SSD Controller Innovations for PC, Automotive and Enterprise

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Silicon Motion at a Glance

A Leading Merchant Supplier in NAND Flash Controllers

~30% Market Share in SSD Controller Market

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Leader in PC OEM PCIe NVMe QLC SSDs

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NAND Transitions for Client SSD

SMI internal estimates

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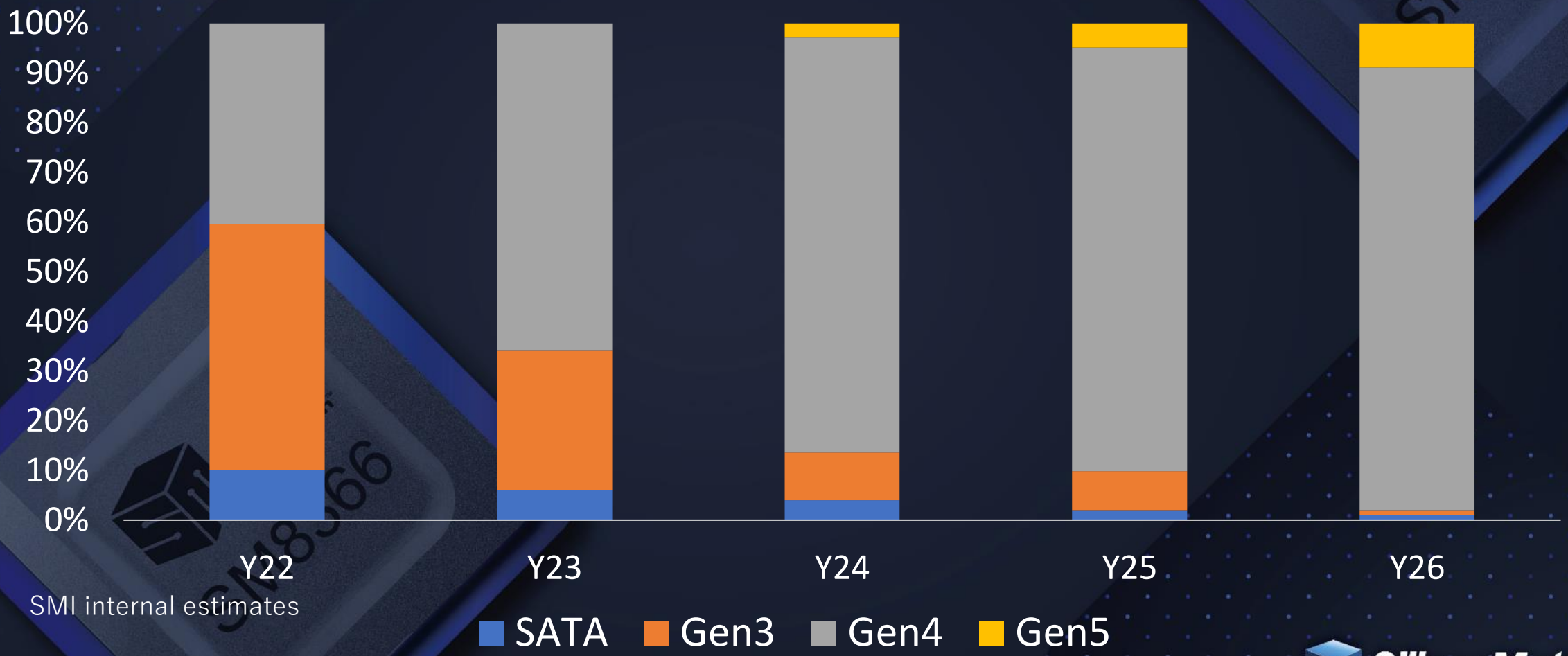
Client SSD Market Trend



SMI internal estimates

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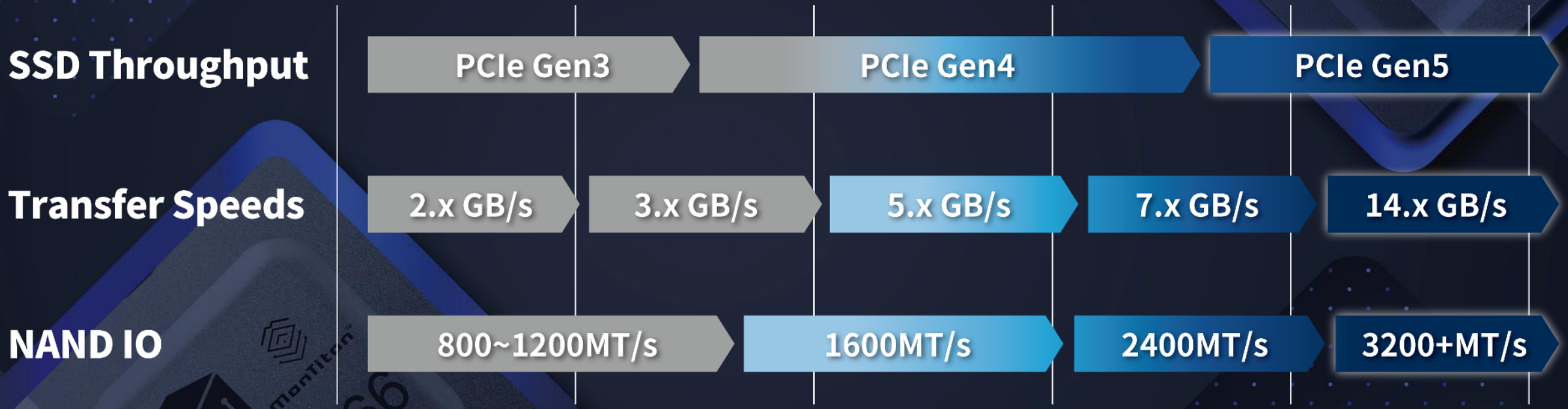
NVMe Client SSD Controller Technology Transitions



