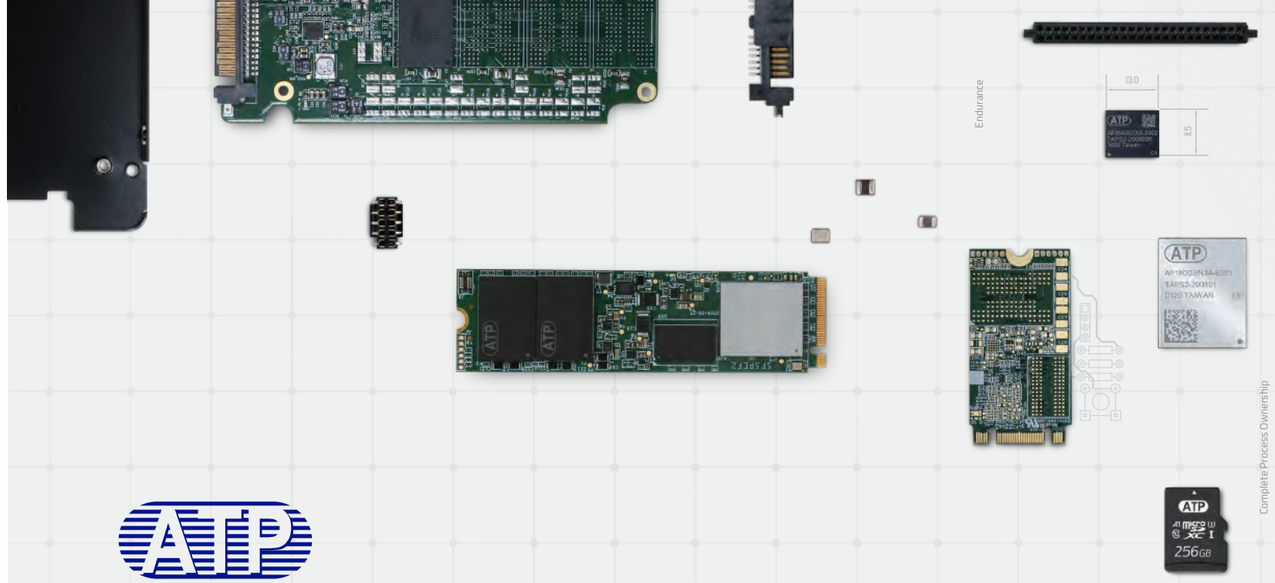
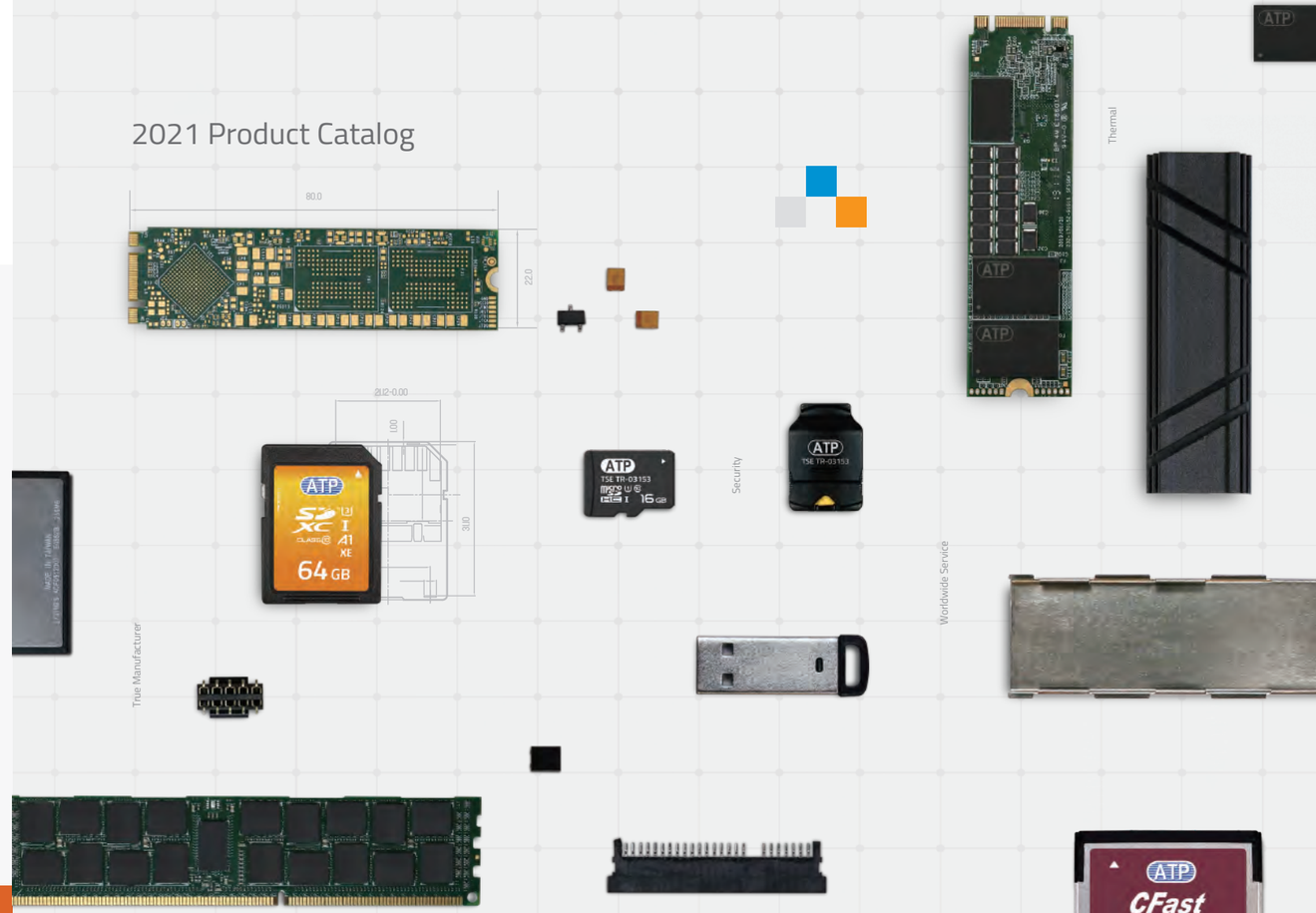


The Global Leader in Specialized Storage and Memory Solutions

WE BUILD WITH YOU



30th Anniversary

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v1.0 02042021

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.

As we celebrate our 30th year, we reinforce our leadership by continuing to blaze the trail as:

The Global Leader in Specialized Storage and Memory Solutions

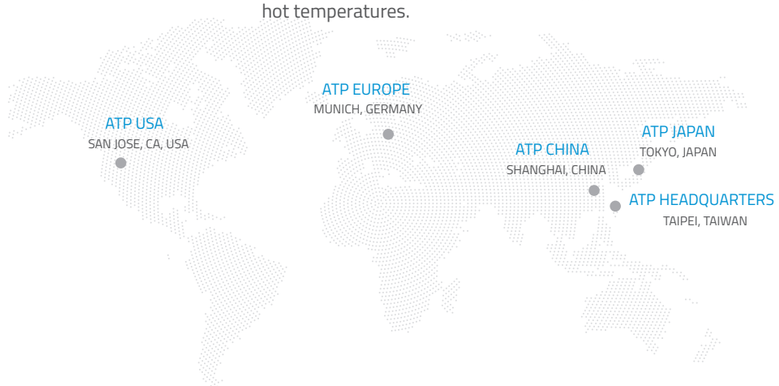
ATP-developed firmware and mass production infrastructure are fully capable of addressing any variety of embedded/ industrial usage cases. We can provide specialized configurations to support unique memory and storage requirements, all with the aim of delivering best total cost of ownership (TCO) for 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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30th Anniversary Message

A natural pearl is formed when a mollusk, such as an oyster, mussel or clam, secretes a substance to coat an irritant that enters it. Layer upon layer of this coating, the "nacre" is deposited until it becomes a lustrous, valuable gem of remarkable beauty and strength.

As a company, ATP has been through many challenges. From its humble beginnings with only two desks in a business suite in Silicon Valley, we have established ourselves as global leaders in industrial storage and memory. Layer upon layer, we transformed ourselves, taking each "irritant" or difficulty as a welcome opportunity to become better and stronger.

Over a span of 30 years, we have distinguished ourselves as providers of memory and storage products with uncompromising quality and reliability. Now, we set the bar higher by empowering our customers with greater consideration of their needs through collaborative customization and by reinforcing product leadership through innovative solutions that address thermal, endurance and other challenges.

We celebrate our anniversary amidst unprecedented global difficulties. We are confident that with our inherent resilience and your continued support as our valued partners, we will continue to build a remarkable future by building memory and storage products the way our customers want them.

Let me take this opportunity to thank all of you for your unwavering friendship, support and partnership.
Your value is beyond measure!

We Build with You.

Tim 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.

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

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.

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.

Pillars of ATP Customization

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.

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.

SECURITY

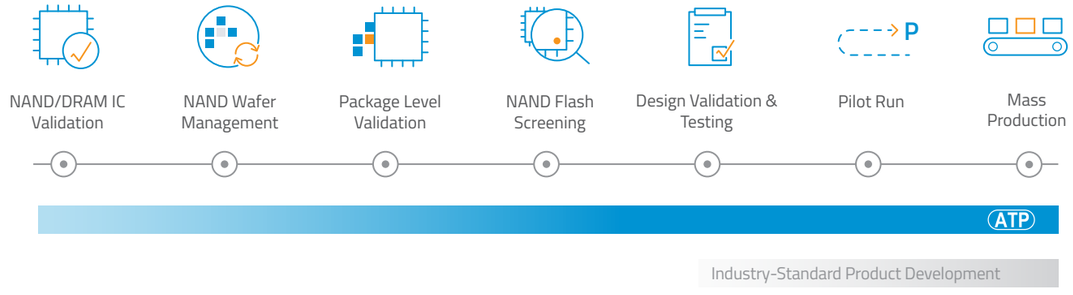
A wide range of optional custom security technologies provide extra layers of protection safeguarding data at rest and in transit.

Beyond World-Class Manufacturing:
Leading Innovations with Specialized Storage and Memory Products

ATP as a True Manufacturer

As a true manufacturer, ATP maintains complete control of its supply and value chains and takes charge of all the stages of the manufacturing process. The quality journey begins with the wafer management and package level validation which provides the very basic component level, the ICs, which serve as the building blocks of all ATP products.

By being a true manufacturer, ATP is capable of developing its own firmware and supporting mass production infrastructure, to fully customize configurations according to customer's requirements, such as thermal, endurance, security, and more.



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.

