56-58. ▲: Customization option available on a project basis.

PCIe® Gen4 High-Capacity NVMe M.2 2280 SSD

PCIe® Gen4 High-Capacity NVMe M.2 2280 SSD		
Product Line	Superior	
	N600Si ³	N600Sc ³
Interface	PCIe G4 x4	
Flash Type	3D TLC	
Form Factor	M.2 2280-D2-M	
Operating Temperature (Tcase) ¹	-40°C to 85°C	0°C to 70°C
Power Loss Protection Options	Firmware Based	
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0	
Capacity	3.84TB	
Performance		
Sequential Read (MB/s) up to	6,400	
Sequential Write (MB/s) up to	6,000	
Random Reads IOPS up to	1,000,000	
Random Writes IOPS up to	400,000	
Endurance and Reliability		
Endurance (TBW) ² up to	11,400 TB	
Reliability MTBF @ 25°C	>2,000,000 hours	
Others		
Dimensions (mm)	80.0 x 22.0 x 3.5 (M.2 2280 Bare PCBA) 80.0 x 24.4 x 12.5 (M.2 2280 with 8mm heatsink)	
Certifications	CE, FCC, BSMI, UKCA, RoHS, REACH	
Warranty	2 years	

KEY FEATURES

- Superior Read/Write performance
- Self-Encrypting Drive (SED) with AES 256-bit encryption, TCG Opal 2.0*
- Thermal Heatsink Solutions**
- End-to-End Data Path Protection
- Anti-sulfuric resistor support*

* May vary by product and project support
 ** Customization available on a project basis.



Technologies & Add-On Services ⁴												
Superior	○	○	○	○	○	○	○	▲	▲	○	▲	▲

1 Case Temperature, the composite temperature as indicated by SMART temperature attributes.
 2 Under highest Sequential write value. May vary by density, configuration and applications.
 3 Data subject to change.
 4 Please refer to pages 56-58. ▲: Customization option available on a project basis.

PCIe® Gen 3 NVMe M.2 2280 / 2242 / 2230 SSD

KEY FEATURES

- MCU-based Power Loss Protection Design with Level 4 (data-in-flight) protection*
- Self-Encrypting Drive (SED) with AES 256-bit encryption, TCG Opal 2.0 *
- Thermal Heatsink Solutions**

- End-to-End Data Path Protection
- TRIM function support

* May vary by product and project support
 ** Customization available on a project basis.



PCIe® Gen 3 NVMe M.2 2280 / 2242 / 2230 SSD

Product Line	Premium		Superior					
	N750Pi	N700Pi	N700Si	N700Sc	N650Si	N650Sc	N600Si	N600Sc
Interface	PCIe G3 x4							
Flash Type	3D TLC (pSLC mode)		3D TLC (pSLC mode)		3D TLC			
Form Factor	M.2 2280-D2-M		M.2 2230-S4-M		M.2 2280-D2-M			
Operating Temperature (Tcase) ¹	-40°C to 85°C		-40°C to 85°C	0°C to 70°C	-40°C to 85°C	0°C to 70°C	-40°C to 85°C	0°C to 70°C
Power Loss Protection Options	Hardware + Firmware Based		Firmware Based		Hardware + Firmware Based or Firmware Based			
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0							
Capacity	40 GB to 320 GB	40 GB to 640 GB	40 GB to 160 GB		120 GB to 960 GB		120 GB to 3.84 TB	
	Performance							
Sequential Read (MB/s) up to	3,150		2,000		3,420			
Sequential Write (MB/s) up to	2,670	2,820	1,600		3,050			
Random Reads IOPS up to	147,789		135,600		222,700		225,200	
Random Writes IOPS up to	114,227		112,000		176,600		179,200	
	Endurance and Reliability							
Endurance (TBW) ² up to	16,000 TB	21,300 TB	4,280 TB		4,640 TB		10,600 TB	
Reliability MTBF @ 25°C	>2,000,000 hours							
	Others							
Dimensions (mm)	80.0 x 22.0 x 3.5 (M.2 2280 Bare PCBA) 80.0 x 24.4 x 12.5 (M.2 2280 with 8 mm heatsink)		30.0 x 22.0 x 2.5		80.0 x 22.0 x 3.5 (M.2 2280 Bare PCBA) 80.0 x 24.4 x 12.5 (M.2 2280 with 8 mm heatsink)			
Certifications	CE, FCC, BSMI, UKCA, RoHS, REACH				CE, FCC, BSMI, UKCA, RoHS, and REACH are available for SSD models with capacities between 120 GB to 1,920 GB; RoHS/VCCI/CE/FCC are available for the 3.84 TB SSD model.			
Warranty	5 years		2 years					

PCIe® Gen 3 NVMe M.2 2280 / 2242 / 2230 SSD

Product Line	Value			
	N600Vc	N600Vc	N600Vi	N600Vc
Interface	PCIe G3 x4			
Flash Type	3D TLC			
Form Factor	M.2 2280 S2-M	M.2 2242 D5-M	M.2 2230-S4-M	
Operating Temperature (Tcase) ¹	0°C to 70°C		-40°C to 85°C	0°C to 70°C
Power Loss Protection Options	Firmware Based			
Optional SED Features	-			
Capacity	120 GB to 960 GB		120GB to 480GB	
	Performance			
Sequential Read (MB/s) up to	2,600		2,050	
Sequential Write (MB/s) up to	1,870		1,550	
Random Reads IOPS up to	184,300		138,000	
Random Writes IOPS up to	145,900		112,600	
	Endurance and Reliability			
Endurance (TBW) ² up to	1,520 TB		768 TB	
Reliability MTBF @ 25°C	>2,000,000 hours			
	Others			
Dimensions (mm)	80.0 x 22.0 x 2.2	42.0 x 22.0 x 3.6	30.0 x 22.0 x 2.5	
Certifications	CE, FCC, BSMI, UKCA, RoHS, REACH			
Warranty	2 years			

Technologies & Add-On Services ³															
PCIe® Gen3 NVMe M.2 2280 / 2242 / 2230	Premium	○	○	○	○	○	○	○	▲	○	-	○	▲	▲	-
	Superior	○	○	○	○	○	○	○	▲	○	-	▲	▲	▲	-
PCIe® Gen3 NVMe M.2 2280 SSD (3.84 TB Model)	Value	○	○	-	○	○	○	○	-	-	-	-	▲	▲	-
	Superior	○	○	-	○	○	○	○	▲	▲	○	○	-	▲	▲

1 Case Temperature, the composite temperature as indicated by SMART temperature attributes.
 2 Under highest Sequential write value. May vary by density, configuration and applications.
 3 Please refer to pages 56-58. ▲: Customization option available on a project basis.

PCIe® Gen4 NVMe U.2 SSD

KEY FEATURES

- 15 mm Fin-Type Heatsink Design
- MCU-based Power Loss Protection Design with Level 4 (data-in-flight) protection*
- Self-Encrypting Drive (SED) with AES 256-bit Encryption, TCG Opal 2.0*
- End-to-End Data Path Protection
- Hot-swappable
- Anti-sulfuric resistor support*

* May vary by product and project support



PCIe® Gen4 NVMe U.2 SSD		
Product Line	Superior	
	N600Si ³	N600Sc ³
Interface	PCIe G4 x4	
Flash Type	3D TLC	
Form Factor	2.5"	
Operating Temperature (Tcase) ¹	-40°C to 85°C	0°C to 70°C
Power Loss Protection Options	Hardware + Firmware Based	
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0	
Capacity	960 GB to 7.68 TB	
	Performance	
Sequential Read (MB/s) up to	3,900	
Sequential Write (MB/s) up to	3,800	
Random Reads IOPS up to	670,000	
Random Writes IOPS up to	601,000	
	Endurance and Reliability	
Endurance (TBW) ² up to	22,800 TB	
Reliability MTBF @ 25°C	>2,000,000 hours	
	Others	
Dimensions (mm)	100 x 69.85 x 15	
Certifications	RoHS/VCCI/CE/FCC/UKCA	
Warranty	2 years	

Technologies & Add-On Services ⁴															
Superior	○	○	○	○	○	○	○	○	○	▲	▲	○	▲	▲	▲

1 Case Temperature, the composite temperature as indicated by SMART temperature attributes.

2 Under highest Sequential write value. May vary by density, configuration and applications.

3 Data subject to change.

4 Please refer to pages 56-58. ▲: Customization option available on a project basis.

PCIe® Gen3 NVMe U.2 SSD

KEY FEATURES

- Thermal Management Solutions*
- High-Capacity NVMe Drive
- LDPC & RAID Data Recovery
- End-to-End Data Path Protection
- S.M.A.R.T / TRIM / Global Wear Leveling
- Hot-swappable

* Customization available on a project basis



PCIe® Gen3 NVMe U.2 SSD	
Product Line	Superior
	N600Si
Interface	PCIe G3 x4
Flash Type	3D TLC
Form Factor	2.5"
Operating Temperature (Tcase) ¹	-40°C to 85°C
Power Loss Protection Options	Hardware + Firmware Based
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0
Capacity	960 GB to 7.68 TB
	Performance
Sequential Read (MB/s) up to	3,100
Sequential Write (MB/s) up to	1,400
Random Reads IOPS up to	190,000
Random Writes IOPS up to	168,000
	Endurance and Reliability
Endurance (TBW) ² up to	21,000 TB
Reliability MTBF @ 25°C	>2,000,000 hours
	Others
Dimensions (mm)	100.0 x 69.85 x 7.0
Certifications	RoHS, VCCI, CE, FCC
Warranty	2 years

Technologies & Add-On Services ³													
Superior	○	○	○	○	○	○	○	○	○	○	○	▲	▲

¹ Case Temperature, the composite temperature as indicated by SMART temperature attributes.

² Under highest Sequential write value. May vary by density, configuration and applications.

³ Please refer to pages 56-58. ▲: Customization option available on a project basis.