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Performance Per Watt

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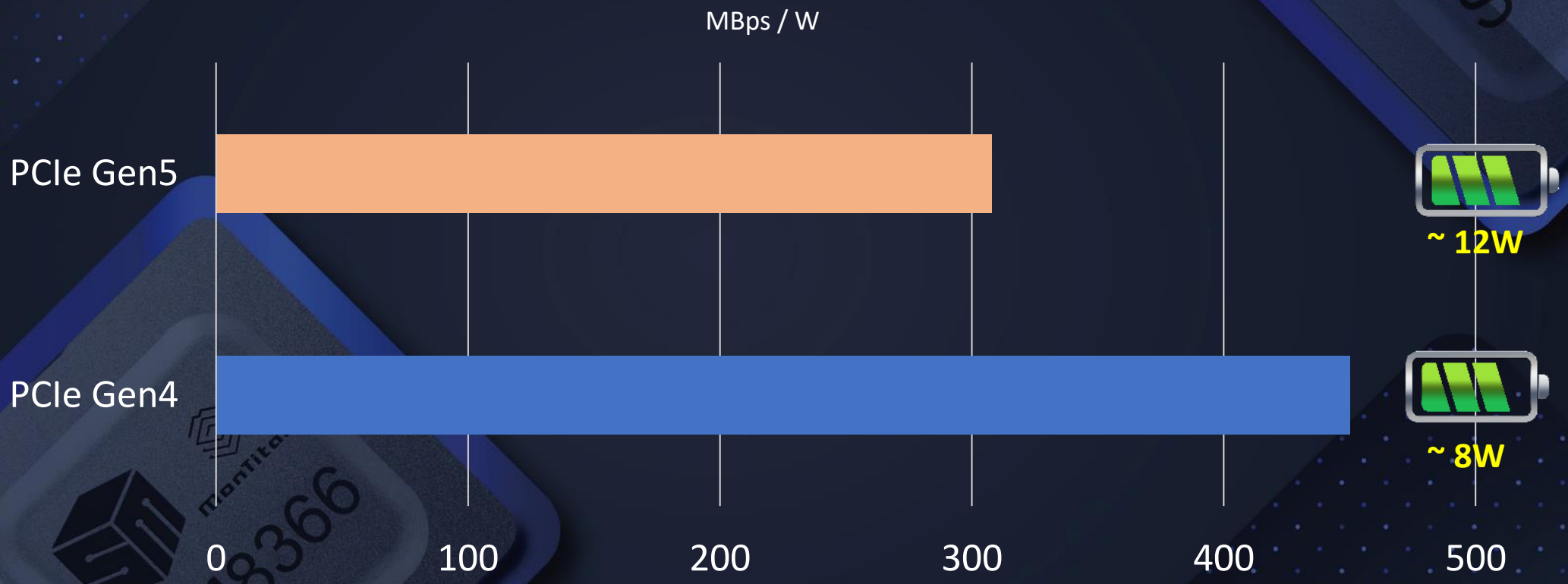
Performance Per Watt



The test results conducted by SMI's VCT lab

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SSD with Fan ！ Make Sense?

