



Extra Fast. Extraordinary.

The Crucial P5 redefines what's possible with innovations that transform the computing experience.

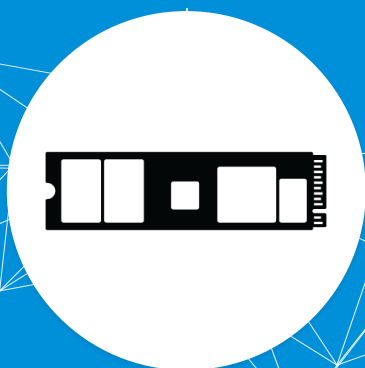
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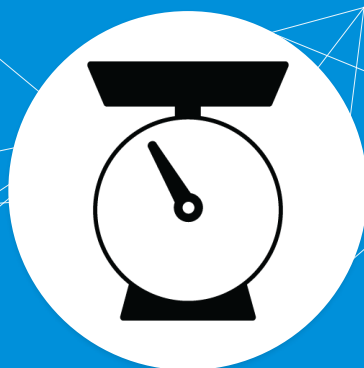
What is NVM Express™?



Built for SSDs

Architected for performance and efficiency. Manageable and scalable.

Enterprise and Client compatible.



Developed to Be Lean

Streamlined protocol with efficient queuing mechanism to scale for multi-core CPUs.



Ready for Next Gen SSDs

Lowers latency by optimizing register interface and command set.

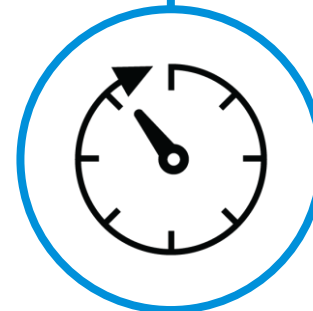


Industry Standard

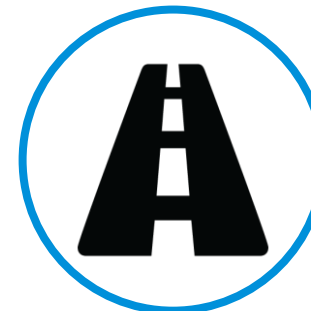
Software, drivers, and manageability that work out of the box.

Why NVMe™?

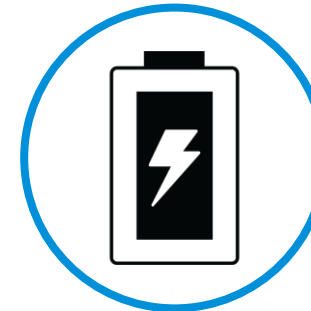
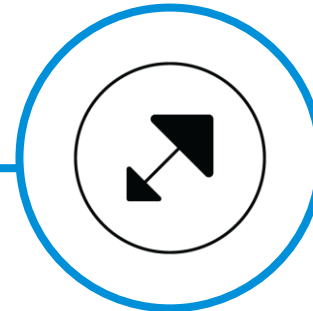
PCIe for **scalable** performance, **flexible** form factors, and industry **stability**



Lower Latency and increase **Efficiency**: lower CPU utilization, lower power, lower TCO



Increased Bandwidth: 1GB/s per lane – lanes per drive directly attached to CPU, eliminate HBA cost and overhead



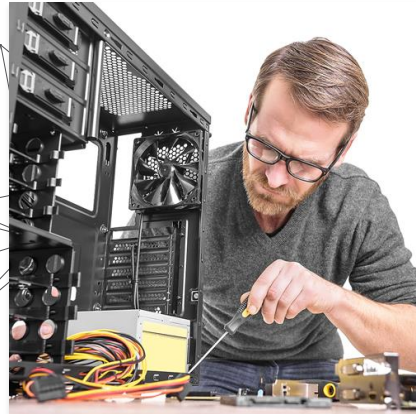
Low power feature from both PCIe and NVMe Security from Trusted Computing Group Opal

Advantages in Client Computing With NVMe™



Client/Mobile

- High performance
- Lower latency
- Improved application responsiveness
- Improved battery efficiency



