ATP Electronics, Inc.

INDUSTRIAL GRADE
DRAM & FLASH SOLUTIONS

ATP Electronics, Inc.

2018
Product Catalog

Product Longevity & Stability

Testing Capabilities

Advanced Technologies & Engineering Support

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Targeted Product Portfolio
Engineered Specifically
for Your Mission-Critical Applications

Printed on fully recyclable paper.

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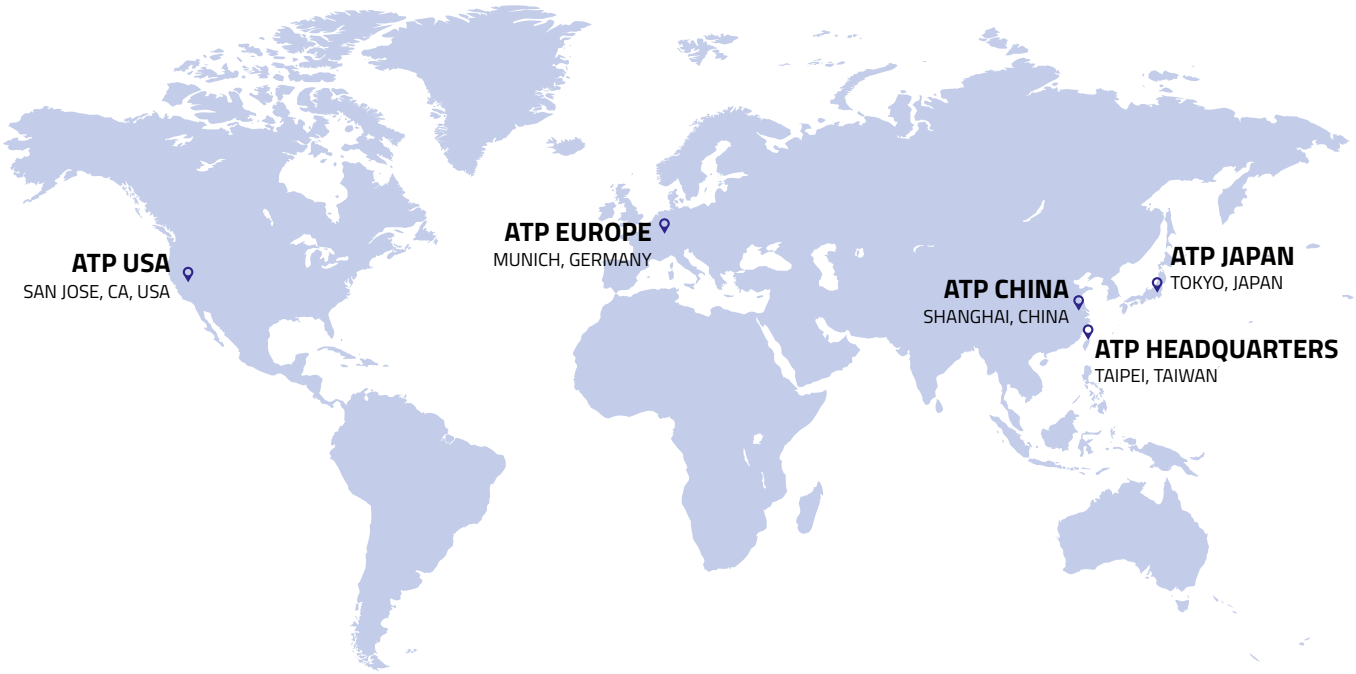
ATP Global Support Offices



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About ATP

For over 25 years, we have been transforming the industrial and enterprise computing landscape with our high-performance and high-endurance NAND flash storage products and DRAM memory modules. Acutely aware of the rigors of data-hungry applications, we design, test and manufacture products according to the most meticulous standards.

The ATP Electronics name is synonymous with absolute dedication to uncompromising product and service quality, and this is why companies around the world entrust their storage and memory needs to us. ATP products are designed and built to meet the exacting demands of modern computing and to accomplish mission-critical tasks even under the toughest operating conditions.

Advanced packaging techniques like System-in-Package (SiP), and unique technologies such as PowerProtector, Secure Erase, and more, demonstrate our astute technical capabilities. Testing and validation processes such as Test During Burn-In and Automatic Test Equipment systems showcase our exceptional manufacturing and testing capabilities as well as our resolute commitment to deliver best-in-class products.

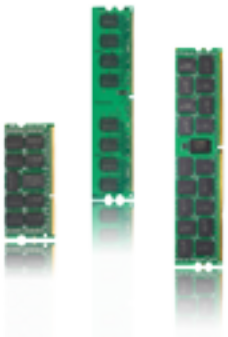
The ATP brand continues to grow through industrial OEM sales channels with offices in the USA, Europe, and Asia offering worldwide engineering and sales support.

Product Range

Memory Cards

Embedded Modules

SSDs

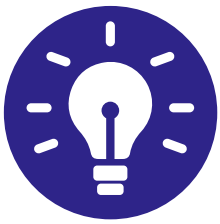


DRAM Modules

Why ATP

Core Competencies

With more than 25 years of solid experience in manufacturing industrial memory and storage solutions, ATP is a trusted name among leading businesses worldwide. Automotive, Health Care, Telecom, IoT, Aerospace/Avionics, and various industries rely on ATP to deliver reliable, durable and high-performance solutions for mission-critical applications.



Our Innovative Technology

We pride ourselves in being at the forefront of the latest memory and storage manufacturing technologies, offering unique features and value-added solutions that safeguard data integrity, deliver reliable performance and prolong usage to maximize your investment. Our top-of-the-line engineering support capabilities enable us to meet your customization requirements. We also offer OEM joint validation programs. Consider our lab your lab.

Our Unwavering Assurance

ATP's strategic partnership with Micron Technology, Inc. under the Product Longevity Program (PLP) ensures long-term bill of materials (BOM) stability for DRAM and NAND flash storage products. Proactive supply chain disaster recovery planning involves dual-sourcing strategy to ensure supply stability. We implement controlled BOM to guarantee long product cycles with buffer inventory, making sure that any changes affecting the process or product, as well as product end of life, are communicated to you.

Our High-Performance Products

Our products undergo rigorous testing to ensure high performance and longevity in the most demanding enterprise and industrial environments. Testing capabilities range from IC level to ensure die reliability; module level covering design and layout, controller hardware and firmware validation, and OEM customer joint validation for new devices and modules to ensure complete module functionality; and, mass production level Rapid Diagnostic Test (RDT) to establish 100% proven reliability at MP scale. ATP memory and storage modules are manufactured at ATP's own facilities and feature exceptional technologies for the most challenging applications and environments.

Industry Associations and Compliances

ATP as a True Manufacturer

As a true manufacturer, we maintain complete control of our supply and value chains, enabling us to offer the finest products and most extensive range of services to our clients.

We at ATP take charge of all the stages of the manufacturing process from materials sourcing all the way to mass production to make sure that all products coming out of our manufacturing facilities are consistently backed by the assurance of quality and long-term product cycles.

At the core of our process ownership is the goal to provide customers the highest quality of products and services. By maintaining control of the base stages of the manufacturing process, we are able to manage every critical phase to ensure that components are evaluated, tested and validated with the utmost care. This gives us the unique advantage and flexibility to meet customers' specific requirements as well as the solid confidence of the ATP name.

We also implement controlled bill of materials (BOM) with longevity planning. We maintain buffer inventory to prevent stock outs, ensuring steady access to valuable, often scarce resources. Any changes affecting the process or product, as well as product end of life, are communicated to our clients. We work together to forecast demand, enabling efficient supply planning and management.

All our products are designed, produced and tested at our own purpose-built factory with state-of-the-art equipment and world-class engineers, allowing us to meet and adapt to customer needs quickly. Our proprietary technologies and resources are available to customers, giving us the unique edge of managing every activity of the manufacturing process to ensure quality and product longevity while significantly restraining costs.

3 Stages of ATP's Process Ownership

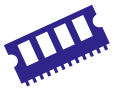
For over 25 years, companies around the world have trusted us to provide the best-in-class memory and flash storage products. Their confidence in the ATP name is rooted in our thorough and stringent testing and validation processes, which start from the component level up to the product level.

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 different host environments.

1. NAND Flash IC Level

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

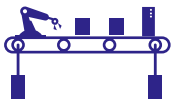
2. Module Level



To ensure complete module functionality and reliability, we perform:

- 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. This stage includes the following components:

- **Built-In Self-Test (BIST)**
  By incorporating additional hardware and software features, ICs can conduct functional and parametric tests on their own. This minimizes dependence on automated test equipment and eliminates the need for an external host or controller, so false failures due to host-related issues are reduced.

