INDUSTRIAL ONLY

Memory & Storage Solutions

◆ Designed and manufactured with extensive screening & testing

◆ Best TCO value with longevity & higher endurance for industrial applications

◆ Full in-house process ownership for uncompromising quality guarantee

ATP

2020 Product Catalog

ATP Global Footprint

ATP Electronics started its operations in Silicon Valley, California, USA in 1991. In 2001, it moved its headquarters in Taipei, Taiwan with manufacturing facilities in Kaohsiung. Today, ATP Electronics has extended its global presence in five countries with support sales and service offices as well as several global and regional franchised distributors including representatives proudly carrying the ATP brand. Additionally, ATP's personnel distribution shows ATP's strong commitment to and focus on delivering quality products and excellent service, with engineering and technical staff making up majority of the total global workforce.
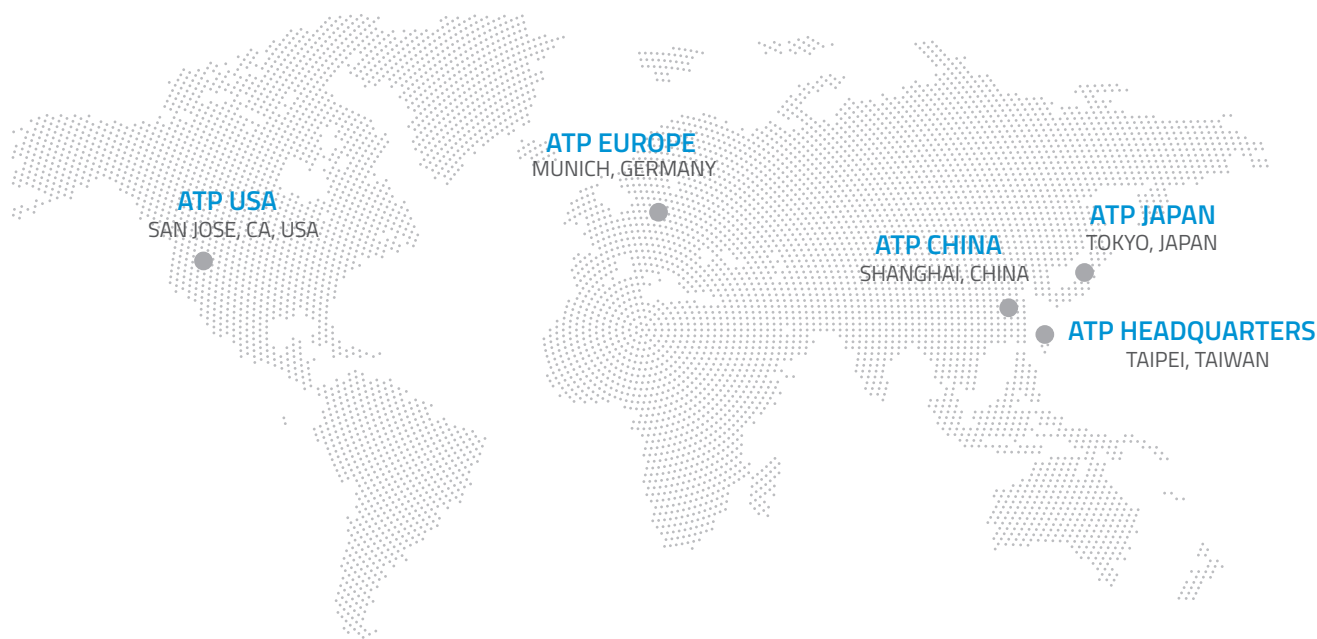
ATP EUROPE
MUNICH, GERMANY

ATP USA
SAN JOSE, CA, USA

ATP CHINA
SHANGHAI, CHINA

ATP JAPAN
TOKYO, JAPAN

ATP HEADQUARTERS
TAIPEI, TAIWAN

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About ATP

ATP Electronics is the leading "Industrial Only" original equipment manufacturer (OEM) of high-performance, high-quality and high-endurance NAND flash products and DRAM modules. Since its inception in 1991, ATP has established itself as a manufacturing leader providing industrial memory and storage solutions designed and built to accomplish mission-critical tasks in diverse industries where high levels of technical proficiency, manufacturing quality, and wide operating temperature ranges are required.

For nearly three decades, ATP has been an established name trusted in key industries, such as:

Networking / Telecommunications	The Internet of Things	Automotive Computing
Industrial/Embedded PC	Health Care	Enterprise Mobility
Aerospace and Defense		

As a true manufacturer, ATP manages 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 the ATP 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. When even the shortest down time and milliseconds of latency can impact business operations, ATP memory and storage products can be trusted to accomplish mission-critical as well as time-critical tasks.

Product Portfolio
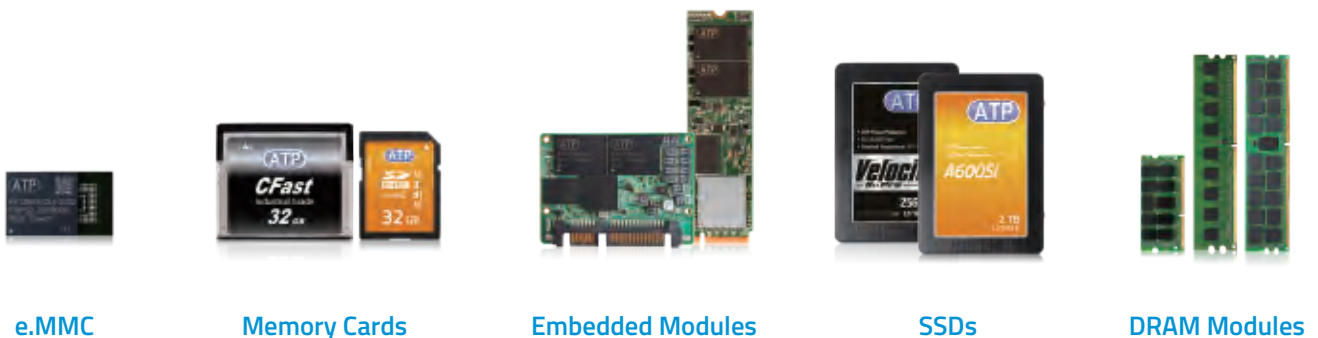
e.MMC	Memory Cards	Embedded Modules	SSDs	DRAM Modules

Industrial Only: Our Commitment, Our Identity

In applications where even the smallest margin of error or the shortest downtime can affect operations and impact the bottom line, it is crucial to choose components that can deliver the most reliable performance within the longest-possible service life to get the most out of the total cost of investment (TCO).

What does it mean to be truly Industrial? There is no standard definition, but it is commonly based on operating temperature support, where a storage device is rated "industrial" if it can operate reliably in extreme temperatures ranging from -40°C to 85°C.

ATP Electronics, as a manufacturing company engaged in delivering memory and storage products for highly rigid applications, goes beyond temperature to define "industrial." It is committed to the "Industrial Only" mindset and skillset in every aspect of its operations.

"Industrial Only" Commitment

◈ Designed and manufactured with extensive screening & testing

High-quality components are the building blocks of high-quality products; thus, ATP makes sure that screening begins at the integrated circuits (IC) level, where NAND flash is screened for temperature tolerance, data retention, disturbance, and other attributes. Meticulous NAND characterization and extensive product reliability tests under extreme temperatures and operating conditions ensure that every product is highly reliable.

◈ Best TCO value with longevity & higher endurance for industrial applications

ATP memory and storage solutions perform dependably over long periods of time. High P/E cycles and long product service life, maximum availability and minimal downtime all translate to better return on investment (ROI) and best total cost of ownership (TCO) value. Additionally, ATP offers longevity support for legacy DRAM modules through a partnership agreement with Micron Technology, Inc.

◈ Full in-house process ownership for uncompromising quality guarantee

From the time wafers are received, to NAND flash screening, design and validation, pilot run and mass production, ATP maintains complete control of all stages of the manufacturing process. By taking charge and ownership of the processes, ATP delivers uncompromising quality guarantee. ATP also maintains control of its supply and value chains, implements controlled bill of materials (BOM) with longevity planning and maintains buffer inventory to ensure steady supply. This flexibility and manufacturing competence are clear differentiators compared with turnkey solutions in the market.

WHY INDUSTRIAL ONLY?

Because TCO Matters

Organizations trying to reduce cost may be tempted to purchase goods based on cheap price. However, purchase price is just the tip of the iceberg. A better metric for cost savings is total cost of ownership (TCO), which is the sum of all related costs incurred within the entire service life of the product.

With ATP's quality guarantee, customers can rest assured that they get the best value out of their TCO. ATP's high-performance, high-endurance memory and storage solutions go through rigorous design validation qualification and outstanding production processes. Customers can rest assured that competent ATP support is available before, during and after sales.