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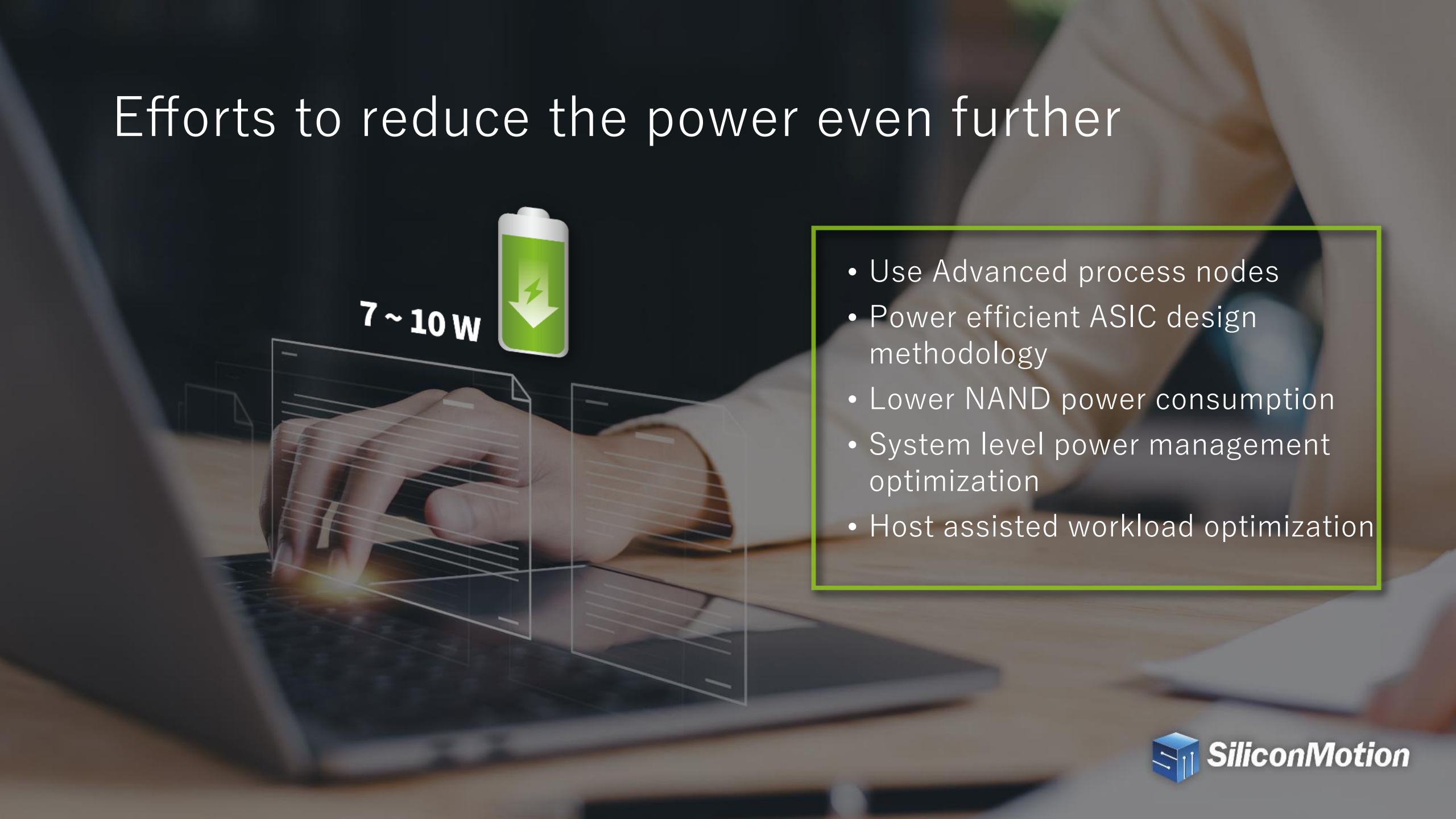
Efforts to reduce the power even further



- Use Advanced process nodes
- Power efficient ASIC design methodology
- Lower NAND power consumption
- System level power management optimization
- Host assisted workload optimization

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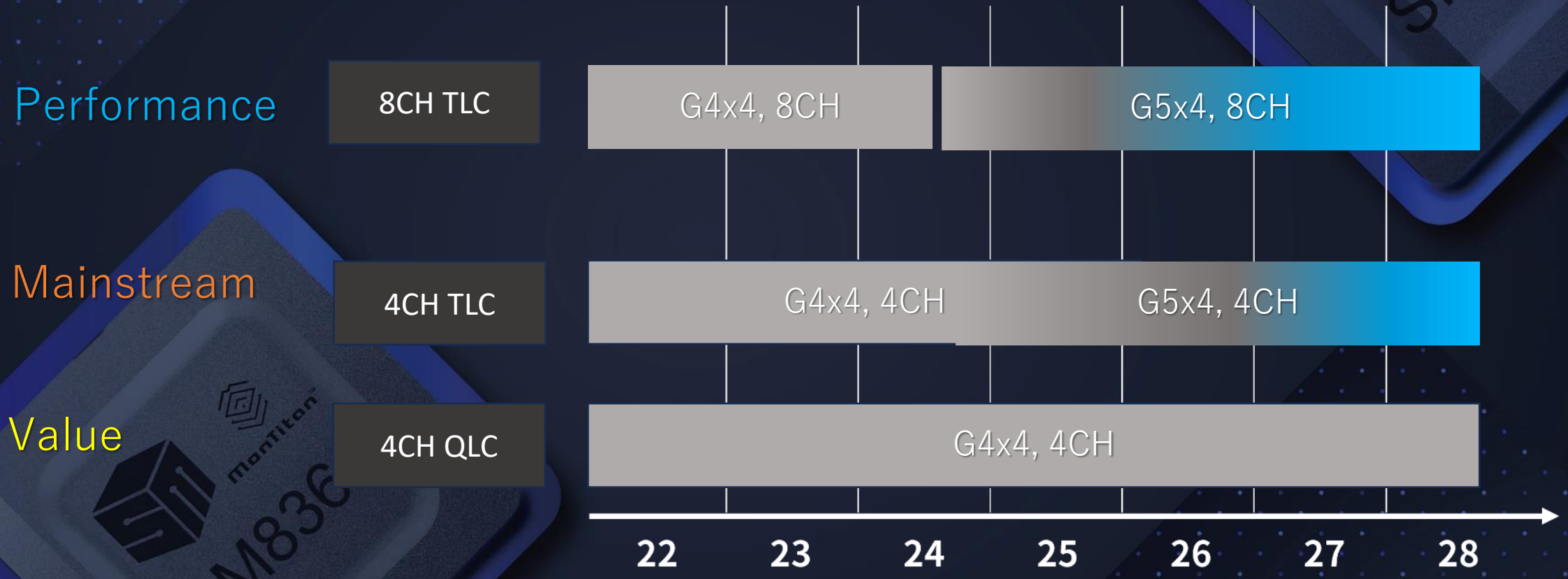
Silicon Motion Client SSD Roadmap



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Silicon Motion Client SSD Roadmap

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Silicon Motion Client SSD Roadmap

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SM2508 Controller for PCs

- PCIe Gen5 x 4, NVMe 2.0
- NAND Interface: x8 NAND Channel
- Supporting 3600MT/s per channel
- 3D TLC / QLC Supported
- Power Consumption: ~3W (Ave.)