- **Wide Temperature**
  ATP's DRAM and flash storage products are designed to withstand extreme temperature variations common in demanding applications. ATP performs wide temperature testing from extremely low -40°C to very high 85°C industrial temperature ranges. Upon request, ATP can also perform temperature testing for commercial ratings (0°C to 70°C or -25°C to 85°C).

- **Complete Drive Test**
  For NAND flash storage products, the entire drive, including firmware, user and spare areas, is thoroughly tested. DRAM products also undergo complete testing, covering PHY and controller, including meta/mapping and data caching areas.

- **Reliability and Quality Trending**
  We make sure that products are consistently high in quality and meet all customers' specifications. ATP implements a rating and quality monitoring system, which entails classifying various grades and establishing proper production-level screening mechanisms to ensure quality.

ATP Market Focus and Applications

ATP is committed to providing the most reliable and enduring memory and storage solutions to enterprise and industrial operations where premium quality is of utmost importance. We recognize that failure or disruption can cause critical impact on business operations; this is why we manufacture all our products according to the strictest standards. ATP products best serve the following markets:

Networking/Telecommunications

Non stop, high speed data transmission 24/7 and immense workload volumes are key challenges in telecom and networking applications. ATP solutions deliver fast, reliable, high-capacity, and future-ready performance to handle arduous and ever-changing demands. State-of-the-art Testing During Burn-In (TDBI) ensures long-term memory reliability, while PowerProtector technology averts the damaging effects of power loss events.

Automotive Computing

From in-vehicle infotainment to navigation systems, surveillance systems, event data recorders, fleet monitoring and more, automotive applications face challenging electrical and environment conditions. ATP solutions employ the unique System in Package (SiP) technology to withstand shock, vibration, dust, electromagnetic interference (EMI), electrostatic discharge (ESD), and variable weather conditions like extreme temperature and humidity.

The Internet of Things

IoT refers to everyday physical objects that collect and transmit data via the Internet. With more and more devices getting connected to the Internet and communicating with one another via Wi-Fi capabilities, the Internet of Things (IoT) is expanding to practically every facet of life. As a member of the Intel® IoT Solutions Alliance, ATP is recognized as one of the leading IoT hardware platforms and manufacturers. We are committed to building a better-connected world by enabling intelligent network infrastructures, enhancing industrial operations, and ensuring safety through IoT.

Automation

The application of technology in manufacturing has been changing how factories operate, making them increasingly intelligent and dynamic. From machine/equipment control to monitoring, processes are being improved with a combination of production, information and communication technologies. ATP's industrial memory and storage products feature PowerProtector for power failure protection, data consistency/retention, industrial operating temperature, and a host of other outstanding reliability technologies for the smart factory.

Industrial/Embedded PC

Embedded systems control many devices available today, and are used in transportation systems, medical equipment, telecommunication systems, military applications and more. ATP memory and storage products designed for industrial PCs and embedded systems feature fast data transfer rates and higher bandwidth. They are extremely durable to withstand the rigors of tough operations, compact enough to fit various form factors, and power-efficient without compromising performance.

Health Care

Health care applications demand very high standards for safety and reliability. They need to address such issues as patient privacy and rigid regulatory compliances. Technology in the medical field should be fast, reliable and interoperable with connected devices to improve the quality of patient care and minimize medical errors. ATP's memory and storage products for health care applications are used in patient monitoring devices, diagnostic imaging systems, life support/data logging, EEG/ECG/EMG devices, and bedside infotainment.

Enterprise Mobility

In this increasingly connected world, business data and employees are also increasingly becoming more mobile. The rugged reliability of ATP industrial memory cards enables convenient and secure access to data on mobile devices for maximum productivity on the go. ATP memory solutions are built with SiP technology for robust protection against the elements, as well as features like Secure Erase to safeguard data integrity.

Aerospace and Defense

In aerospace and defense applications, the smallest margin of error is intolerable. Devices operate in severe conditions, so every component should be extremely reliable. ATP products meet the most rigid military standards, making sure that critical missions are accomplished. Security features like Secure Erase ensure that sensitive data is totally wiped out when the storage device is at its end of life or if it will be repurposed or disposed of, so it cannot be retrieved or restored by adversarial groups.

2018 Product Highlights

Industrial Temperature NVMe™ SSDs Unleash the Real Speed of NAND Flash

ATP's new NVMe™-based SSDs in the M.2 form factor leverage the blazing-fast bandwidth of the PCI Express® (PCIe®) interface to support the growing data-hungry needs of today's enterprise. Fitting in a PCIe 3.0 x4 slot, ATP NVMe SSDs outperform Serial ATA 6 Gb/s SSDs with 4-6X faster access, over 3X lower latency, and higher Input/Output per Second (IOPS). Industrial operating temperature (iTemp) enables NVMe SSDs to deliver stable performance even in extreme temperatures ranging from -40°C to 85°C.

High Speed

- 32 Gb/s bandwidth on a PCIe 3.0 8 Gb/s interface, x4 lanes
- Sequential read speed up to 2,540 MB/s
- Sequential write speed up to 1,100 MB/s

High Capacity & Performance

- Massive densities up to 1 TB
- Random Read IOPS: up to 100,000
- Dynamic Thermal Throttling mechanism to prevent overheating

High Endurance & Reliability

- Available in industrial (-40°C to 85°C) or commercial (0°C to 70°C) operating temperature
- 1,536 TB maximum TBW

Extensive SATA III SSD Range Offers Ideal Solutions for Embedded and Industrial Applications

ATP's solid state drives using the SATA 6 Gb/s interface offer high speed, stable performance and power savings, making them leading choices in embedded and industrial applications.

Available in different form factors and capacities ranging from 8 GB to 1 TB, ATP's SATA 6 Gb/s SSDs consume less power than traditional hard disk drives, are more resistant to shocks and vibrations because they have no mechanical parts, and are suitable for big workloads demanding consistently dependable performance.

Tried and Tested Performance

- High-speed SATA 6 Gb/s transfer speed
- Available in industrial (-40°C to 85°C) or commercial (0°C to 70°C) operating temperature
- Temperature sensor to detect device's & controller's temperatures*
- Dynamic Thermal Throttling mechanism to prevent overheating*

* For certain models only.

Compact Form Factor Options

- 2.5" SSD
- M.2 2280, 2260, 2242
- mSATA
- SlimSATA

Power-Packed with Unique Technologies

- Enhanced power loss protection with PowerProtector
- Dynamic Over-Provisioning for consistent performance and extended endurance*
- Advanced Wear Leveling for longer endurance

Accelerate Enterprise Performance with DDR4-2666

Data-intensive applications will benefit greatly from the fast data transfer speed, low voltage, and copious density of ATP's latest range of industrial DDR4 modules.

Built for the latest Intel® Xeon® Scalable and 8th-generation Intel® Core™ i7/i5/i3 processors, ATP's latest DDR4 modules with 2666 MT/s data transfer rate and low 1.2V power consumption boost performance, keep systems cool and save on energy costs.

24/7 Stable Performance

- 2666 MT/s data rate
- Available in densities from 4 to 32 GB (RDIMM) and 4 to 16 GB (ECC UDIMM, ECC SO-DIMM, UDIMM and SO-DIMM)

Energy-Efficiency

- Low 1.2V power consumption

Defensive Durability

- Thicker 30µ gold finger plating
- Conformal Coating

3D MLC Memory Cards Deliver Enhanced Reliability and Endurance

As global trends inevitably shift from 2D planar NAND to 3D, ATP leads the implementation of 3D multi-level cell (MLC) flash technology on its SD and microSD memory cards. The 3D MLC memory cards take advantage of 3D NAND's higher performance and capacity while sustaining the reliability and endurance levels of the previous generation. They meet the growing demands of automotive applications such as in-vehicle infotainment (IVI), event data recording and Advanced Driver Assistance Systems (ADAS) with fast random read-write performance (SDA A1 spec) and reliability under extremely low or high temperatures.

Benefits of ATP 3D MLC Memory Cards

- Superior endurance
- A1 Application Performance Class min. Random read/write: 1500/500 IOPS
- Optimized cost efficiency
- Rugged design–waterproof/dustproof, ESD-resistant
- Passed environmental testing (bend/torque/salt/spray/solar radiation)
- High endurance via Advanced Wear Leveling algorithm
- Advanced data integrity and retention technologies: SD Life Monitor, Auto Refresh, and Dynamic Data Refresh*

*By model

ATP 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.

Data Integrity

SD Life Monitor/S.M.A.R.T.

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

Power Failure Protection/PowerProtector

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.