Visible cost

Distribution

Fulfillment

Concept

Invisible cost

Engineering

Design

Workflow

Obsolescence

Pricing

ATP's Enablers to Reduce Your Total Cost of Ownership (TCO)

Services
- Global & local FAE* support
- Global & local distributor & rep network
- ATP regional sales offices
- Joint validation
- Stable supply

*FAE: Field Applications Engineer

Engineering
- Controlled BOM
- In-house development
- Own firmware development
- Customization/usage cases
- Built-in Security available
- Longevity design
- Ruggedized product design

Manufacturing
- Own manufacturing facilities
- Process ownership
- NAND wafer characterization and management
- Own NAND package up to 16 dies
- 100% test

Quality
- Strategic alignment with top suppliers
- Tier1 NAND & DRAM wafer supply
- DRAM lifetime warranty
- NAND quality assurance
- Quality certifications according to leading industry standards
- Part qualification according to established standards for reliable, high quality components
- Production Part Approval Process (PPAP)
- Industry leading low Defective Parts Per Million (DPPM)
- Top rated at customer score cards

Certified "Industrial Only"

According to leading industry standards

ISO 9001:2015	Sony Green Partner	ISO 14001:2015	OHSAS 18001:2007	VDA 6.3	IATF 16949 (LOC)

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

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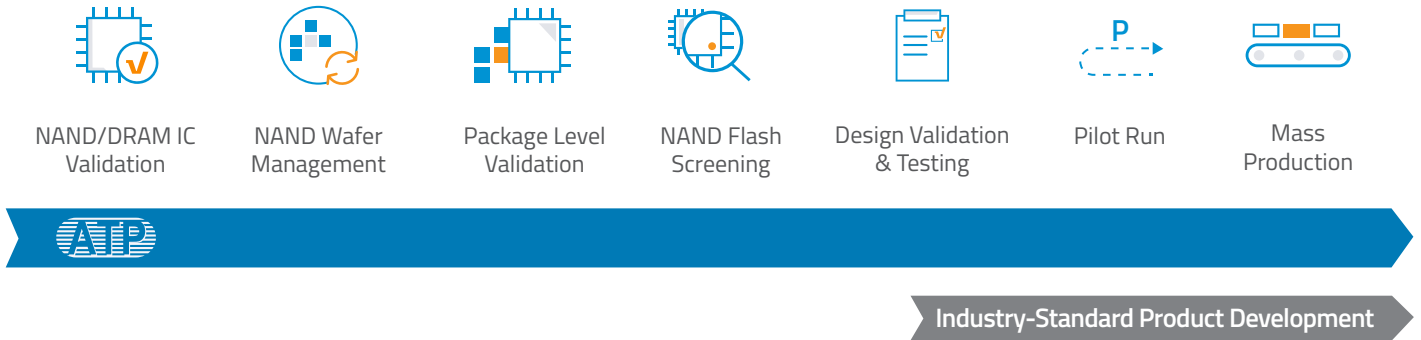- MIL-STD-883
- IEC 61000-4-2:2008
- JESD78B
- UL94-v0

Industry Associations and Compliances

Exclusive Inside Peek:
Our Passion for Precision and Reliability

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.

| NAND/DRAM IC Validation | NAND Wafer Management | Package Level Validation | NAND Flash Screening | Design Validation & Testing | Pilot Run | Mass Production |

ATP

Industry-Standard Product Development

## 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.

NAND Flash IC Level

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

Mass Production Level

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

1 **2** **3**
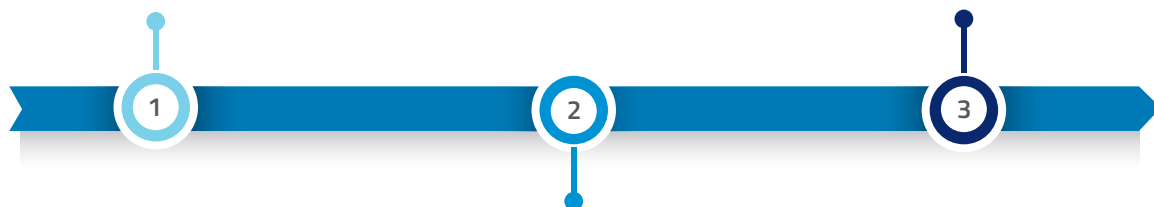
Module Level

To ensure complete module functionality and reliability, ATP performs:
- Module design/layout validation
- Controller hardware validation
- Controller firmware/FTL (flash translation layer) validation
- OEM customer joint validation: Compatibility testing for new device; module-level validation with host platform

Key Manufacturing Processes

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

Packaged IC

System-in-Package (SiP)

Surface Mount Technology (SMT)
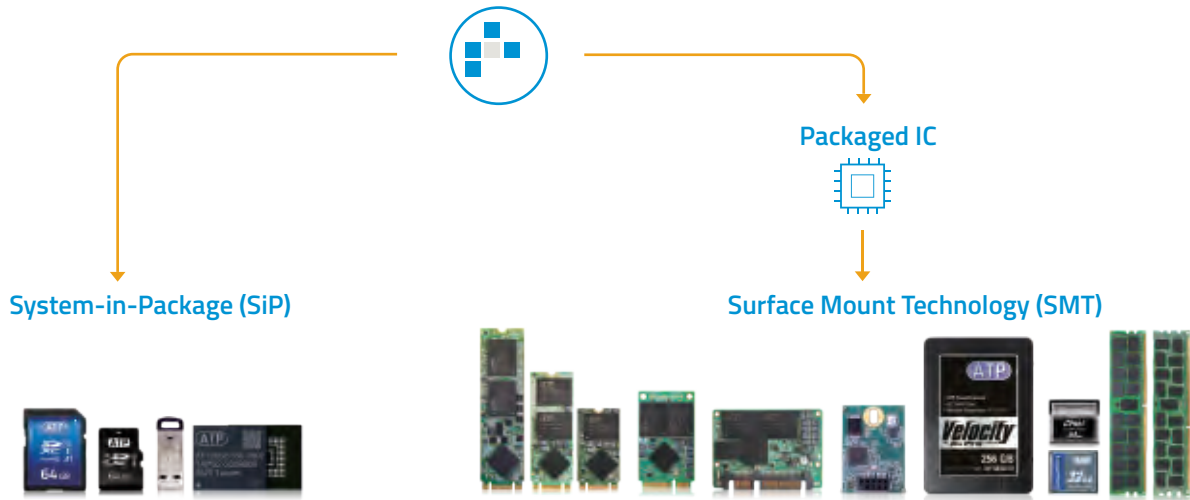
SiP Process

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

Air Shower   Clean Room   Wafer   Wafer Grinding
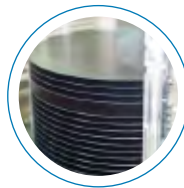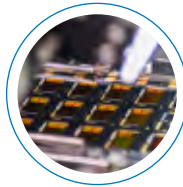
Wafer Saw   Die Attach   Wire Bonding   Molding
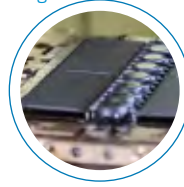
Surface Mount Technology

ATP's SMT process includes mandatory 100% Solder Paste Inspection (SPI) In-Line System, which is optional for other manufacturers. In ATP's N_2 Reflow, oxygen concentration is 5X lower—just under 1000 ppm—to avoid oxidation, while other manufacturers typically have 5000 ppm.

Solder Paste Printing   Solder Paste Inspection   Component Placement
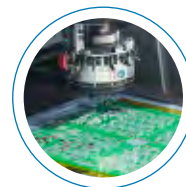
N_2 Reflow   Automatic Optical Inspection   PCB Depanelization

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

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

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

Data at Rest
- Protection of data stored on the media against unauthorized access

SecurStor Features

Feature and Description		SecurStor-enabled SD & microSD Cards	SecurStor-enabled SSDs	SecurStor-enabled Managed NAND Solutions
UniqueID Hardware-based product identification, using physically unclonable function (PUF) technology where needed.		*	*	*
SecurBoot Ensures the integrity and validity of the storage device's firmware image.		**	**	**
SecurUpdate Ensures the integrity and validity of any update to the firmware.		**	**	**
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.		**	**	**
SecurCopy Pairs the storage device with a specific type of customer device to prevent illegal copying.		**	**	**
SecurWrite Puts the device into "Write-Once" mode.		**	**	**
SecurEncrypt AES-256 encryption for the User Data area.		*	*	*
TCG OPAL and other features defined for data storage devices by the Trusted Computing Group.		***	*	*
SecurWipe Fast, safe and permanent removal of data by deleting the encryption key.		**	**	**

* Default ** Optional *** Not Available for this form factor

All-Terrain Automotive Storage Solutions for the Road Ahead

ATP Electronics leverages nearly 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.

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 (31% of ATP's total workforce)
- Global presence in five countries with support sales and service offices
- Global and regional franchised distributors

Testing Capabilities

ATP exercises total control of the manufacturing process to meticulously characterize, test and validate every component and finished product. On top of standard tests, ATP offers own-designed unique and customized hardware, software and firmware testing.

Below are examples of tests performed from IC, Module/Drive up to Mass Production Level.

