Next-Gen Performance & Efficiency with EDSFF SSD and QLC Technology

Mike Scriber
Supermicro Corp
NVMe Form Factor Comparison

U.2
(7.5mm/15.0mm)

M.2
(without carrier)

EDSFF
Short
(without carrier)

EDSFF
Long
(includes carrier)

E1.S
NF1
(without carrier)

E1.L
Why do we need new SSD form factors?

- Higher storage density - more TB per rack unit
- Higher efficiency - thermal and power performance
- Higher capacity – vendor technology competition
- Better cost per GB – vendor price competition
- Storage disaggregation
  - Improved resource management
  - Heavy compute applications (HPC)
  - GPU based applications
What is EDSFF*?

1. A group of 15 companies working together

2. Industry standard connector and form factor optimized for NVMe

3. Built for increased operational efficiency and dense storage

Intel® SSDs with EDSFF* Form Factor

- E1.L 18mm
- E1.L 9.5mm
- E1.S

*Other names and brands may be claimed as the property of others.

List of EDSFF members provided at https://edsffspec.org
ALL EDSFF* SSDs support the same:

1. **Connector**
   - Drives high volumes

2. **Pinout**
   - Allows interoperability, simplifies backplane design

3. **Base Features**
   - But differentiated by segment and use case

**Systems Designed with Flexibility for Storage and Beyond**

*Other names and brands may be claimed as the property of others.
Scalable, thermal efficient, and dense, E1.L is a building block for high-volume storage. E1.L allows high storage density, scalability, serviceability, and efficient cooling optimized for 1U servers.
Ruler vs. 2.5” Storage Chassis Implementation

**2.5” FORM FACTOR**
- Backplane requires cut outs to optimize thermals
- Cables add cost and complicate installation, thermals
- LED controller adds failure point
- Drive cages add cost, failure points

**E1.L FORM FACTOR**
- Eliminate the backplane
- Simplified thermal implementation
- No add in cards required
- No cables to SSDs
- Geographic drive mapping for simplified drive management

Less complicated chassis
Reduced component cost per SSD
Simple hot swap with high density capabilities
Advantage. Thermal efficiency.

Thermal efficiency
Up to 55% less airflow$^4$ vs U.2 15mm

E1.L
U.2
15mm

2019 Storage Developer Conference. © Insert Your Company Name. All Rights Reserved.
## Benefits of E1.L Versus U.2

### E1.L: Optimized for Storage

**Key Benefits:**

- Scalable bandwidth, drives, and PCIe* lanes
- NVMe* drives for 1U rack space
- Dense JBOF, disaggregated storage
- Thermally optimized form factor

### Key Points:

1. **Reduce System Complexity**
   - Remove complicated cabling and backplane solutions

2. **Capacity**
   - Increase capacity with more media sites

3. **Efficiency**
   - Up to 2x less required airflow\(^1\)

4. **Density**
   - 2.5x higher\(^2\)

5. **Hot Pluggable**
   - Front serviceability

6. **Enabling Future Technology**
   - PCIe* Gen 4.0 and 5.0 ready

---

\(^1\) Source – Intel. Comparing airflow required to maintain equivalent temperature of a 4TB U.2 15mm Intel® SSD DC P4500 to a 4TB “Ruler” form factor for Intel® SSD DC P4500. Results have been estimated or simulated using internal analysis or architecture simulation or modeling, and provided for informational purposes. Simulation involves three drives for each form factor in a sheet metal representation of a server, 12.5mm pitch for “Ruler” form factor, 1000m elevation, limiting SSD on case temp of 70°C or thermal throttling performance, whichever comes first. 5°C guard band. Results used as a proxy for airflow anticipated on EDSFF spec compliant “Ruler” form factor Intel® SSD P4510.