Advanced Wear Leveling

Manages the reads and writes across blocks evenly to optimize the overall 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.

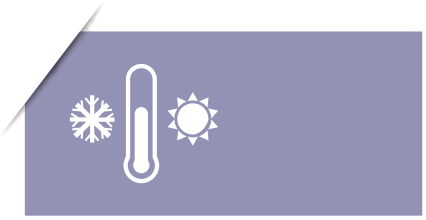
Secure Erase

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

Data Reliability

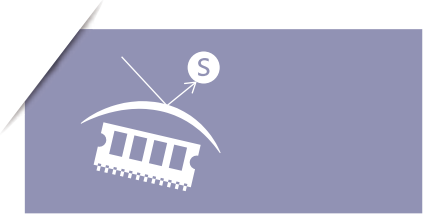
Industrial Temperature

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



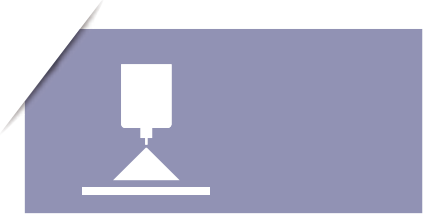
Anti-Sulfur Resistors

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



Conformal Coating

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

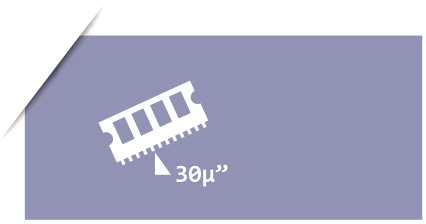


SiP (System in Package)

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.



ATP Technologies

Data Retention

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.

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.

For detailed information on available solutions for your industrial application needs, visit the ATP website at **http://www.atpinc.com**.

DRAM Solutions

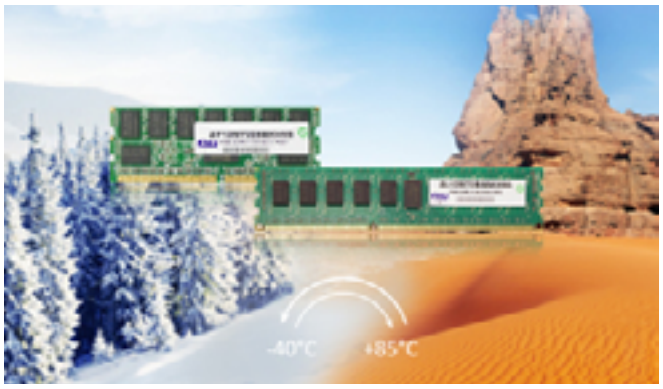
Intense Performance for Intense Workloads

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 DDR4-2666. They are available as RDIMM, RDIMM VLP, UDIMM/UDIMM ECC, SO-DIMM/SO-DIMM ECC, SO-CDIMM, Mini-RDIMM, FB-DIMM, and Mini-UDIMM/Mini-UDIMM ECC.

ATP DRAM Unique Features

Unique memory technologies and solutions enable ATP DRAM modules to deliver peak performance and exceptional reliability in any demanding industrial computing environment.

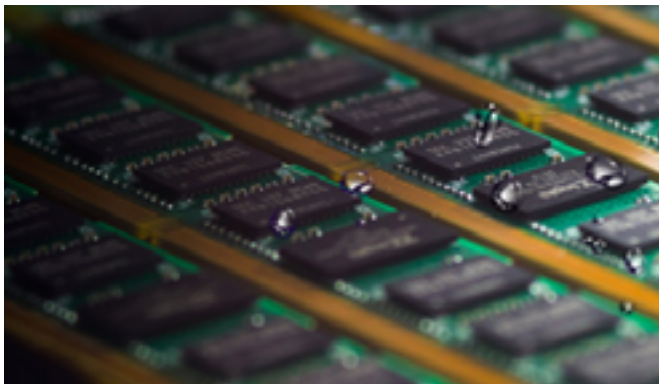
Industrial Temperature



ATP DRAM modules can endure extreme temperatures ranging from -40°C to 85°C, ensuring long-term stability for systems installed in telecom, industrial and military/ aerospace operations where consistent availability and steadfast performance are of critical importance.

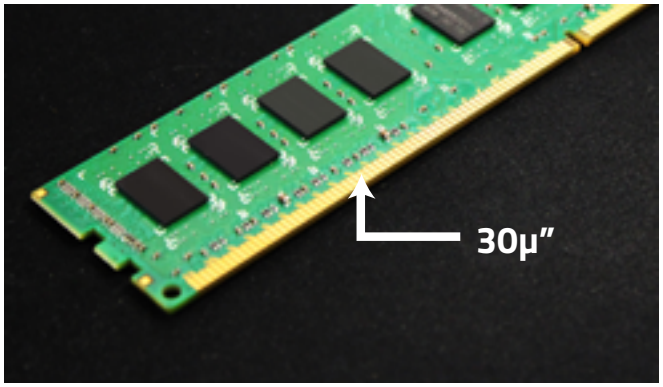
ATP's modules undergo two levels of testing to ensure maximum reliability:
1. Advanced IC Level Testing screens for ICs with the best reliability and quality characteristics that are suitable for applications requiring wide temperature.
2. Enhanced Module Level Test During Burn-In (TDBI) and Automatic Test Equipment (ATE) guarantee that modules meet and even exceed qualifying parameters.

Conformal Coating



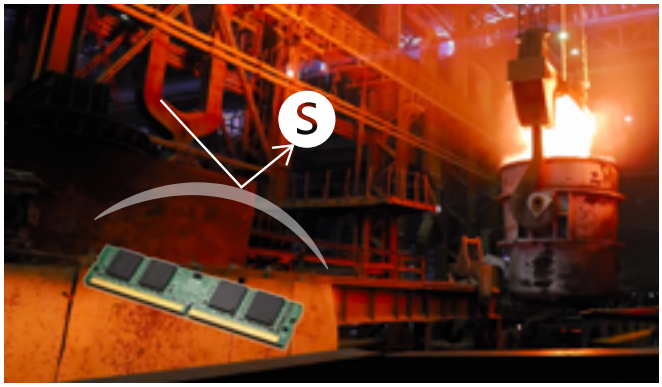
A protective layer of Parylene is applied to electronic circuits and modules, accessing spaces as narrow as 0.01 mm to shield against dust, chemical, extreme temperatures, moisture and corrosion. The coating film is formed by the chemical vapor deposition (CVD) process, and unlike dipping and spraying techniques, is completely pinhole free as the film conforms to any irregular shape, forming a vacuum-like environment to coat all components and points of failure.

Increased Thickness, Strength



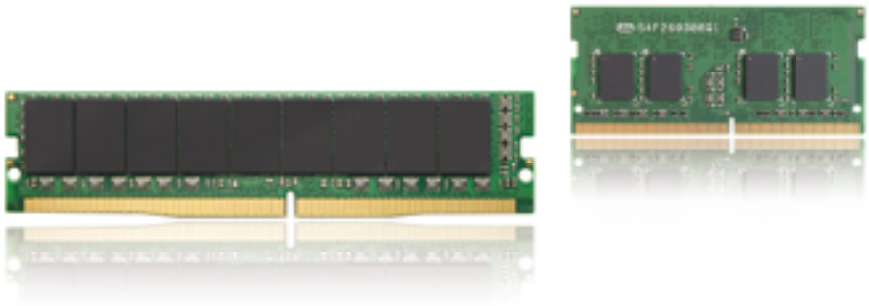
In order to ensure the quality of the signal transmission between the connector and ATP DRAM module, ATP utilizes gold finger plating with 30μ" thickness, compared to competitors' DRAM modules thickness typically at less than 10μ".

Anti-Sulfur Resistors



Ordinary silver resistors corrode and become non-conductive when exposed to sulfur. ATP DRAM modules use anti-sulfur resistors that repel the damaging effects of sulfur contamination, guaranteeing continued dependable performance for a long time and lowering the total cost of ownership by preventing unnecessary downtime and expensive component replacements.

ATP DDR4-2666 modules for Intel® Xeon® Scalable and 8th-generation Intel® Core™ Processors



Rev Up Your Enterprise

Blaze through massive memory workloads while generating big power savings with ATP DDR4-2666 modules built for the latest Intel® Xeon® Platinum, Gold, Silver and Bronze Scalable processors and 8th-generation Intel® Core™ i7/ i5/i3 processors. Designed to meet growing and evolving enterprise demands, ATP DDR4 solutions can expand operational capabilities, cut down TCO, and ensure that your organizations are ready for the future.