IC LEVEL	DRIVE LEVEL	MP LEVEL

Endurance Testing: UBER (Uncorrectable Bit Error Rate) based on different ECC levels
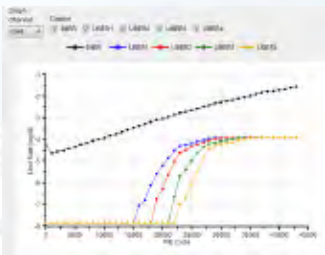
High Temperature Data Retention Testing: UBER after P/E cycling
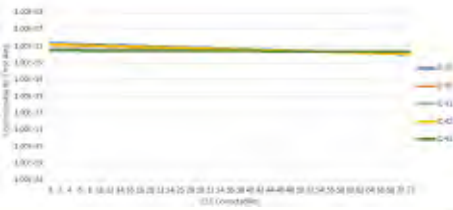
Power Cycling Test
Uses ATP-developed tester platforms/scripts to uncover any power failure conditions such as unstable or marginal voltage supply, sudden power loss and power spikes that cause glitches.

Joint Validation Test (Memory Cards)
Compatibility and function tests with client-supplied host devices and systems to proactively detect failures and optimized system in prototype design phase.

Rapid Diagnostic Test
NAND screening test at mass production level, which involves complete, block-by-block testing of the entire drive including firmware, user and spare areas to improve drive reliability and endurance.

ATP has the capability to run high-low temperature testing in the chamber at mass production volumes

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.

Driver Monitoring System (DMS)

Fleet Surveillance/ Management

Telematics

In-Vehicle Infotainment (IVI)/ Navigation System

Autonomous/ Self-Driving Car

Advanced Driver Assistance System (ADAS)

Drive Recorder / Surround View Monitoring

In-Vehicle Computer Automotive

Event Data Recorder (EDR) / Tachograph

EV/PHV Charging Station
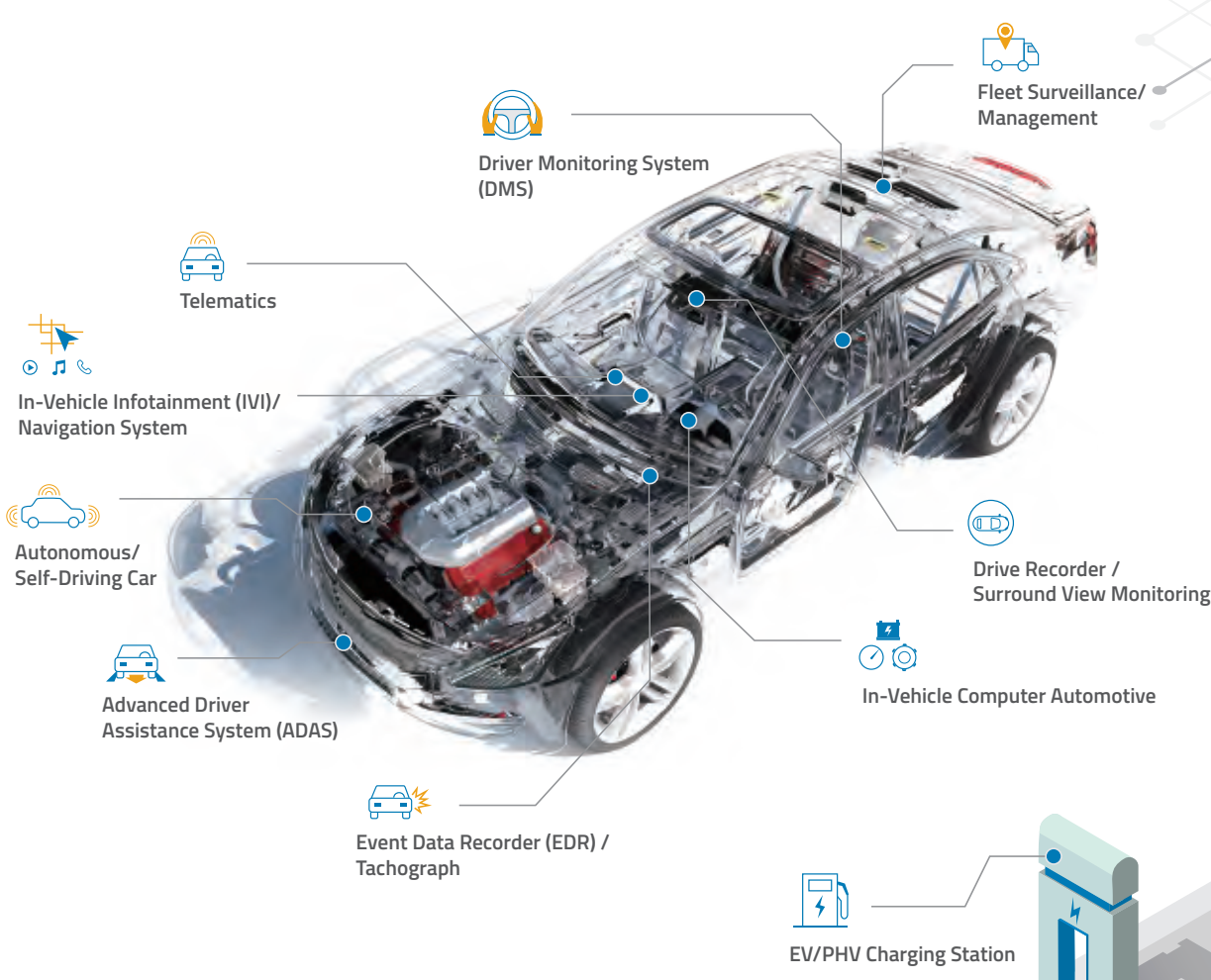
Complete Automotive Storage Portfolio

Product	Dimensions (L x W x H mm)	NAND Type	Densities	Operating Temp.	Data Transfer Rate (max.)	TBW* (max.)	Power Failure Protection	Secure Erase (S/W)**	Life Monitor (S/W)**
SD									
SDHC/SDXC	32.0 x 24.0 x 2.1	C-Temp 2D NAND	4 GB~128 GB	-25°C~ 85°C	Read: 96 MB/s Write: 64 MB/s	154 TB	✓	✓	✓***
		I-Temp 2D NAND		-40°C~ 85°C					
microSDHC/ microSDXC	15.0 x 11.0 x 1.0	C-Temp 2D NAND	4 GB***~32 GB	-25°C~ 85°C	Read: 64 MB/s Write: 24 MB/s	39 TB	✓	✓	✓***
		I-Temp 2D NAND		-40°C~ 85°C					
SDHC/SDXC	32.0 x 24.0 x 2.1	C-Temp 3D NAND	32 GB~256 GB	-25°C~ 85°C	Read: 98 MB/s Write: 64 MB/s	154 TB	✓	✓	✓***
		I-Temp 3D NAND		-40°C~ 85°C					
microSDHC/ microSDXC	15.0 x 11.0 x 1.0	C-Temp 3D NAND	32 GB~256 GB	-25°C~ 85°C	Read: 98 MB/s Write: 64 MB/s	154 TB	✓	✓	✓***
		I-Temp 3D NAND		-40°C~ 85°C					
Managed NAND									
e.MMC	11.5 x 13.0 x 1.3 (max.)	3D SLC mode	8 GB~64 GB	-40°C~ 85°C	Read: 300 MB/s Write: 240 MB/s	1,320 TB	✓	✓	✓
		3D MLC	16 GB~128 GB		Read: 300 MB/s Write: 170 MB/s	824 TB			
e.MMC	11.5 x 13.0 x 1.3 (max.)	3D SLC mode	8 GB~64 GB	-40°C~ 105°C	Read: 300 MB/s Write: 240 MB/s	1,213 TB	✓	✓	✓
		3D MLC	16 GB~128 GB		Read: 300 MB/s Write: 170 MB/s	309 TB			

- **NVMe, SATA, BGA SSD, UFS by project support**

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

WHAT'S NEW

3D TLC-Based S600Sia SD/microSD Cards
Expand ATP's Automotive/Industrial Portfolio

ATP's first 3D triple-level cell (TLC) flash-based A1 Performance Class SD and microSD cards employing 64-layer 3D NAND technology are built for tough demands of industrial and automotive applications.

Aside from supporting wide operating temperature ranges from -40°C to 85°C, ATP S600Sia SD/microSD cards undergo extensive cross-temperature tests and implement temperature-related variables and mechanisms to enhance drive integrity. Dynamic Self-Recovery Calibration enables the SD/microSD to adapt to various temperature modes through a combination of firmware and hardware solutions.