SATA III M.2 2280 / 2242 SSD

KEY FEATURES

- MCU-based Power Loss Protection Design with Level 4 (data-in-flight) protection*
- Self-Encrypting Drive (SED) with AES 256-bit encryption, TCG Opal 2.0**
- LDPC & RAID Data Recovery
- End-to-End Data Path Protection
- TRIM / Global Wear Leveling support

* May vary by product and project support
 ** Customization available on a project basis



SATA III M.2 2280 SSD							
Product Line	Premium		Superior				Value
	A750Pi	A700Pi	A650Si	A650Sc	A600Si	A600Sc	A600Vc
Interface	SATA III 6 Gb/s						
Flash Type	3D TLC (pSLC mode)		3D TLC				3D TLC
Form Factor	2280 D2-B-M				2280 S2-B-M		
Operating Temperature (Tcase) ¹	-40°C to 85°C		0°C to 70°C	-40°C to 85°C	0°C to 70°C		
Power Loss Protection Options	Hardware + Firmware Based						Firmware Based
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0						-
Capacity	80 GB to 320 GB		120 GB to 960 GB			32 GB to 1 TB	
Performance							
Sequential Read (MB/s) up to	560		560		560		560
Sequential Write (MB/s) up to	520		480		510		525
Random Reads IOPS up to	90,000		100,000		100,000		72,000
Random Writes IOPS up to	88,000		90,000		88,000		85,000
Endurance and Reliability							
Endurance (TBW) ² up to	19,200 TB	12,800 TB	4,655 TB		2,792 TB		1,530 TB
Reliability MTBF @ 25°C	>2,000,000 hours						
Others							
Dimensions (mm)	80 x 22 x 3.35						80 x 22 x 2.2
Certifications	CE, FCC, BSMI, UKCA, RoHS, REACH						
Warranty	5 years			2 years			

SATA III M.2 2242 SSD								
Product Line	Premium			Superior				Value
	A800Pi	A750Pi	A700Pi	A650Si	A650Sc	A600Si	A600Sc	A600Vc
Interface	SATA III 6 Gb/s							
Flash Type	SLC	3D TLC (pSLC mode)		3D TLC				3D TLC
Form Factor	2242 D2-B-M							
Operating Temperature (Tcase) ¹	-40°C to 85°C			-40°C to 85°C	0°C to 70°C	-40°C to 85°C	0°C to 70°C	0°C to 70°C
Power Loss Protection Options	Hardware + Firmware Based							Firmware Based
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0							-
Capacity	8 GB to 64 GB	40 GB to 160 GB		120 GB to 480 GB			32 GB to 1 TB	
Performance								
Sequential Read (MB/s) up to	530	560		560		560		560
Sequential Write (MB/s) up to	400	520		480		510		525
Random Reads IOPS up to	76,000	68,000		100,000		100,000		70,500
Random Writes IOPS up to	76,000	88,000		90,000		88,000		81,000
Endurance and Reliability								
Endurance (TBW) ² up to	5,333 TB	9,600 TB	6,400 TB	2,327 TB		1,396 TB		1,530 TB
Reliability MTBF @ 25°C	>2,000,000 hours							
Others								
Dimensions (mm)	42 x 22 x 3.5							
Certifications	CE, FCC, UKCA, RoHS, REACH	CE, FCC, BSMI, UKCA, RoHS, REACH						
Warranty	5 years			2 years				

Technologies & Add-On Services ³													
Premium	○	○	○	○	○	○	○	○	▲	○	○	▲	▲
Superior	○	○	○	○	○	○	○	○	▲	○	▲	▲	▲
Value	○	○	—	○	○	○	—	○	—	—	—	—	—

1 Case Temperature, the composite temperature as indicated by SMART temperature attributes.
 2 Under highest Sequential write value. May vary by density, configuration and applications.
 3 Please refer to pages 56-58. ▲: Customization option available on a project basis.

SATA III 2.5" SSD

KEY FEATURES

- MCU-based Power Loss Protection Design with Level 4 (data-in-flight) protection*
- Self-Encrypting Drive (SED) with AES 256-bit encryption, TCG Opal 2.0*
- NSA-compliant Secure Erase*
- MIL-STD-810G standards*

* May vary by product and project support



SATA III 2.5" SSD								
Product Line	Premium			Superior			Value	
	A800Pi	A750Pi	A700Pi	A650Si	A650Sc	A600Si	A600Sc	A600Vc
Interface	SATA III 6 Gb/s							
Flash Type	SLC	3D TLC (pSLC mode)			3D TLC			
Form Factor	2.5"							
Operating Temperature (Tcase) ¹	-40°C to 85°C			-40°C to 85°C	0°C to 70°C	-40°C to 85°C		0°C to 70°C
Power Loss Protection Options	Hardware + Firmware Based							Firmware Based
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0							
Capacity	8 GB to 256 GB	80 GB to 640 GB		120 GB to 1,920 GB			32 GB to 1 TB	
Performance								
Sequential Read (MB/s) up to	520	560			560			560
Sequential Write (MB/s) up to	420	520			520			525
Random Reads IOPS up to	76,000	90,000			100,000			72,000
Random Writes IOPS up to	74,000	88,000			91,000			85,000
Endurance and Reliability								
Endurance (TBW) ² up to	21,333 TB	38,400 TB	25,600 TB	9,310 TB		5,585 TB		1,530 TB
Reliability MTBF @ 25°C	>2,000,000 hours							
Reliability Number of Insertions	10,000 minimum							
Others								
Dimensions (mm)	100 x 69.85 x 9.2			100 x 69.85 x 7/9.2				100 x 69.85 x 7
Certifications	CE, FCC, UKCA, RoHS, REACH			CE, FCC, BSMI, UKCA, RoHS, REACH				
Warranty	5 years			2 years				

Technologies & Add-On Services ³												
Premium	○	○	○	○	○	○	○	▲	○	○	▲	▲
Superior	○	○	○	○	○	○	○	▲	○	▲	▲	▲
Value	○	○	—	○	○	○	○	—	—	—	—	—

¹ Case Temperature, the composite temperature as indicated by SMART temperature attributes.

² Under highest Sequential write value. May vary by density, configuration and applications.

³ Please refer to pages 56-58. ▲: Customization option available on a project basis.

SATA III mSATA SSD

KEY FEATURES

- MCU-based Power Loss Protection Design with Level 4 (data-in-flight) protection*
- Self-Encrypting Drive (SED) with AES 256-bit encryption, TCG Opal 2.0*
- LDPC & RAID Data Recovery
- End-to-End Data Path Protection
- TRIM / Global Wear Leveling support

* May vary by product and project support



SATA III mSATA SSD								
Product Line	Premium			Superior			Value	
	A800Pi	A750Pi	A700Pi	A650Si	A650Sc	A600Si	A600Sc	A600Vc
Interface	SATA III 6 Gb/s							
Flash Type	SLC	3D TLC (pSLC mode)			3D TLC			
Form Factor	MO-300A							
Operating Temperature (Tcase) ¹	-40°C to 85°C	-40°C to 85°C		-40°C to 85°C	0°C to 70°C	-40°C to 85°C		0°C to 70°C
Power Loss Protection Options	Hardware + Firmware Based							Firmware Based
Optional SED Features	AES 128/256-bit Encryption			AES 256-bit Encryption, TCG Opal 2.0				-
Capacity	8 GB to 128 GB	40 GB to 160 GB			120 GB to 480 GB			32 GB to 1 TB
Performance								
Sequential Read (MB/s) up to	530	560		560		560		560
Sequential Write (MB/s) up to	430	520		480		510		525
Random Reads IOPS up to	76,000	90,000	94,000	100,000		100,000		72,000
Random Writes IOPS up to	-	88,000	85,000	90,000		88,000		85,000
Endurance and Reliability								
Endurance (TBW) ² up to	10,667 TB	9,600 TB	6,400 TB	2,327 TB		1,396 TB		1,530 TB
Reliability MTBF @ 25°C	>2,000,000 hours							
Others								
Dimensions (mm)	50.8 x 29.85 x 3.5							
Certifications	CE, FCC, UKCA, RoHS, REACH			CE, FCC, BSMI, UKCA, RoHS, REACH				
Warranty	5 years			2 years				

Technologies & Add-On Services ³												
Premium	○	○	○	○	○	○	○	▲	○	○	▲	▲
Superior	○	○	○	○	○	○	○	▲	○	▲	▲	▲
Value	○	○	—	○	○	○	—	—	—	—	—	—

¹ Case Temperature, the composite temperature as indicated by SMART temperature attributes.

² Under highest Sequential write value. May vary by density, configuration and applications.

³ Please refer to pages 56-58. ▲: Customization option available on a project basis.

USB 3.2 NANODURA Dual

KEY FEATURES

- Superior Random Write performance
- Global wear leveling
- Bad block management algorithm
- High reliability
- Plug and Play with hot-swappable connection supported
- OTG Type-C connector supported



USB 3.2 NANODURA Dual	
Product Line	Superior B600Sc
Interface	USB 3.2
Flash Type	TLC
Form Factor	USB Type-A USB Type-A/Type-C Dual Connector (Optional)
Operating Temperature	0°C to 70°C
Power Loss Protection Options	Firmware Based
Optional SED Features	-
Capacity	32 GB to 128 GB
	Performance
USB 3.1 Sequential Read (MB/s) up to	270
USB 3.1 Sequential Write (MB/s) up to	85
USB 2.0 Sequential Read (MB/s) up to	45
USB 2.0 Sequential Write (MB/s) up to	30
	Endurance and Reliability
Endurance (TBW) ¹ up to	84 TB
Reliability MTBF @ 25°C	>2,000,000 hours
Reliability Number of Insertions	10,000 minimum
	Others
Dimensions (mm)	28 x 12.25 x 4.65 Dual Connector: 36.40 x 12.25 x 4.65
Certifications	CE, FCC, UKCA, RoHS
Warranty	2 years

Technologies & Add-On Services ²				
Superior	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¹ Under highest Sequential write value. May vary by density, configuration and applications.

² Please refer to pages 56-58. ▲: Customization option available on a project basis.