High-performance computing (HPC) applications such as telecommunication infrastructure, networking storage systems, NAS (Network Attached Storage), micro/cloud servers, and embedded systems like industrial PCs will greatly benefit from:

Accelerated Performance

Enterprise-level density meets large-scale, memory-intensive workloads. The fast 2666 MT/s data rate delivers speedy performance for greater productivity.

Immense Power Savings

A mere 1.2V power consumption keeps systems cool and energy costs at a minimum, translating to better efficiency and big savings.

Future-Ready Scalability

The 8 Gbit IC design enables cost-effective expansion of memory footprints to keep pace with future requirements.

Product Family

Type	Data Rate	Voltage	PCB Height	Operating Temperature	Golden Finger	Density
RDIMM	2666 MT/s	1.2 V	STD 31.25 mm	0-85°C	30 µ	4 GB/8 GB/16 GB/32 GB
ECC UDIMM	2666 MT/s	1.2 V	STD 31.25 mm	0-85°C	30 µ	4 GB/8 GB/16 GB
ECC SO-DIMM	2666 MT/s	1.2 V	STD 30 mm	0-85°C	30 µ	4 GB/8 GB/16 GB
UDIMM	2666 MT/s	1.2 V	STD 31.25 mm	0-85°C	30 µ	4 GB/8 GB/16 GB
SO-DIMM	2666 MT/s	1.2 V	STD 30 mm	0-85°C	30 µ	4 GB/8 GB/16 GB

Legacy (SDR/DDR) DRAM Modules

Micron endorses ATP as a partner to support selected 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.

The expanded coverage demonstrates the strong partnership between ATP and Micron. As a strategic partner, 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.

Endorsements

"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

Standard Solutions		
Module Type	DDR SO-DIMM	DDR SO-DIMM (Industrial Grade)
Capacity	128 MB / 256 MB / 512 MB/ 1 GB	256 MB / 512 MB / 1 GB
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 RDIMM	DDR UDIMM	DDR SO-DIMM	SDRAM SO-DIMM
Capacity	1 GB / 2 GB	256 MB / 512 MB	256 MB / 512 MB / 1 GB	64 MB / 128 MB / 256 MB / 512 MB
Function	Registered ECC	Unbuffered ECC/ Unbuffered Non ECC	Unbuffered ECC	Unbuffered Non ECC
Frequency	400 MHz	400 MHz	400 MHz	133 MHz
Number of Pins	184	184	200	144
PCB Height	1.125"/1.2"	1.25"	1.25"	1.0"/1.25"

ATP Testing Systems

Highly complex and demanding networks should maintain availability and operational efficiency while running round the clock. Any down time arising from component failure has the potential to cause disastrous data losses with significant legal and financial impact. Aware of the need for outstanding reliability at all times, ATP makes sure that DRAM modules coming out of its manufacturing facilities are thoroughly tested and potential failures screened out.

Memory chips, such as all semiconductor devices, follow a reliability/failure pattern known as the "Bathtub Curve." According to this pattern, most failures occur during the first three months of use. Once the early life failure (ELF) period passes, failures become extremely rare, and the useful life is estimated to be 20 years or more. End of life failures refer to those that occur when the semiconductor product wears out and fails.

Test During Burn-In (TDBI)

ATP's Test During Burn-In (TDBI) aims to effectively screen out defective DRAM chips that will potentially fail during the early life failure (ELF) period. By ensuring that only robust DRAM chips are on the module, TDBI can significantly lower failure rates and extend the product service life.

The ATP TDBI system simulates the ELF period by applying extreme high/low temperature, high/low voltage, and pattern testing on the DRAM modules.

The system consists of:

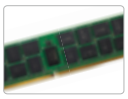
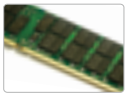
- Miniature Chamber, which isolates temperature cycling to the targeted area.
- Module Riser Adapters from the motherboard, which allow easy module insertions in production-level volumes.
- Multiple temperature sensors, which regulate temperature profiles, operating on a wide testing temperature range of -40° to 85°C.

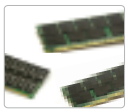
Automatic Testing Equipment (ATE)

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. For specific weaknesses of some ICs, ATE can provide specific testing patterns to stress the screening of the particular defects during the testing.

Also, based on customers' requests, tailor-made electrical testing patterns can be programed and implemented into the ATE testing process. The ATE testing system can pinpoint individual defective ICs or defective DRAM PCB boards, thus providing a more efficient failure analysis method for both new product development and mass production stages.

Complete DRAM Product Line

Product	Category	Speed (MT/s)	Form Factor	Features
DDR4 	LRDIMM/RDIMM UDIMM/UDIMM ECC SO-DIMM/SO-DIMM ECC Mini-RDIMM Mini-UDIMM ECC	2133 2400 2666	▪ Low profile ▪ Very Low Profile (VLP) options (VLP: 0.74" height) ▪ Ultra Low Profile (ULP) options (ULP: 0.7"~0.72" height)	▪ Density: 2 GB to 64 GB ▪ Increased performance and bandwidth (up to 3200 MT/s) ▪ Decreased voltage for better power consumption ▪ Provides better reliability, availability and serviceability (RAS) and improves data integrity.
DDR3 	RDIMM UDIMM/UDIMM ECC SO-RDIMM SO-DIMM/SO-DIMM ECC Mini-RDIMM Mini-UDIMM ECC	1866 1600 1333 1066	▪ Low profile ▪ Very Low Profile (VLP) options (VLP: 0.74" height) ▪ Ultra Low Profile (ULP) options (ULP: 0.7"~0.72" height)	▪ Density: 1 GB to 32 GB ▪ Chipkill support ▪ Fly-by command/address/control bus with on-DIMM termination. ▪ Higher bandwidth performance, effectively up to 1866 MT/s ▪ Better performance at low power; 1.5 V (Normal) and 1.35 V (Low Voltage)
DDR2 	RDIMM UDIMM/UDIMM ECC SO-RDIMM SO-CDIMM SO-DIMM Mini-RDIMM FB-DIMM*	800 667 533 400	▪ Low Profile ▪ Very Low Profile (VLP) options (VLP: 0.72"~0.74" height)	▪ Density: 1 GB to 8 GB ▪ Chipkill support FB-DIMM ▪ Low power and low voltage options ▪ Apple FB-DIMM
DDR* 	UDIMM/UDIMM ECC SO-CDIMM SO-DIMM	400 333 266	▪ Low Profile ▪ Very Low Profile (VLP) options (VLP: 0.72"~0.74" height)	▪ Chipkill support ▪ Legacy system support
SDRAM* 	SO-DIMM	133 100	▪ Low Profile	▪ Legacy system support

Product Portfolio	Category	Product	Features
Industrial Grade Family 	SO-DIMM UDIMM RDIMM Mini-DIMM	DDR4 DDR3 DDR2 DDR* SDRAM*	▪ Extended temperature: -40°C ~ 95°C ▪ Controlled BOM and SPD ▪ For mission-critical industrial applications ▪ Conformal Coating

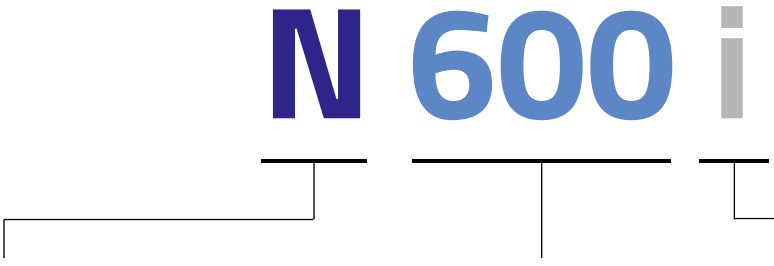
* Available on a project basis.

Flash Solutions

Ruggedized Industrial Flash Products for Mission-Critical Applications

ATP's industrial flash products deliver dependable performance, efficient responsiveness, and long usage life to accomplish mission-critical tasks. Sturdy and built to withstand rigorous operating environments, ATP flash storage comes in different form factors such as 2.5" SSDs, M.2 embedded modules, mSATA, SlimSATA, 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® 3.0 x4 interface for reliable, blazing-fast, and future-ready performance.

Flash Products Naming Rule



Interface
(uppercase)

N: PCIe (NVMe)
A: SATA
B: USB
I : PATA/IDE (CF)
S: SD/microSD

Product Endurance spec.
(number)

600: Standard
700: Enhanced
800: Optimal
900: Reserved

Temp./Segment/Category
(lowercase)

c: Commercial Temp
i: Industrial Temp
a: Automotive Line
p: Premium Line (with I-Temp)
v: Value Line (with C-Temp)

Flash Product Line

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 PowerProtector 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.