These memory cards undergo endurance, data retention and wide temperature tests from IC to drive level to deliver automotive and industrial grade reliability, performance and endurance. They come in capacities of up to 256 GB, offering significant reductions in cost per GB. They meet increasing data storage needs and offer portable convenience for backup, edge computing, event data recording and map navigation with or without Internet connection.
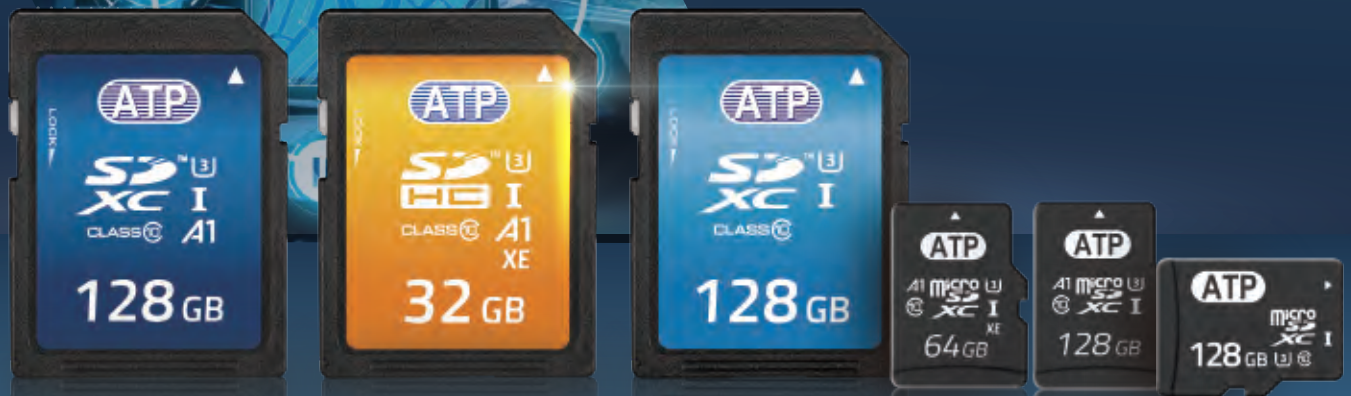
ATP I-Temp NVMe SSDs Combine High Performance 8-Channel PCIe Gen 3 x4, End-to End Data Protection, MCU-Based Power Management

The latest M.2 2280 NVMe N600Si/N600Sc solid state modules harness the speed and performance of PCIe NVMe, the reliability and endurance features of 3D NAND flash and the high capacity of triple level flash (TLC). The 8-channel high-performance controllers optimize the advantage of PCIe 3.1 and NVMe 1.3 SSD specifications.

Microcontroller unit (MCU)-based design improves device protection and data integrity with a unique power management and power loss protection mechanism in the event of power failures, glitches and power current challenges. The latest NVMe modules come in both I-Temp (N600Si) and C-Temp (N600Sc) ratings and provide RAID support and end-to-end data protection.

ATP Next-Gen A600Si/A600Sc SATA SSDs Feature FW-Programmable MCU for Enhanced Power Loss Protection

ATP A600Si and A600Sc Serial ATA solid state drives (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).

Integrated into its latest PLP technology, ATP PowerProtector 4, the new MCU design allows the PLP array to perform intelligently in various temperatures, power glitches and charge states.

ATP SATA SSDs with the new PowerProtector 4 MCU-based design have the following advantages:

- Enhanced device protection with input over-voltage protection
- Better data integrity with under-charge/over-charge protection for hold-up capacitors
- Fast power on/off control
- Precise control of reset signal generation and power up/down sequences
- Industrial operating temperature -40°C to 85°C
- RAID support
- End-to-end data protection
- Customization options

ATP Introduces First "Industrial Only" SLC-Based E800Pi e.MMC with Premium Endurance of 60K P/E Cycles for High-Reliability Applications

The SLC-based E800Pi e.MMC offers a very high endurance rating of 60K program/erase (P/E) cycles. Its strong resistance against high and cross temperatures makes it suitable to operate in extremely hot or cold settings from -40°C to 85°C (industrial temperature rating). It is designed according to JEDEC e.MMC v4.41 standard with support for enhanced features such as Health Report, Field Firmware Update (FFU) and Fast Boot operation. The S.M.A.R.T. (Self-Monitoring, Analysis, and Reporting Technology) feature monitors various parameters of endurance and reliability, indicating activity that is out of the normal range to help predict storage failure for preventive action. Available in capacities from 1 GB to 2 GB, the SLC-based E800Pi e.MMC is ideal for use in boot-up and other high-reliability embedded systems applications.

ATP "Industrial Only" e.MMC Obtains Automotive Grade 2 Rating

Wide Temp Support from -40 to +105°C Meets Tough Reliability Qualifications

ATP e.MMC has successfully garnered AEC-Q100 Grade 2 rating, which means it can perform reliably at temperatures ranging from -40°C to 105°C, going a notch higher than Grade 3-rated solutions to deliver better performance and sustained reliability.

AEC-Q100 is a set of qualification test sequences for integrated circuits developed by the Automotive Electronics Council (AEC), the standardization body for establishing standards for reliable, high quality electronic components.

As a soldered-down solution, the ATP e.MMC resists shocks and vibrations, making it ideal for embedded and automotive applications requiring rugged endurance and durability. Through ATP's strict screening, testing and validation, the e.MMC achieves 2-3X higher endurance than standard e.MMC. Features such as low-density parity check error correcting code (LDPC ECC) and SRAM soft error detection ensure data integrity and dependable operation, while QR code traceability helps identify each piece for accurate tracking and efficient inventory management.

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.

- **Long-Term DDR3 Supply Commitment with 8 Gbit Components.** ATP will continue to support the legacy memory requirements of customers still using DDR3 high-density RDIMM, UDIMM, SODIMM by providing its own DDR3 8 Gbit components for these modules. The 8 Gbit components, which are also used on ATP's own-built DDR3 modules, are free from row hammer effects. They are manufactured and tested according to ATP's exacting standards to guarantee high quality.

* May vary by product and project support.
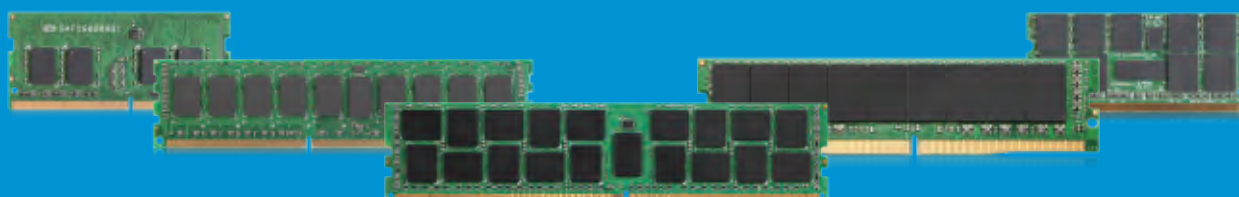
High-Speed, High-Performance ATP DDR4-3200 DRAM Modules Accelerate Access for Data-Driven IPC/HPC Applications

ATP Electronics' new DDR4 industrial-grade DRAM modules deliver high-speed data transfers of up to 3200 MT/s with peak transfer rate of 25600 MB/s and 1600 MHz I/O bus clock. The performance boost fully unleashes the capabilities of AMD EPYC processors (formerly codenamed Rome) and 2nd Generation Intel® Xeon® Scalable processors (formerly codenamed Cascade Lake) as well as future AMD Milan and Genova, and Intel® Cooper Lake and Ice Lake to deliver the lowest latency and accelerated performance for data-centric high-performance computing (HPC) and industrial PC (IPC) applications.

The increased interface speed amplifies theoretical peak performance for the most critical computing applications in industries such as telecommunication infrastructures, networking storage systems, network-attached storage (NAS) servers, micro/cloud servers, and embedded systems like industrial PCs.

ATP DDR4-3200 DRAM memory modules 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
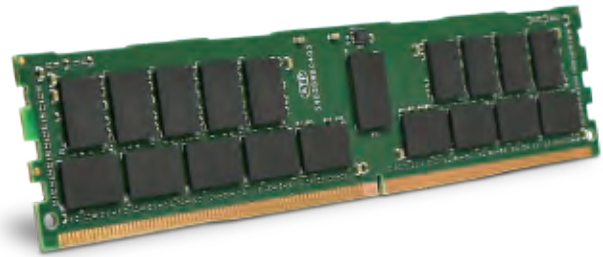
DDR4-3200 Advantages Over DDR3-1866

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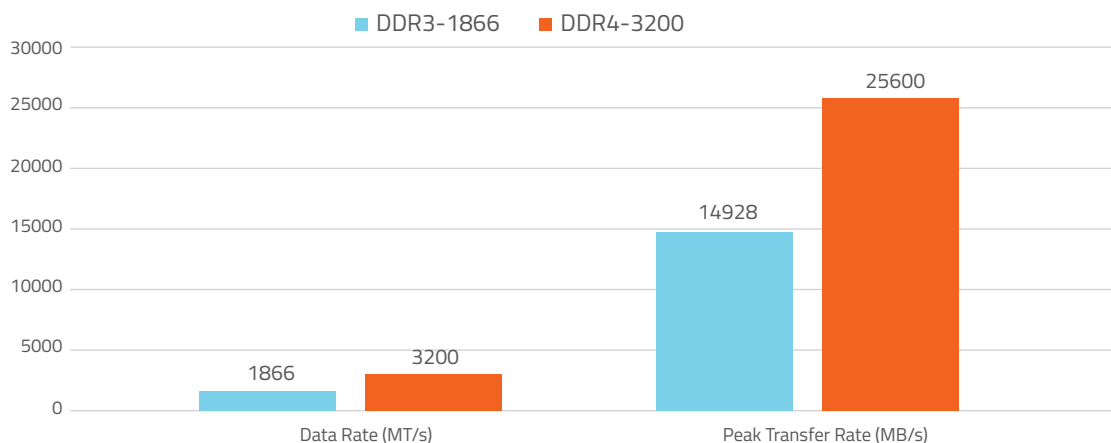
Figure 1. Performance comparison: DDR3-1866 vs. DDR4-3200

ATP Reaffirms Commitment to Long-Term DDR3 Legacy Memory Module Supply with ATP DDR3 8 Gbit Components

As the DRAM market makes a steady migration to DDR4 memory, several key manufacturers have already announced end-of-life (EOL) production of DDR3 modules based on high density DDR3 8 Gbit components including EOL notice of the components. However, a sizable number of customers in the networking and embedded industries are still unable to shift to the latest generation and continue to use legacy systems requiring specific DDR3 memory such as VLP RDIMMs or high-density SO-DIMMs. To avert a supply shortage that could adversely affect these customers' business operations, ATP has decided to provide its own DDR3 8 Gbit components for these modules.