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

3. Mass Production Level

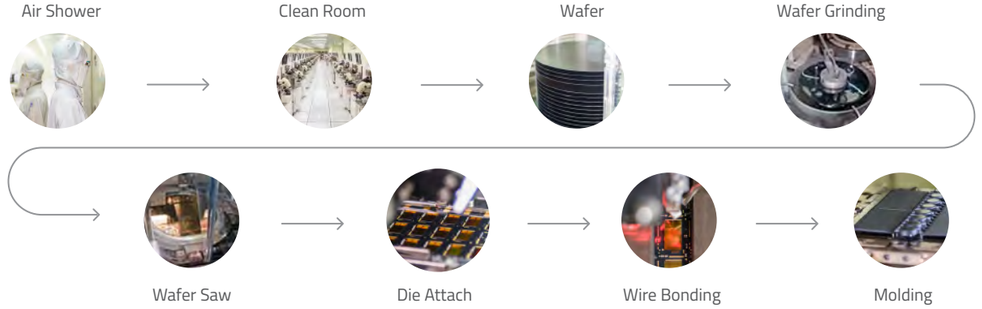
100% Rapid Diagnostic Test (RDT) performed during the pilot run ensures proven reliability at mass production (MP) scale.

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.

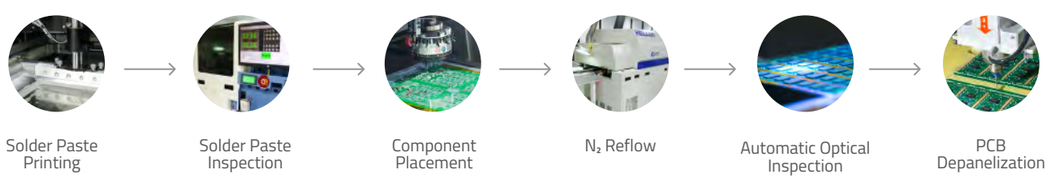
SiP Process

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 N_2 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.



Customizable Thermal Management Solutions

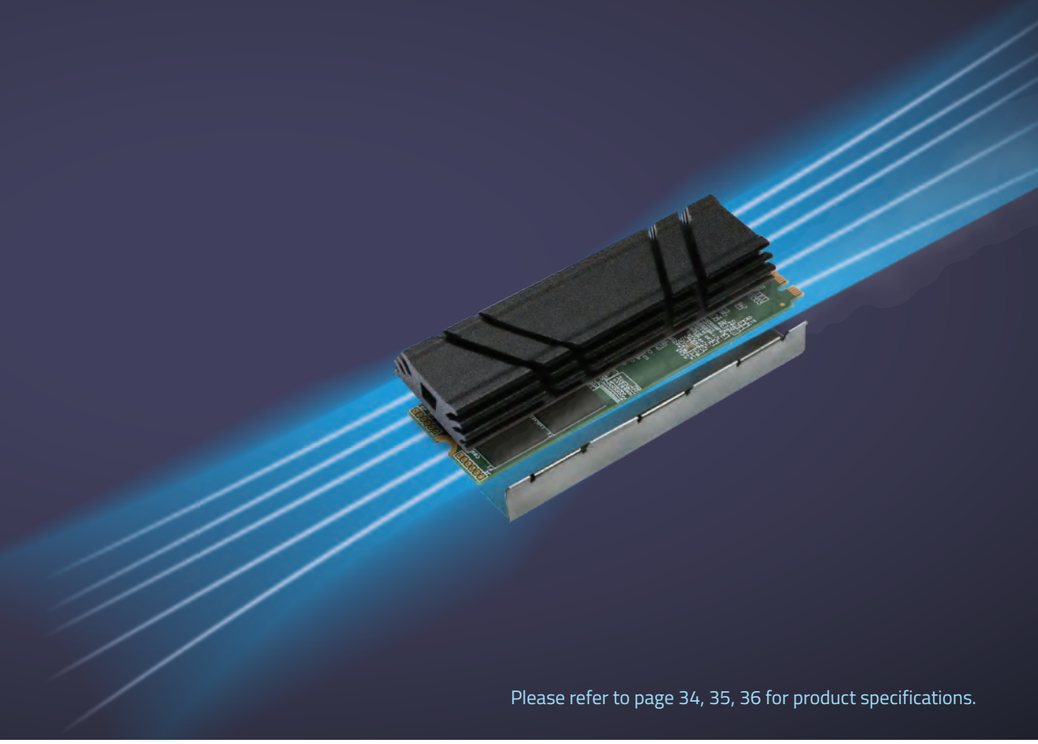
Overheating is a major challenge for high-performance, high-speed solid-state drives such as NVMe modules. Common causes of overheating include multiple die stacking per integrated circuit (IC), controller heat and intensive components in the limited printed circuit board (PCB) space, especially for double-sided designs, and intense workloads.

Why Traditional Solutions May Not Suffice

Excessive heat can cause thermal shutdown, which can damage the SSD and compromise the data stored in it. To prevent this, SSDs are typically equipped with a thermal throttling mechanism, which cools the device by reducing the clock speed when a certain temperature is reached. The challenge, however, is that such mechanism causes drastic performance drops and thus makes it difficult to sustain the performance.

Enhanced Sustained Performance in Various Scenarios

It is common to associate industrial temperature rating with the drive's ability to operate within -40°C to 85°C; however, operating temperature is just one thing to consider, especially when consistent sustained performance is critical.



Please refer to page 34, 35, 36 for product specifications.

The ATP Solution: Thermal Joint Validation Service

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. Our Thermal Joint Validation Service process is described in the following steps.

ASSESSMENT

- Customer's system/mechanical and performance criteria
- User applications
- System specifications including, but not limited to:
  - Temperature
  - Airflow
  - Mechanical design
  - Workload and performance requirement

SIMULATION

Proprietary ATP-built mini chamber to simulate and adjust thermal environments based on customer's profile.

ATP Mini Chamber Gen. 2

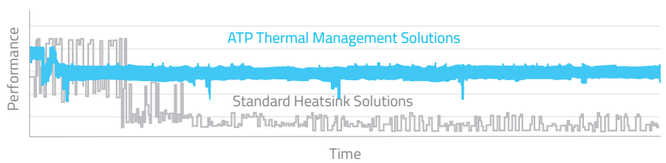
CUSTOMIZATION

ATP's customized thermal management solution consists of the following components:

- **Adaptive Thermal Control** through the ATP Dynamic Thermal Throttling mechanism, which 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.
- **H/W Heatsink Solution:** A variety of HW heatsink options (materials, dimensions, types) are available to match the mechanical constraints of each system design.
- **Garbage Collection F/W Tuning.** A periodic background refresh offsets the significant performance drop caused by the long garbage collection process.

OPTIMIZATION

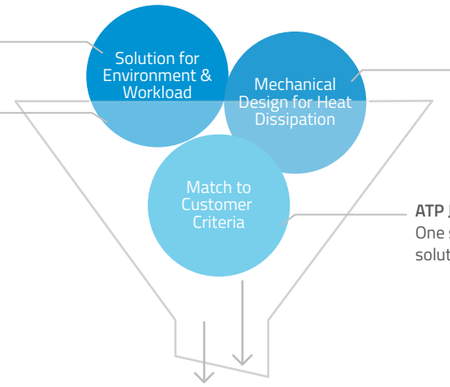
An optimized solution combines both HW and FW to meet customer's needs. As the graph below shows, performance can drop sharply when standard thermal throttling is used. ATP NVMe SSDs with the customized thermal management solution, on the other hand, deliver higher sustained write performance.



Overview of ATP's Joint Validation Service for Thermal Management

Understand environment for customer's application:
ATP air flow suggestion

ATP Dynamic Thermal Throttling:
Sustained performance at high temperature



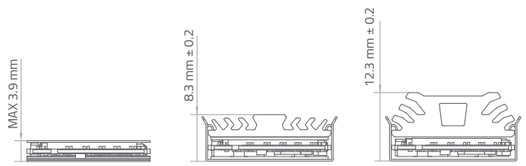
Customized Heatsink: Designed to dissipate heat effectively and fit into customer's system device.
- Heatsink material
- Heatsink specifications

ATP Joint Validation Package
One size doesn't fit all. ATP offers a total solution for sustained value.

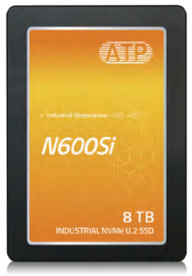
ATP Thermal Management Solutions

NVMe M.2 2280 with Copper Foil Heatsink, 4 mm / 8 mm Fin-Type Heatsink

- Recommended for applications requiring stable/sustained Read/Write performance at high temperatures.
- Various heatsink solutions (Copper foil / 4 mm or 8 mm fin-type options)
- Adaptive Thermal Control through Dynamic Thermal Throttling
- Power Loss Protection Design
- LDPC (Low Density Parity Check) ECC algorithm
- RAID Engine Support
- End-to-End Data Path Protection



Copper Foil Heatsink | 4 mm Fin-Type Heatsink | 8 mm Fin-Type Heatsink



High Density U.2 Thermal SSD

- Recommended for applications requiring stable/sustained Read/Write performance at high temperatures.
- Thermal pad covering the controller and NAND flash area to dissipate heat through the U.2 aluminum housing
- Advanced Thermal Control (ATC) Technology ensuring data reliability
- Power Loss Protection Design
- LDPC (Low Density Parity Check) ECC algorithm
- RAID Engine Support
- End-to-End Data Path Protection

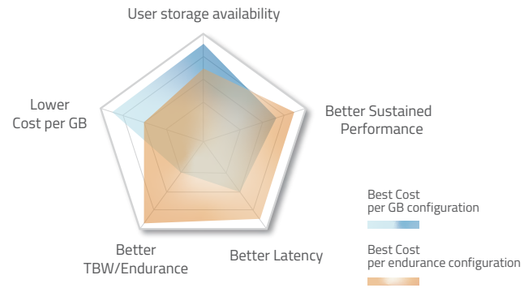
ATP's pSLC Premium Line with Customizable Endurance

A700/E700 Series SSDs with pSLC NAND Flash Offer Higher Reliability and 10X TLC's Endurance to Offer Best TCO Value

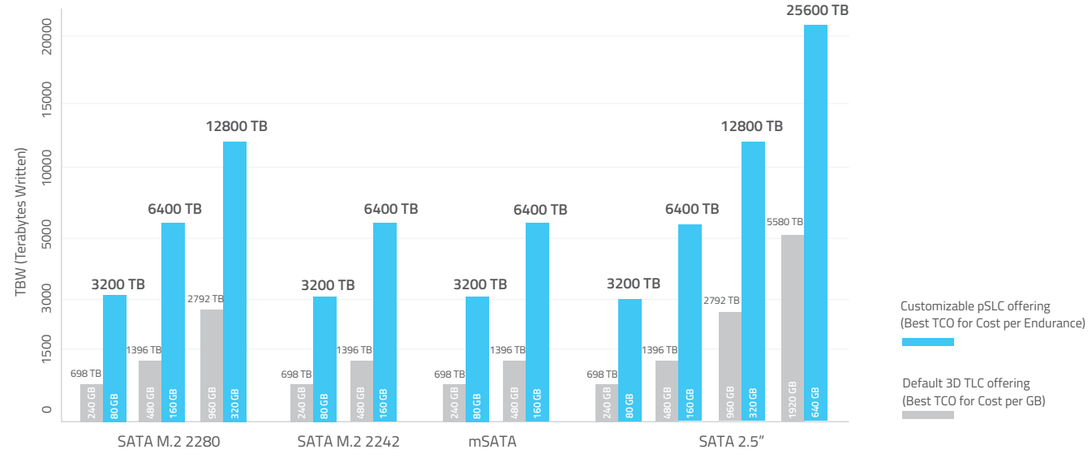
ATP is offering embedded SSDs with customizable endurance, starting with the A700Pi / E700Pi Series, a new generation of Premium Line flash storage built with 3D triple-level cell (TLC) NAND configured as pseudo single-level cell (pSLC). For this generation, the new ATP-developed firmware and supporting mass production infrastructure are fully customizable to endurance specifications that are tailor-fitted to customer's requirements to address any variety of embedded/industrial usage cases.