Performance

- Sequential Read: ~14GB/s
- Sequential Write: ~12GB/s
- Random Read: ~2.5M IOPS
- Random Write: ~2.4M IOPS

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SSD Controller for Automotive

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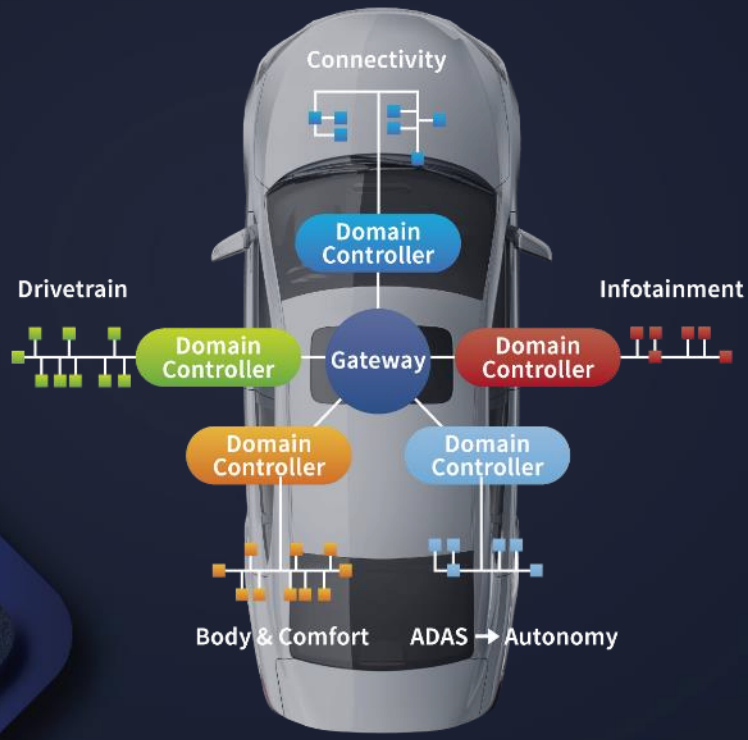
Automotive E/E Architecture Evolution

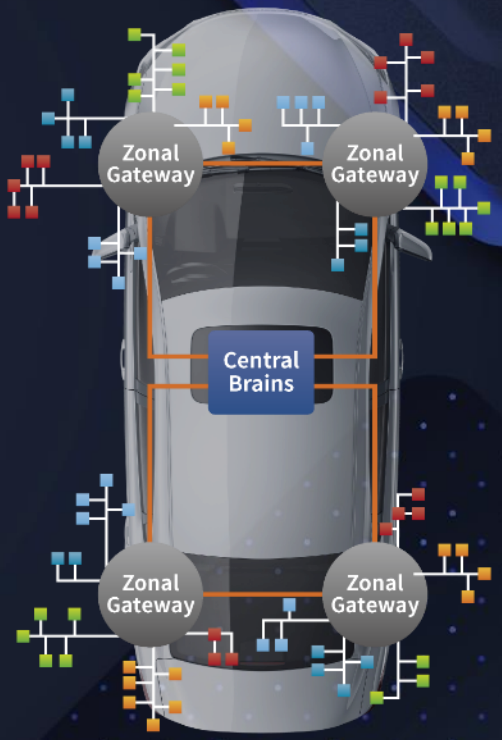
Electronic/Electric Architecture From Distributed to Centralized & Zone