ATP-Built from IC to Module

ATP's own-built DDR3 modules consist of meticulously characterized and tested high-quality integrated circuits (ICs). The components are manufactured according to ATP's exacting standards using 2x nm manufacturing process technology and are tested via an extensive component test program to improve the overall memory module performance.

ATP DDR3 8 Gbit components are free from row hammer effects, thus preventing any disastrous random bit flips caused by the electrical charge of cells leaking to adjacent cells and successively writing data to them. At module level, ATP implements 100% test during burn-in (TDBI) into the production flow to guarantee the high quality module.

ATP DDR3 Configurations

A typical monolithic DDR3 DRAM chip has a density of 4 Gigabits (Gb). To pack 8 Gb in a monolithic DRAM die, manufacturers employ a die-stacking method called dual-die package (DDP), which combines two bare memory dies within a single chip package. Each die has a separate set of control lines where each memory die is separately selectable, and the processor treats the chip as two components despite being in the same package.

ATP DDR3 components are available in monolithic 8 Gb one-chip select (1CS) or as DDP two-chip select (2CS) for a variety of memory modules based on this technology.

With ATP's own-built DDR3 modules, the company reaffirms its commitment to continue supporting legacy memory requirements to maximize customers' infrastructure investments.

DDR3 RDIMM								
Capacity (GB)	Form Factor	ECC	Org	Ranks	Component Org	Component Qty.	Technology	Speed up to (MT/s)
32	RDIMM	Yes	4G x 72	4	1G x 4 x 2R	36 / 72 Die	DDP	1333
16	VLP RDIMM	Yes	2G x 72	2	1G x 4 x 2R	18 / 36 Die	DDP	1600

DDR3 UDIMM								
Capacity (GB)	Form Factor	ECC	Org	Ranks	Component Org	Component Qty.	Technology	Speed up to (MT/s)
16	UDIMM ECC	Yes	2G x 72	2	1G x 8	18	Mono	1600
16	ULP UDIMM ECC	Yes	2G x 72	2	1G x 8	18	Mono	1600
16	UDIMM	No	2G x 64	2	1G x 8	16	Mono	1600

DDR3 SO-DIMM								
Capacity (GB)	Form Factor	ECC	Org	Ranks	Component Org	Component Qty.	Technology	Speed up to (MT/s)
16	SO-DIMM ECC	Yes	2G x 72	2	1G x 8	18	Mono	1600
16	SO-DIMM	No	2G x 64	2	1G x 8	16	Mono	1600

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." - Kris Baxter, Vice President, Micron Technology, Inc.
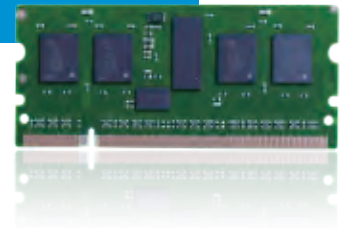
Product Information

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 / 512 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.
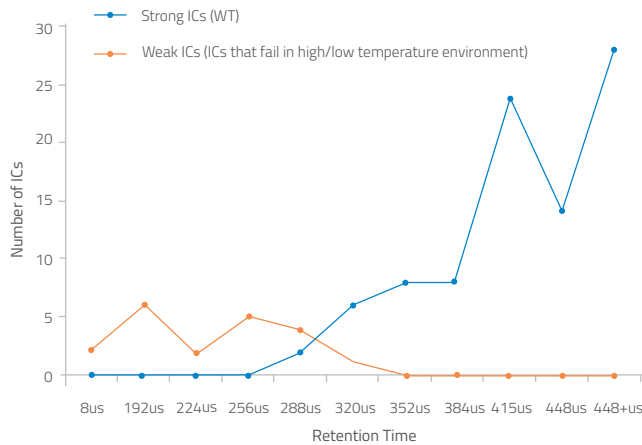
Weak ICs that fail in high-low temperature environments are screened out.

- **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.

Memory Modules

Temperature | Load | Speed

Time

ATP DRAM Modules

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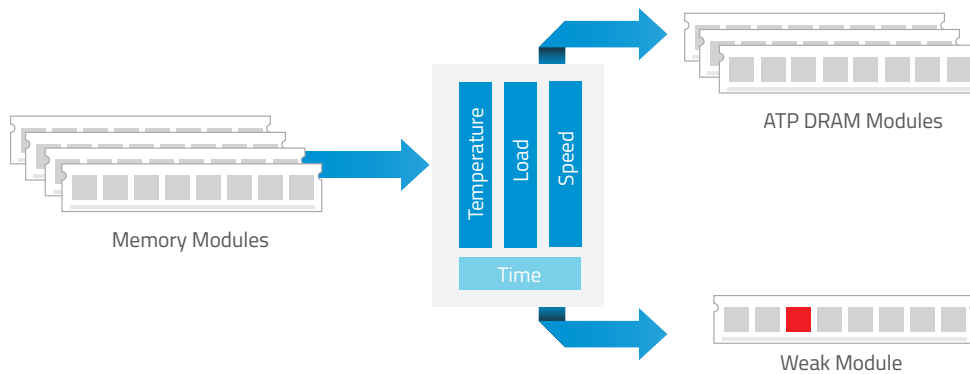
The ATP TDBI system applies extreme high/low temperature, high-low voltage, and pattern testing on DRAM modules. The system consists of:

- 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.
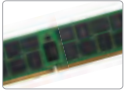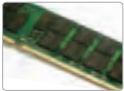
TDBI Screens Up to 0.01% Error to Ensure Utmost Reliability
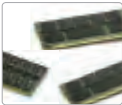
Through accelerated testing methods such as TDBI, ATP significantly lowers failure rates and extends the product service life by making sure that only robust DRAM chips are on the module. Even just 0.01% error on a 99.99% effective device can increase the failure rates at module level and lead to failure 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.

TDBI Failure Rate Summary

Year	Q2	Q3	Q4	Following Q1
Failure Rate DDR3 8 GB 1600 RDIMM with 18 chips	2.89%	2.97%	2.68%	1.97%
Failure Rate DDR3 16 GB 1600 RDIMM with 36 chips	4.01%	4.08%	3.59%	3.30%
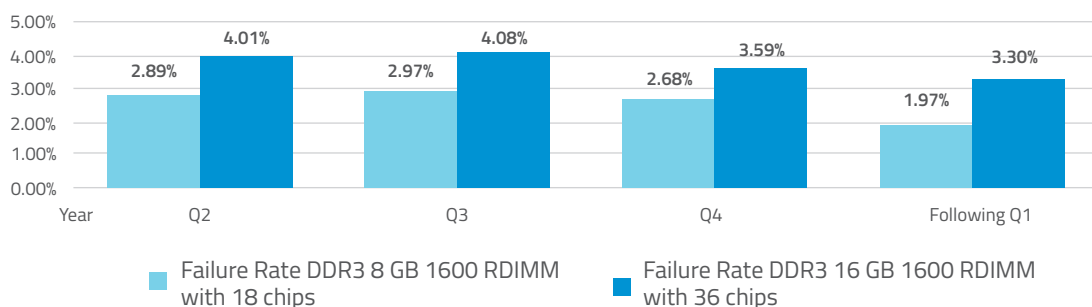
Complete DRAM Portfolio

Product	Category	Speed (MT/s)	Form Factor	Features
DDR4	LRDIMM/RDIMM UDIMM/UDIMM ECC SO-DIMM/SO-DIMM ECC/ SO-RDIMM Mini-RDIMM Mini-UDIMM ECC	3200 2933 2666 2400 2133	• 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 128 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	UDIMM/UDIMM ECC SO-DIMM	800 667 533 400	• Low Profile • Very Low Profile (VLP) options (VLP: 0.72"~0.74" height)	• Density: 256 MB to 4 GB • Chipkill support
DDR*	UDIMM/UDIMM ECC SO-DIMM	400 333 266	• Low Profile	• 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® 3.1 x4 interface for reliable, blazing-fast, and future-ready performance. ATP's latest flash offering is the automotive/industrial grade e.MMC, a managed NAND solution.

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. Memory cards are also used as handy boot devices, conveniently storing the gateway operating system.