Purpose-built for applications that require uncompromising endurance and reliability, these Premium Line storage solutions with pSLC extend the general endurance to more than 10 times of the same triple-level cell (TLC) products. The pSLC technology dramatically improves the sustained write performance and reliability of the drives, making them suitable for write-intensive applications.

Customizable Premium Line with 3D TLC NAND flash configured as pSLC offers a balance in usable density at a better price point (Cost per GB), and impressive improvements in reliability, sustained performance, and endurance (Cost per TBW), which all boil down to best TCO value.



The following graph shows the new customizable pSLC-configured SATA III SSDs demonstrating significant improvements in endurance compared with default 3D TLC offerings.



A700/E700 Series Product Lineup

SATA M.2 2280

Please refer to page 37 for product specifications.

SATA M.2 2242

mSATA

Please refer to page 39 for product specifications.

SATA 2.5"

Please refer to page 38 for product specifications.

e.MMC

Please refer to page 42 for product specifications.

I-Temp NVMe/SATA SSDs Feature Breakthrough MCU Design for Enhanced Power Management and Customizable PLP Capabilities

ATP N600 Series M.2 2280 NVMe and A600 Series Serial ATA (SATA) SSDs feature a completely new design of the power loss protection (PLP) array, which utilizes a new power management IC (PMIC) and new firmware-programmable MCU (microcontroller unit). The new MCU design is integrated into ATP's latest PLP technology, which allows the PLP array to perform intelligently in various temperatures, power glitches and charge states.

In addition to the MCU-based PLP array, the M.2 2280 NVMe N600 Series modules combine the speed and performance of PCIe NVMe with the reliability and endurance features of 3D NAND flash, the high capacity of triple level flash (TLC), high-performance 8-channel controllers, and end-to-end data protection.

Please refer to page 34, 37, 38, 39 for product specifications.

ATP SATA and NVMe SSDs with the new MCU-based design have the following advantages:

Enhanced Device Protection

- Suppression of power-up inrush current according to customer request.
- Input over-voltage protection to prevent damage to the SSD circuitry.

Fast Power On/Off Control

Cuts the time required from power-off to re-power on the SSD.

Precise Control of Reset Signal Generation and Power Up/Down Sequences

Prevents potential issues in the power up/down of the SSD.

Industrial Operating Temperature Support

Ensures reliable operation in extreme environments from -40°C to 85°C. As components perform and react differently in severely cold or hot scenarios, ATP's power loss protection technology ensures reliable PLP capacitance in all states of cold start, hot temperature workload, and cross temperature.

Customization Options

The new MCU-based design allows PLP capabilities to be tailor-fitted according to unique customer requirements, application-specific needs, or use cases.

ECC Engine / RAID Support

Error detection and correction with redundant backup algorithm to eliminate the possibility of uncorrectable errors.

Better Data Integrity

- Input power noise de-glitch to prevent incorrect cache flushing caused by false triggers such as noisy or unstable host input voltage.
- Under-charge/over-charge protection for hold-up power capacitors.

End-to-End Data Path Protection

Prevents unauthorized access to data while it is being transferred from one storage device to another.

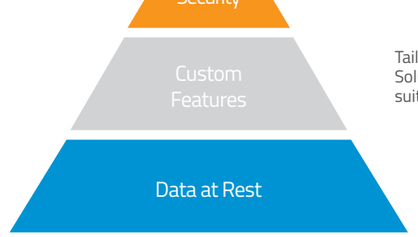
ATP SecurStor

Fortified Security for Mission-Critical Applications

ATP's SecurStor products provide solutions to the growing data security concerns in the industry and will be available in a variety of interfaces, form factors and capacities.

SecurStor includes data-at-rest features as well as a wide range of optional custom features tailored to an application's individual requirements. Implementations based on SecurStor-enabled storage devices can help protect data stored on the media as well as in transit and assure a safe and reliable system operation.

SecurStor



Addressing security requirements of connected devices in (I)IoT / Industry 4.0 to secure communication between devices, on the edge, or in the cloud

Tailor-made security features, developed by ATP Solutions for specific security requirements and suitable for legacy systems

Protection of data stored on the media against unauthorized access

Data at Rest

SecurEncrypt
AES-256 encryption for the User Data area.

TCG OPAL
Plus other features defined for data storage.

SecurWipe
Fast, safe and permanent removal of data by deleting the encryption key.

Custom Features

SecurUpdate
Ensures the integrity and validity of any update to the firmware.

UniqueID
Hardware-based product identification, using physically unclonable function (PUF) technology where needed.

SecurCopy
Pairs the storage device with a specific type of customer device to prevent illegal copying.

SecurWrite
Puts the device into "Write-Once" mode.

IoT Security

SecurAccess
Password-protected access to all or part(s) of the User Data area.

SecurOS
Ensures the integrity and validity of the operating system or application image stored in the User Data Area.

SecurBoot
Ensures the integrity and validity of the stored system's BIOS configuration.

ATP TSE Solutions for the German Fiscal Market

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

What is a TSE?

A Technical Security Solution (TSE) is an add-on to current POS systems and cash registers. It ensures tamper-proof recording of all fiscal transactions to prevent unauthorized manipulation.

Why is a TSE needed?

German fiscal regulation requires new electronic cash registers (shipped from January 2020) in Germany to be fitted with a TSE device by March 31, 2021. The deadline for current systems is on December 31, 2022.

What makes ATP TSE Solutions different?

They fully comply with the requirements of BSI TR-03153, with a projected maximum of certificate validity of 8 years, which is longer compared with the 5 years typically offered by other vendors.

Please refer to page 31 for product specifications.

SecurBoot, SecurEncrypt Solutions

Security solutions for OS platforms

SecurBoot

Ensures the integrity and validity of the stored system's BIOS configuration.

SecurEncrypt

AES-256 XTS hardware encryption for the User Data area.

Please refer to page 31 for product specifications.

What does the ATP TSE Solution consist of?

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.

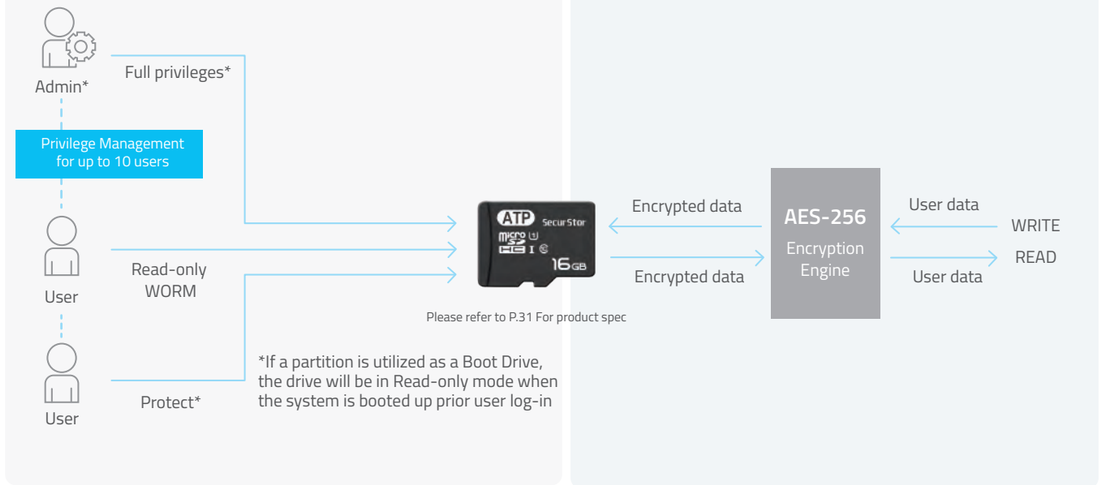
Cryptographic Service Provider (CSP)

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

Key Specifications:

- 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 depending on payload size(s).



Key Specifications:

- Self encryption with Hardware AES-256 XTS engine
- FIPS 140-2 Level 3 Security Policy compliant-ready
- AES Key Protection
- Authentication / Privilege Control
  - Administrator Setup with PIN Code Control when firstly Initialized
  - Up to 10 Individual User Accounts data privileges setup with three kinds of configurations:
    1. Full privileges
    2. Read Only (WORM)
    3. Protect (Unable to Read/Write)
  - User Log-in History with Time Tag
  - SecurWipe Support*

Platform/OS Compatibility Support

Windows 10

x86 Windows 10**

ARM Raspbian Linux (Android)

Other OS (Optional on request)

*This operation is irreversible and makes all data un-readable.
**SecurBoot not supported with Windows OS.

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.

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.

- Drive Recorder / Surround View Monitoring
- Driver Monitoring System (DMS)
- Autonomous/ Self-Driving Car
- Automotive Test Equipment / Data Logger
- Telematics
- Event Data Recorder (EDR) / Tachograph
- Fleet Surveillance/ Management
- EV/PHV Charging Station
- In-Vehicle Infotainment (IVI)/ Navigation System
- In-Vehicle Computer Automotive
- Advanced Driver Assistance System (ADAS)

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

Automotive Storage Portfolio

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	S600Si / S600Sc	UHS-I	8 GB to 256 GB	MLC / TLC	154	98	64	-40 to 85 / -25 to 85
	S600Sia	UHS-I	32 GB to 256 GB	TLC	154	96	64	-40 to 85
microSD/ microSDHC/ microSDXC	S600Si / S600Sc	UHS-I	8 GB to 256 GB	MLC / TLC	154	98	61	-40 to 85 / -25 to 85
	S600Sia	UHS-I	32 GB to 256 GB	TLC	154	98	61	-40 to 85
e.MMC	E700Pia	v5.1, HS400	8 GB to 64 GB	Pseudo SLC	1,320	300	240	-40 to 85 (AEC-Q100 Grade 3)
	E600Sia	v5.1, HS400	16 GB to 128 GB	MLC	824	300	170	-40 to 85 (AEC-Q100 Grade 3)
	E700Paa	v5.1, HS400	8 GB to 64 GB	Pseudo SLC	1,213	300	240	-40 to 105 (AEC-Q100 Grade 2)
	E600Saa	v5.1, HS400	16 GB to 128 GB	MLC	309	300	170	-40 to 105 (AEC-Q100 Grade 2)
M.2 2280	N600Sc	PCIe G3x4	3.84 TB	TLC	10,600	2,700	1,500	0 to 70
U.2	N600Si	PCIe G3x4	960 GB to 8 TB	TLC	21,000	3,100	1,400	-40 to 85

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

N700 Series PCIe® Gen3 x4 NVMe™ Type 1620 HSBGA SSDs:

Tiniest NVMe Storage Solutions with Impressive Performance and Endurance

Please refer to page 43 for product specifications.