USB 2.0 NANODURA

USB 2.0 NANODURA			
Product Line	Premium		Superior
	B800Pi		B600Sc
Interface	USB 2.0 (480 Mbps)		
Flash Type	SLC		MLC
Form Factor	USB Type-A		
Operating Temperature	-40°C to 85°C		0°C to 70°C
Power Loss Protection Options	Firmware Based		
Optional SED Features	-		
Capacity	512 MB to 8 GB		4 GB to 8 GB
Performance			
Sequential Read (MB/s) up to	31		26
Sequential Write (MB/s) up to	21		10
Endurance and Reliability			
Endurance (TBW) ¹ up to	192 TB		9.6 TB
Reliability MTBF @ 25°C	>5,000,000 hours		>2,000,000 hours
Reliability Number of Insertions	10,000 minimum		
Others			
Dimensions (mm)	34 x 12.2 x 4.5		
Certifications	CE, FCC, UKCA, RoHS		
Warranty	5 years		2 years

KEY FEATURES

- Global wear leveling
- Bad block management algorithm
- High reliability
- Plug and Play with hot-swappable connection supported



Technologies & Add-On Services ²					
Premium	○	○	○	○	○
Superior	○	○	○	—	○

1 Under highest Sequential write value. May vary by density, configuration and applications.
 2 Please refer to pages 56-58. ▲: Customization option available on a project basis.

USB 2.0 eUSB

USB 2.0 eUSB			
Product Line	Premium		Superior
	B800Pi	B800Pi	B600Sc
Interface	Compatible with USB 2.0 (480 Mbps)		
Flash Type	SLC		MLC
Form Factor	Pitch 2.54 mm / 2.00 mm		
Operating Temperature	-40°C to 85°C		0°C to 70°C
Power Loss Protection Options	Firmware Based	Hardware + Firmware Based	
Optional SED Features	-		
Capacity	1 GB to 16 GB	1 GB to 32 GB	8 GB to 32 GB
Performance			
Sequential Read (MB/s) up to	36	30	25
Sequential Write (MB/s) up to	23	25	19
Endurance and Reliability			
Endurance (TBW) ¹ up to	1,548 TB	1,280 TB	38.4 TB
Reliability MTBF @ 25°C	>5,000,000 hours		>2,000,000 hours
Reliability Number of Insertions	10,000 minimum		
Others			
Dimensions (mm)	36.9 x 26.6 x 9.5		
Certifications	CE, FCC, UKCA, RoHS		
Warranty	5 years		2 years

KEY FEATURES

- Superior Random Write Performance
- Global wear leveling
- Power Loss Protection
- Hardware Write Protect*

* May vary by product and project support

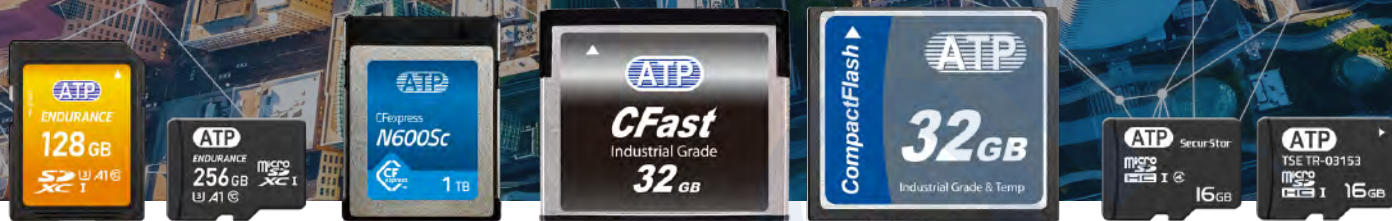


Technologies & Add-On Services ²								
Premium	○	○	▲	○	○	▲	▲	
Superior	○	○	▲	○	—	▲	▲	

1 Under highest Sequential write value. May vary by density, configuration and applications.
 2 Please refer to pages 56-58. ▲: Customization option available on a project basis.

Memory Cards

Small Cards, Big Performance for the Intelligent Edge



From smart factory to smart delivery, these small, low-power removable storage devices are excellent for surveillance, robotics, point-of-sale (POS) transactions, and handheld computing to swap operating systems (OS) and/or application programs or to extend storage capacity. The small yet ruggedized form factor is IP57/IP67-certified and supports the industrial temperature range (-40°C to 85°C) to assure reliable function in harsh environments.

ATP industrial SD and microSD cards offer excellent portability and expansion as removable storage media. Also available as Technical Security Solutions (TSE) for the German fiscal market, TSE microSD cards ensure tamper-proof point-of-sale (POS) transactions.

ATP offers a series of products compliant with CompactFlash Association standards, from legacy CF cards and CFAST (SATA interface) to CFexpress (PCIe/NVMe). ATP's latest CFexpress Type B memory cards are the most common PCIe/NVMe form factors of CFA specifications using the PCIe 4.0 x 2 interface. They deliver superior high-speed performance compared with other cards using the PCIe 3.0 x 2 interface.

Key Differentiators*

- **One Size Does Not Fit All.** Applications for removable storage are so numerous and so varied that off-the-shelf solutions may not be suitable for specific content volumes, security, reliability and endurance requirements. ATP can custom configure firmware and hardware so customers get what they really need.
- **ATP Joint Validation Service.**** Compatibility and function tests are conducted using client's host devices and systems to ensure compatibility.
- **Complete Coverage Rapid Diagnostic Test** includes testing in extreme temperatures to ensure reliable operation from -40°C to 85°C. RDT covers all areas of the storage device including user, firmware and spare areas.
- **Heavy Duty Construction.** Whether manufactured using System in Package (SiP) or Surface Mount Technology (SMT), ATP memory cards are exceptionally robust, resistant to damaging elements such as dust (IP5X/IP6X), humidity/water (IPX7), electrostatic discharge (ESD), extreme temperature, shock/vibration, and more.

* May vary by product and project support.

** Value-added service

SD/SDHC/SDXC Card

KEY FEATURES

- SD Life Monitor
- High endurance
- Low latency
- Read Disturb Protector
- Power failure protection
- Industrial temperature
- 100% MP Level Test



SD/SDHC/SDXC Card							
Product Line	Premium			Superior			
	S800Pi	S750Pi	S700Pi	S750Sc	S700Sc	S650Si	S650Sc
Interface	512 MB to 2 GB, HS mode 4 GB to 8 GB, UHS-I			UHS-I			
Flash Type	SLC	3D TLC (pSLC mode)		3D TLC (pSLC mode)		3D TLC	
Form Factor	SD Card						
Operating Temperature	-40°C to 85°C			-25°C to 85°C		-40°C to 85°C	-25°C to 85°C
Power Loss Protection Options	Firmware Based						
Optional SED Features	-						
Capacity	512 MB to 8 GB	8 GB to 32 GB	8 GB to 64 GB	8 GB to 32 GB	8 GB to 64 GB	32 GB to 128 GB	
Performance							
Sequential Read (MB/s) up to	68	99	95	99	95	96	
Sequential Write (MB/s) up to	39	82	70	82	70	57	
Endurance and Reliability							
Endurance (TBW) ¹ up to	192 TB	1,745 TB	1,164 TB	1,745 TB	1,164 TB	582 TB	
Reliability MTBF @ 25°C	>5,000,000 hours	>3,000,000 hours		>3,000,000 hours		>2,000,000 hours	
Reliability Number of Insertions	20,000 (SDA spec minimum 10,000)						
Others							
Dimensions (mm)	32.0 x 24.0 x 2.1						
Certifications	CE, FCC, UKCA, RoHS						
Warranty	5 years			3 years	2 years	3 years	

SD/SDHC/SDXC Card				
Product Line	Superior			
	S600Si	S600Sc	S600Sia/Sca	S600Sc
Interface	UHS-I			
Flash Type	3D TLC	MLC	MLC / 3D TLC	3D TLC
Form Factor	SD Card			
Operating Temperature	-40°C to 85°C	-25°C to 85°C	-40°C to 85°C/ -25°C to 85°C	-25°C to 85°C
Power Loss Protection Options	Firmware Based			
Optional SED Features	-			
Capacity	32 GB to 512 GB	8 GB to 16 GB	8 GB to 64 GB	32 GB to 512 GB
Performance				
Sequential Read (MB/s) up to	96	68	96	
Sequential Write (MB/s) up to	66	23	65	66
Endurance and Reliability				
Endurance (TBW) ¹ up to	1,396 TB	19 TB	307 TB	1,396 TB
Reliability MTBF @ 25°C	>2,000,000 hours			
Reliability Number of Insertions	20,000 (SDA spec minimum 10,000)			
Others				
Dimensions (mm)	32.0 x 24.0 x 2.1			
Certifications	CE, FCC, UKCA, RoHS			
Warranty	2 years			

Technologies & Add-On Services ²											
Premium	▲	○	○	○	▲	—	○	○	○	○	▲
Superior	▲	○	○	○	○	▲	○	▲	○	○	▲

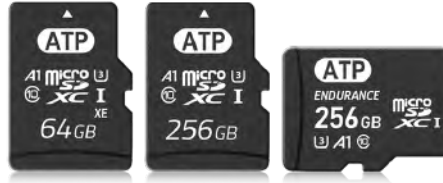
¹ Under highest Sequential write value. May vary by density, configuration and applications.