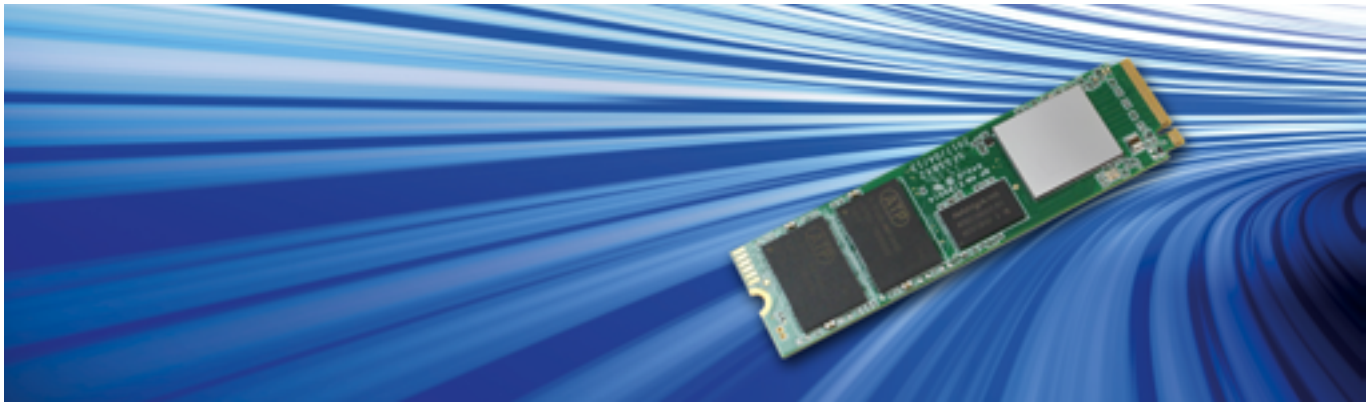
Superior Line

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), giving users the flexibility to 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.

NVMe™ M.2 SSDs: NAND Flash in the Fast Lane



The NVM Express® (NVMe™) protocol takes advantage of the high-bandwidth bus technology of the PCI Express® (PCIe®) interface, bringing dramatic improvements in speed and capabilities and outperforming Serial ATA (SATA) 6 Gb/s by up to 6X. Designed to move past the limitations of mechanical drives, NVMe was specifically built from the ground up for faster, more efficient access to storage devices with non-volatile memory such as current NAND flash solutions and future non-volatile memory technologies. These SSDs can deliver fast, reliable and durable performance for any demanding application.

ATP debuts this new industry standard protocol in its latest line of SSDs in the M.2 2280 form factor. ATP's NVMe SSD modules fit on a PCIe Gen3 x4 slot, delivering up to 32 Gb/s (8 Gb/s per lane) bandwidth and high sequential read/write speeds. With an industrial operating temperature rating of -40°C to 85°C, NVMe SSDs give dependable performance even in extreme temperatures. Dynamic Thermal Throttling automatically adjusts the speed to maintain cooler operation under intense and heavy workloads.

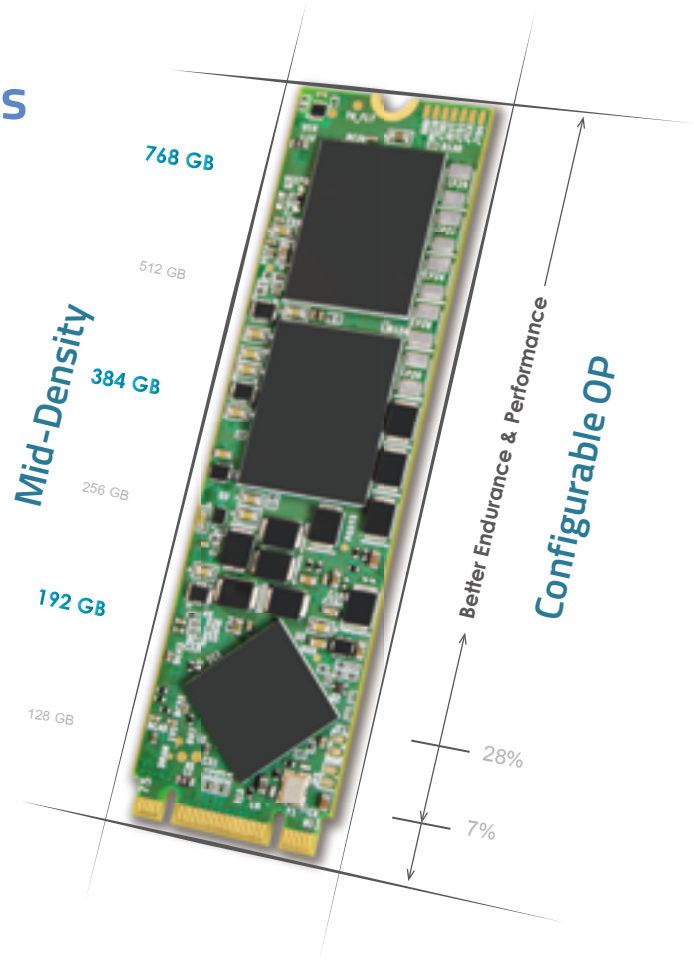
Key Features

- Superior Read/Write performance
- LDPC & RAID Data Recovery for error correction
- Dynamic Thermal Throttling
- Global wear leveling
- TRIM function support

Product Name		M.2 NVMe 2280-D2-M	
Product Line		Superior	
Naming		N600i	N600c
Flash Type		iTemp MLC	MLC
Density		128 GB to 1 TB	
Performance	Sequential Read up to (MB/s)	2,540	
	Sequential Write up to (MB/s)	1,100	
	Random Read IOPS (4K, QD32)	Up to 100,000	
Interface		PCIe Gen3 8 Gb/s Interface, x4 Lanes	
Operating Temperature		-40°C to 85°C	0°C to 70°C
Reliability	TBW* (max.)	1,280 TB	1,536 TB
	DWPD* (max.)	1.75	2.10
	MTBF @ 25°C	>2,000,000 hours	
Dimensions: L x W x H (mm)		80.0 x 22.0 x 3.5	

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

Configurable SSDs



Mid-Density NAND Flash Modules Offer More Choices for Cost-Effective Storage Allocation

ATP has announced the release of the new Mid-Density technology for industrial NAND flash module solutions. This ATP signature technology provides a different perspective when it comes to the cost-effectiveness of NAND flash storage.

Typically, NAND flash storage products are offered in powers of two - 64/128/256/512 GB or 1 TB. As capacities increase, so does the gap between each capacity point, resulting in higher marginal cost jumps.

ATP offers storage capacities that do not come in powers of two. These "in-between" capacities, such as 96/192/384/768 GB, expand ATP's portfolio to give users more choices that can match what they really need and what they are willing to pay for, resulting in optimized cost-per-gigabyte. Mid-density options minimize the cost jump from lower to higher capacity, giving users a wider range of choices based on their needs and resulting in more cost-effective resource allocation.

Adjustable Dynamic Over-Provisioning Optimizes SSD Performance and Endurance

ATP launches a new breed of embedded SSDs breaking the mold from rigid factory-set configurations.

ATP embedded SSDs featuring the ATP Dynamic Over-Provisioning (OP) solution offer the freedom and flexibility to configure SSDs according to the actual workloads of specific applications. While OP percentage is typically set to a default 7% for client applications or 28% for enterprise storage applications, ATP recognizes that it is essential to determine and implement the right configurations that will address various workloads to ensure the operational health of the storage device.

Different OP percentages can affect SSD performance and endurance. With ATP's Dynamic Over-Provisioning solution, users can evaluate actual workloads and configure the over-provisioned space accordingly using simple software. They have the freedom and flexibility to optimally configure SSDs with 7%, 14%, 28% and even 50% or more OP space for the best-possible performance and endurance. By enabling users to configure the OP setting based on actual needs, the ATP Dynamic Over-Provisioning solution maximizes the performance and life span of the SSD, translating to greater productivity and better operational efficiency.

Industrial SATA III SSDs: High-Performance, High-Density Storage in Compact Form Factors

Serial ATA (SATA) SSDs use the most common storage interface and are extensively deployed for applications requiring strict data integrity and maximum uptime. ATP's SATA SSDs provide the excellent balance of reliable performance, high capacity, and cost-efficiency to meet demanding data-intensive applications.