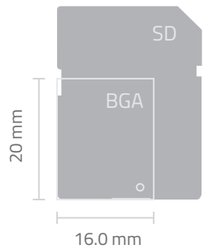
Despite their ultra-small form factor, ATP's N700 Series NVMe Heat Sink Ball Grid Array (HSBGA) solid state drives (SSDs) surprisingly pack a mean punch. These SSDs with high-speed PCIe 3.0 interface x4 lanes and NVMe protocol deliver up to 32 Gb/s bandwidth at 8 Gb/s per lane, while dimensions of just 16 (L) x 20 (W) x 1.6 (H) mm, the M.2 Type 1620 form factor, and 291-ball packaging take up minimal space within tightly confined systems.

N700 Series SSDs are configured with pseudo single-level cell (pSLC) NAND flash. By storing only one bit per cell, they increase the reliability and lifetime of the NAND flash memory, while benefiting from the lower cost compared with native SLC, due to the higher cell density.

These diminutive powerhouses store hefty capacities of 40/80/160 GB and are packed with advanced features to meet the ultra-portability and reliability requirements of ultra-compact Internet of Things (IoT) devices and embedded systems. They provide high-speed reliable storage in harsh environments such as in transportation, aerospace, smart factories, mining operations, steel fabrication and more.

Key Features

- **pSLC Mode.** Configured to store only one bit per cell to increase endurance and reliability, offering 2X-3X sustainable performance.
- **Stable Performance.** The ATP Optimized Thermal Throttling firmware (FW) will maintain the "Steady State" condition to avoid huge performance drops that will adversely impact the system, thus optimizing best performance for application requests and enhancing overall sustained performance.
- **Optimized Power Consumption.** Consuming low power at only 5 mW during Power State 4 (Sleep Mode), the ATP NVMe HSBGA SSDs deliver huge power savings.
- **DRAM-Less Configuration.** Host Memory Buffer (HMB) support helps these DRAM-less SSDs to improve performance by obtaining DRAM resources as cache, thus overcoming the limited memory capacity within the storage and optimizing I/O performance without requiring the SSD to bring up its own DRAM.
- **Vibration-Resistant Storage.** ATP N700 Series SSDs are soldered down, making them vibration-resistant and able to withstand rigorous shaking.
- **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



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, and DDR4 modules including the latest DDR4-3200. 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, which deliver robust performance, durable build and the right density for the toughest workloads.

Key Differentiators*

- **Wide Temperature.** Industrial-grade performance with wide-temperature ICs supporting -40°C to 85°C operating range.
- **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.
- **Module-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 module-level TDBI can detect and screen out the 0.01% error to ensure utmost reliability.
- **DDR4-3200 DRAM Modules with 16 Gb Monolithic Integrated Circuit (IC) Design.** ATP's fastest and low-power DDR4-3200 DRAM modules with 16 Gb monolithic integrated circuit (IC) design achieve higher module density and data rate compared with previous-generation 8 Gb base solutions. The maximum peak transfer rate of 25,600 MB/s is 20% faster than DDR4-2666, while the 1.2V low power consumption generates big savings.

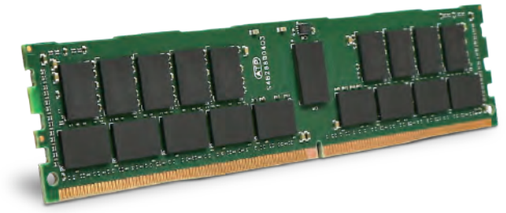
* May vary by product and project support.

DDR4-3200 DRAM Solutions with 16 Gb Monolithic Design Deliver Density and Performance Boost for HPC Applications

ATP's fastest and low-power DDR4-3200 DRAM modules with 16 Gb monolithic integrated circuit (IC) design achieve higher module density and data rate compared with previous-generation 8 Gb base solutions by utilizing 36 pieces of 16 Gb memory chips, thus doubling the single-module density from 32 GB to 64 GB. They also deliver a maximum peak transfer rate of 25,600 MB/s, which is 20% faster than DDR4-2666.

The increased density and speed boost the memory requirements of high-performance computing (HPC) environments such as large data centers, telecommunication infrastructures, and networking storage systems, where huge amounts of data are processed at blistering speeds. The 1.2V low-power design allows operation at higher speeds without higher power and cooling requirements, translating to lower consumption and substantially higher savings.

ATP DDR4-3200 DRAM memory modules with 16 Gb monolithic design are available in the following configurations and densities:
- SO-DIMM, UDIMM, ECC UDIMM, ECC SO-DIMM and RDIMM
- 4 GB / 8 GB / 16 GB / 32 GB / 64 GB / 128 GB



DDR4-3200 Advantages Over DDR3-1866

- **Faster data transfer speed.** ATP's latest DDR4 modules for embedded and industrial applications deliver high-speed data transfers up to 3200 MT/s. DDR4-3200, the latest industrial DDR4 offering from ATP, transfers data about 70% faster than DDR3-1866, one of the fastest DDR3 versions available, for a big boost in theoretical peak performance.
- **Lower power consumption.** DDR4 modules are more energy-efficient, operating only at 1.2V compared with DDR3's 1.5V or 1.35V. The reduced power consumption gives substantial power savings and allows operation at higher speeds without higher power and cooling requirements.
- **Higher module density.** DIMM densities reaching up to 128 GB – a big leap from DDR3's 32 GB capacities.

Table 1 shows a comparison between DDR3-1866 and DDR4-3200.

Item	DDR3-1866	DDR4-3200
I/O bus clock	933 MHz	1600 MHz
Data rate	1866 MT/s	3200 MT/s
Peak transfer rate	14928 MB/s	25600 MB/s

Table 1. DDR3-1866 vs. DDR4-3200

Figure 1 compares the performance of DDR3-1866 and DDR4-3200.

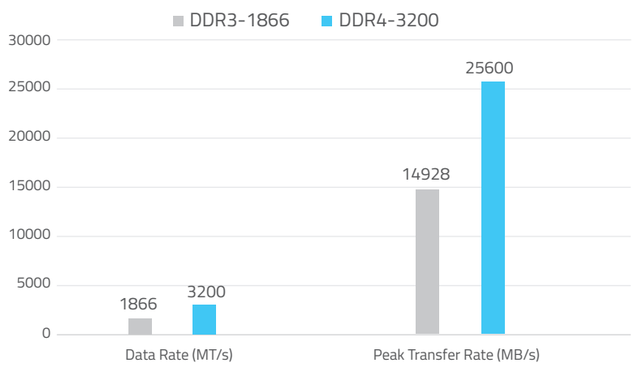


Figure 1. Performance comparison: DDR3-1866 vs. DDR4-3200

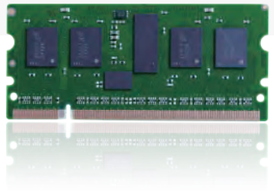
Micron and ATP Partnership and License Agreements Ensure Legacy DDR2/DDR/SDR DRAM Module Supply

Recognizing that legacy memory modules are still in prevalent use, ATP Electronics, Inc. and Micron Technology, Inc. have signed partnership and license agreements to ensure consistent supply for customers that are yet unable to upgrade to newer-generation platforms after Micron announced end-of-life (EOL) notices for these modules.

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



Product Information

Module Type	DDR2 UDIMM	DDR2 SO-DIMM
Capacity	1 GB / 2 GB	256 MB / 1 GB / 2 GB / 4 GB
Function	Unbuffered ECC / Unbuffered Non-ECC	Unbuffered Non-ECC
Frequency	800 MHz	800 MHz
Number of Pins	240	200
PCB Height	1.18"	1.18"

Legacy (SDR/DDR) DRAM Modules

Under a license agreement with Micron Technology, Inc. signed in August 2015, ATP will continue to manufacture legacy SDR/DDR DRAM modules for Micron's customers who are unable to migrate. The agreement was expanded in 2016 with the addition of selected legacy DRAM modules specifically for customers using AMD Embedded/Geode platforms. ATP works closely and exclusively with Micron to transfer module designs and extend long-term support to offer the legacy modules in selected form factors (SO-DIMM, UDIMM and RDIMM) and densities, along with ATP's unique services and features.

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 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.

"Micron Technology, Inc. is committed to supporting legacy application requirements. By partnering with ATP, we're able to provide stability for our customers who are unable to transition their existing platforms."
- Bruce Franklin, Product Marketing Director, Micron's Embedded Business Unit

"Embedded applications require a long life cycle, which is why AMD is pleased to collaborate with ATP and Micron to support the extended life of AMD's Geode platform. ATP's legacy SDR/DDR SO-DIMM module solutions utilizing Micron memory are a critical component to industrial control and automation, industrial PCs, HMI panels, point of sales and communication applications."
- Colin Cureton, Product Marketing Manager, AMD Embedded Solutions

Product Information

Module Type	DDR SO-DIMM	DDR SO-DIMM (Industrial Grade)
Capacity	128 MB / 256 MB / 512 MB / 1 GB	256 MB / 512 MB
Function	Unbuffered Non-ECC	Unbuffered Non-ECC
Frequency	400 MHz	400 MHz
Number of Pins	200	200
PCB Height	1.25"	1.25"

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

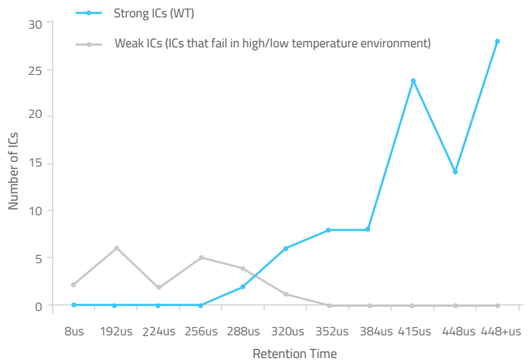
ATP DRAM Modules: Tested Rigorously for Maximum Reliability

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.

Stringent Testing

ATP DRAM modules undergo two levels of stringent testing:

- **Advanced IC-Level Testing.** At this level, integrated circuits (ICs) are screened for the best reliability and quality characteristics that are suitable for applications requiring wide temperature support.



Weak ICs that fail in high-low temperature environments are screened out.

- **Enhanced Module-Level Tests:** Automatic Test Equipment (ATE) and Test During Burn-In (TDBI) guarantee that modules meet and even exceed qualifying parameters.