Traditional Architecture

Doman Architecture



Centralized & Zone Architecture



Future

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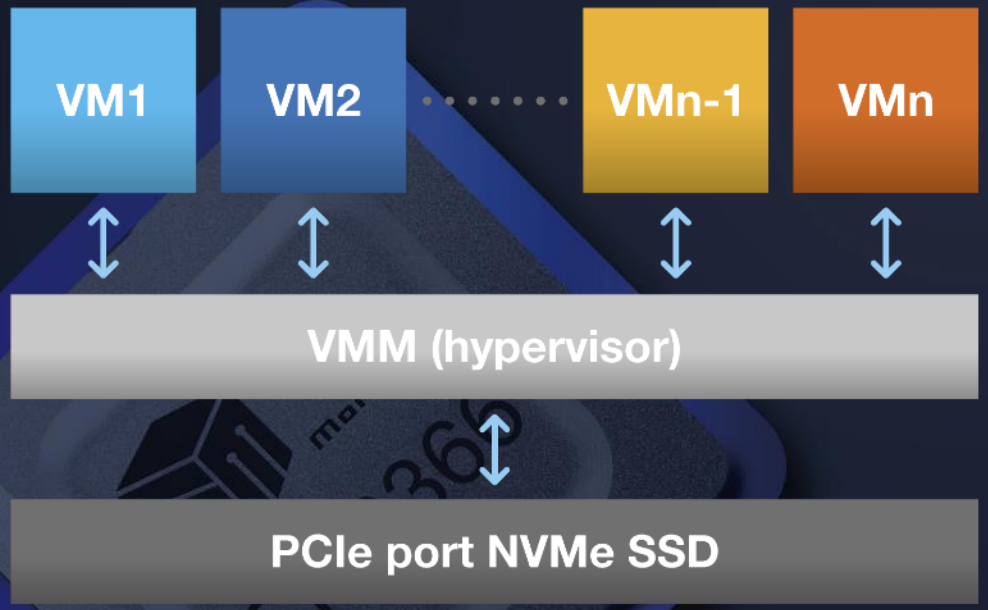
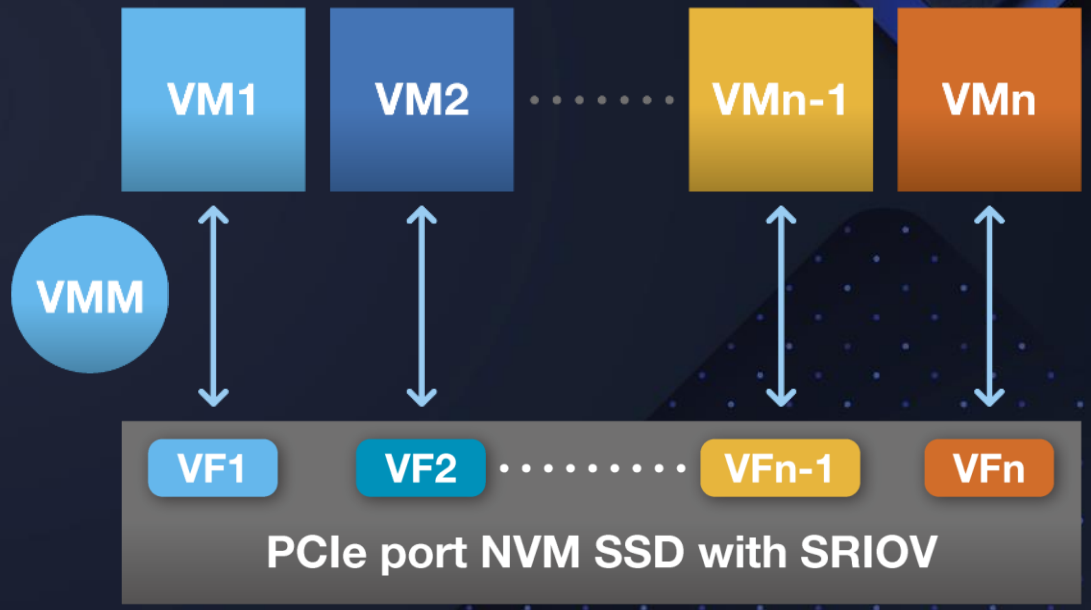
Built-in SR-IOV Capability for Automotive Storage

One Storage Directly Support Virtual I/Os to Multiple VFs





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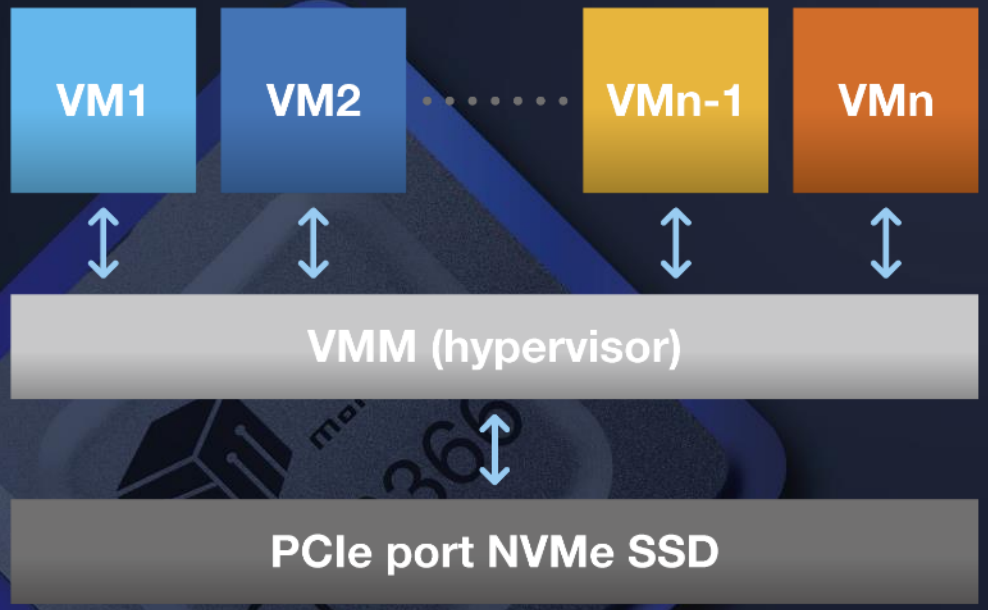