\(^2\) Source – Intel. Comparing maximum capacity per 1 rack unit of Intel® Server Board S2600WP Family, 24 U.2 bay option using 4TB U.2 15mm Intel® SSD DC P4500 to 8TB Intel® AF1000 Server design, 32 “ruler” drive bays using 8TB “ruler” form factor for Intel® SSD DC P4500.

---

*Other names and brands may be claimed as the property of others.*
QLC vs TLC

- QLC has 4-bits per cell, while TLC has 3-bits per cell.
  - 33% capacity improvement
- QLC costs 32% less than TLC
  - Closing the price gap between SSDs and HDDs
- QLC EDSFF using 16K block writes
- QLC EDSFF: 15.36TB now, 30.72TB in Oct/Nov.
- TLC EDSFF: 15.36TB in Oct/Nov.
- QLC EDSFF endurance is <0.5 DWPD
  - 8TB drive * 1 DWPD = 8TB per day
  - 16TB drive * .5 DWPD = 8TB per day

EDSFF Long SSD is the first QLC flash drive
## Key specifications

### Optimized for Read Intensive Workloads

<table>
<thead>
<tr>
<th>Specification</th>
<th>Intel® SSD D5-P4326</th>
<th>Intel® SSD D3-S4510</th>
<th>HDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rand. Read / Write</td>
<td>580K / 11K IOPs†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seq. Read/ Write</td>
<td>3200/1600 MB/s†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endurance: Rand/Seq.</td>
<td>0.18/0.9 DWPD†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Read Latency</td>
<td>137µs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

†Derived using 15.36TB drive and 16K aligned write.

### Space Efficient Capacity

<table>
<thead>
<tr>
<th>Form Factor</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.2 15mm</td>
<td>15.36TB/30.72TB²</td>
</tr>
<tr>
<td>E1.L</td>
<td>15.36TB/30.72TB²</td>
</tr>
</tbody>
</table>

²Capacity per 2U³

<table>
<thead>
<tr>
<th>Form Factor</th>
<th>Capacity per 2U³</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.2 (15.36TB)</td>
<td>737TB</td>
</tr>
<tr>
<td>HDD (4TB)</td>
<td>192TB</td>
</tr>
<tr>
<td>E1.L (30.72TB)</td>
<td>1,966TB</td>
</tr>
</tbody>
</table>

³Source: Intel. 30.72TB Intel® SSD D5-P4326 available in 2019. Schedule subject to change, please contact your Intel representative for the most up to date schedules and roadmaps.

### Efficient Storage Acceleration

<table>
<thead>
<tr>
<th>Feature</th>
<th>Intel® SSD D5-P4326</th>
<th>Intel® SSD D3-S4510</th>
<th>HDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot plug support</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-band monitoring</td>
<td>Yes (SMART standards)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Out-of-band monitoring</td>
<td>Yes (support NVMe*-MI standard)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NVMe* Drive Serviceability

### Data Integrity and Availability

<table>
<thead>
<tr>
<th>Feature</th>
<th>Intel® SSD D5-P4326</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Annual Failure Rate</td>
<td>Same as for TLC NVMe SSD - Intel® SSD DC P4510 Series</td>
</tr>
<tr>
<td>End-to-End data protection Features</td>
<td></td>
</tr>
<tr>
<td>Power Loss Imminent</td>
<td></td>
</tr>
</tbody>
</table>

4. Source: Intel. 30.72TB Intel® SSD D5-P4326 available in 2019. Schedule subject to change, please contact your Intel representative for the most up to date schedules and roadmaps.