FUNCTIONAL/ATE TESTING	SYSTEM TESTING
▪ Detects structural and component defects ▪ Screens out marginal timings/ SI sensitivities	▪ 100% System-level burn-in testing ▪ 100% TDBI* accelerated burn-in testing effectively screens out weak ICs

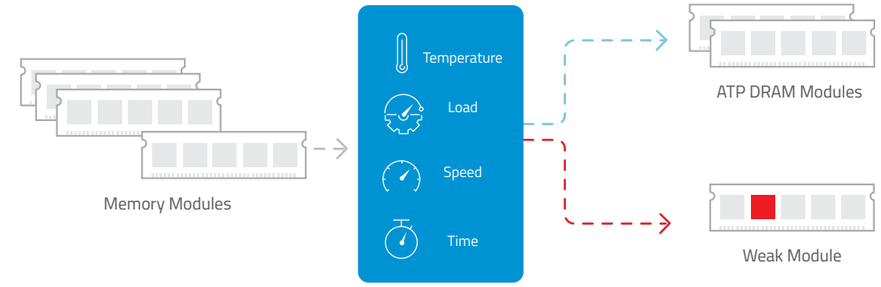
*Test During Burn-In. On a project basis; value-added service.

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.

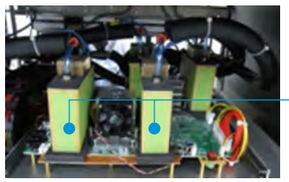
Test During Burn-in (TDBI)

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.



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

- The **miniature chamber**, which 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. 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, which allow easy module insertions in production-level volumes

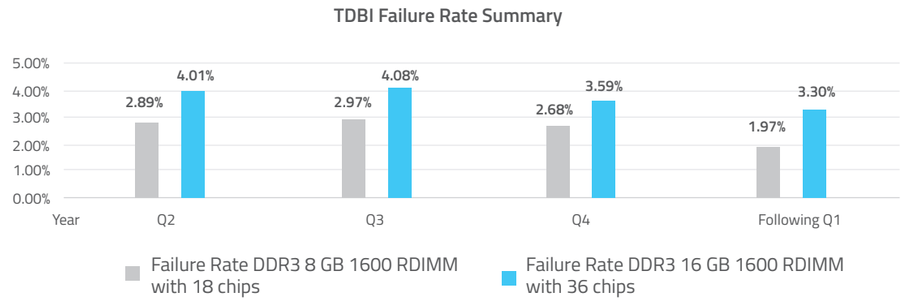


TDBI Mini Chambers

The ATP mini chamber isolates temperature cycling only to the module being tested to make sure that the motherboard and the rest of the testing systems are not thermally stressed.

TDBI Screens Up to 0.01% Error to Ensure Utmost Reliability

Through accelerated testing methods such as TDBI, ATP significantly lowers failure rates and extends the product service life by making sure that only robust DRAM chips are on the 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. TDBI detects and screens out up to 0.01% error to ensure the DRAM modules' reliability. With its unique TDBI system, ATP has radically reduced the failure rate to 500 defective parts per million (DPPM), which is much lower than the standard industry limit of 3,500 DPPM.



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
DDR4	RDIMM	4 GB to 128 GB	3200	●	●	●	▲	▲	-	▲
	ECC UDIMM	4 GB to 32 GB	3200	●	●	●	▲	▲	▲	▲
	Non-ECC UDIMM	2 GB to 32 GB	3200	●	●	●	▲	▲	▲	▲
	ECC SO-DIMM	4 GB to 32 GB	3200	-	●	●	▲	▲	▲	▲
	Non-ECC SO-DIMM	2 GB to 32 GB	3200	-	●	●	▲	▲	▲	▲
	Mini-RDIMM	4 GB to 16 GB	2400	●	●	●	▲	▲	-	-
	Mini-UDIMM	4 GB to 16 GB	2400	●	●	●	▲	▲	-	-

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
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 16 GB	1600	●	●	●	▲	▲	-	-
	Mini-UDIMM	1 GB to 16 GB	1600	●	●	●	▲	▲	-	-

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
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	ECC UDIMM	512 MB	400	-	●	●	-	-	-	-
	Non-ECC UDIMM	256 MB	400	-	●	●	-	-	-	-
	ECC SO-DIMM	256 MB to 512 MB / 1 GB	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

Customizable 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, 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 a PCIe® 3.1 x4 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.

Memory Cards

Small Cards, Big Performance for the Intelligent Edge

ATP memory cards meet the growing data storage needs of the Internet of Things (IoT) and industrial IoT by enabling the intelligent edge. These small and low-power yet powerful data collection solutions are excellent for gateways. They store huge amounts of data closer to the source, providing local intelligence and ensuring reliable operation even with limited or no Internet connection.

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 CFast cards combine the convenient and trusted format of CompactFlash with the speed, capacity and performance of SATA III, while maintaining backward compatibility with other SATA versions. CompactFlash cards in the original IDE/PATA interface continue to enjoy wide usage in industrial and embedded environments due to their durability and rugged build.

Key Differentiators*

- **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 (RDT)** 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 Cards

Key Features

- SD Life Monitor
- Advanced Wear Leveling
- SiP (System in Package)
- AutoRefresh technology
- Dynamic Data Refresh
- Power failure protection
- Industrial Temperature
- Joint Validation
- 100% MP Level Test

Product Name		SD/SDHC/SDXC				
Product Line		Premium			Superior	
Naming		S800Pi	S700Pi	S700Pi	S700Sc	S700Sc
Flash Type		SLC	Pseudo SLC	Pseudo SLC	Pseudo SLC	Pseudo SLC
Density		512 MB to 8 GB	4 GB to 8 GB	8 GB to 64 GB	4 GB to 8 GB	8 GB to 64 GB
Performance	Sequential Read up to (MB/s)	70	76	98	76	98
	Sequential Write up to (MB/s)	39	50	60	50	60
Interface		512 MB ~ 2 GB, HS mode 4 GB ~ 8 GB, UHS-I	UHS-I			
Operating Temperature		-40°C to 85°C			-25°C to 85°C	
Reliability	TBW* (max.)	192 TB	128 TB	320 TB	128 TB	320 TB
	MTBF @ 25°C	>5,000,000 hours	>3,000,000 hours			
	Number of Insertions	20,000 (SDA spec minimum 10,000)				
Dimensions: L x W x H (mm)		32.0 x 24.0 x 2.1				

Product Name		SD/SDHC/SDXC			
Product Line		Superior			
Naming		S600Si	S600Sc	S600Sia	S600Sc
Flash Type		MLC / TLC	MLC	TLC	TLC
Density		8 GB to 256 GB	8 GB to 128 GB	32 GB to 256 GB	32 GB to 256 GB
Performance	Sequential Read up to (MB/s)	98	96	98	98
	Sequential Write up to (MB/s)	64	61	64	64
Interface		UHS-I			
Operating Temperature		-40°C to 85°C	-25°C to 85°C	-40°C to 85°C	-25°C to 85°C
Reliability	TBW* (max.)	154 TB	154 TB	154 TB	154 TB
	MTBF @ 25°C	>2,000,000 hours			
	Number of Insertions	20,000 (SDA spec minimum 10,000)			
Dimensions: L x W x H (mm)		32.0 x 24.0 x 2.1			

Technologies & Add-On Services**										
Premium	Δ	●	●	●	Δ	●	●	●	●	Δ
Superior	Δ	●	●	●	●	●	Δ	●	●	Δ

* Under highest Sequential write value. May vary by density, configuration and applications.
** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

microSD/microSDHC/microSDXC Cards

Key Features

- SD Life Monitor
- Advanced Wear Leveling
- SiP (System in Package)
- AutoRefresh technology
- Dynamic Data Refresh
- Power failure protection
- Industrial temperature
- Joint Validation
- 100% MP Level Test

Product Name		microSD/microSDHC/microSDXC				
Product Line		Premium			Superior	
Naming		S800Pi	S700Pi	S700Pi	S700Sc	S700Sc
Flash Type		SLC	Pseudo SLC	Pseudo SLC	Pseudo SLC	Pseudo SLC
Density		512 MB to 8 GB	4 GB to 16 GB	8 GB to 64 GB	4 GB to 16 GB	8 GB to 64 GB
Performance	Sequential Read up to (MB/s)	80	76	98	76	98
	Sequential Write up to (MB/s)	39	54	62	54	62
Interface		512 MB~2 GB, HS mode 4 GB~8 GB, UHS-I	UHS-I			
Operating Temperature		-40°C to 85°C			-25°C to 85°C	
Reliability	TBW* (max.)	192 TB	256 TB	320 TB	256 TB	320 TB
	MTBF @ 25°C	>5,000,000 hours	>3,000,000 hours			
	Number of Insertions	20,000 (SDA spec minimum 10,000)				
Dimensions: L x W x H (mm)		15.0 x 11.0 x 1.0				

Product Name		microSD/microSDHC/microSDXC			
Product Line		Superior			
Naming		S600Si	S600Sc	S600Sia	S600Sc
Flash Type		MLC / TLC	MLC	TLC	TLC
Density		8 GB to 256 GB	8 GB to 32 GB	32 GB to 256 GB	32 GB to 256 GB
Performance	Sequential Read up to (MB/s)	98	68	98	98
	Sequential Write up to (MB/s)	61	24	61	61
Interface		UHS-I			
Operating Temperature		-40°C to 85°C	-25°C to 85°C	-40°C to 85°C	-25°C to 85°C
Reliability	TBW* (max.)	154 TB	39 TB	154 TB	154 TB
	MTBF @ 25°C	>2,000,000 hours			
	Number of Insertions	20,000 (SDA spec minimum 10,000)			
Dimensions: L x W x H (mm)		15.0 x 11.0 x 1.0			

Technologies & Add-On Services**										
Premium	Δ	●	●	●	Δ	●	●	●	●	Δ
Superior	Δ	●	●	●	●	●	Δ	●	●	Δ

* Under highest Sequential write value. May vary by density, configuration and applications.
** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

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	Sequential Read up to (MB/s)	9
	Sequential Write up to (MB/s)	39
Interface		UHS-I
Operating Temperature		-25°C to 85°C
Reliability	MTBF @ 25°C	>2,000,000 hours
	Number of Insertions	10,000
Dimensions: L x W x H (mm)		15.0 x 11.0 x 1.0

SecurStor microSD

Key Features

- Self encryption with Hardware AES-256 XTS engine
- FIPS 140-2 Level 3 Security Policy compliant-ready
- AES Key Protection
- Authentication / Privilege Control
  - Administrator Setup with PIN Code Control when firstly Initialized
  - Up to 10 Individual User Accounts data privileges setup with three kinds of configurations:
    1. Full privileges
    2. Read Only (WORM)
    3. Protect (Unable to Read/Write)
  - User Log-in History with Time Tag
  - SecurWipe Support*

*This operation is irreversible and makes all data un-readable.