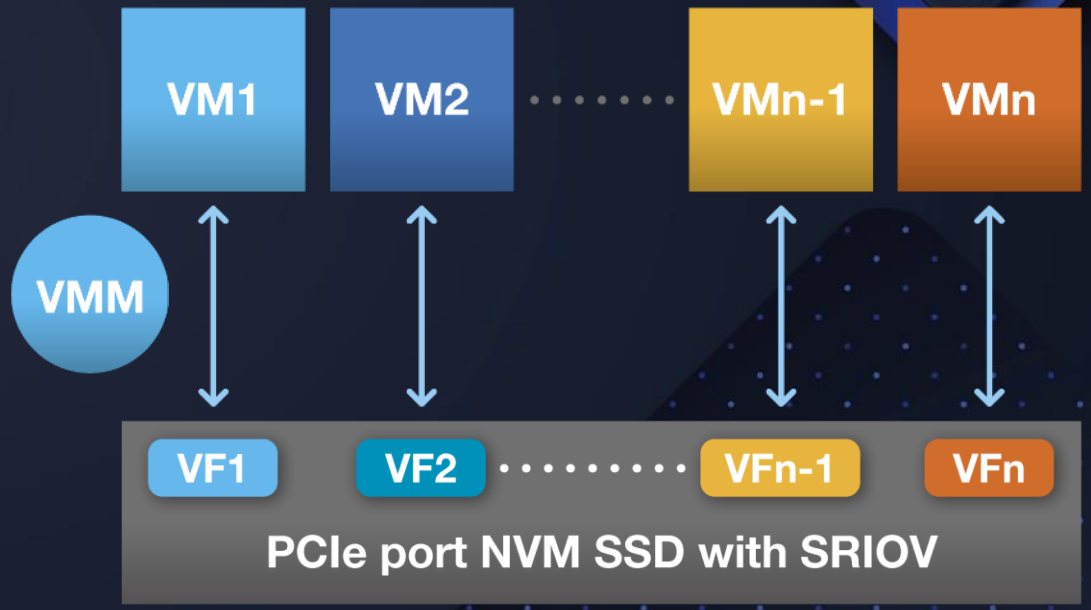

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SM2264XT-AT for Automotive

- PCIe Gen4 x 4, NVMe 1.4
- NAND Interface: x8 NAND Channel
- Supporting 1600MT/s per channel
- Built-in SR-IOV Capability
- 3D TLC / QLC Supported

Performance

- Sequential Read: 7000 MB/s
- Sequential Write: 6500 MB/s
- Random Read: 1000K IOPS
- Random Write: 1000K IOPS

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SMI SSD Controllers for Automotive Quality

Qualification

TSMC Automotive Service

- Tightened process control and scrap criteria
- Documentations and FA

ASPICE certification

SMI Automotive team follow ASPICE process to maintain product design flow and documentation control.

Data Path Protection

- End-to-end data path protection
- SRAM ECC for SRAM soft/hard errors

AEC-Q100 Grade2 / Grade3

Grade 2: -40°C to +105°C
Grade 3: -40°C to +85°C

Certification

IATF16949 compliance

FMEA (Failure Mode and Effect Analysis) Zero-defect quality management standard

Functional Safety for ISO 26262

Safety Levels: ISO26262 for ASIL A, ASIL B, ASIL C and ASIL D

Traceability

OTP controller die stores unique ID to trace back wafer map or wafer lot

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Silicon Motion Expertise Fuels Enterprise Success

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Silicon Motion Expertise Fuels Enterprise Success

Performance / Watt

NAND Management

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MonTitan™ Enterprise SSD Development Platform

MonTitan™

- SSD Controller ASIC

- Reference Design Kit

- Enterprise Firmware

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SM8366 SSD Controller

MonTitan™

Enterprise Features

- PCIe Gen5, Dual Ported.
- NVMe 2.0
- OCP NVMe SSD Spec.
- SR-IOV / MPF
- Namespaces
- SMART Monitoring
- E2E Data Protection
- Secure Boot
- AES-256
- TCG Opal
- Attestation

High Performance

Sequential : 14GB/s
Random: 3GB/s

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MonTitan Platform

FW Defined and Hardware Accelerated

Performance and QOS at Exceptional Power Control

Future Proofed to Adopt New Standards

Flexible and Configurable for Customer Customization

Unified FW programming Model for Development Acceleration

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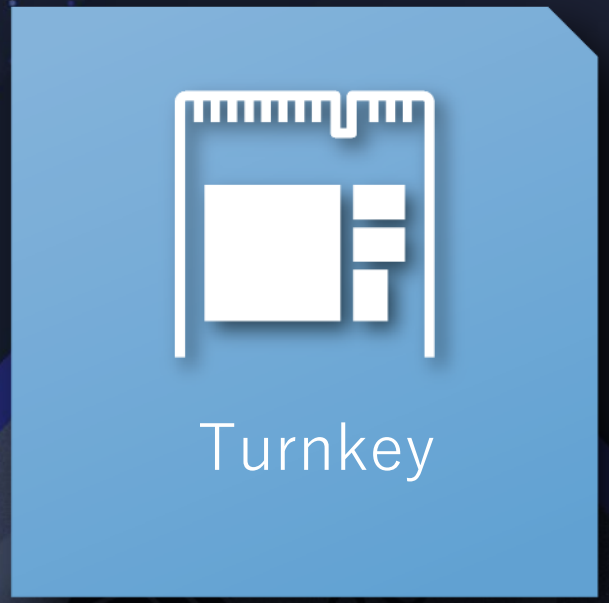
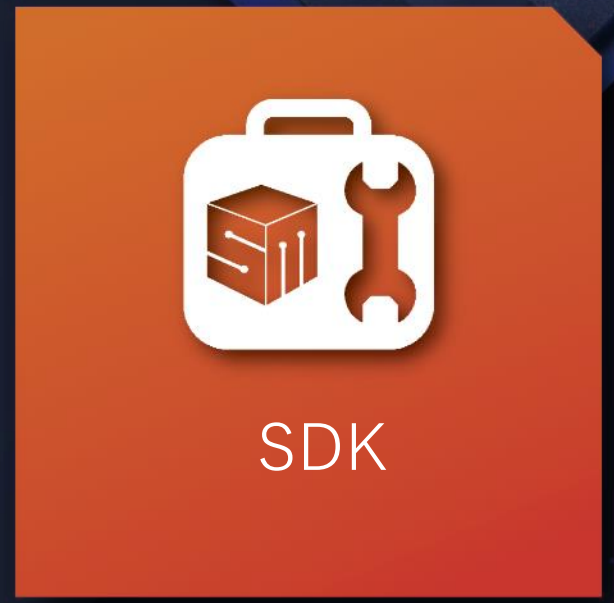
Enterprise Firmware Support Options