Wide Temperature Ratings

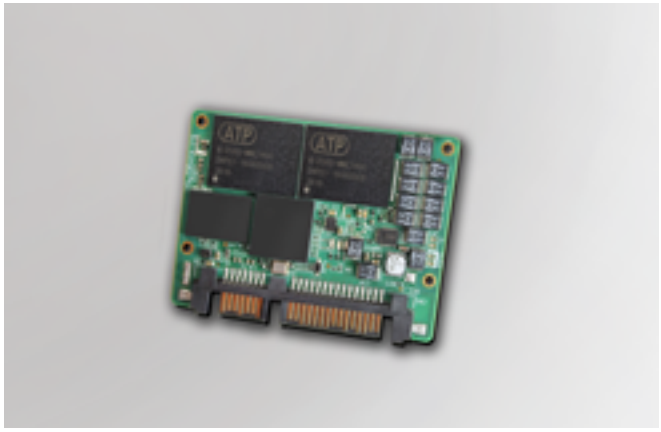
ATP offers an extensive range of SATA SSDs in small form factors packed with high densities and able to withstand severe temperature shifts common in industrial environments. Wide operating temperature ratings of -40°C to 85°C make these small SSDs capable of functioning dependably in extremely cold or hot locations.

M.2: Power-Packed Performance in a Lean Footprint

M.2 SSD modules provide higher performance and capacity while minimizing the overall module footprint. ATP M.2 iTemp modules are available in types 2242, 2260 and 2280 and are suitable for networking and thin storage systems, point-of-sale systems (POS), and industrial computer applications. Adopting the double-sided M.2 configuration to enable higher densities, M.2 2242 SSDs pack up to 256 GB capacity; 2260 has a maximum capacity of 512 GB; and 2280 loads a massive capacity of up to 1 TB.

SlimSATA: Premium Reliability

Occupying just half the footprint of a 1.8" SSD and holding up to 512 GB capacity, ATP's SlimSATA SSDs are ideal for business-critical industrial PCs, advanced telecommunications computing architecture, single-board computers, surveillance and security, and networking environments.



mSATA: Cost-Effective Efficiency

Just roughly the size of a business card, ATP's iTemp mSATA SSDs offer up to 512 GB capacity and the same speed and efficiency of SATA. They are designed to fit in systems with space constraints and high-performance requirements such as embedded and networking applications.

Memory Card Solutions for Automotive Applications

The era of Internet of Vehicles (IoV) continues to drive the automotive industry evolution forward and vehicles are becoming more connected. ATP's automotive solutions deliver the quality and reliability assurance to meet the requirements of major automotive OEM/Tier 1 suppliers, system developers and service providers for higher levels of data accuracy, consistency and integrity in applications such as maps/navigation systems, in-vehicle infotainment (IVI), Advanced Driver Assistance Systems (ADAS), and other data-intensive applications. These solutions can withstand extreme temperatures, dust and shock/vibration, and maintain data integrity under power cycling or sudden power-off events.

Leveraging over 25 years of manufacturing experience and 8 years of automotive experience, ATP uses its vast knowledge base to analyze and simulate usage cases according to customized test criteria with specific software and test scripts. This enables ATP to tailor-fit products and adapt to customer-specific requirements. Under the Joint Validation program, compatibility and functional tests are conducted with customers' host devices and systems.
At mass production stage, 100% production level burn-in test using wide temperature ranges sorts out manufacturing or component defects before shipping to customers.

Quality Capabilities

- VDA 6.3/APQP/ASPICE*
- Certifications: ISO9001, ISO14001, ISO/TS16949**
- Product Validation: PPAP*
- IMDS (International-Material-Data-System)
- Continuous improvement — 8D reports and failure analysis

* Available on a project basis.
**On select models

Engineering Capabilities

- ATP IVI Test Plan
- Selected AEC-Q100 test items and conditions approved by customers
- Power Cycling test: ATP unique F/W and testing script
- ATP NAND flash IC-level test (Data Retention, Endurance, Read Disturbance)
- Joint Validation: compatibility and function tests with IVI systems

Product Line		Automotive			
Product Name		SD/SDHC/SDXC		microSD/microSDHC/microSDXC	
Naming		S600a			
Flash Type		iTemp MLC	MLC	iTemp MLC	MLC
Density		8 GB* to 64 GB		8 GB* to 32 GB	
Performance	Sequential Read up to (MB/s)	95		95	
	Sequential Write up to (MB/s)	79		79	
Interface		8 GB ~ 64 GB, UHS-I		8 GB ~ 64 GB, 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.)	76.8 TB		38 TB	
	MTBF @ 25°C	>2,000,000 hours		>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		15.0 x 11.0 x 1.0	

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

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			Value
Naming		S800p	S700p	S700c	S600i	S600c	S600v
Flash Type		SLC	iTemp SLC mode	SLC mode	iTemp MLC	MLC	MLC
Density		512 MB to 8 GB	4 GB to 64 GB	4 GB to 64 GB	8 GB to 64 GB	8 GB to 256 GB*	8 GB to 32 GB
Performance	Sequential Read up to (MB/s)	69	96	96	96		96
	Sequential Write up to (MB/s)	39	80	80	78		59
Interface		512 MB~2 GB, HS mode 4 GB~8 GB, UHS-I	UHS-I	UHS-I			UHS-I
Operating Temperature		-40°C to 85°C		-25°C to 85°C	-40°C to 85°C	-25°C to 85°C	-25°C to 85°C
Reliability	TBW** (max.)	192 TB	512 TB	512 TB	77 TB	307 TB	38 TB
	MTBF @ 25°C	>5,000,000 hours	>3,000,000 hours	>3,000,000 hours	>2,000,000 hours		>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					

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

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

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

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			Value
Naming		S800p	S700p	S700c	S600i	S600c	S600v
Flash Type		SLC	iTemp SLC mode	SLC mode	iTemp MLC	MLC	MLC
Density		512 MB to 8 GB	4 GB to 16 GB	4 GB to 64 GB	8 GB to 32 GB	8 GB to 128 GB	8 GB to 32 GB
Performance	Sequential Read up to (MB/s)	82	88	96	79	96	79
	Sequential Write up to (MB/s)	39	78	85	75	81	75
Interface		512 MB~2 GB, HS mode 4 GB~8 GB, UHS-I	UHS-I	UHS-I			UHS-I
Operating Temperature		-40°C to 85°C		-25°C to 85°C	-40°C to 85°C	-25°C to 85°C	-25°C to 85°C
Reliability	TBW* (max.)	192 TB	128 TB	512 TB	38 TB	153 TB	38 TB
	MTBF @ 25°C	>5,000,000 hours	>3,000,000 hours	>3,000,000 hours	>2,000,000 hours		>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					

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

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

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

CompactFlash Cards

Key Features

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

Product Name		CompactFlash Card		
Product Line		Premium	Superior	
Naming		I800p	I700c	I600c
Flash Type		SLC	SLC mode	MLC
Density		512 MB to 32 GB	4 GB to 16 GB	8 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		-40°C to 85°C	0°C to 70°C	
Reliability	TBW* (max.)	1,280 TB	128 TB	38 TB
	DWPD* (max.)	22.4	11.2	1.7
	MTBF @ 25°C	>5,000,000 hours	>2,000,000 hours	
	Number of Insertions:	10,000 minimum		
Dimensions: L x W x H (mm)		36.4 x 42.8 x 3.3		

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

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

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

CFast Cards

Key Features

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

Product Name		CFast Card		
Product Line		Premium	Superior	
Naming		A800p	A600i	A600c
Flash Type		SLC	iTemp 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	445	445
	Sequential Write up to (MB/s)	300	160	160
	Random Read IOPS up to	35,800	29,400	29,400
Interface		SATA III 6 Gb/s		
Operating Temperature		-40°C to 85°C	-40°C to 85°C	0°C to 70°C
Reliability	TBW* (max.)	2,667 TB	267 TB	320 TB
	DWPD* (max.)	46.8	2.9	3.5
	MTBF @ 25°C	>2,000,000 hours	>2,000,000 hours	
	Number of Insertions:	10,000 minimum		
Dimensions: L x W x H (mm)		36.4 x 42.8 x 3.6		

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

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

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

M.2

Key Features

- Global wear leveling
- TRIM function support
- Static Data Refresh and Idle Clean F/W algorithm
- Firmware live update
- PowerProtector