² Please refer to pages 56-58. ▲: Customization option available on a project basis.

microSD/microSDHC/microSDXC Card

KEY FEATURES

- SD Life Monitor
- High endurance
- Low latency
- Read Disturb Protector
- Power failure protection
- Industrial temperature
- 100% MP Level Test



microSD/microSDHC/microSDXC Card							
Product Line	Premium			Superior			
	S800Pi	S750Pi	S700Pi	S750Sc	S700Sc	S650Si	S650Sc
Interface	512 MB to 2 GB, HS mode 4 GB to 8 GB, UHS-I			UHS-I			
Flash Type	SLC			3D TLC (pSLC mode)		3D TLC	
Form Factor	microSD Card						
Operating Temperature	-40°C to 85°C			-25°C to 85°C		-40°C to 85°C	-25°C to 85°C
Power Loss Protection Options	Firmware Based						
Optional SED Features	-						
Capacity	512 MB to 8 GB	8 GB to 64 GB		8 GB to 64 GB		32 GB to 256 GB	
Performance							
Sequential Read (MB/s) up to	68	99	95	99	95	99	
Sequential Write (MB/s) up to	39	82	70	82	70	59	
Endurance and Reliability							
Endurance (TBW) ¹ up to	192 TB	3,490 TB	1,164 TB	3,490 TB		1,164 TB	
Reliability MTBF @ 25°C	>5,000,000 hours	>3,000,000 hours		>3,000,000 hours		>2,000,000 hours	
Reliability Number of Insertions	20,000 (SDA spec minimum 10,000)						
Others							
Dimensions (mm)	15.0 x 11.0 x 1.0						
Certifications	CE, FCC, UKCA, RoHS						
Warranty	5 years			3 years	2 years	3 years	

microSD/microSDHC/microSDXC Card			
Product Line	Superior		
	S600Si	S600Sc	S600Sc
Interface	UHS-I		
Flash Type	3D TLC	MLC	3D TLC
Form Factor	microSD Card		
Operating Temperature	-40°C to 85°C	-25°C to 85°C	-25°C to 85°C
Power Loss Protection Options	Firmware Based		
Optional SED Features	-		
Capacity	32 GB to 512 GB	8 GB to 32 GB	32 GB to 512 GB
Performance			
Sequential Read (MB/s) up to	96	68	96
Sequential Write (MB/s) up to	66	24	66
Endurance and Reliability			
Endurance (TBW) ¹ up to	1,396 TB	38 TB	1,396 TB
Reliability MTBF @ 25°C	>2,000,000 hours		
Reliability Number of Insertions	20,000 (SDA spec minimum 10,000)		
Others			
Dimensions (mm)	15.0 x 11.0 x 1.0		
Certifications	CE, FCC, UKCA, RoHS		
Warranty	2 years		

Technologies & Add-On Services ²											
Premium	▲	○	○	○	▲	—	○	○	○	○	▲
Superior	▲	○	○	○	○	▲	○	▲	○	○	▲

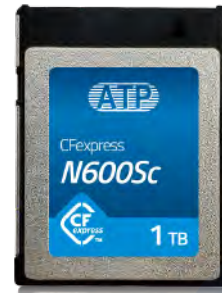
¹ Under highest Sequential write value. May vary by density, configuration and applications.
² Please refer to pages 56-58. ▲: Customization option available on a project basis.

PCIe® Gen4 NVMe CFexpress Card

KEY FEATURES

- Superior Read/Write performance
- Self-Encrypting Drive (SED) with AES 256-bit Encryption, TCG Opal 2.0*
- DRAM-less configuration supporting Host Memory Buffer (HMB)*
- Hardware Write Protect*
- Anti-sulfuric resistor support*

* May vary by product and project support



PCIe® Gen4 NVMe CFexpress Card		
Product Line	Superior	
	N600Si ²	N600Sc ²
Interface	PCIe G4 x2	
Flash Type	3D TLC	
Form Factor	CFexpress Type B	
Operating Temperature	-40°C to 85°C	0°C to 70°C
Power Loss Protection Options	Firmware Based	
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0	
Capacity	128 GB to 1 TB	
Performance		
Sequential Read (MB/s) up to	3,500	
Sequential Write (MB/s) up to	3,100	
Random Reads IOPS up to	210,000	
Random Writes IOPS up to	200,000	
Endurance and Reliability		
Endurance (TBW) ¹ up to	1,000 TB	
Reliability MTBF @ 25°C	>2,000,000 hours	
Reliability Number of Insertions	10,000 minimum	
Others		
Dimensions (mm)	29.6 x 38.5 x 3.8	
Certifications	CE, FCC, RoHS, UKCA	
Warranty	2 years	

Technologies & Add-On Services ³															
Superior	○	○	○	○	○	○	○	▲	▲	○	▲	▲	○	▲	

1 Under highest Sequential write value. May vary by density, configuration and applications.

2 Data subject to change.

3 Please refer to pages 56-58. ▲: Customization option available on a project basis.

CFast Card

CFast Card	
Product Line	Premium A800Pi
Interface	SATA III 6 Gb/s
Flash Type	SLC
Form Factor	CFast Type I
Operating Temperature	-40°C to 85°C
Power Loss Protection Options	Hardware + Firmware Based
Optional SED Features	-
Capacity	8 GB to 32 GB
Performance	
Sequential Read (MB/s) up to	500
Sequential Write (MB/s) up to	300
Random Reads IOPS up to	35,800
Random Writes IOPS up to	-
Endurance and Reliability	
Endurance (TBW) ¹ up to	2,667 TB
Reliability MTBF @ 25°C	>2,000,000 hours
Reliability Number of Insertions	10,000 minimum
Others	
Dimensions (mm)	36.4 x 42.8 x 3.6
Certifications	CE, FCC, UKCA, RoHS
Warranty	5 years

KEY FEATURES

- Advanced wear leveling algorithm
- Bad block management
- AutoRefresh technology
- Power Loss Protection
- S.M.A.R.T



Technologies & Add-On Services ²										
Premium	○	○	▲	○	○	○	○	○	▲	▲

1 Under highest Sequential write value. May vary by density, configuration and applications.
2 Please refer to pages 56-58. ▲: Customization option available on a project basis.

CompactFlash Card

CompactFlash Card			
Product Line	Premium	Superior	
	I800Pi	I700Sc	I600Sc
Interface	UDMA 0-4	UDMA 0-6	
Flash Type	SLC	Pseudo SLC	MLC
Form Factor	CF Type I		
Operating Temperature	-40°C to 85°C	0°C to 70°C	
Power Loss Protection Options	Hardware + Firmware Based	Firmware Based	
Optional SED Features	-		
Capacity	512 MB to 32 GB	8 GB to 16 GB	16 GB to 32 GB
Performance			
Sequential Read (MB/s) up to	61	110	108
Sequential Write (MB/s) up to	55	80	46
Endurance and Reliability			
Endurance (TBW) ¹ up to	1,280 TB	128 TB	38 TB
Reliability MTBF @ 25°C	>5,000,000 hours	>2,000,000 hours	
Reliability Number of Insertions	10,000 minimum		
Others			
Dimensions (mm)	36.4 x 42.8 x 3.3		
Certifications	CE, FCC, RoHS, UKCA		
Warranty	5 years	2 years	

KEY FEATURES

- Global wear leveling and bad block management
- AutoRefresh technology
- Power Loss Protection
- Power saving mode
- S.M.A.R.T support



Technologies & Add-On Services ²									
Premium	○	○	○	○	○	○	○	▲	▲
Superior	○	○	-	○	○	○	-	▲	▲

1 Under highest Sequential write value. May vary by density, configuration and applications.
2 Please refer to pages 56-58. ▲: Customization option available on a project basis.

SecurStor microSD Card

KEY FEATURES

- Additional AES Key Protection
- Library access possible (MBR required)
- Authentication / Privilege Control
- Total 10 User Accounts can set up privileges individually

SECURITY FEATURES*

- **Multi-Layer Authentication:** Privilege control for up to 10 users offer high levels of protection.
- **SecurBoot:** Ensures the integrity and validity of the system's stored BIOS configuration.
- **Hardware AES-256 XTS Encryption (SecurEncrypt):** Protects the User Data area with the highest level of hardware encryption without performance trade-off.

- **Secure Erase:** Deletes the encryption key to prevent unauthorized retrieval or recovery of the user data.
 - Compliance with US Air Force System Security Instruction (AFSSI) 5020 standard or alike is available on a per-request basis

* Actual availability of specific features may vary by product and capacity. Please contact ATP for details.

Product Name	SecurStor microSD
Product Line	SecurStor
Flash Type	MLC
Density	4 GB to 16 GB
Performance Sequential Read (MB/s) up to	10.35
Performance Sequential Write (MB/s) up to	5.3
Interface	UHS-I
Operating Temperature	-25°C to 85°C
Reliability MTBF @ 25°C	>2,000,000 hours
Reliability Number of Insertions	10,000
Dimensions (mm)	15.0 x 11.0 x 1.0



TSE Storage Solutions

KEY FEATURES

- Compliant with the requirements of the BSI TR-03153, Common Criteria PP-SMAERS, PP-CSP
 - Projected Certificate Validity: Up to 8 years (also available with 5-year validity)
- Form Factors: microSD, SD, USB
- Capacities: 8 GB and 16 GB
- Data Retention: Up to 10 years (depending on test conditions)
- Lifetime: 20 million signatures*
- OS Support: Windows, Android, Linux

* May vary on payload size (s)

Product Name	TSE Storage Solutions
Product Line	SecurStor
Flash Type	MLC
Density	8 GB / 16 GB
Performance Signature time	<150 ms
Interface	UHS-I
Operating Temperature	-25°C to 85°C
Reliability MTBF @ 25°C	>2,000,000 hours
Reliability Number of Insertions	10,000
Dimensions (mm)	15.0 x 11.0 x 1.0



Managed NAND

Extreme Endurance, Advanced Performance in a Tiny Package



ATP's managed NAND solutions integrate raw NAND flash memory and hardware controller. As soldered-down solutions, they are secure against constant vibrations, making them ideal for embedded and automotive applications requiring rugged endurance and durability.

Integrated circuits (IC) package customization service is enabled by ATP's process ownership. Legacy land grid array (LGA) package support is available from 3 to 5 years. ATP also offers packaging flexibility:

- Package sizes (9x10, 11.5x13, 12x18 mm)
- Package forms (100-/132-ball BGA, LGA)
- Die packages (octa-die or higher)



e.MMC offerings use a 153-ball fine pitch ball grid array (FBGA package). Smaller than a typical postage stamp, its tiny footprint makes the e.MMC perfectly suitable for embedded systems with space constraints but require rugged endurance, reliability and durability in harsh environments.