Product Name		SecurStor microSD
Product Line		SecurStor
Flash Type		MLC
Density		4 GB to 16 GB
Performance	Sequential Read up to (MB/s)	9
	Sequential Write up to (MB/s)	39
Interface		UHS-I
Operating Temperature		-25°C to 85°C
Reliability	MTBF @ 25°C	>2,000,000 hours
	Number of Insertions	10,000
Dimensions: L x W x H (mm)		15.0 x 11.0 x 1.0

CFast Cards

Key Features

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

Product Name		CFast Card		
Product Line		Premium	Superior	
Naming		A800Pi	A600Si	A600Sc
Flash Type		SLC	MLC	MLC
Density		8 GB to 32 GB	16 GB to 128 GB	16 GB to 128 GB
Performance	Sequential Read up to (MB/s)	500	510	510
	Sequential Write up to (MB/s)	300	175	175
	Random Read IOPS up to	35,800	29,400	29,400
Interface		SATA III 6 Gb/s		
Operating Temperature (Tcase)*		-40°C to 85°C	-40°C to 85°C	0°C to 70°C
Endurance	TBW** (max.)	2,667 TB	267 TB	320 TB
	MTBF @ 25°C	>2,000,000 hours		
Reliability Number of Insertions		10,000 minimum		
Dimensions: L x W x H (mm)		36.4 x 42.8 x 3.6		

Technologies & Add-On Services***									
Premium	●	●	●	●	●	●	●	Δ	Δ
Superior	●	●	●	●	●	●	Δ	Δ	Δ

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

CompactFlash Cards

Key Features

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

Product Name		CompactFlash Card		
Product Line		Premium	Superior	
Naming		I800Pi	I700Sc	I600Sc
Flash Type		SLC	Pseudo SLC	MLC
Density		512 MB to 32 GB	8 GB to 16 GB	16 GB to 32 GB
Performance	Sequential Read up to (MB/s)	61	110	108
	Sequential Write up to (MB/s)	55	80	46
Interface		UDMA 0~4	UDMA 0~6	
Operating Temperature (Tcase)*		-40°C to 85°C	0°C to 70°C	
Endurance	TBW** (max.)	1,280 TB	128 TB	38 TB
	MTBF @ 25°C	>5,000,000 hours	>2,000,000 hours	
Reliability Number of Insertions		10,000 minimum		
Dimensions: L x W x H (mm)		36.4 x 42.8 x 3.3		

Technologies & Add-On Services***								
Premium	●	●	●	●	●	●	Δ	Δ
Superior	●		●	●	●		Δ	Δ

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

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 are guaranteed to deliver outstanding performance, rugged durability, and many years of reliable performance. They support the latest high-speed NVMe™ protocol on a PCIe® 3.1 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*

- **Customizable FW/HW Thermal Management.** Currently available for high-density NVMe and 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 improve sustained performance.

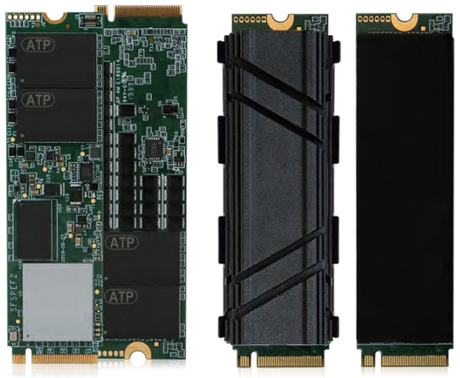
- **High-Performance, High-Density Storage in Compact Form Factors.** ATP M.2 and mSATA modules deliver power-packed performance and massive storage capacity in lean footprints, making them ideal for space-restricted systems such as embedded/IPCs, point-of-sale (POS), and networking systems.

- **MCU-Based Power Loss Protection (PLP).*** NVMe modules and selected 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.

M.2 NVMe



Key Features

- Superior Read/Write performance
- LDPC & RAID Data Recovery for error correction
- Thermal Management Solutions*
- Global wear leveling
- TRIM function support
- End-to End Data Protection
- MCU-based Power Loss Protection Design (May vary by product and project support.)

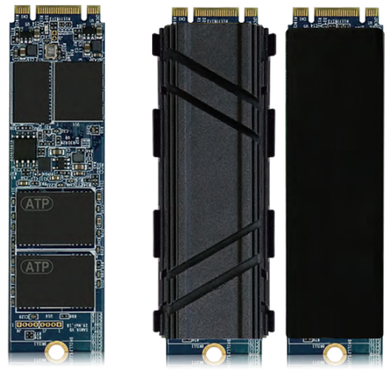
* Customization available on a project basis

Product Name		M.2 NVMe 2280-D2-M	
Product Line		Superior	
Naming		N600Si	N600Sc
Flash Type		TLC	
Density		120 GB to 1920 GB	
Performance	Sequential Read up to (MB/s)	3,420	
	Sequential Write up to (MB/s)	3,050	
	Random Read IOPS (4K, QD32)	225,200	
Interface		PCIe Gen3 Interface, x4 Lanes	
Operating Temperature (Tcase)*		-40°C to 85°C	0°C to 70°C
Endurance TBW** (max.)		5,585 TB	
Reliability MTBF @ 25°C		>2,000,000 hours	
Dimensions: L x W x H (mm)		80.0 x 22.0 x 3.5	

Technologies & Add-On Services***											
Superior	●	Δ	●	●	●	Δ	●	Δ	Δ	●	●

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

High-Capacity M.2 NVMe



Key Features

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

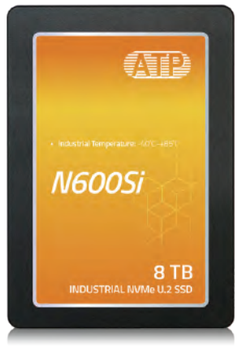
* Customization available on a project basis

Product Name		High-Capacity M.2 M.2
Product Line		Superior
Naming		N600Sc
Flash Type		TLC
Density		3.84 TB
Performance	Sequential Read up to (MB/s)	2,700
	Sequential Write up to (MB/s)	1,500
Interface		PCIe G3x4, NVMe
Operating Temperature (Tcase)*		0°C to 70°C
Reliability TBW** (max.)		10,600 TB
Reliability MTBF @ 25°C		>2,000,000 hours
Dimensions: L x W x H (mm)		80.0 x 22.0 x 3.6

Technologies & Add-On Services***					
Superior	●	●	●	●	●

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** Please refer to pages 44-46.
For Security-related features and configurations, please refer to page 13.

High-Density Thermal U.2 NVMe



Key Features

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

* Customization available on a project basis

Product Name		High-Capacity U.2
		U.2
Product Line		Superior
Naming		N600Si
Flash Type		TLC
Density		960 GB to 8 TB
Performance	Sequential Read up to (MB/s)	3,100
	Sequential Write up to (MB/s)	1,400
Interface		PCIe G3x4, NVMe
Operating Temperature (Tcase)*		-40°C to 85°C
Reliability TBW** (max.)		21,000 TB
Reliability MTBF @ 25°C		>2,000,000 hours
Dimensions: L x W x H (mm)		100 x 69.85 x 7

Technologies & Add-On Services***									
Superior	●	●	●	●	●	●	●	●	●

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** Please refer to pages 44-46.
For Security-related features and configurations, please refer to page 13.

M.2 SATA

Key Features

- MCU-based Power Loss Protection Design*
- LDPC & RAID Data Recovery
- End-to-End Data Protection
- TRIM / Global Wear Leveling support

* Customization available on a project basis

Product Name	M.2						
	2242 D2-B-M						
Product Line	Premium		Superior				Value
Naming	A800Pi	A700Pi	A600Si	A600Sc	A600Si	A600Sc	A600Vc
Flash Type	SLC	Pseudo SLC	MLC	MLC	TLC	TLC	TLC
Density	8 GB to 64 GB	80 GB to 160 GB	16 GB to 64 GB	16 GB to 64 GB	120 GB to 480 GB	120 GB to 480 GB	32 GB to 128 GB
Performance Sequential Read up to (MB/s)	530	560	440	440	560	560	560
Performance Sequential Write up to (MB/s)	400	520	80	80	440	440	420
Performance Random Read IOPS up to	76,000	84,500	38,400	38,400	100,000	100,000	68,000
Interface	SATA III 6 Gb/s						
Operating Temperature (Tcase)*	-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	0°C to 70°C
Endurance TBW** (max.)	5,333 TB	6,400 TB	145.5 TB	174.6 TB	1,396 TB	1,396 TB	147.7 TB
Reliability MTBF @ 25°C	>2,000,000 hours						
Dimensions: L x W x H (mm)	42.0 x 22.0 x 3.5						42.0 x 22.0 x 3.2

Product Name	M.2 SATA			
	2280 D2-B-M			2280 S2-B-M
Product Line	Premium	Superior		Value
Naming	A700Pi	A600Si	A600Sc	A600Vc
Flash Type	Pseudo SLC	TLC	TLC	TLC
Density	80 GB to 320 GB	120 GB to 960 GB	120 GB to 960 GB	32 GB to 512 GB
Performance Sequential Read up to (MB/s)	560	560		560
Performance Sequential Write up to (MB/s)	520	440		440
Performance Random Read IOPS up to	94,000	100,000		72,000
Interface	SATA III 6 Gb/s			
Operating Temperature (Tcase)*	-40°C to 85°C	-40°C to 85°C	0°C to 70°C	0°C to 70°C
Endurance TBW** (max.)	12,800 TB	2,792 TB	2,792 TB	590.8 TB
Reliability MTBF @ 25°C	>2,000,000 hours			
Dimensions: L x W x H (mm)	80.0 x 22.0 x 3.5	80.0 x 22.0 x 3.35		80.0 x 22.0 x 2.2

Technologies & Add-On Services***									
Premium	●	●	●	●	●	●	●	Δ	Δ
Superior	●	●	●	●	●	●	Δ	Δ	Δ
Value	●		●	●	●				

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

2.5" SSDs

Key Features

- MCU-based Power Loss Protection Design*
- LDPC & RAID Data Recovery
- End-to-End Data Protection
- TRIM / Global Wear Leveling support
- Write-protect disabled/enabled
- NSA-compliant Secure Erase

* Customization available on a project basis

Product Name		2.5" SSD			
Product Line		Premium		Superior	
Naming		A800Pi	A700Pi	A600Si	A600Sc
Flash Type		SLC	Pseudo SLC	MLC	MLC
Density		8 GB to 256 GB	80 GB to 640 GB	64 GB	
Performance	Sequential Read up to (MB/s)	520	560	440	
	Sequential Write up to (MB/s)	420	520	80	
	Random Read IOPS up to	76,000	95,000	38,400	
Interface		SATA III 6 Gb/s			
Operating Temperature (Tcase)*		-40°C to 85°C		-40°C to 85°C	0°C to 70°C
Endurance TBW** (max.)		21,333 TB	25,600 TB	145.5 TB	174.6 TB
Reliability	MTBF @ 25°C	>2,000,000 hours			
	Number of Insertions	10,000 minimum			
Dimensions: L x W x H (mm)		100.0 x 69.9 x 9.2	100.0 x 69.9 x 7 / 9.2	100.0 x 69.9 x 9.2	

Product Name		2.5" SSD		
Product Line		Superior		Value
Naming		A600Si	A600Sc	A600Vc
Flash Type		TLC	TLC	TLC
Density		120 GB to 1920 GB	120 GB to 1920 GB	32 GB to 512 GB
Performance	Sequential Read up to (MB/s)	560		560
	Sequential Write up to (MB/s)	500		440
	Random Read IOPS up to	100,000		72,000
Interface		SATA III 6 Gb/s		
Operating Temperature (Tcase)*		-40°C to 85°C	0°C to 70°C	0°C to 70°C
Endurance TBW** (max.)		5,585 TB		590.8 TB
Reliability	MTBF @ 25°C	>2,000,000 hours		
	Number of Insertions	10,000 minimum		
Dimensions: L x W x H (mm)		100.0 x 69.9 x 7 / 9.2		100.0 x 69.9 x 7.0