ATP industrial SD and microSD cards are the ideal storage format for industrial and automotive applications as they can be conveniently inserted into and easily removed from small host devices for convenient data transfer and storage expansion. 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	iTemp SLC mode	iTemp 3D SLC mode	SLC mode	3D SLC mode
Density		512 MB to 8 GB	4 GB to 8 GB	8 GB to 32 GB	4 GB to 8 GB	8 GB to 32 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	UHS-I	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				Value
Naming		S600Si	S600Sc	S600Sia	S600Sc	S600Vc
Flash Type		iTemp MLC / 3D TLC	MLC	iTemp 3D TLC	3D TLC	3D TLC
Density		8 GB to 256 GB**	8 GB to 128 GB**	32 GB to 256 GB	32 GB to 256 GB	32 GB to 128 GB
Performance	Sequential Read up to (MB/s)	98	96	98	98	100
	Sequential Write up to (MB/s)	64	61	64	64	78
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	-25°C to 85°C
Reliability	TBW* (max.)	154 TB	154 TB	154 TB	154 TB	36 TB
	MTBF @ 25°C	>2,000,000 hours				>1,000,000 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				

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

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

* Please refer to pages 41-43.   Δ: Customization option available on a project basis.
* For Security-related features and configurations, please refer to page 9.

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	iTemp SLC mode	iTemp 3D SLC mode	SLC mode	3D SLC mode
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
Performance — 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		UHS-I	
Operating Temperature	-40°C to 85°C			-25°C to 85°C	
Reliability — TBW* (max.)	192 TB	256 TB	640 TB	256 TB	640 TB
Reliability — MTBF @ 25°C	>5,000,000 hours	>3,000,000 hours			
Reliability — 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				Value
Naming	S600Si	S600Sc	S600Sia	S600Sc	S600Vc
Flash Type	iTemp MLC / 3D TLC	MLC	iTemp 3D TLC	3D TLC	3D TLC
Density	8 GB to 256 GB	8 GB to 32 GB	32 GB to 256 GB	32 GB to 256 GB	32 GB to 128 GB
Performance — Sequential Read up to (MB/s)	98	68	98	98	100
Performance — Sequential Write up to (MB/s)	61	24	61	61	78
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	-25°C to 85°C
Reliability — TBW* (max.)	154 TB	39 TB	154 TB	154 TB	36 TB
Reliability — MTBF @ 25°C	>2,000,000 hours				>1,000,000 hours
Reliability — 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*									
Product Line — Premium	Δ	●	●	●	Δ	●	●	●	●	Δ
Product Line — Superior	Δ	●	●	●	●	●	Δ	●	●	Δ
Product Line — Value			●					●		

* Please refer to pages 41-43.   Δ: Customization option available on a project basis.
* For Security-related features and configurations, please refer to page 9.

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	I800Pi	I700Sc	I600Sc
Flash Type	SLC	SLC mode	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
Performance — 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	
Endurance — TBW* (max.)	1,280 TB	128 TB	38 TB
Endurance — DWPD* (max.)	22.4	11.2	1.7
Reliability — 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		

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

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

* Please refer to pages 41-43.   Δ: Customization option available on a project basis.
* For Security-related features and configurations, please refer to page 9.

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	A800Pi	A600Si	A600Sc
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	510	510
Performance — Sequential Write up to (MB/s)	300	175	175
Performance — 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
Endurance — TBW* (max.)	2,667 TB	267 TB	320 TB
Endurance — DWPD* (max.)	46.8	2.9	3.5
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		

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

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

* Please refer to pages 41-43.   Δ: Customization option available on a project basis.
* For Security-related features and configurations, please refer to page 9.

Solid State Drives and Modules

Reliable Storage Solutions for the Data Era

ATP's embedded storage solutions deliver reliable performance and efficient responsiveness for mission-critical as well as time-critical applications in an era where billions of devices are creating astounding amounts of data. Whether data goes to the cloud or stays at the edge, ATP solid state drives (SSDs) and modules feature the latest technologies in different form factors and capacities with specifications to meet the diverse and rigorous requirements of industrial applications. 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 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 the 2.5" SSDs, M.2, mSATA, SlimSATA and eUSB modules.

Key Differentiators*

- **I-Temp Support.** ATP industrial SSDs can withstand extreme temperatures from -40°C to 85°C, enabling them to operate reliably even in extremely cold or hot operating environments.

- **High-Performance, High-Density Storage in Compact Form Factors.** ATP M.2, SlimSATA 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 select 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, ATP PowerProtector 4, the new MCU design allows the PLP array to perform intelligently in various temperatures, power glitches and charge states. ATP's PLP mechanism prevents data loss during any power failure event by ensuring that the last read/write/erase command is completed, and data is stored safely in non-volatile flash memory. ATP SSDs with PowerProtector use tantalum capacitors, which have minimal sensitivity to temperature and humidity, assuring high reliability and endurance even in harsh environments.

- **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.
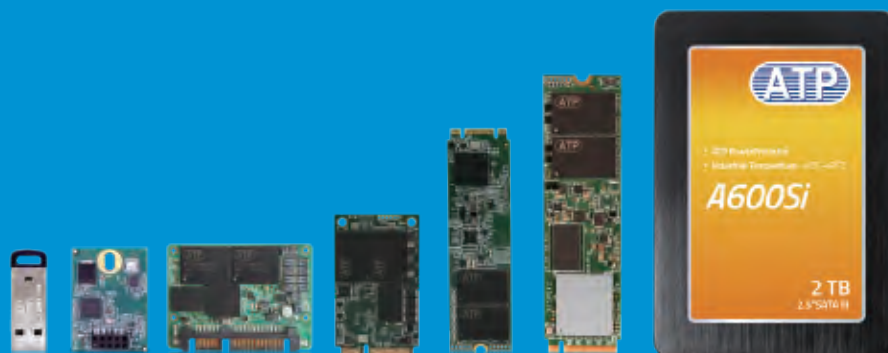
M.2 NVMe

Key Features

- Superior Read/Write performance
- LDPC & RAID Data Recovery for error correction
- Dynamic Thermal Throttling
- Global wear leveling
- TRIM function support
- End-to End Data Protection
- MCU-based Power Protector 4 (May vary by product and project support.)

Product Name		M.2 NVMe	
		2280-D2-M	
Product Line		Superior	
Naming		N600Si	N600Sc
Flash Type		I-Temp 3D TLC	C-Temp 3D TLC
Density		120 GB to 1920 GB	
Performance	Sequential Read up to (MB/s)	3,280	
	Sequential Write up to (MB/s)	3,050	
	Random Read IOPS (4K, QD32)	211,200	
Interface		PCIe Gen3 Interface, x4 Lanes	
Operating Temperature		-40°C to 85°C	0°C to 70°C
Endurance	TBW* (max.)	5,120 TB	
	DWPD* (max.)	3.7	
Reliability 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.

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

* Please refer to pages 41-43.   Δ: Customization option available on a project basis.

* For Security-related features and configurations, please refer to page 9.

M.2 SATA

Key Features

- Global wear leveling
- TRIM function support
- Static Data Refresh and Idle Clean F/W algorithm
- Firmware live update
- MCU-based Power Protector 4 (May vary by product and project support.)

Product Name	M.2						
	2242 D2-B-M						
Product Line	Premium		Superior				Value
Naming	A800Pi	A700Pi	A600Si	A600Sc	A600Si	A600Sc	A600Vc
Flash Type	SLC	iTemp SLC mode	iTemp MLC	MLC	iTemp 3D TLC	3D TLC	3D TLC
Density	8 GB to 64 GB	60 GB to 120GB	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	500	80	80	440	440	420
Performance Random Read IOPS up to	76,000	100,000	38,400	38,400	100,000	100,000	68,000
Interface	SATA III 6 Gb/s						
Operating Temperature	-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	4,500 TB	145.5 TB	174.6 TB	1,396 TB	1,396 TB	147.7 TB
Endurance DWPD* (max.)	77.9	20	3.1	3.8	4.0	4.0	1.6
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			
	2280 D2-B-M			2280 S2-B-M
Product Line	Premium	Superior		Value
Naming	A700Pi	A600Si	A600Sc	A600Vc
Flash Type	iTemp SLC mode	iTemp 3D TLC	3D TLC	3D TLC
Density	60 GB to 240 GB	120 GB to 960 GB		32 GB to 256 GB
Performance Sequential Read up to (MB/s)	560	560		560
Performance Sequential Write up to (MB/s)	500	440		440
Performance Random Read IOPS up to	100,000	100,000		69,000
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
Endurance TBW* (max.)	9,000 TB	2,792 TB	2,792 TB	295.4 TB
Endurance DWPD* (max.)	20	4.0	4.0	1.6
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

* 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 41-43.   Δ: Customization option available on a project basis.

* For Security-related features and configurations, please refer to page 9.