Turnkey



SDK

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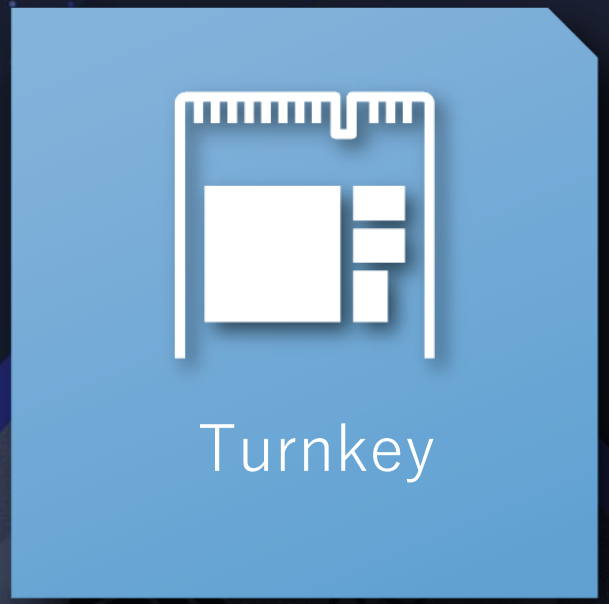
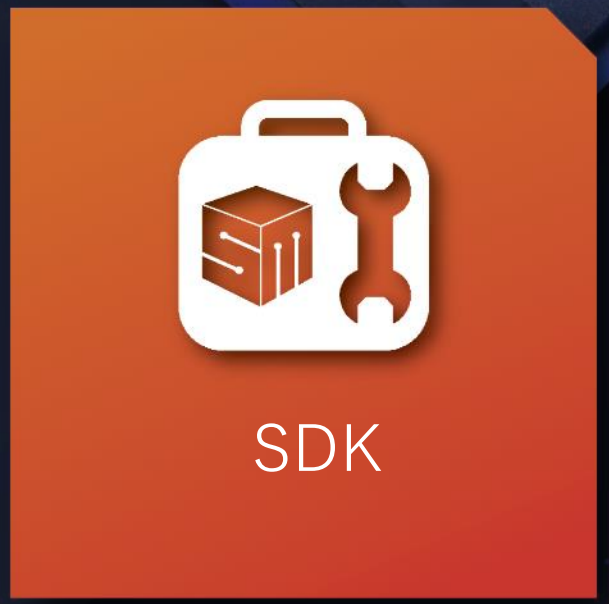
Enterprise Firmware Support Options



Turnkey

Layered FW



SDK

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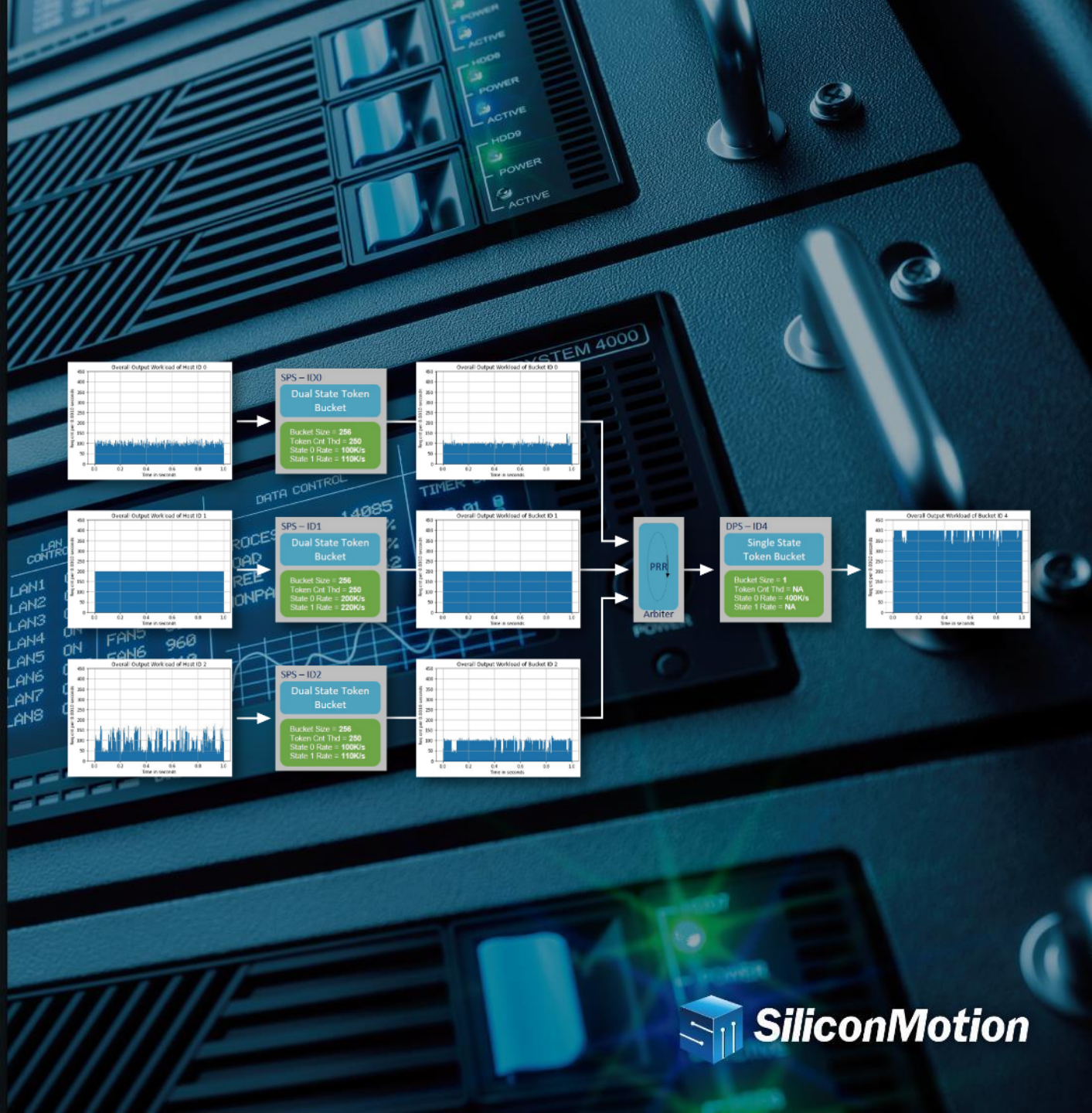
PerformaShape™