Key Differentiators*

- **Extreme Endurance:**** 2-3X Higher than standard e.MMC for higher terabytes written (TBW), healthy memory storage, and long product service life.
- **SRAM Soft Error Detection and Recovery.***** Maximizes data integrity by providing timely error detection, logging, and configurable action to address the error.
- **Product Traceability.** Laser imprints important information on the ATP e.MMC to identify each piece for accurate tracking and efficient inventory management.

* May vary by product and project support.

** Under best write amplification index (WAI) with highest sequential write value. May vary by density, test configuration, workload and applications.

*** Configuration is predetermined by the customer with ATP and cannot be changed on the field.

NVMe Heat Sink Ball Grid Array (HSBGA) SSDs are ATP's tiniest NVMe flash storage solutions. They use high-speed PCIe 3.0 interface x4 lanes and NVMe protocol to deliver up to 32 Gb/s bandwidth at 8 Gb/s per lane.

Key Differentiators*

- **pSLC Mode.** Storing only one bit per cell increases endurance and reliability, offering 2X-3X better sustainable performance.
- **Optimized Power Consumption.** Consuming low power at only 5 mW during Power State 4 (Sleep Mode) to deliver huge power savings.
- **DRAM-Less Configuration.** Host Memory Buffer (HMB) support improves performance by obtaining DRAM resources as cache, thus overcoming the limited memory capacity within the storage and optimizing I/O performance.
- **Better Thermal Dissipation.** The heat sink effectively transfers heat to cool the device and keep the performance at optimal levels.
- **Optional Security Features:** HW Write Protect, HW Quick Erase, HW Secure Erase (Data Sanitization, AFSSI-5020), AES-256 Encryption, TCG Opal 2.0

e.MMC

KEY FEATURES

- AEC-Q100 Grade 2 (-40°C~105°C) Compliant*
 - AEC-Q100 Grade 3 (-40°C~85°C) Compliant*
 - Extra-high endurance: 2-3X higher than standard e.MMC*
 - Complies with JEDEC e.MMC v5.1 Standard (JESD84-B51)
 - 153-ball FBGA (RoHS compliant, "green package")
 - LDPC ECC engine*
- * May vary by product and project support



e.MMC									
Product Line	Extended Industrial Grade		Automotive Grade 2		Automotive Grade 3		Industrial Grade		
	Premium	Superior	Premium	Superior	Premium	Superior	Premium		
	E700Pa	E600Sa	E700Paa	E600Saa	E700Pia	E600Sia	E750Pi	E700Pi	E700Pi
Flash Type	3D MLC (pSLC mode)	3D MLC	3D MLC (pSLC mode)	3D MLC	3D MLC (pSLC mode)	3D MLC	3D TLC (pSLC mode)	3D MLC (pSLC mode)	3D TLC (pSLC mode)
IC Package	153-ball FBGA								
JEDEC Specification	v5.1, HS400								
Power Loss Protection Options	Firmware Based								
Operating Temperature	-40°C to 105°C		-40°C to 105°C		-40°C to 85°C		-40°C to 85°C		
Capacity*	8 GB to 64 GB	16 GB to 128 GB	8 GB to 64 GB	16 GB to 128 GB	8 GB to 64 GB	16 GB to 128 GB	10 GB to 21 GB	8 GB to 64 GB	10 GB to 40 GB
Performance									
Sequential Read/Write up to (MB/s) (Max.)**	300 / 240	300 / 170	300 / 240	300 / 170	300 / 240	300 / 170	295 / 215	300 / 240	290 / 225
Bus Speed Modes	x1 / x4 / x8								
ICC (Typical RMS in Read/Write) mA (Max.)	145 / 175	125 / 175	145 / 175	125 / 175	145 / 175	125 / 175	95.5 / 92	145 / 175	100 / 110
ICCC (Typical RMS in Read/Write) mA (Max.)	120 / 100	115 / 95	120 / 100	115 / 95	110 / 95	115 / 95	104 / 87.5	120 / 100	105 / 100
Endurance and Reliability									
Endurance TBW** (Max.)	1,213 TB	309 TB	1,213 TB	309 TB	1,320 TB	824 TB	1,034 TB	1,320 TB	1,364 TB
Reliability MTBF @ 25°C	>2,000,000 hours								
Others									
Dimensions (mm)	11.5 x 13.0 x 1.3								
Certifications	AEC-Q100, RoHS, REACH							RoHS, REACH	
Warranty	One Year								

e.MMC								
Product Line	Industrial Grade			Commercial Grade				
	Superior			Premium		Superior	Value	
	E650Si	E600Si	E600Si	E750Pc	E700Pc	E650Sc	E600Vc	E600Vc
Flash Type	3D TLC	3D MLC	3D TLC	3D TLC (pSLC mode)		3D TLC	3D TLC	
IC Package	153-ball FBGA							
JEDEC Specification	v5.1, HS400							
Power Loss Protection Options	Firmware Based							
Operating Temperature	-40°C to 85°C				-25°C to 85°C			
Capacity*	32 GB to 64 GB	16 GB to 128 GB	32 GB to 128 GB	10 GB to 21 GB	10 GB to 40 GB	32 GB to 64 GB	32 GB to 128 GB	32 GB
Performance								
Sequential Read/Write up to (MB/s)**	270 / 215	300 / 170	290 / 225	295 / 215	290 / 225	270 / 215	290 / 225	250 / 135
Bus Speed Modes	x1 / x4 / x8							
ICC (Typical RMS in Read/Write) mA (Max.)	69.5 / 68.5	125 / 175	100 / 110	95.5 / 92	100 / 110	69.5 / 68.5	100 / 110	81.5 / 49.5
ICCC (Typical RMS in Read/Write) mA (Max.)	88 / 85.5	110 / 100	105 / 100	104 / 87.5	105 / 100	88 / 85.5	105 / 100	80.5 / 61.5
Endurance and Reliability								
Endurance TBW** (Max.)	70 TB	824 TB	52 TB	1,034 TB	1,364 TB	70 TB	52 TB	8.3 TB
Reliability MTBF @ 25°C	>2,000,000 hours							
Others								
Dimensions (mm)	11.5 x 13.0 x 1.0						9.0 x 10.0 x 0.8	
Certifications	RoHS, REACH							
Warranty	One Year							

Technologies & Add-On Services***													
Premium	○	○	○	○	○	○	○	○	○	○	○	○	▲
Superior	○	○	○	○	○	○	○	○	○	○	○	○	▲
Value	○	○	○	○	○	○	○	○	▲	○	○	○	▲

* Low-density parity-check error correcting code. By product support.
 ** All performance is collected or measured using ATP proprietary test environment, without file system overhead.
 *** Please refer to pages 56-58. ▲: Customization option available on a project basis.

PCIe® Gen 3 NVMe M.2 Type 1620 HSBGA SSD

KEY FEATURES

- PCIe Gen3 x4, NVMe 1.3, M.2 Type 1620
- pSLC mode with 2X-3X of Sustainable Performance*
- High/Stable performance with Optimized Thermal Throttling Firmware/Heatsink (HSBGA)
- Optimized Power Consumption: 5 mW during Power State 4
- DRAM-less configuration supporting Host Memory Buffer (HMB)*
- Optional Security features available**

* Under highest Sequential write value. May vary by density, configuration, and applications.

** Customization available on a project basis



PCIe® Gen 3 NVMe M.2 Type 1620 HSBGA SSD				
Product Line	Premium		Value	
	N700Pi	N700Pc	N600Vi	N600Vc
Interface	PCIe G3 x4		PCIe G3 x4	
Flash Type	3D TLC (pSLC mode)		3D TLC	
Form Factor	291-Ball, HSBGA		291-Ball, HSBGA	
Operating Temperature (Tcase) ¹	-40°C to 85°C	0°C to 70°C	-40°C to 85°C	0°C to 70°C
Power Loss Protection Options	Firmware Based		Firmware Based	
Optional SED Features	AES 256-bit Encryption, TCG Opal 2.0		-	
Capacity	40 GB to 160 GB		120 GB to 480 GB	
Performance				
Sequential Read (MB/s) up to	2,000		2,050	
Sequential Write (MB/s) up to	1,600		1,550	
Random Reads IOPS up to	135,600		138,000	
Random Writes IOPS up to	112,000		112,600	
Endurance and Reliability				
Endurance (TBW) ² up to	4,280 TB		768 TB	
Reliability MTBF @ 25°C	>2,000,000 hours		>2,000,000 hours	
Others				
Dimensions (mm)	16.0 x 20.0 x 1.6		16.0 x 20.0 x 1.6	
Certifications	RoHS, REACH		RoHS, REACH	
Warranty	1 year		1 year	

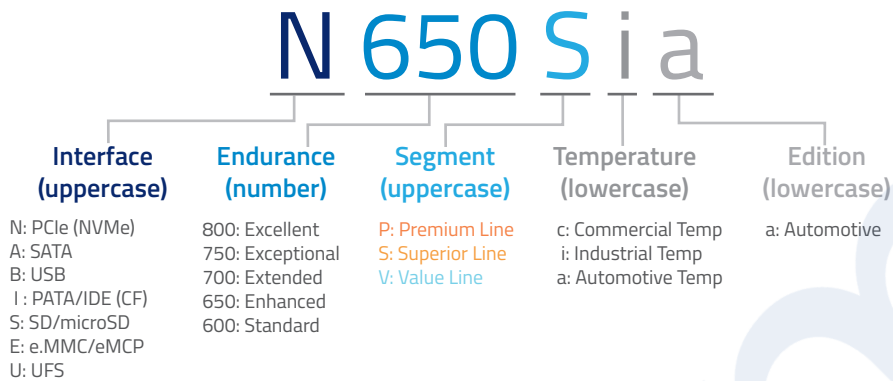
Technologies & Add-On Services ³													
Premium	○	○	○	○	○	○	○	▲	▲	▲	○	○	▲
Value	○	○	○	○	○	○	—	—	—	○	○	○	—

¹ Case Temperature, the composite temperature as indicated by SMART temperature attributes.

² Under highest Sequential write value. May vary by density, configuration and applications.