Product Name		M.2						
		2242 D2-B-M			2260 D2-B-M			
Product Line		Premium	Superior		Premium		Superior	
Naming		A800p	A600i	A600c	A800p	A700p	A600i	A600c
Flash Type		SLC	iTemp MLC	MLC	SLC	iTemp SLC mode	iTemp MLC	MLC
Density		8 GB to 64 GB	32 GB to 256 GB*		32 GB to 128 GB	64 GB to 512 GB	64 GB to 512 GB	
Performance	Sequential Read up to (MB/s)	530	520		530	550	550	
	Sequential Write up to (MB/s)	400	150		430	440	450	
	Random Read IOPS up to	76,000	70,000		76,000	73,000	70,000	
Interface		SATA III 6 Gb/s						
Operating Temperature		-40°C to 85°C	-40°C to 85°C	0°C to 70°C	-40°C to 85°C		-40°C to 85°C	0°C to 70°C
Reliability	TBW** (max.)	5,333 TB	267 TB	320 TB	10,677 TB	8,533 TB	1,067 TB	1,280 TB
	DWPD** (max.)	77.9	2.9	3.5	78.0	46.8	11.7	14.0
	MTBF @ 25°C	>2,000,000 hours						
Dimensions: L x W x H (mm)		42.0 x 22.0 x 3.5			60.0 x 22.0 x 3.5			

Product Name		M.2		
		2280 D2-B-M		
Product Line		Premium	Superior	
Naming		A700p	A600i	A600c
Flash Type		iTemp SLC mode	iTemp MLC	MLC
Density		64 GB to 512 GB	128 GB to 1 TB	
Performance	Sequential Read up to (MB/s)	550	550	
	Sequential Write up to (MB/s)	440	450	
	Random Read IOPS up to	73,000	70,000	
Interface		SATA III 6 Gb/s		
Operating Temperature		-40°C to 85°C	-40°C to 85°C	0°C to 70°C
Reliability	TBW** (max.)	17,066 TB	2,133 TB	2,560 TB
	DWPD** (max.)	46.8	2.9	3.5
	MTBF @ 25°C	>2,000,000 hours		
Dimensions: L x W x H (mm)		80.0 x 22.0 x 3.5		

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

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

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

2.5" SSDs

Key Features

- Global wear leveling
- TRIM function support
- Static Data Refresh and Idle Clean F/W algorithm
- Firmware live update
- PowerProtector
- Write protect disabled/enabled
- NSA-compliant Secure Erase

Product Name		Velocity 2.5" SSD			
		SII Pro	XE	MV	
Product Line		Premium		Superior	
Naming		A800p	A700p	A600i	A600c
Flash Type		SLC	iTemp SLC mode	iTemp MLC	MLC
Density		8 GB to 256 GB	64 GB to 512 GB	64 GB to 1 TB	64 GB to 1 TB
Performance	Sequential Read up to (MB/s)	520	540	530	530
	Sequential Write up to (MB/s)	420	450	420	420
	Random Read IOPS up to	76,000	73,000	70,000	70,000
Interface		SATA III 6 Gb/s			
Operating Temperature		-40°C to 85°C		-40°C to 85°C	0°C to 70°C
Reliability	TBW* (max.)	21,333 TB	17,066 TB	2,133 TB	2,560 TB
	DWPD* (max.)	77.9	46.8	5.8	7.0
	MTBF @ 25°C	>2,000,000 hours			
Dimensions: L x W x H (mm)		100.0 x 69.9 x 9.2			

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

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

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

mSATA

Key Features

- Global wear leveling
- TRIM function support
- AutoRefresh and Idle Clean F/W algorithm
- Firmware live update
- PowerProtector

Product Name		mSATA				
Product Line		Premium		Superior		Value
Naming		A800p	A700p	A600i	A600c	A600v
Flash Type		SLC	iTemp SLC mode	iTemp MLC	MLC	MLC
Density		8 GB to 128 GB	64 GB to 256 GB	16 GB to 512 GB	16 GB to 512 GB	32 GB to 128 GB
Performance	Sequential Read up to (MB/s)	530	550	550	550	450
	Sequential Write up to (MB/s)	430	440	450	450	400
	Random Read IOPS up to	76,000	73,700	70,000	70,000	60,000
Interface		SATA III 6 Gb/s				
Operating Temperature		-40°C to 85°C		-40°C to 85°C	0°C to 70°C	0°C to 70°C
Reliability	TBW* (max.)	10,667 TB	8,533 TB	1,067 TB	1,280 TB	160 TB
	DWPD* (max.)	77.9	46.8	2.9	3.5	3.5
	MTBF @ 25°C	>5,000,000 hours		>2,000,000 hours		>2,000,000 hours
Dimensions: L x W x H (mm)		50.8 x 29.85 x 3.4				

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

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

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

SlimSATA

Key Features

- Global wear leveling
- TRIM function support
- AutoRefresh and Idle Clean F/W algorithm
- Firmware live update
- PowerProtector

Product Name		SlimSATA			
Product Line		Premium		Superior	
Naming		A800p	A700p	A600i	A600c
Flash Type		SLC	iTemp SLC mode	iTemp MLC	MLC
Density		8 GB to 128 GB	64 GB to 256 GB	16 GB to 512 GB	16 GB to 512 GB
Performance	Sequential Read up to (MB/s)	530	550	550	550
	Sequential Write up to (MB/s)	430	440	450	450
	Random Read IOPS up to	76,000	73,700	70,000	70,000
Interface		SATA III 6 Gb/s			
Operating Temperature		-40°C to 85°C		-40°C to 85°C	0°C to 70°C
Reliability	TBW* (max.)	10,667 TB	8,533 TB	1,067 TB	1,280 TB
	DWPD* (max.)	77.9	46.8	2.9	3.5
	MTBF @ 25°C	>5,000,000 hours	>2,000,000 hours	>2,000,000 hours	
Dimensions: L x W x H (mm)		54.0 x 39.0 x 4.0			

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

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

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

eUSB

Key Features

- Global wear leveling
- PowerProtector

Product Name		eUSB	
Product Line		Premium	Superior
Naming		B800p	B600c
Flash Type		SLC	MLC
Density		1 GB to 32 GB	8 GB to 32 GB
Performance	Sequential Read up to (MB/s)	30	25
	Sequential Write up to (MB/s)	25	19
Interface		Compatible with USB 2.0 (480 Mbps)	
Operating Temperature		-40°C to 85°C	0°C to 70°C
Reliability	TBW* (max.)	1,280 TB	38.4 TB
	DWPD* (max.)	37.4	1.7
	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	

* Under highest Sequential write value. May vary by density, configuration and applications.
** 2.00 mm connector pin pitch by project support.

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

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

NANODURA

Key Features

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

Product Name		NANODURA	
Product Line		Premium	Superior
Naming		B800p	B600c
Flash Type		SLC	MLC
Density		512 MB to 8 GB	8 GB to 16 GB
Performance	Sequential Read up to (MB/s)	21	25
	Sequential Write up to (MB/s)	16	18
Interface		Compatible with USB 2.0 (480 Mbps)	
Operating Temperature		-40°C to 85°C	0°C to 70°C
Reliability	TBW* (max.)	192 TB	19.2 TB
	DWPD* (max.)	13.5	1.7
	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 4.6	

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

Technologies & Add-On Services*				SiP
Product Line	Premium	●	●	●
	Superior	●	Δ	●

* Please refer to pages 10-12. Δ: Customization option available on a project basis.