2.5" SSDs

Key Features

- Global wear leveling
- TRIM function support
- Static Data Refresh and Idle Clean F/W algorithm
- Firmware live update
- MCU-based Power Protector 4 (May vary by product and project support.)
- Write protect disabled/enabled
- NSA-compliant Secure Erase

Product Name		2.5" SSD			
Product Line		Premium		Superior	
Naming		A800Pi	A700Pi	A600Si	A600Sc
Flash Type		SLC	iTemp SLC mode	iTemp MLC	MLC
Density		8 GB to 256 GB	60 GB to 480 GB	64 GB	
Performance	Sequential Read up to (MB/s)	520	540	440	
	Sequential Write up to (MB/s)	420	500	80	
	Random Read IOPS up to	76,000	100,000	38,400	
Interface		SATA III 6 Gb/s			
Operating Temperature		-40°C to 85°C		-40°C to 85°C	0°C to 70°C
Endurance	TBW* (max.)	21,333 TB	18,000 TB	145.5 TB	174.6 TB
	DWPD* (max.)	77.9	20	3.1	3.8
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		iTemp 3D TLC	3D TLC	3D TLC
Density		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)	480		440
	Random Read IOPS up to	100,000		72,000
Interface		SATA III 6 Gb/s		
Operating Temperature		-40°C to 85°C	0°C to 70°C	0°C to 70°C
Endurance	TBW* (max.)	5,585 TB		590.8 TB
	DWPD* (max.)	4.0		1.6
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

* 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 41-43.   Δ: Customization option available on a project basis.

* For Security-related features and configurations, please refer to page 9.

mSATA

Key Features

- Global wear leveling
- TRIM function support
- AutoRefresh and Idle Clean F/W algorithm
- Firmware live update
- MCU-based Power Protector 4 (May vary by product and project support.)

Product Name		mSATA			
Product Line		Premium		Superior	
Naming		A800Pi	A700Pi	A600Si	A600Sc
Flash Type		SLC	iTemp SLC mode	iTemp MLC	MLC
Density		8 GB to 128 GB	60 GB to 120 GB	16 GB to 64 GB	
Performance	Sequential Read up to (MB/s)	530	560	440	
	Sequential Write up to (MB/s)	430	500	80	
	Random Read IOPS up to	76,000	100,000	38,400	
Interface		SATA III 6 Gb/s			
Operating Temperature		-40°C to 85°C		-40°C to 85°C	0°C to 70°C
Endurance	TBW* (max.)	10,667 TB	4,500 TB	145.5 TB	174.6 TB
	DWPD* (max.)	77.9	20	3.1	3.8
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		iTemp 3D TLC	3D TLC	3D TLC
Density		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		420
	Random Read IOPS up to	100,000		72,000
Interface		SATA III 6 Gb/s		
Operating Temperature		-40°C to 85°C	0°C to 70°C	0°C to 70°C
Endurance	TBW* (max.)	1,396 TB		590.8 TB
	DWPD* (max.)	4.0		1.6
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

* 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 41-43.   Δ: Customization option available on a project basis.

* For Security-related features and configurations, please refer to page 9.

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		A800Pi	A600Si	A600Sc
Flash Type		SLC	iTemp MLC	MLC
Density		8 GB to 128 GB	16 GB to 64 GB	16 GB to 64 GB
Performance	Sequential Read up to (MB/s)	530	400	400
	Sequential Write up to (MB/s)	430	80	80
	Random Read IOPS up to	76,000	38,400	38,400
Interface		SATA III 6 Gb/s		
Operating Temperature		-40°C to 85°C	-40°C to 85°C	0°C to 70°C
Endurance	TBW* (max.)	10,667 TB	145.5 TB	174.6 TB
	DWPD* (max.)	77.9	3.1	3.8
Reliability MTBF @ 25°C		>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 41-43.   Δ: Customization option available on a project basis.

* For Security-related features and configurations, please refer to page 9.

eUSB

Product Name	eUSB		
Product Line	Premium	Superior	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
Performance — Sequential Write up to (MB/s)	25	19	17
Interface	Compatible with USB 2.0 (480 Mbps)		
Operating Temperature	-40°C to 85°C	0°C to 70°C	
Endurance — TBW* (max.)	1,280 TB	38.4 TB	76.8 TB
Endurance — DWPD* (max.)	37.4	1.7	1.7
Reliability — 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)	36.9 x 26.6 x 9.5		
Connector Pin Pitch**	2.54 mm**		2.54 mm / 2.00 mm

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

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

* Please refer to pages 41-43.   Δ: Customization option available on a project basis.
* For Security-related features and configurations, please refer to page 9.

NANODURA

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)	21	25
Performance — 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
Endurance — TBW* (max.)	192 TB	19.2 TB
Endurance — DWPD* (max.)	13.5	1.7
Reliability — 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)	34.0 x 12.2 x 4.5	

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

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

* Please refer to pages 41-43.   Δ: Customization option available on a project basis.
* For Security-related features and configurations, please refer to page 9.

e.MMC
Extreme Endurance, Advanced Performance in a Tiny Package

The ATP e.MMC integrates raw NAND flash memory and hardware controller integrated within 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. As a soldered-down solution, the ATP e.MMC is secure against constant vibrations, making it ideal for embedded and automotive applications requiring rugged endurance and durability. ATP e.MMC products with Automotive Grade (AG) 2 rating offer wide temperature support from 40 to +105°C while AG3-rated e.MMC supports industrial temperature ranging from -40°C to 85°C. ATP e.MMC complies with stringent qualifications and testing specific to the automotive industry, such as AEC-Q100 reliability specifications, Production Part Approval Process (PPAP) and Advanced Product Quality Planning (APQP).

Key Differentiators*

- **Extreme Endurance: 2-3X Higher than Standard e.MMC.** Through stringent NAND flash sorting, screening, testing and meticulous validation, the ATP e.MMC achieves up to 1,320 TBW**, thus ensuring high P/E cycles, healthy memory storage, and long product service life.

- **SRAM Soft Error Detection and Recovery.** The ATP e.MMC advanced SRAM Soft Error Detection and Recovery mechanism maximizes data integrity by providing timely error detection, logging, and configurable action to address the error***. The mechanism helps avoid unpredictable events that could damage the system, or worse, cause personal safety risks in critical autonomous applications.

- **Product Traceability.** Laser imprints important information on the ATP e.MMC to identify each piece for accurate tracking and efficient inventory management.

- **Premium Endurance with Pure SLC*.** Select ATP e.MMC products with single-level cell (SLC) NAND flash offer a very high endurance rating of up to 60K program/erase (P/E) cycles as well as strong resistance against high and cross temperatures.

* 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.
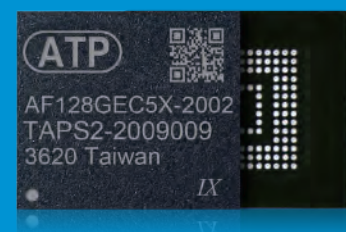
e.MMC

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
- Native SLC NAND with 60K P/E cycle
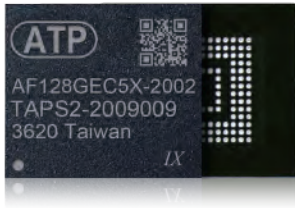- Complies with JEDEC e.MMC v5.1 Standard (JESD84-B51)
- 153-ball FBGA (RoHS compliant, "green package")
- LDPC ECC engine*
- Designed with 3D NAND

Product Name	e.MMC						
	Industrial Grade			Automotive Grade 3		Automotive Grade 2	
Product Line	Premium	Premium	Superior	Premium	Superior	Premium	Superior
Naming	E800Pi	E700Pi	E600Si	E700Pia	E600Sia	E700Paa	E600Saa
IC Package	153-ball FBGA						
JEDEC Specification	V4.41	v5.1, HS400					
Flash Type	Native SLC	3D SLC Mode	3D NAND	3D SLC Mode	3D NAND	3D SLC Mode	3D NAND
Density	1 GB to 2 GB	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)	31 / 23	300 / 240	300 / 170	300 / 240	300 / 170	300 / 240	300 / 170
Performance** — Random Read/Write up to (IOPS)	750 / 1000	15K / 30K					
Operating Temperature	-40°C to 85°C (Industrial)			-40°C to 85°C (AEC-Q100 Grade 3)		-40°C to 105°C (AEC-Q100 Grade 2)	
Reliability — Max. TBW**	90 TB	1320 TB	824 TB	1320 TB	824 TB	1213 TB	309 TB
Reliability — MTBF @ 25°C	> 2,000,000 Device hours						
ICC (Typical RMS in Read/Write) mA	93	135 / 155	135 / 180	135 / 155	135 / 180	135 / 155	135 / 180
ICCQ (Typical RMS in Read/Write) mA	69	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 1.0	11.5 x 13.0 x 1.3 (max.)					

*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.

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

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.

Advanced Wear Leveling

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

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.

PowerProtector

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.

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, defense, and business applications with intense security requirements.

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.

* Compatibility and support may vary by platform or operating system.
** For Security-related features and configurations, please refer to page 9.

Solutions & Technologies

Industrial Temperature

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

SiP (System in Package)

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

Conformal Coating

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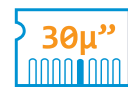
Thicker Gold Finger

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

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.

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.

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.