Technologies & Add-On Services***									
Premium	●	●	●	●	●	●	●	Δ	Δ
Superior	●	●	●	●	●	●	Δ	Δ	Δ
Value	●		●	●	●				

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

mSATA

Key Features

- MCU-based Power Loss Protection Design*
- LDPC & RAID Data Recovery
- End-to-End Data Protection
- TRIM / Global Wear Leveling support
- AutoRefresh and Idle Clean F/W algorithm

* Customization available on a project basis

Product Name		mSATA			
Product Line		Premium		Superior	
Naming		A800Pi	A700Pi	A600Si	A600Sc
Flash Type		SLC	Pseudo SLC	MLC	MLC
Density		8 GB to 128 GB	80 GB to 160 GB	16 GB to 64 GB	
Performance	Sequential Read up to (MB/s)	530	560	440	
	Sequential Write up to (MB/s)	430	520	80	
	Random Read IOPS up to	76,000	94,000	38,400	
Interface		SATA III 6 Gb/s			
Operating Temperature (Tcase)*		-40°C to 85°C		-40°C to 85°C	0°C to 70°C
Endurance TBW** (max.)		10,667 TB	6,400 TB	145.5 TB	174.6 TB
Reliability MTBF @ 25°C		>2,000,000 hours			
Dimensions: L x W x H (mm)		50.8 x 29.85 x 3.5			

Product Name		mSATA		
Product Line		Superior		Value
Naming		A600Si	A600Sc	A600Vc
Flash Type		TLC	TLC	TLC
Density		120 GB to 480 GB	120 GB to 480 GB	32 GB to 512 GB
Performance	Sequential Read up to (MB/s)	560		560
	Sequential Write up to (MB/s)	440		440
	Random Read IOPS up to	100,000		72,000
Interface		SATA III 6 Gb/s		
Operating Temperature (Tcase)*		-40°C to 85°C	0°C to 70°C	0°C to 70°C
Endurance TBW** (max.)		1,396 TB		590.8 TB
Reliability MTBF @ 25°C		>2,000,000 hours		
Dimensions: L x W x H (mm)		50.8 x 29.85 x 3.5		50.8 x 29.85 x 3.5

Technologies & Add-On Services***									
Premium	●	●	●	●	●	●	●	Δ	Δ
Superior	●	●	●	●	●	●	Δ	Δ	Δ
Value	●		●	●	●				

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

eUSB

Key Features

- Global wear leveling
- Power Loss Protection

Product Name		eUSB		
Product Line		Premium	Superior	
Naming		B800Pi	B600Sc	B600Sc
Flash Type		SLC	MLC	MLC
Density		1 GB to 32 GB	8 GB to 32 GB	16 GB to 64 GB
Performance	Sequential Read up to (MB/s)	30	25	44
	Sequential Write up to (MB/s)	25	19	17
Interface		Compatible with USB 2.0 (480 Mbps)		
Operating Temperature (Tcase)*		-40°C to 85°C	0°C to 70°C	
Endurance TBW** (max.)		1,280 TB	38.4 TB	76.8 TB
Reliability	MTBF @ 25°C	>5,000,000 hours	>2,000,000 hours	
	Number of Insertions	10,000 minimum		
Dimensions: L x W x H (mm)		36.9 x 26.6 x 9.5		
Connector Pin Pitch**		2.54 mm***		2.54 mm / 2.00 mm

Technologies & Add-On Services****							
Premium	●	●	●	●	●	Δ	Δ
Superior	●	●	●	Δ		Δ	Δ

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** By project support pitch 2.00mm.
**** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

NANODURA

Key Features

- Global wear leveling
- Bad block management algorithm
- High reliability
- Hot swap supported

Product Name		NANODURA	
Product Line		Premium	Superior
Naming		B800Pi	B600Sc
Flash Type		SLC	MLC
Density		512 MB to 8 GB	8 GB to 16 GB
Performance	Sequential Read up to (MB/s)	31	25
	Sequential Write up to (MB/s)	21	18
Interface		Compatible with USB 2.0 (480 Mbps)	
Operating Temperature (Tcase)*		-40°C to 85°C	0°C to 70°C
Endurance TBW** (max.)		192 TB	19.2 TB
Reliability	MTBF @ 25°C	>5,000,000 hours	>2,000,000 hours
	Number of Insertions	10,000 minimum	
Dimensions: L x W x H (mm)		34.0 x 12.2 x 4.5	

Technologies & Add-On Services***				
Premium	●	●	●	●
Superior	●	●	Δ	●

* Case Temperature, the composite temperature as indicated by SMART temperature attributes.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

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.

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.

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 duringPower 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

* 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.

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*
- Designed with 3D NAND

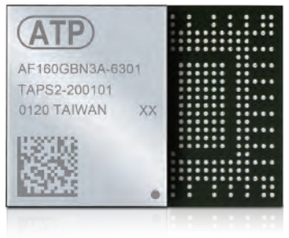
Product Name		e.MMC					
		Extended Industrial Grade		Automotive Grade 3		Automotive Grade 2	
Product Line		Premium	Superior	Premium	Superior	Premium	Superior
Naming		E700Pa	E600Sa	E700Pia	E600Sia	E700Paa	E600Saa
IC Package		153-ball FBGA					
JEDEC Specification		v5.1, HS400					
Flash Type		Pseudo SLC	MLC	Pseudo SLC	MLC	Pseudo SLC	MLC
Density*		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
Bus Speed Modes		x1 / x4 / x8					
Performance** Seq. Read/Write up to (MB/s)		300 / 240	300 / 170	300 / 240	300 / 170	300 / 240	300 / 170
Operating Temperature		-40°C to 105°C		-40°C to 85°C (AEC-Q100 Grade 3)		-40°C to 105°C (AEC-Q100 Grade 2)	
Reliability	Max. TBW**	1213 TB	309 TB	1320 TB	824 TB	1213 TB	309 TB
	MTBF @ 25°C	> 2,000,000 Device hours					
ICC (Typical RMS in Read/Write) mA		135 / 155	135 / 180	135 / 155	135 / 180	135 / 155	135 / 180
ICCQ (Typical RMS in Read/Write) mA		110 / 95	110 / 100	110 / 95	110 / 100	110 / 95	110 / 100
Dimensions: L x W x H (mm)		11.5 x 13.0 x 1.3 (max)					

Product Name		e.MMC					
		Industrial Grade		Industrial Grade		Commercial Grade	
Product Line		Premium	Superior	Premium	Superior	Premium	Value line
Naming		E700Pi	E600Si	E700Pi	E600Si	E700Pc	E600Vc
IC Package		153-ball FBGA					
JEDEC Specification		v5.1, HS400					
Flash Type		Pseudo SLC	MLC	Pseudo SLC	TLC	Pseudo SLC	TLC
Density*		8 GB to 64 GB	16 GB to 128 GB	10 GB to 21 GB	32 GB to 64 GB	10 GB to 21 GB	32 GB to 64 GB
Bus Speed Modes		x1 / x4 / x8					
Performance** Seq. Read/Write up to (MB/s)		300 / 240	300 / 170	290 / 220	290 / 220	290 / 220	290 / 220
Operating Temperature		-40°C to 85°C (Industrial)		-40°C to 85°C (Industrial)		-25°C to 85°C (Commercial)	
Reliability	Max. TBW**	1320 TB	824 TB	148 TB	13.46 TB	296 TB	26.92 TB
	MTBF @ 25°C	> 2,000,000 Device hours					
ICC (Typical RMS in Read/Write) mA		135 / 155	135 / 180	80 / 99	100 / 73	80 / 99	100 / 73
ICCQ (Typical RMS in Read/Write) mA		110 / 95	110 / 100	109 / 94	108 / 90	109 / 94	108 / 90
Dimensions: L x W x H (mm)		11.5 x 13.0 x 1.3 (max)		11.5 x 13.0 x 1.0			

Technologies & Add-On Services***									
Premium	Δ	●	Δ	●	●	●	●	●	●
Superior	Δ	●	●	●	●	●	●	●	●
Value	●	●	Δ	●	●	●	Δ	●	●

* 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 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

NVMe HSBGA



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 HMB* (Host Memory Buffer)
- Optional Security features available**

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

Product Name		HSBGA M.2, Type 1620	
Product Line		Premium	
Naming		N700Pi	N700Pc
IC Package		291-Ball, HSBGA	
Flash Type		Pseudo SLC	
Density*		40 GB, 80 GB, 160 GB	
Performance**	Sequential Read up to (MB/s)	2,000	
	Sequential Write up to (MB/s)	1,700	
	Random Read IOPS (4K, QD32)	95,000	
Interface/Protocol		PCIe Gen3 Interface, x4 Lanes NVMe 1.3	
Operating Temperature (Tcase)***		-40°C to 85°C (Industrial)	0°C to 70°C (Commercial)
Endurance TBW**** (max.)		4280 TB	
Reliability MTBF @ 25°C		>2,000,000 hours	
Dimensions: L x W x H (mm)		16 x 20 x 1.6	

Technologies & Add-On Services*****										
Premium	●	●	●	●	●	●	Δ	●	●	Δ

* Full user capacity SLC Mode
** All performance is collected or measured using ATP proprietary test environment, without file system overhead.
*** Case Temperature, the composite temperature as indicated by SMART temperature attributes.
**** Under highest Sequential write value. May vary by density, configuration and applications.
***** Please refer to pages 44-46. Δ: Customization option available on a project basis.
For Security-related features and configurations, please refer to page 13.

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.

Sudden Power-Off Recovery (SPOR)

The Sudden Power-Off Recovery (SPOR) 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.

Industrial Temperature

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

Conformal Coating

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

SiP (System in Package)

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

Thicker Gold Finger

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

Advanced Wear Leveling

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

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 federal and business applications with intense security requirements.

Vibration-Proof BGA Package

The ATP e.MMC comes in a 153-ball fine pitch ball grid array (FBGA) package and is soldered directly to the printed circuit board, making it resistant against vibrations for reliable performance even during grueling operations.

TCG Opal 2.0

Supported on ATP's M.2 NVMe SSDs, the 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.

3D NAND Flash Technology

Stacking up vertically instead of scaling down planarly expands the capacity within the limited die size. It also delivers better performance, endurance and data retention by reducing cell-to-cell interference and utilizing proven architecture and technology suitable for withstanding a wide operating temperature range from -40°C to 85°C.

End-to-End Data 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.

ATP Dynamic Thermal Throttling

ATP Dynamic Thermal Throttling intelligently regulates speed and power to reduce heat without aggressive declines in performance. It keeps the SSD from overheating while maintaining optimal performance and prevents abrupt drops leading to unstable operation.

SecurStor**

ATP's SecurStor products provide solutions to the growing data security concerns in the industry and will be available in a variety of interfaces, form factors and capacities.

* Compatibility and support may vary by platform or operating system.
** For Security-related features and configurations, please refer to page 13.

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.