³ Please refer to pages 56-58. ▲: Customization option available on a project basis.

Flash Products Naming Rule



Premium Line

The ATP Premium Line consists of mass storage solutions built for uncompromising performance, maximum dependability, and exceptional endurance. Outfitted with best-in-class technologies ensuring the highest levels of reliability, these solutions are hardwired for the most demanding mission-critical applications where system failures or interruptions can significantly impact operations. With industrial temperature ratings of -40°C to 85°C , these rugged solutions can withstand harsh operating environments and extreme temperatures. Unparalleled usage life and brisk write speeds set the Premium Line a cut above the rest. High input/output operations per second (IOPS) ensure consistently high performance, and ATP's power loss protection technology guarantees that data in transit are safely stored to the flash chip in the event of a power loss, thus safeguarding data integrity, averting data loss or corruption, and preventing device damage.

Superior Line

The ATP Superior Line brings together powerful and proven features and technologies for rigorous operations in diverse industries, capably handling mixed workloads with high IOPS requirements. Generous storage densities make these products ideal for data-hungry and write-intensive applications; mid-density drive options offer a wider range of choices for cost efficiency; and, configurable over-provisioning gives users flexibility to make adjustments based on actual workloads for the optimal balance between drive performance and endurance. ATP Superior Line products are available in both industrial temperature (-40°C to 85°C) and commercial temperature ratings (embedded SSD: 0°C to 70°C ; SD/microSD card: -25°C to 85°C), so users can choose the temperature range most appropriate for their needs.

Value Line

The ATP Value Line integrates advanced essential solutions to the growing needs of enterprises and industries, offering sustained, reliable performance and consistent reliability. Superb choices as embedded boot or boot image devices, they are ideally suited for Internet of Things (IoT) applications, spurring greater connectivity for homes, cars, medical equipment, and other smart devices. Ample storage capacity is available for installing an operating system with space to spare for other applications.

Automotive Edition

The ATP Automotive Edition consists of tailor-made solutions to meet automotive customers' requirements for maximum data reliability. These solutions undergo the strictest levels of testing and are certified according to automotive-industry standards, including but not limited to IATF 16949 Certification, APQP, PPAP, IMDS, AEC-Q100, product selection/features and joint validation tests depending on project support and according to customer request.

Solutions & Technologies

As a technology-driven company, ATP is committed to developing innovative solutions and harnessing the most advanced technologies to ensure that our products deliver the highest levels of data integrity, reliability and retention for mission-critical applications.



• Life Monitor/S.M.A.R.T.*

Provides a user-friendly interface for monitoring the health status and life expectancy of a flash product.



• AutoRefresh

Monitors the error bit level in every operation. Before the error bit in a block reaches or exceeds the preset threshold value, AutoRefresh moves the data to a healthy block, thus preventing the controller from reading blocks with too many error bits and averting read disturbance and data corruption.



• Hardware-based Power Loss Protection

This hardware-based power failure protection prevents data loss during a power loss event by ensuring that the last read/write/erase command is completed, and data is stored safely in non-volatile flash memory. Select NVMe modules and SATA SSDs feature a new microcontroller unit (MCU)-based design that allows the PLP array to perform intelligently in various temperatures, power glitches and charge states to protect both device and data.



• Firmware-based Power Loss Protection

The firmware-based power failure protection effectively protects data written to the device prior to power loss. After the host receives a signal from the device that the WRITE operation has been successfully completed, newly written as well as previously written data are protected even if a sudden power loss occurs.



• Advanced Wear Leveling

Manages the reads and writes across blocks evenly to optimize the overall life expectancy of a flash product.



• Dynamic Data Refresh

Runs automatically in the background to reduce the risk of read disturbance and sustain data integrity in seldom-accessed areas by sequentially scanning the user area flag record without affecting the read/write operation. The data that has been completely moved to another block will be read and compared with the source data to ensure data integrity.



• End-to-End Data Path Protection

Ensures error checking and correction as data moves from the host to the storage device controller and vice versa. By covering the entire data path, end-to-end protection guarantees integrity at any point during data transfer.



• Auto-Read Calibration

As program/erase (P/E) cycles increase, memory cells age and cause voltage shifts that lead to high bit error rates (BER) when predefined read thresholds are fixed. The Auto-Read Calibration (ARC) function reduces BER and enhances reliability by adjusting/calibrating the read thresholds. ARC is supported by the TLC LDPC controller.

* Compatibility and support may vary by platform or operating system.

- Flash solutions
- DRAM solutions
- ◆ Flash/DRAM solutions
- ✦ Value-added solutions



- **Secure Erase**

A sanitization solution made especially for SSDs and memory cards making sure that sensitive data is not recovered or retrieved if the SSD or memory card needs to be disposed or repurposed. By making sure that no remnant of sensitive data remains, Secure Erase is the ideal solution for government and business applications with intense security requirements.



- **TCG Opal 2.0**

TCG Opal Security Subsystem Class (SSC) 2.0 is a set of specifications for self-encrypting drives that present a hierarchy of security management standards to secure data from theft and tampering. Security features include hardware-based data encryption, pre-boot authentication (PBA) and AES-128/256 data encryption to protect the confidentiality of data at rest.



- **Dynamic Thermal Throttling**

This mechanism provides a delicate balance between performance and temperature instead of dramatic performance reduction. Temperature sensors continuously detect the device temperature. After sophisticated FW transactions, the performance gradually declines, and the temperature is adjusted.



- **Industrial Temperature**

Operational stability in extreme temperatures from -40°C to 85°C .



- **Wide Temp DRAM Modules**

These modules use unique ATP testing and technologies to enable support for industrial temperature operating ranges from -40°C to 85°C but at lower price points than modules with native industrial grade ICs.



- **SiP (System in Package)**

Manufacturing process that encapsulates all exposed components to provide protection and shielding.



- **Vibration-Proof BGA Package**

Soldered-down solutions can withstand vigorous shaking and are resistant against vibrations for reliable performance even during grueling operations.



◆ Anti-Sulfur Resistors

ATP DRAM modules and NAND flash storage products offer an anti-sulfur resistor option to prevent the corrosive effects of sulfur contamination, guaranteeing continued dependable performance for a long time.



◆ Conformal Coating

Protects electronic circuits with a coating of the chemical compound Parylene to resist dust, chemical contaminants, extreme temperature, moisture and corrosion.



■ Chamfering PCB Design

Chamfering refers to the process of “beveling or tapering” the connector edges for easier insertion into the memory slots. The bevel is done at specific angles, typically at around 40° to 50°.



■ Thicker Gold Finger

30µm-thick gold plating of the DRAM contact optimizes signal transmission quality between the connector and DRAM modules.



● Complete Drive Test *

For NAND flash storage products, the entire drive, including firmware, user and spare areas, is thoroughly tested to ensure that there are no bad blocks. DRAM products also undergo complete testing, covering PHY and controller, including meta/mapping and data caching areas.



● Joint Validation *

ATP conducts compatibility/function tests with client-supplied host devices and systems, to proactively detect and minimize failures that may not be caught in production tests, thus improving overall quality.



■ Test During Burn-In (TDBI) *

TDBI involves subjecting ATP DRAM modules to various temperatures, power cycling, voltages and other stress conditions within a certain period. It aims to cause weak ICs to fail so they can be screened out, thus making sure that the modules contain only the most robust ICs.

* Compatibility and support may vary by platform or operating system.

- Flash solutions
- DRAM solutions
- ◆ Flash/DRAM solutions
- ✦ Value-added solutions

Form Factor	Product Line	Life Monitor/ S.M.A.R.T.	Firmware-based Power Loss Protection	Hardware-based Power Loss Protection	AutoRefresh	Advanced Wear Leveling	Dynamic Data Refresh	End-to-End Data Path Protection	Auto-Read Calibration	Secure Erase	TCG Opal 2.0	Dynamic Thermal Throttling	Industrial Temperature	SIP	Vibration-Proof BGA Package	Anti-Sulfur Resistors	Conformal Coating	Complete Drive Test	Joint Validation
PCIe® Gen4 NVMe M.2 2280 SSD (240 GB to 1920 GB)	Superior	○	○	○	○	○	○	○	○	▲	▲	—	○	—	—	▲	▲	—	—
	Premium	○	○	—	○	○	○	○	○	▲	▲	—	○	—	—	▲	▲	—	—
PCIe® Gen4 High-Capacity NVMe M.2 2280 SSD (3.84 TB)	Superior	○	○	—	○	○	○	○	○	▲	▲	—	○	—	—	▲	▲	—	—
	Premium	○	○	○	○	○	○	○	○	▲	○	—	○	—	—	▲	▲	—	—
PCIe® Gen3 NVMe M.2 2280 / 2242 / 2230 SSD	Superior	○	○	○	○	○	○	○	○	▲	○	—	▲	—	—	▲	▲	—	—
	Value	○	○	—	○	○	○	○	○	—	—	—	—	—	—	▲	▲	—	—
PCIe® Gen3 High-Capacity NVMe M.2 2280 SSD	Superior	○	○	—	○	○	○	○	○	▲	▲	○	○	—	—	—	▲	—	▲
PCIe® Gen4 NVMe U.2 SSD	Superior	○	○	○	○	○	○	○	○	▲	▲	—	○	—	—	—	▲	—	▲
	Premium	○	○	○	○	○	○	○	○	▲	○	—	○	—	—	▲	▲	—	—
PCIe® Gen3 NVMe U.2 SSD	Superior	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	▲	—	▲
	Premium	○	○	○	○	○	○	○	○	▲	○	—	○	—	—	▲	▲	—	—
SATA III M.2 2280 / 2242 SSD	Superior	○	○	○	○	○	○	○	○	▲	○	—	▲	—	—	▲	▲	—	—
	Value	○	○	—	○	○	○	—	○	—	—	—	—	—	—	—	—	—	—
SATA III 2.5" SSD	Superior	○	○	○	○	○	○	—	○	▲	○	—	▲	—	—	▲	▲	—	—
	Value	○	○	—	○	○	○	—	○	—	—	—	—	—	—	—	—	—	—
SATA III mSATA SSD	Superior	○	○	○	○	○	○	—	○	▲	○	—	▲	—	—	▲	▲	—	—
	Value	○	○	—	○	○	○	—	○	—	—	—	—	—	—	—	—	—	—
USB 3.2 NANODURA Dual	Superior	○	○	—	—	○	—	—	—	—	—	—	—	○	—	—	—	—	—
	Premium	○	○	—	—	○	—	—	—	—	—	—	○	○	—	—	—	—	—
USB 2.0 NANODURA	Superior	○	○	—	—	○	—	—	—	—	—	—	—	○	—	—	—	—	—
	Premium	○	○	▲	—	○	—	—	—	—	—	—	○	—	—	▲	▲	—	—
USB 2.0 eUSB	Superior	○	○	▲	—	○	—	—	—	—	—	—	—	—	—	▲	▲	—	—
	Premium	▲	○	—	○	○	▲	—	—	○	—	—	○	○	—	—	—	○	▲
(micro)SD/(micro)SDHC/ (micro)SDXC Card	Superior	▲	○	—	○	○	○	—	▲	○	—	—	▲	○	—	—	—	○	▲
	Premium	▲	○	—	○	○	○	—	—	○	—	—	—	—	—	—	—	○	—
PCIe® Gen4 NVMe CFexpress Card	Superior	○	○	—	○	○	○	○	○	▲	▲	—	○	—	—	▲	▲	○	▲
	Premium	○	○	▲	○	○	○	—	—	○	—	—	○	—	—	▲	▲	—	—
Compact Flash Card	Premium	○	○	○	○	○	○	—	—	—	—	—	○	—	—	▲	▲	—	—
	Superior	○	○	—	○	○	○	—	—	—	—	—	—	—	—	▲	▲	—	—
eMMC	Premium	○	○	—	○	○	○	○	○	○	—	—	○	○	○	—	—	○	▲
	Value	○	○	—	○	○	○	○	○	○	—	—	▲	○	○	—	—	○	▲
PCIe® Gen3 NVMe M.2 Type 1620 HSBGA SSD	Premium	○	○	—	○	○	○	○	○	▲	▲	—	▲	○	○	—	—	—	▲
	Value	○	○	—	○	○	○	○	—	—	—	—	○	○	○	—	—	—	—