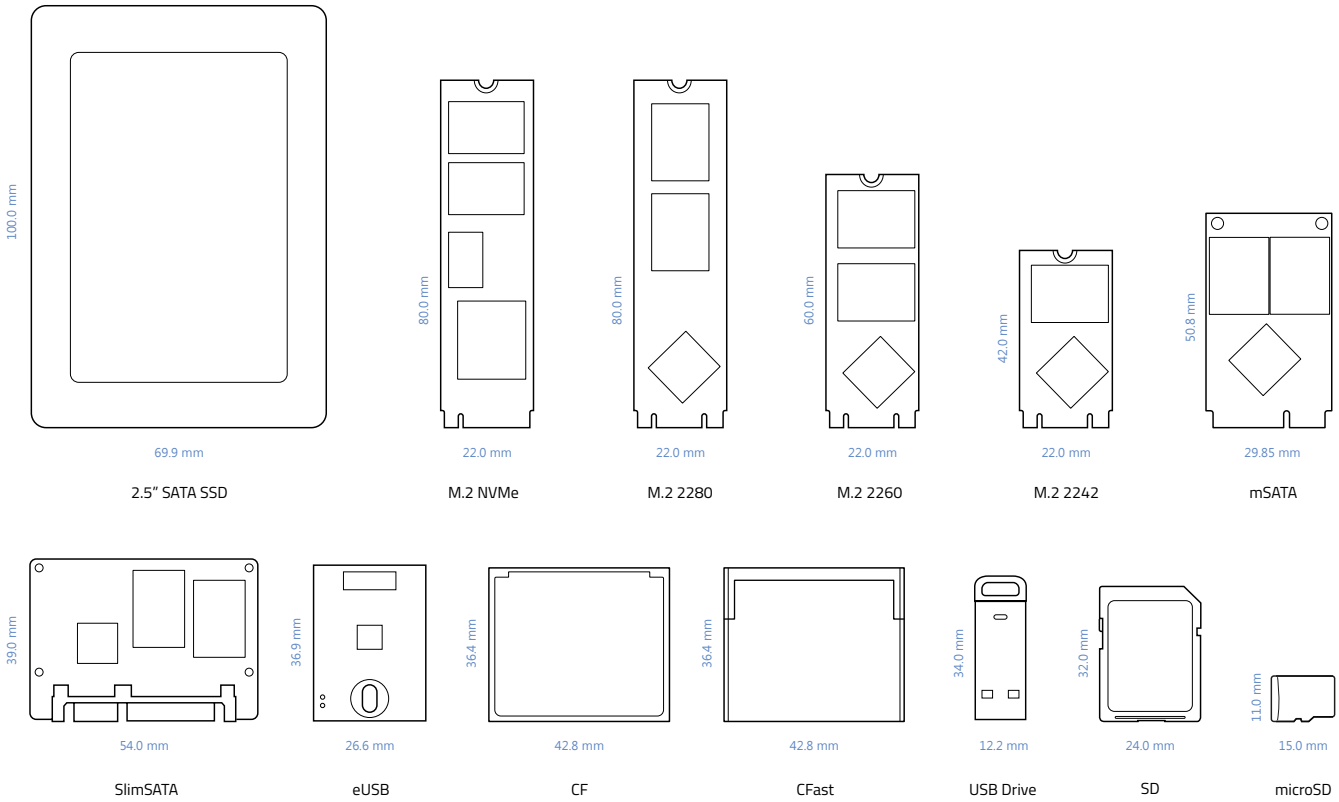
Complete Flash Products

Product			Dimensions (L x W x H mm)	Flash Type	Densities	Operating Temp.	Data Transfer Rate (max.)	TBW** (max.)	Power Failure Protection / PowerProtector	Secure Erase (S/W)***	Life Monitor (S/W)***
SATA											
2.5" SSD	Velocity SII Pro		100.0 x 69.9 x 9.2	SLC	8 GB~256 GB	-40°C~ 85°C	Read: 520 MB/s Write: 420 MB/s	21,333 TB	✓	✓	✓
	Velocity XE			iTemp SLC mode	64 GB~512 GB	-40°C~ 85°C	Read: 540 MB/s Write: 450 MB/s	17,066 TB	✓	✓	✓
	Velocity MV			iTemp MLC	64 GB~1 TB	-40°C~ 85°C	Read: 530 MB/s Write: 420 MB/s	2,133 TB	✓	✓	✓
				MLC		0°C~ 70°C		2,560 TB			
M.2	2280 D2-B-M		80.0 x 22.0 x 3.5	iTemp SLC mode	64 GB~512 GB	-40°C~ 85°C	Read: 550 MB/s Write: 440 MB/s	17,066 TB	✓	✓	✓
				iTemp MLC	128 GB~1 TB		Read: 550 MB/s Write: 450 MB/s	2,133 TB			
				MLC		0°C~ 70°C		2,560 TB			
	2260 D2-B-M		60.0 x 22.0 x 3.5	SLC	32 GB~128 GB	-40°C~ 85°C	Read: 530 MB/s Write: 430 MB/s	10,667 TB	✓	✓	✓
				iTemp SLC mode	64 GB~512 GB		Read: 550 MB/s Write: 440 MB/s	8,533 TB			
				iTemp MLC			Read: 550 MB/s Write: 450 MB/s	1,067 TB			
				MLC		0°C~ 70°C		1,280 TB			
	2242 D2-B-M		42.0 x 22.0 x 3.5	SLC	8 GB~64 GB	-40°C~ 85°C	Read: 530 MB/s Write: 400 MB/s	5,333 TB	✓	✓	✓
				iTemp MLC	32 GB~256 GB*		Read: 520 MB/s Write: 150 MB/s	267 TB			
				MLC		0°C~ 70°C		320 TB			
mSATA			50.8 x 29.85 x 3.4	SLC	8 GB~128 GB	-40°C~ 85°C	Read: 530 MB/s Write: 430 MB/s	10,667 TB	✓	✓	✓
				iTemp SLC mode	64 GB~256 GB		Read: 550 MB/s Write: 440 MB/s	8,533 TB			
				iTemp MLC	16 GB~512 GB		Read: 550 MB/s Write: 450 MB/s	1,067 TB			
				MLC		0°C~ 70°C		1,280 TB			
SlimSATA			54.0 x 39.0 x 4.0	SLC	8 GB~128 GB	-40°C~ 85°C	Read: 530MB/s Write: 430 MB/s	10,667 TB	✓	✓	✓
				iTemp SLC mode	64 GB~256 GB		Read: 550 MB/s Write: 440 MB/s	8,533 TB			
				iTemp MLC	16 GB~512 GB		Read: 550 MB/s Write: 450 MB/s	1,067 TB			
				MLC		0°C~ 70°C		1,280 TB			
CFast			36.4 x 42.8 x 3.6	SLC	8 GB~32 GB	-40°C~ 85°C	Read: 500 MB/s Write: 300 MB/s	2,667 TB	✓	✓	✓
				iTemp MLC	16 GB~128 GB		Read: 445 MB/s Write: 160 MB/s	267 TB			
				MLC		0°C~ 70°C		320 TB			

Product		Dimensions (L x W x H mm)	Flash Type	Densities	Operating Temp.	Data Transfer Rate (max.)	TBW** (max.)	Power Failure Protection / PowerProtector	Secure Erase (S/W)***	Life Monitor (S/W)***
NVMe										
M.2		80.0 x 22.0 x 3.5	iTemp MLC	128 GB~1 TB	-40°C~ 85°C	Read: 2,540 MB/s Write: 1,100 MB/s	1,280 TB	✓	✓	✓
			MLC		0°C~ 70°C		1,536 TB			
PATA/IDE										
CompactFlash		36.4 x 42.8 x 3.3	SLC	512 MB~32 GB	-40°C~ 85°C	Read: 61 MB/s Write: 55 MB/s	1,280 TB	✓	✓	✓
			SLC mode	4 GB~16 GB	0°C~ 70°C	Read: 110 MB/s Write: 80 MB/s	128 TB	-	✓	✓
			MLC	8 GB~32 GB		Read: 108 MB/s Write: 46 MB/s	38 TB	-	✓	✓
USB Drive										
eUSB		36. 9 x 26.6 x 9.5	SLC	1 GB~32 GB	-40°C~ 85°C	Read: 30 MB/s Write: 25 MB/s	1,280 TB	✓	-	-
			MLC	8 GB~32 GB	0°C~ 70°C	Read: 25 MB/s Write: 19 MB/s	38.4 TB	✓	-	-
NANODURA		34 x 12.2 x 4.6	SLC	512 MB~8 GB	-40°C~ 85°C	Read: 21 MB/s Write: 16 MB/s	192 TB	-	-	-
			MLC	8 GB~16 GB	0°C~ 70°C	Read: 25 MB/s Write: 18 MB/s	19.2 TB	-	-	-
SD										
SD/SDHC/SDXC		32.0 x 24.0 x 2.1	SLC	512 MB~8 GB	-40°C~ 85°C	Read: 69 MB/s Write: 39 MB/s	192 TB	✓	✓	✓
			SLC mode	4 GB~64 GB	-25°C~ 85°C	Read: 96 MB/s Write: 80 MB/s	512 TB			
			iTemp SLC mode		-40°C~ 85°C					
			MLC	8 GB~256 GB*	-25°C~ 85°C	Read: 96 MB/s Write: 78 MB/s	307 TB			
			iTemp MLC	8 GB~64 GB	-40°C~ 85°C		77 TB			
microSD/ microSDHC/ microSDXC		15.0 x 11.0 x 1.0	SLC	512 MB~8 GB	-40°C~ 85°C	Read: 82 MB/s Write: 39 MB/s	192 TB	✓	✓	✓
			SLC mode	4 GB~64 GB	-25°C~ 85°C	Read: 96 MB/s Write: 85 MB/s	512 TB			
			iTemp SLC mode	4 GB~16 GB	-40°C~ 85°C	Read: 88 MB/s Write: 78 MB/s	128 TB			
			MLC	8 GB~128 GB	-25°C~ 85°C	Read: 96 MB/s Write: 81 MB/s	153 TB			
			iTemp MLC	8 GB~32 GB	-40°C~ 85°C	Read: 79 MB/s Write: 75 MB/s	38 TB			

* By project support.
** Under highest Sequential write value. May vary by density, configuration and applications.
*** ATP software support for demo use only.

Product Dimensions (Size) Comparison



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