Read Retry

Read Retry allows the adjustment of reference voltage in multi-level cell (MLC) flash memory so that the four memory states are distributed and significantly separated from each other in order to prevent retention errors and ensure that data is read accurately.

Add-On Services

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)

Components are subjected to low and elevated temperatures within an enclosed chamber to detect failure as a result of high-failure rates in the early life failure (ELF) period.

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.

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.

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	
SD/ SDHC/ SDXC	S800Pi	HS mode / UHS-I**	512 MB to 8 GB	SLC	192	70	39	-40 to 85
	S700Pi / S700Sc	UHS-I	4 GB to 64 GB	Pseudo SLC	320	98	60	-40 to 85 / -25 to 85
	S600Si / S600Sc	UHS-I	8 GB to 256 GB	MLC / TLC	154	98	64	-40 to 85 / -25 to 85
	S600Sia	UHS-I	32 GB to 256 GB	TLC	154	98	64	-40 to 85
	S600Sc	UHS-I	32 GB to 256 GB	TLC	154	98	64	-25 to 85
microSD/ microSDHC/ microSDXC	S800Pi	HS mode UHS-I**	512 MB to 8 GB	SLC	192	80	39	-40 to 85
	S700Pi / S700Sc	UHS-I	4 GB to 64 GB	Pseudo SLC	320	98	62	-40 to 85 / -25 to 85
	S600Si / S600Sc	UHS-I	8 GB to 256 GB	MLC / TLC	154	98	61	-40 to 85 / -25 to 85
	S600Sia	UHS-I	32 GB to 256 GB	TLC	154	98	61	-40 to 85
	S600Sc	UHS-I	32 GB to 256 GB	TLC	154	98	61	-25 to 85

* Under highest Sequential write value. May vary by density, configuration and applications.
** HS mode from 512 MB ~ 2 GB, UHS-I from 4 GB ~ 8 GB.

Form Factor	Product Line Naming	Interface	Capacity	NAND	Reliability TBW (max) *	Sequential Performance MB/s (up to)		Operating Temperature (°C)
						Read	Write	
CFast	A800Pi	SATA 6Gb/s	8 GB to 32 GB	SLC	2,667	500	300	-40 to 85
	A600Si / A600Sc	SATA 6Gb/s	16 GB to 128 GB	MLC	320	510	175	-40 to 85 / 0 to 70
CompactFlash	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.

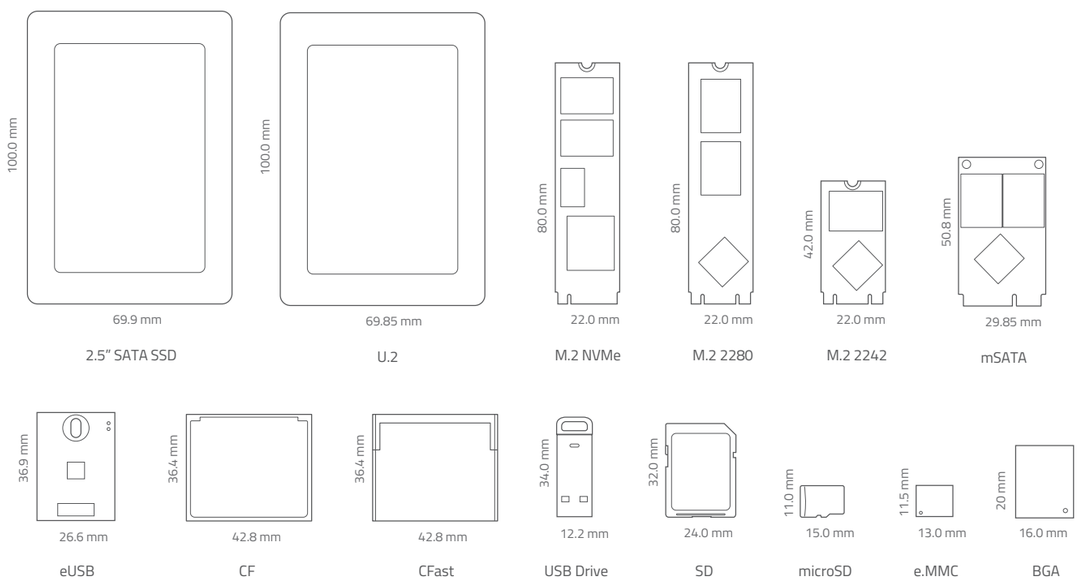
Form Factor	Product Line Naming	Interface	Capacity	NAND	Reliability TBW (max) *	Sequential Performance MB/s (up to)		Operating Temperature (°C)
						Read	Write	
M.2 2280	N600Si / N600Sc	PCIe G3x4	120 GB to 1,920 GB	TLC	5,585	3,420	3,050	-40 to 85 / 0 to 70
	N600Sc	PCIe G3x4	3.84 TB	TLC	10,600	2,700	1,500	0 to 70
	A700Pi	SATA 6Gb/s	80 GB to 320 GB	Pseudo SLC	12,800	560	520	-40 to 85
	A600Si / A600Sc	SATA 6Gb/s	120 GB to 960 GB	TLC	2,792	560	440	-40 to 85 / 0 to 70
	A600Vc	SATA 6Gb/s	32 GB to 512 GB	TLC	590.8	560	440	0 to 70
M.2 2242	A800Pi	SATA 6Gb/s	8 GB to 64 GB	SLC	5,333	530	400	-40 to 85
	A700Pi	SATA 6Gb/s	80 GB to 160 GB	Pseudo SLC	6,400	560	520	-40 to 85
	A600Si / A600Sc	SATA 6Gb/s	16 GB to 64 GB	MLC	174.6	440	80	-40 to 85 / 0 to 70
	A600Si / A600Sc	SATA 6Gb/s	120 GB to 480 GB	TLC	1,396	560	440	-40 to 85 / 0 to 70
	A600Vc	SATA 6Gb/s	32 GB to 128 GB	TLC	147.7	560	420	0 to 70
U.2	N600Si	PCIe G3x4	8 TB	TLC	21,000	3,100	1,400	-40 to 85
2.5"	A800Pi	SATA 6Gb/s	8 GB to 256 GB	SLC	21,333	520	420	-40 to 85
	A700Pi	SATA 6Gb/s	80 GB to 640 GB	Pseudo SLC	25,600	560	520	-40 to 85
	A600Si / A600Sc	SATA 6Gb/s	64 GB	MLC	174.6	440	80	-40 to 85 / 0 to 70
	A600Si / A600Sc	SATA 6Gb/s	120 GB to 1,920 GB	TLC	5,585	560	500	-40 to 85 / 0 to 70
	A600Vc	SATA 6Gb/s	32 GB to 512 GB	TLC	590.8	560	440	0 to 70
mSATA	A800Pi	SATA 6Gb/s	8 GB to 128 GB	SLC	10,667	530	430	-40 to 85
	A700Pi	SATA 6Gb/s	80 GB to 160 GB	Pseudo SLC	6,400	560	520	-40 to 85
	A600Si / A600Sc	SATA 6Gb/s	16 GB to 64 GB	MLC	174.6	440	80	-40 to 85 / 0 to 70
	A600Si / A600Sc	SATA 6Gb/s	120 GB to 480 GB	TLC	1,396	560	440	-40 to 85 / 0 to 70
	A600Vc	SATA 6Gb/s	32 GB to 512 GB	TLC	590.8	560	440	0 to 70
eUSB	B800Pi **	USB 2.0	1 GB to 32 GB	SLC	1,280	30	25	-40 to 85
	B600Sc **	USB 2.0	8 GB to 32 GB	MLC	38.4	25	19	0 to 70
	B600Sc ***	USB 2.0	16 GB to 64 GB	MLC	76.8	44	17	0 to 70
USB (NANODURA)	B800Pi	USB 2.0	512 MB to 8 GB	SLC	192	31	21	-40 to 85
	B600Sc	USB 2.0	8 GB to 16 GB	MLC	19.2	25	18	0 to 70

* Under highest Sequential write value. May vary by density, configuration and applications.
** Connector Pin Pitch = 2.54 mm
*** Connector Pin Pitch = 2.54 mm / 2.00 mm

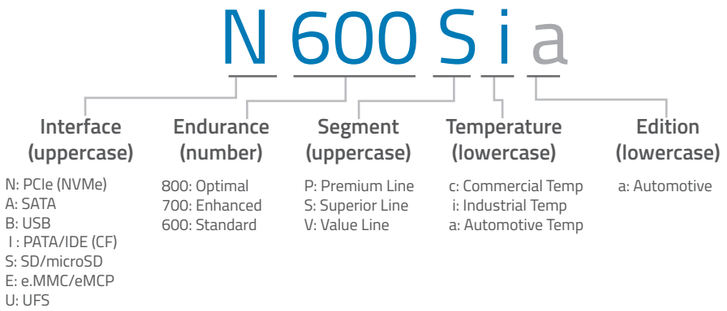
Form Factor	Product Line Naming	Interface	Capacity	NAND	Reliability TBW (max) *	Sequential Performance MB/s (up to)		Operating Temperature (°C)
						Read	Write	
e.MMC	E700Pa	v5.1, HS400	8 GB to 64 GB	Pseudo SLC	1,213	300	240	-40 to 105
	E600Sa	v5.1, HS400	16 GB to 128 GB	MLC	309	300	170	-40 to 105
	E700Pia	v5.1, HS400	8 GB to 64 GB	Pseudo SLC	1,320	300	240	-40 to 85 (AEC-Q100 Grade 3)
	E600Sia	v5.1, HS400	16 GB to 128 GB	MLC	824	300	170	-40 to 85 (AEC-Q100 Grade 3)
	E700Paa	v5.1, HS400	8 GB to 64 GB	Pseudo SLC	1,213	300	240	-40 to 105 (AEC-Q100 Grade 2)
	E600Saa	v5.1, HS400	16 GB to 128 GB	MLC	309	300	170	-40 to 105 (AEC-Q100 Grade 2)
	E700Pi	v5.1, HS400	8 GB to 64 GB	Pseudo SLC	1,320	300	240	-40 to 85
	E600Si	v5.1, HS400	16 GB to 128 GB	MLC	824	300	170	-40 to 85
	E700Pi	v5.1, HS400	10 GB to 21 GB	Pseudo SLC	148	290	220	-40 to 85
	E600Si	v5.1, HS400	32 GB to 64 GB	TLC	13.46	290	220	-40 to 85
	E700Pc	v5.1, HS400	10 GB to 21 GB	Pseudo SLC	296	290	220	-25 to 85
	E600Vc	v5.1, HS400	32 GB to 64 GB	TLC	26.92	290	220	-25 to 85
HSBGA M.2, Type 1620	N700Pi / N700Pc	PCIe G3x4	40 GB / 80 GB / 160 GB	Pseudo SLC	4,280	2,000	1,700	-40 to 85 / 0 to 70

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

Product Dimensions (Size) Comparison



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.

Certifications

According to leading industry standards


ISO 9001:2015


ISO 14001:2015


ISO45001:2018


ISO 17025


VDA 6.3


IATF 16949 (LOC)


Sony
Green Partner

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

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

Industry Associations and Compliances