Complete Flash Portfolio

Form Factor	Product Line Naming	Interface	Capacity	NAND	Reliability TBW (max) *	Sequential Performance MB/s (up to)		Operating Temperature (°C)
						Read	Write	
PCIe® Gen4 NVMe M.2 2280 SSD	N600Si / N600Sc	PCIe G4 x4	240 GB to 3.84 TB	3D TLC	11,400	6,450	6,000	-40 to 85 / 0 to 70
	N750Pi	PCIe G3 x4	40 GB to 320 GB	3D TLC (pSLC mode)	16,000	3,150	2,670	-40 to 85
	N700Pi	PCIe G3 x4	40 GB to 640 GB	3D TLC (pSLC mode)	21,300	3,150	2,820	-40 to 85
PCIe® Gen3 NVMe M.2 2280 SSD	N650Si / N650Sc	PCIe G3 x4	120 GB to 960 GB	3D TLC	4,640	3,420	3,050	-40 to 85 / 0 to 70
	N600Si / N600Sc	PCIe G3 x4	120 GB to 3.84 TB	3D TLC	10,600	3,420	3,050	-40 to 85 / 0 to 70
	N600Vc	PCIe G3 x4	120 GB to 960 GB	3D TLC	1,520	2,600	1,870	0 to 70
SATA III M.2 2280 SSD	A750Pi	SATA 6Gb/s	80 GB to 320 GB	3D TLC (pSLC mode)	19,200	560	520	-40 to 85
	A700Pi	SATA 6Gb/s	80 GB to 320 GB	3D TLC (pSLC mode)	12,800	560	520	-40 to 85
	A650Si / A650Sc	SATA 6Gb/s	120 GB to 960 GB	3D TLC	4,655	560	480	-40 to 85 / 0 to 70
	A600Si / A600Sc	SATA 6Gb/s	120 GB to 960 GB	3D TLC	2,792	560	510	-40 to 85 / 0 to 70
	A600Vc	SATA 6Gb/s	32 GB to 1 TB	3D TLC	1,530	560	525	0 to 70
PCIe® Gen3 NVMe M.2 2242 SSD	N600Vc	PCIe G3x4	120 GB to 960 GB	3D TLC	1,520	2,600	1,870	0 to 70
SATA III M.2 2242 SSD	A800Pi	SATA 6Gb/s	8 GB to 64 GB	SLC	5,333	530	400	-40 to 85
	A750Pi	SATA 6Gb/s	40 GB to 160 GB	3D TLC (pSLC mode)	9,600	560	520	-40 to 85
	A700Pi	SATA 6Gb/s	40 GB to 160 GB	3D TLC (pSLC mode)	6,400	560	520	-40 to 85
	A650Si / A650Sc	SATA 6Gb/s	120 GB to 480 GB	3D TLC	2,327	560	480	-40 to 85 / 0 to 70
	A600Si / A600Sc	SATA 6Gb/s	120 GB to 480 GB	3D TLC	1,396	560	510	-40 to 85 / 0 to 70
	A600Vc	SATA 6Gb/s	32 GB to 1 TB	3D TLC	1,530	560	525	0 to 70
PCIe® Gen3 NVMe M.2 2230 SSD	N700Si / N700Sc	PCIe G3 x4	40 GB to 160 GB	3D TLC (pSLC mode)	4,280	2,000	1,600	-40 to 85 / 0 to 70
	N600Vi / N600Vc	PCIe G3 x4	120 GB to 480 GB	3D TLC	768	2,050	1,550	-40 to 85 / 0 to 70
PCIe® Gen4 NVMe U.2 SSD	N600Si / N600Sc	PCIe G4 x4	960 GB to 7.68 TB	3D TLC	22,800	3,900	3,800	-40 to 85 / 0 to 70
PCIe® Gen3 NVMe U.2 SSD	N600Si	PCIe G3 x4	960 GB to 7.68 TB	3D TLC	21,000	3,100	1,400	-40 to 85
SATA III 2.5" SSD	A800Pi	SATA 6Gb/s	8 GB to 256 GB	SLC	21,333	520	420	-40 to 85
	A750Pi	SATA 6Gb/s	80 GB to 640 GB	3D TLC (pSLC mode)	38,400	560	520	-40 to 85
	A700Pi	SATA 6Gb/s	80 GB to 640 GB	3D TLC (pSLC mode)	25,600	560	520	-40 to 85
	A650Si / A650Sc	SATA 6Gb/s	120 GB to 1,920 GB	3D TLC	9,310	560	520	-40 to 85 / 0 to 70
	A600Si / A600Sc	SATA 6Gb/s	120 GB to 1,920 GB	3D TLC	5,585	560	520	-40 to 85 / 0 to 70
	A600Vc	SATA 6Gb/s	32 GB to 1 TB	3D TLC	1,530	560	525	0 to 70
	A800Pi	SATA 6Gb/s	8 GB to 128 GB	SLC	10,667	530	430	-40 to 85
	A750Pi	SATA 6Gb/s	40 GB to 160 GB	3D TLC (pSLC mode)	9,600	560	520	-40 to 85
	A700Pi	SATA 6Gb/s	40 GB to 160 GB	3D TLC (pSLC mode)	6,400	560	520	-40 to 85
	A650Si / A650Sc	SATA 6Gb/s	120 GB to 480 GB	3D TLC	2,327	560	480	-40 to 85 / 0 to 70
SATA III mSATA SSD	A600Si / A600Sc	SATA 6Gb/s	120 GB to 480 GB	3D TLC	1,396	560	510	-40 to 85 / 0 to 70
	A600Vc	SATA 6Gb/s	32 GB to 1 TB	3D TLC	1,530	560	525	0 to 70
	A800Pi	SATA 6Gb/s	8 GB to 128 GB	SLC	10,667	530	430	-40 to 85
	A750Pi	SATA 6Gb/s	40 GB to 160 GB	3D TLC (pSLC mode)	9,600	560	520	-40 to 85
	A700Pi	SATA 6Gb/s	40 GB to 160 GB	3D TLC (pSLC mode)	6,400	560	520	-40 to 85
	A650Si / A650Sc	SATA 6Gb/s	120 GB to 480 GB	3D TLC	2,327	560	480	-40 to 85 / 0 to 70
	A600Si / A600Sc	SATA 6Gb/s	120 GB to 480 GB	3D TLC	1,396	560	510	-40 to 85 / 0 to 70
	A600Vc	SATA 6Gb/s	32 GB to 1 TB	3D TLC	1,530	560	525	0 to 70
	A800Pi	SATA 6Gb/s	8 GB to 128 GB	SLC	10,667	530	430	-40 to 85
	A750Pi	SATA 6Gb/s	40 GB to 160 GB	3D TLC (pSLC mode)	9,600	560	520	-40 to 85
USB 3.2 NANODURA Dual	B600Sc	USB 3.2	32 GB to 128 GB	3D TLC	84	270	85	0 to 70
	B800Pi	USB 2.0	512 MB to 8 GB	SLC	192	31	21	-40 to 85
USB 2.0 NANODURA	B600Sc	USB 2.0	4 GB to 8 GB	MLC	9.6	26	10	0 to 70
	B800Pi	USB 2.0	1 GB to 32 GB	SLC	1,584	36	25	-40 to 85
USB 2.0 eUSB	B600Sc	USB 2.0	8 GB to 32 GB	MLC	38.4	25	19	0 to 70
	B800Pi	USB 2.0	1 GB to 32 GB	SLC	1,584	36	25	-40 to 85

* Under highest Sequential write value. May vary by density, configuration and applications.