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

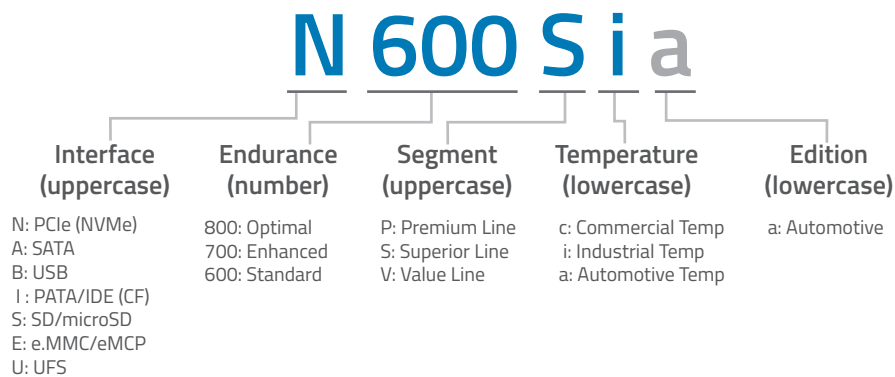|	Product	Dimensions (L x W x H mm)	Flash Type	Densities	Operating Temp.	Data Transfer Rate (max.)	TBW* (max.)	Power Failure Protection / PowerProtector	Secure Erase (S/W)**	Life Monitor (S/W)**
SATA										
2.5" SSD	**Velocity SII Pro**	100.0 x 69.9 x 9.2	SLC	8 GB~256 GB	-40°C~ 85°C	Read: 520 MB/s 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		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~256 GB		Read: 550 MB/s Write: 440 MB/s	8,533 TB			
			iTemp MLC	64 GB~512 GB		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	16 GB~256 GB		Read: 550 MB/s Write: 350 MB/s	533 TB			
			MLC		0°C~ 70°C		640 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: 510 MB/s Write: 175 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 4.5	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: 70 MB/s Write: 39 MB/s	192 TB	✓	✓	✓***
		SLC mode	4 GB~64 GB	-25°C~ 85°C -40°C~ 85°C	Read: 76 MB/s Write: 50 MB/s	128 TB			
		3D NAND SLC mode	8 GB~32 GB	-25°C~ 85°C -40°C~ 85°C	Read: 98 MB/s Write: 60 MB/s	320 TB			
		MLC	8 GB~128 GB	-25°C~ 85°C -40°C~ 85°C	Read: 96 MB/s Write: 61 MB/s	154 TB			
		3D NAND TLC	8 GB~256 GB	-25°C~ 85°C -40°C~ 85°C	Read: 98 MB/s Write: 64 MB/s	154 TB			
microSD/ microSDHC/ microSDXC	15.0 x 11.0 x 1.0	SLC	512 MB~8 GB	-40°C~ 85°C	Read: 80 MB/s Write: 39 MB/s	192 TB	✓	✓	✓***
		SLC mode	4 GB~16 GB	-25°C~ 85°C -40°C~ 85°C	Read: 76 MB/s Write: 54 MB/s	256 TB			
		3D NAND SLC mode	8 GB~64 GB	-25°C~ 85°C -40°C~ 85°C	Read: 98 MB/s Write: 62 MB/s	640 TB			
		MLC	8 GB~32 GB	-25°C~ 85°C -40°C~ 85°C	Read: 68 MB/s Write: 24 MB/s	39 TB			
		3D NAND TLC	8 GB~256 GB	-25°C~ 85°C -40°C~ 85°C	Read: 98 MB/s Write: 61 MB/s	154 TB			
Managed NAND									
e.MMC	11.5 x 13.0 x 1.3 (max.)	3D SLC mode	8 GB~64 GB	-40°C~ 85°C	Read: 300 MB/s Write: 240 MB/s	1,320 TB	✓	✓	✓
		3D MLC	16 GB~128 GB		Read: 300 MB/s Write: 170 MB/s	824 TB	✓	✓	✓
		SLC	1 GB~2 GB		Read: 31 MB/s Write: 23 MB/s	90 TB	✓	✓	✓

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

Flash Products Naming Rule

N 600 S i a

Interface (uppercase)	Endurance (number)	Segment (uppercase)	Temperature (lowercase)	Edition (lowercase)
N: PCIe (NVMe)	800: Optimal	P: Premium Line	c: Commercial Temp	a: Automotive
A: SATA	700: Enhanced	S: Superior Line	i: Industrial Temp	
B: USB	600: Standard	V: Value Line	a: Automotive Temp	
I : PATA/IDE (CF)				
S: SD/microSD				
E: e.MMC/eMCP				
U: UFS				

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), so users can choose the temperature range most appropriate for their needs.
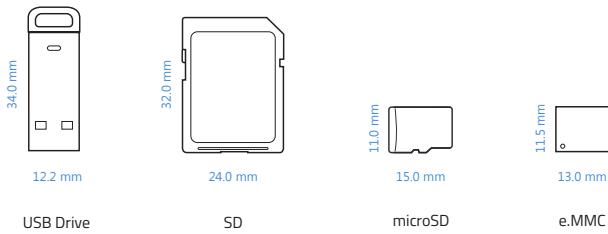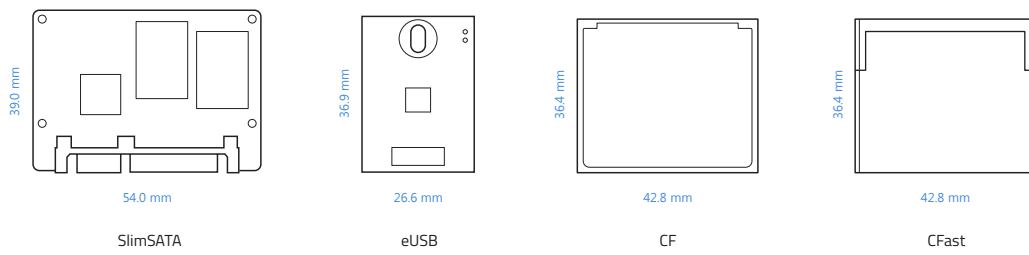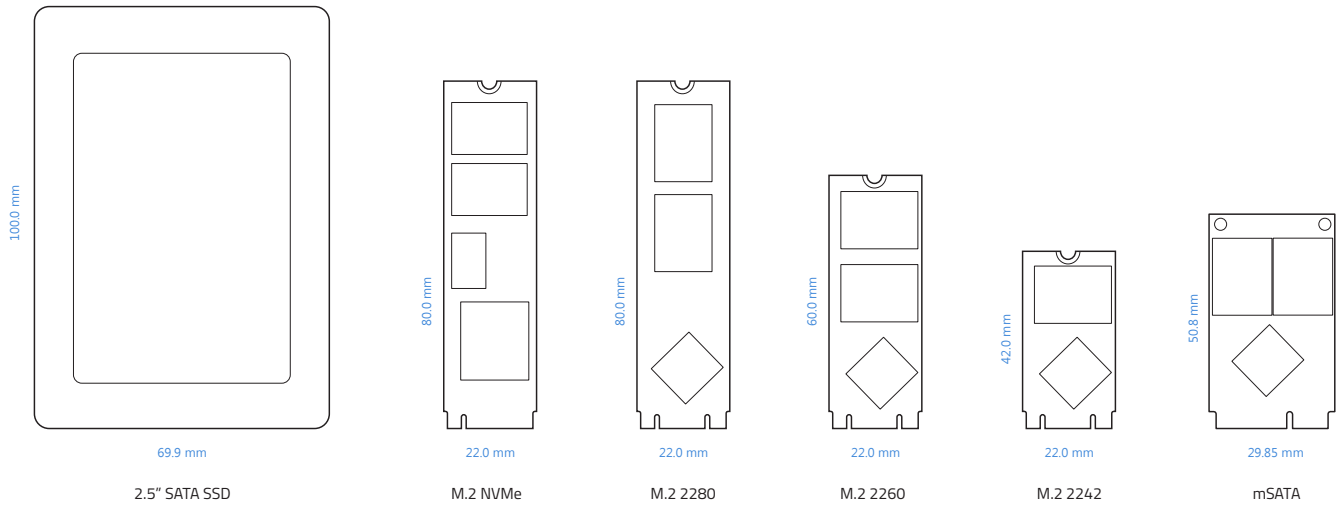
Value Line

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.

Product Dimensions (Size) Comparison

100.0 mm — 69.9 mm
2.5" SATA SSD

80.0 mm — 22.0 mm
M.2 NVMe

80.0 mm — 22.0 mm
M.2 2280

60.0 mm — 22.0 mm
M.2 2260

42.0 mm — 22.0 mm
M.2 2242

50.8 mm — 29.85 mm
mSATA

39.0 mm — 54.0 mm
SlimSATA

36.9 mm — 26.6 mm
eUSB

36.4 mm — 42.8 mm
CF

36.4 mm — 42.8 mm
CFast

34.0 mm — 12.2 mm
USB Drive

32.0 mm — 24.0 mm
SD

11.0 mm — 15.0 mm
microSD

11.5 mm — 13.0 mm
e.MMC

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