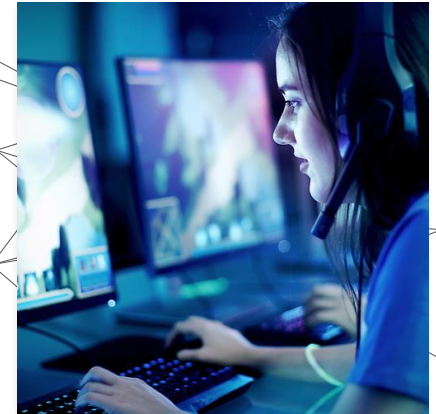
Workstation

- Accelerates applications
- Excels in demanding environments



Video / Edit / Content

- High bandwidth required for 4K
- Create new workflows for content creation when working with large data sets



Gaming

- Decreased load times
- High quality textures and realism
- Faster response times

Crunches, saves, deploys, and guards.

Introducing the Crucial® P5 PCIe NVMe™ SSD



Conquer Expectations

- Up to 6X the Performance over SATA
- 3D NAND and cutting-edge controller technology for fierce read/write speeds up to 3400/3000MB/s
- Pushing the limits of PCIe® Gen 3 NVMe™



Seamless Performance

- Operating systems open almost instantly
- Apps launch in seconds
- Games load before you're ready to spawn



Unprecedented Endurance

- Dynamic write acceleration, error correction, and adaptive thermal protection optimize performance and durability.



Robust Security to Keep Data Safe

- Enhance data security with the P5's rapid, full-drive encryption
- Transparently minimizes the risk of data loss without performance degradation.