Form Factor	Product Line Naming	Interface	Capacity	NAND	Reliability TBW (max) *	Sequential Performance MB/s (up to)		Operating Temperature (°C)
						Read	Write	
SD/ SDHC/ SDXC Card	S800Pi	HS mode / UHS-I	512 MB to 8 GB	SLC	192	68	39	-40 to 85
	S750Pi / S750Sc	UHS-I	8 GB to 32 GB	3D TLC (pSLC mode)	1,745	99	82	-40 to 85 / -25 to 85
	S700Pi / S700Sc	UHS-I	8 GB to 64 GB	3D TLC (pSLC mode)	1,164	95	70	-40 to 85 / -25 to 85
	S650Si / S650Sc	UHS-I	32 GB to 128 GB	3D TLC	582	96	57	-40 to 85 / -25 to 85
	S600Si	UHS-I	32 GB to 512 GB	3D TLC	1,396	96	66	-40 to 85
	S600Sc	UHS-I	8 GB to 16 GB	MLC	19	68	23	-25 to 85
	S600Sia / Sca	UHS-I	8 GB to 64 GB	MLC / 3D TLC	307	96	65	-40 to 85 / -25 to 85
	S600Sc	UHS-I	32 GB to 512 GB	3D TLC	1,396	96	66	-25 to 85
microSD/ microSDHC/ microSDXC Card	S800Pi	HS mode / UHS-I	512 MB to 8 GB	SLC	192	68	39	-40 to 85
	S750Pi / S750Sc	UHS-I	8 GB to 64 GB	3D TLC (pSLC mode)	3,490	99	82	-40 to 85 / -25 to 85
	S700Pi / S700Sc	UHS-I	8 GB to 64 GB	3D TLC (pSLC mode)	1,164	95	70	-40 to 85 / -25 to 85
	S650Si / S650Sc	UHS-I	32 GB to 256 GB	3D TLC	1,164	99	59	-40 to 85 / -25 to 85
	S600Si	UHS-I	32 GB to 512 GB	3D TLC	1,396	96	66	-40 to 85
	S600Sc	UHS-I	8 GB to 32 GB	MLC	38	68	24	-25 to 85
	S600Sc	UHS-I	32 GB to 512 GB	3D TLC	1,396	96	66	-25 to 85

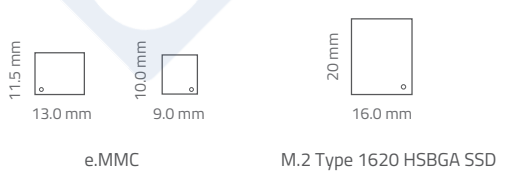
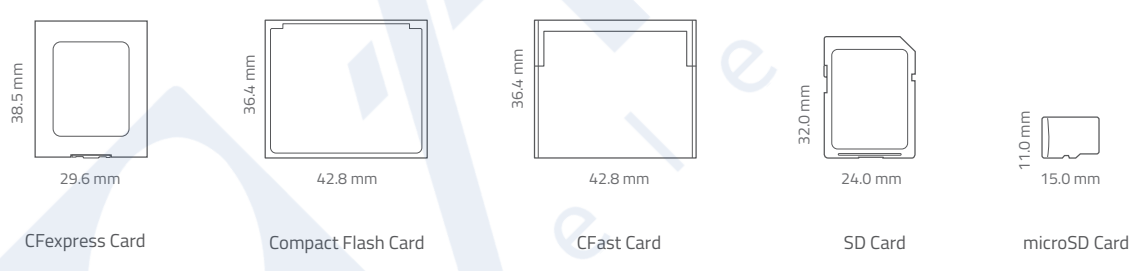
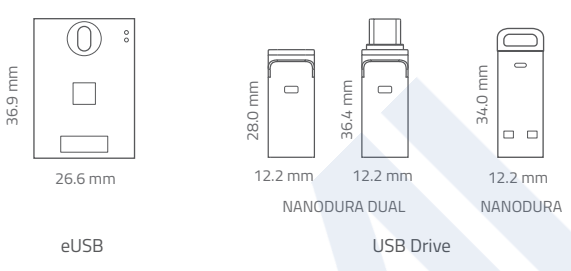
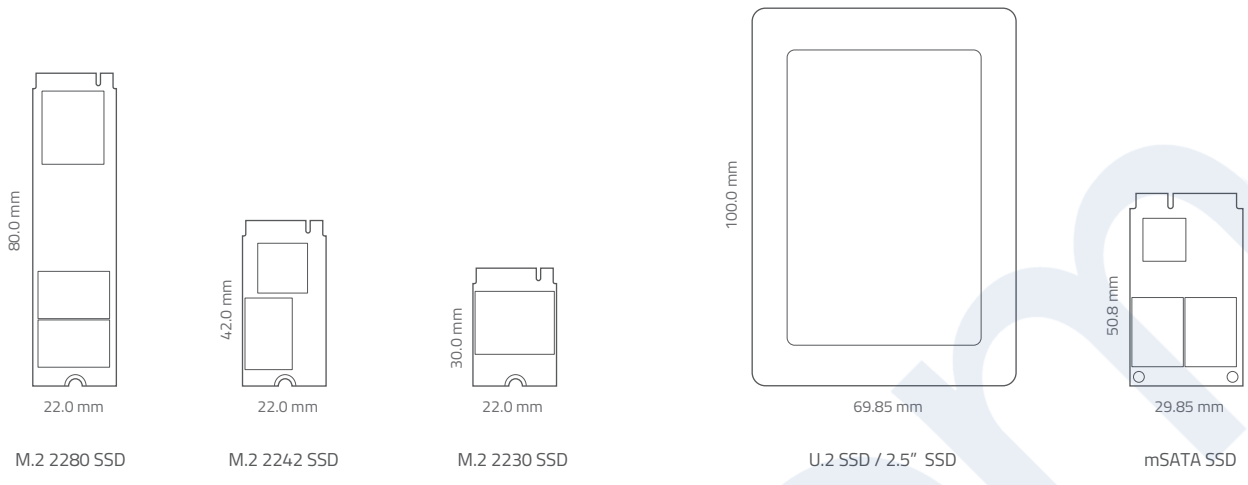
Form Factor	Product Line Naming	Interface	Capacity	NAND	Reliability TBW (max) *	Sequential Performance MB/s (up to)		Operating Temperature (°C)
						Read	Write	
PCIe® Gen4 NVMe CFexpress Card	N600Si / N600Sc	PCIe G4 x2	128 GB to 1 TB	3D TLC	1,000	3,500	3,100	-40 to 85 / 0 to 70
CFast Card	A800Pi	SATA 6Gb/s	8 GB to 32 GB	SLC	2,667	500	300	-40 to 85
CompactFlash Card	I800Pi	UDMA 0~4	512 MB to 32 GB	SLC	1,280	61	55	-40 to 85
	I700Sc	UDMA 0~6	8 GB to 16 GB	Pseudo SLC	128	110	80	0 to 70
	I600Sc	UDMA 0~6	16 GB to 32 GB	MLC	38	108	46	0 to 70

* Under highest Sequential write value. May vary by density, configuration and applications.

Form Factor	Product Line Naming	Interface	Capacity	NAND	Reliability TBW (max) *	Sequential Performance MB/s (up to)		Operating Temperature (°C)
						Read	Write	
e.MMC	E700Pa	v5.1, HS400	8 GB to 64 GB	3D MLC (pSLC mode)	1,213	300	240	-40 to 105
	E600Sa	v5.1, HS400	16 GB to 128 GB	3D MLC	309	300	170	-40 to 105
	E700Paa	v5.1, HS400	8 GB to 64 GB	3D MLC (pSLC mode)	1,213	300	240	-40 to 105 (AEC-Q100 Grade 2)
	E600Saa	v5.1, HS400	16 GB to 128 GB	3D MLC	309	300	170	-40 to 105 (AEC-Q100 Grade 2)
	E700Pia	v5.1, HS400	8 GB to 64 GB	3D MLC (pSLC mode)	1,320	300	240	-40 to 85 (AEC-Q100 Grade 3)
	E600Sia	v5.1, HS400	16 GB to 128 GB	3D MLC	824	300	170	-40 to 85 (AEC-Q100 Grade 3)
	E750Pi	v5.1, HS400	10 GB to 21 GB	3D TLC (pSLC mode)	1,034	295	215	-40 to 85
	E700Pi	v5.1, HS400	8 GB to 64 GB	3D MLC (pSLC mode)	1,320	300	240	-40 to 85
	E700Pi	v5.1, HS400	10 GB to 40 GB	3D TLC (pSLC mode)	1,364	290	225	-40 to 85
	E650Si	v5.1, HS400	32 GB to 64 GB	3D TLC	70	270	215	-40 to 85
	E600Si	v5.1, HS400	16 GB to 128 GB	3D MLC	824	300	170	-40 to 85
	E600Si	v5.1, HS400	32 GB to 128 GB	3D TLC	52	290	225	-40 to 85
	E750Pc	v5.1, HS400	10 GB to 21 GB	3D TLC (pSLC mode)	1,034	295	215	-25 to 85
	E700Pc	v5.1, HS400	10 GB to 40 GB	3D TLC (pSLC mode)	1,364	290	225	-25 to 85
	E650Sc	v5.1, HS400	32 GB to 64 GB	3D TLC	70	270	215	-25 to 85
	E600Vc	v5.1, HS400	32 GB to 128 GB	3D TLC	52	290	225	-25 to 85
PCIe® Gen 3 NVMe M.2 Type 1620 HSBGA SSD	N700Pi / N700Pc	PCIe G3 x4	40 GB to 160 GB	3D TLC (pSLC mode)	4,280	2,000	1,600	-40 to 85 / 0 to 70
	N600Vi / N600Vc	PCIe G3 x4	120 GB to 480 GB	3D TLC	768	2,050	1,550	-40 to 85 / 0 to 70

* Under highest Sequential write value. May vary by density, configuration and applications.

Product Dimensions (Size) Comparison



From our humble beginnings with only two desks in a business suite in Silicon Valley, we have established ourselves as global leaders in storage and memory. Today, over 70% of companies listed on Gartner's Magic Quadrant report for Primary Storage, Data Center and Cloud Computing, and WAN-Edge Infrastructure consider ATP as a strategic supplier.