- Isolate at the IO command level focusing on Tenant performance
- QoS Sets are defined through application specifics and / or mapped to specific media hierarchy
- Eliminate noise neighbor effects while maintaining maximum SSD performance



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PCIe Gen5 NVMe SSDs

FW Provides Fastest Time to Market and Lowest Development Cost

- NVMe 2.0
- OCP NVMe Data Center Specification 2.0
- Hardware Reference Design Kit, U.2, E1.S, E3.S
- Improved QoS with PerformaShape™ Technology

8TB, U.2 Performance

- Sequential Read 14GB/s
- Sequential Write 11GB/s
- Random Read 3.0M IOPS (4KB)
- Random Write 425K IOPS (4KB – 7% OP)

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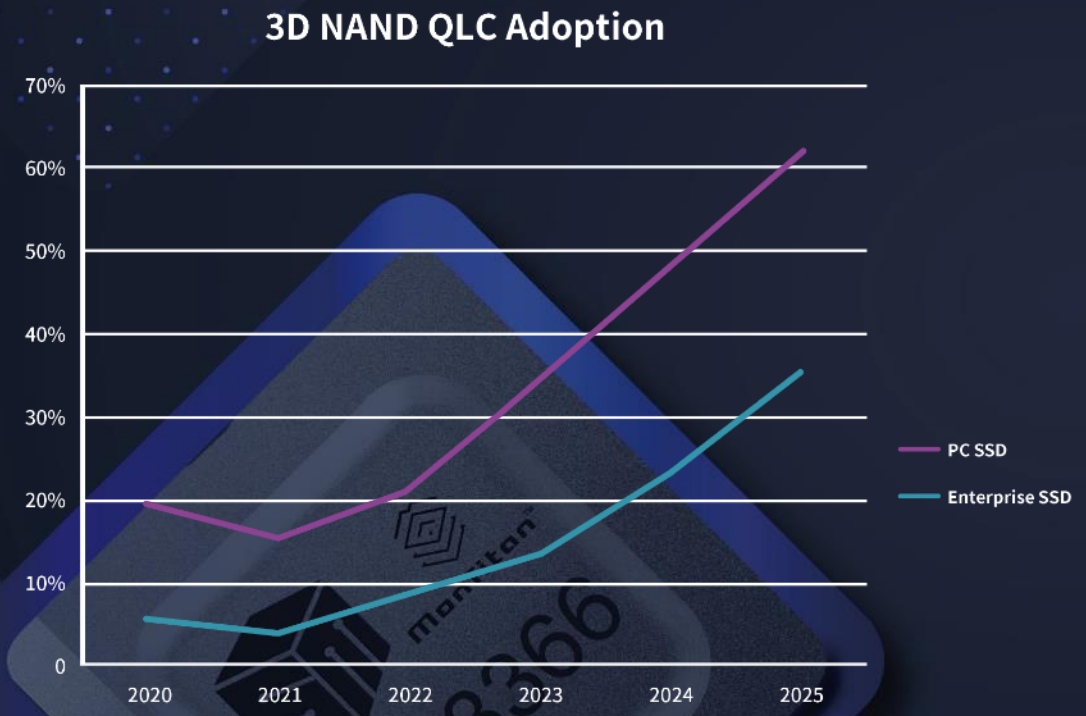
QLC Presents Opportunity



- Cost benefit promises of QLC NAND
- Acceleration of higher capacity support
- Early adoption by AFA suppliers that have host-based control of data placement and system level performance

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PCIe Gen5 QLC based ZNS SSD

Application Specific Data Placement Unlocks the Lower Cost QLC SSDs

- Extended SSD Life by reducing WA
- Reduced Latency; Improved Throughput
- Enable Higher Capacity SSD
- Reduction in DRAM Footprint

- 16TB, ODP QLC NAND
- User Configurable Number of Zones, 4-32
- Best in Class QoS

U.2 16TB Performance

Sequential Read 14GB/s

Sequential Write 2.2 GB/s

Random Read 2.2 M IOPS (4B)

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In Summary

Silicon Motion provides innovations in Client, Automotive and Enterprise Markets:

- Power Performance Optimizations during the PCI Gen4 -> PCIe Gen5 Transition
- Acceleration of lower cost QLC solutions
- Automotive controller with SR-IOV will enable the future central computing architecture in cars
- Customer Collaborative Turnkey and Layered Firmware

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Meet Us at Booth #315

To explore SMI's experts' insight at FMS's Forum