Crucial® P5 NVMe PCIe M.2 SSD

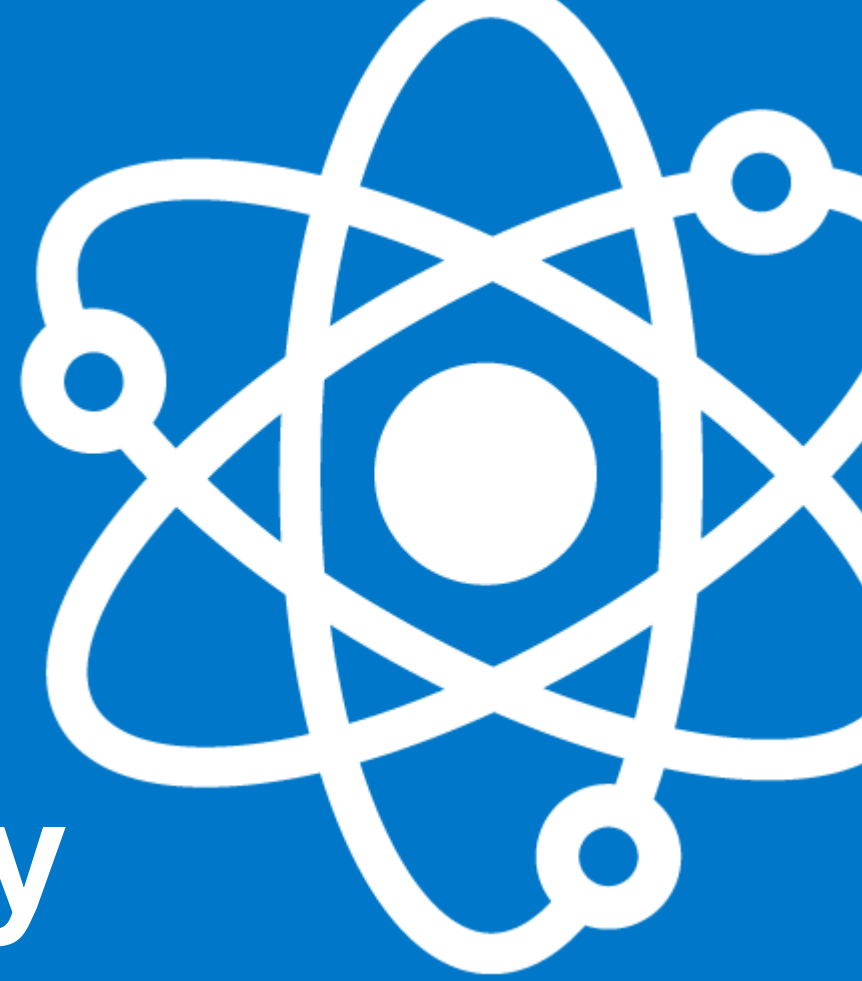
Product Overview

Features

- **Performance**
 - Dynamic Write Acceleration
 - Redundant Array of Independent NAND (RAIN)
- **Security**
 - AES 256-bit encryption
- **Management**
 - Storage Executive SSD management tool
 - NVMe standard Self-Monitoring and Reporting Technology (SMART)
- **Power**
 - Adaptive Thermal Protection
 - NVMe Autonomous Power State Transition (APST) Support
- **Reliability**
 - Multistep Data Integrity Algorithms
 - Error Correction Code (ECC)
 - Integrated Power Loss Immunity

| | P5 SSD | |
|------------------------------|-------------|-------------|
| Form Factor | M.2 | M.2 |
| Capacity | 500GB | 1000GB |
| Sequential Read/Write (MB/s) | 3,400/3,000 | 3,400/3,000 |
| Random Read/Write (kIOPS) | 210k/500k | 390k/500k |
| Endurance (TBW) | 300 | 600 |
| MTTF (Million Device Hours) | 2.0 | 2.0 |





Feature Set Summary

How You Benefit

Client Core Feature Set



Power Efficiency



Dynamic Write Acceleration



Host Control Thermal Management



TCG Client Data Security



Storage Executive



Data Path Protection



RAIN



Device Self-Test



Secure Erase

Power Efficiency

Increase Battery Life For Mobile Applications

Benefits

- Maximizes efficiency with minimum amount of power
- Delivers deep energy savings for notebooks and desktops alike
- Modern Standby Certified

What does this mean for your mobile battery life?

- Increased battery life with lower power states that are up to 98% more than HDDs¹ extending device batter life and user productivity
- With modern standby...

1. Compared against a 2.5-inch consumer 7200 RPM HDD, tested internally, configured running client standard implementations



Dynamic Write Acceleration

Performance Optimization

How it Works

- Switch between NAND level cell modes, on-the-fly
- Optimized for client computing environments, where data writing operations tend to occur in bursts, offering the highest performance possible without decreasing user capacity.



Host Control Thermal Management

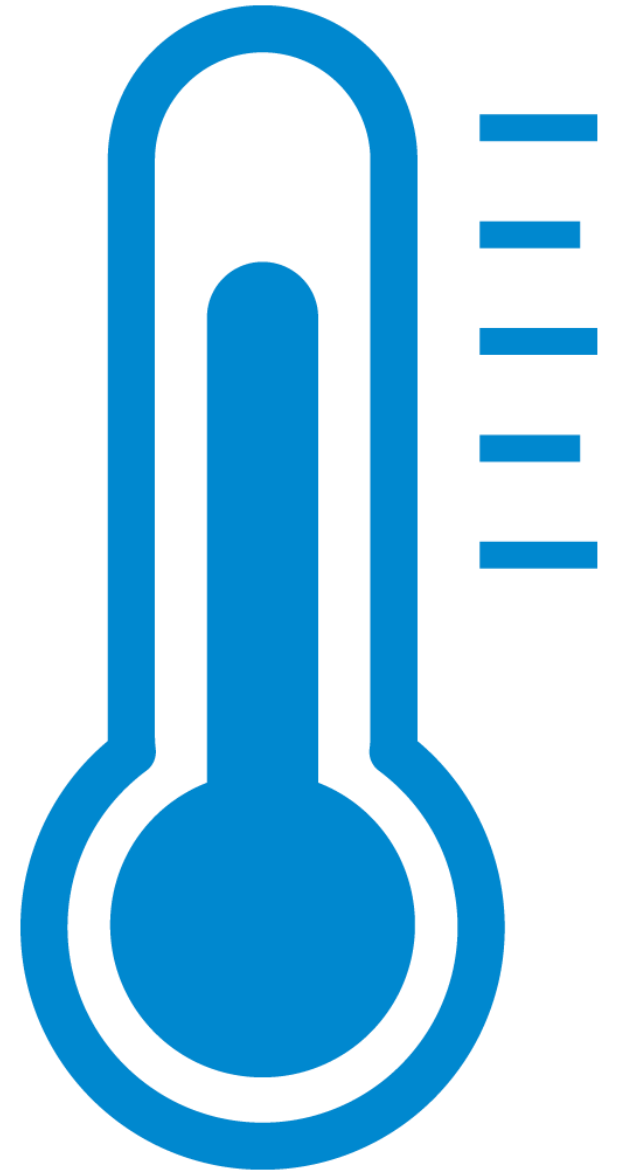
Keep Your System Cooled

Benefits

- Automatically adjusts SSD I/O activity to protect against overheating
- Default throttling thresholds can be customized by the host
- Thermal management reported through SMART which can be monitored through Storage Executive

How it Works

- SSD automatically measures the temperature multiple times per minute
- If an over-temperature threshold is exceeded, performance will be throttled
- Full performance will be restored after the temperature returns to a safe level
- Thermal events are logged in SMART
- Get/Set Features can be used by the host to dynamically tune the drive's thermal profile



TCG Client Data Security

Secure & Protect Your Data

Benefits

- Seamless and transparent implementation
- Most affordable Client-class SSD security option
- No impact to performance

How it Works

- Non-SED TCG Pyrite
 - Lock/Unlock access to data at rest
 - Provides similar protection to ATA Security implemented in SATA drives
 - Can be used in regions that are sensitive to data encryption
- SED TCG Opal 2.0
 - Protects data at rest through encryption
 - Encryption key never leaves the drive
 - Trusted Platform Module (TPM) can be used to marry the drive to a single system
 - Superior data protection



Micron[®] Storage Executive

SSD Management Made Easy

Get the Most out of Your SSD with Our Free Downloadable Tool

- Generate usage reports
- Download the latest firmware
- See how much storage you've used
- Monitor SSD operating temperature and overall health
- Device Self-test Support
- Reset the drive's encryption password
- Enable Secure Erase

Compatible with all Micron and Crucial SSDs

- Simple and consistent interface no matter which SSD you're using



Data Path Protection

Protect Data as it Flows Through Your SSD

Standard Data Path Protection (on Client SSDs)

- Multi-layer protection of user data as it flows through the SSD
- Protects the integrity of user data so that what you write to the SSD is what's read from the SSD
- Comes standard on all Micron client SSDs



RAIN

Protection Against Storage Component Failure

RAIN = Redundant Array of Independent NAND

- Protects your data at the storage component (NAND) level
- Works similar to how RAID is used with multiple hard drives to increase reliability
- Protection goes well beyond the more commonly used error correction code (ECC) level

How RAIN Calculates and Stores Parity Data

- Parity data (calculated from user data) is stored together as a logical concatenation, similar to RAID in traditional hard drive arrays
- Stripe-to-parity ratio is automatically selected based on drive design, target usage model, and the drive's NAND knowledge
- If any element of a stripe fails, that element is recreated using surviving data (XOR) and parity data



Device Self-Test

Diagnostic Drive Testing

Benefits

- Used to verify the integrity and functionality of the SSD controller and the NAND
- DST is performed as a background operation with limited impact on performance
- Testing can be managed with Storage Executive

How it Works

- Short Device Self-Test completes in ~2 minutes
- Extended Device Self-Test completes in ~15 minutes
- Device Self-Test results and current test status are logged to the drive



Secure Erase

Securely Erase All User Data on a Micron SSD

Format NVM Secure Erase Command

- All NAND blocks containing user data will be erased

Cryptographic Erase Command

- Provides rapid data destruction by deleting and generating a new encryption key
- SED TCG Opal only