© 2019 Supermicro®
1U 32-bay NVMe EDSFF Long Server

KEY FEATURES

• 1U Extremely high density/high capacity NVMe* storage server
• Supports 32 NVMe hot-swappable SSDs
• BMC for remote system power on/off and system monitoring
• Dual socket Intel® Xeon® Scalable processor server (SKL & CLX)
• Individual SSD power cycling
• Intel® QuickAssist Technology for HW 100Gb encryption/compression

APPLICATIONS

• High Throughput Ingest
• High Density Hot Storage
• HPC / Data Analytics
• Media/Video Streaming
• Content Delivery Network (CDN)
• Big Data Top of Rack Storage

CHASSIS DIMENSIONS:
H 1.71” x W 17.26” x D 35.95” (43.6 x 438.4 x 913.1mm)

DRIVE BAYS:
32 x EDSFF long NVMe Hot-swap SSDs
(2 sleds with 16 drives per sled)

SERVER CAPABILITY:
Dual Socket Intel® Xeon® Scalable processor (SKL and CLX)
24 DIMMs for up to 6TB memory
2 M.2 boot drives

I/O:
2x X16 PCIe* slots, 2x 10GbE ports, 1x IPMI ports, 2x USB ports, 1x UID button, 1x Reset button

POWER SUPPLIES:
2x 1600W (N+1) 96% efficient Digital Platinum Level Redundant Power Supplies

COOLING:
8 x 40mm high speed Hot-swappable Fans

*Other names and brands may be claimed as the property of others.
1U 32-bay NVME* EDSFF* JBOF (coming soon)

KEY FEATURES

- 1U Extremely High Density High Capacity NVMe Storage Enclosure
- Supports 32 NVMe Hot-swappable SSDs
- BMC for Remote System Power on/off and system monitoring
- Tool-less SSD tray
- Flexible to configure up to 8 Hosts
- Individual SSD power cycling
- PCIe* External Cable Spec 0.7 compliant
- Slide Rail included

*Other names and brands may be claimed as the property of others.

APPLICATIONS

- High Throughput Ingest
- High Density Hot Storage
- HPC / Data Analytics
- Media/Video Streaming
- Content Delivery Network (CDN)
- Big Data Top of Rack Storage

CHASSIS DIMENSIONS:

H 1.71” x W 17.26” x D 31.95” (43.6 x 438.4 x 811.7mm)

DRIVE BAYS:

32 x EDSFF NVMe* Hot-swap SSDs
(2 sleds with 16 drives per sled)

HOST SCALEABILITY:

Supports up to 8 host systems with X16 AOCs

I/O:

4x X16 Mini-SAS HD ports, 2x X16 PCIe Slots, 2x IPMI ports, 1x UID button, 1x Reset button

POWER SUPPLIES:

2x 1000W (N+1) 96% efficient Digital Titanium Level Redundant Power Supplies

COOLING:

8 x 40mm high speed Hot-swappable Fans
## Benefits of E1.S Versus M.2

<table>
<thead>
<tr>
<th>Form Factor</th>
<th>Thermally Optimized</th>
<th>Density</th>
<th>Hot Pluggable</th>
<th>Form factor Flexibility</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1.S enables flexible designs and carrier cards</td>
<td>Better airflow and thermal zones</td>
<td>66% Higher¹</td>
<td>Front Serviceability</td>
<td>Multiple widths, heat spreader, guide rails and latch enclosure</td>
<td>Up to 2x Per drive¹</td>
</tr>
</tbody>
</table>

E1.S: Optimized Compute/Servers

### Key Benefits:

- Improved system cooling for efficiency
- Reduce system complexity
- Low cost storage scaling
- Lower base system infrastructure cost
- Small servers with full feature set

---

¹ 2x capacity when comparing generic M.2 SSD with 6 media sites, and generic EDSFF 1U Short with up to 12 media sites
**SSG-1029P-NES32R**

**KEY FEATURES**

- Up to 32 EDSFF short devices (128TB)
- Up to 6TB Memory (24 DIMM)
- RDMA optimized Configuration for low latency
- Redundant Power Supplies

---

**System Specification**

**PROCESSOR SUPPORT**
Dual Intel Xeon Scalable processors (Socket P)
3 UPI Support

**CHIPSET**
Intel® C627 chipset

**MEMORY**
24 DIMM, Up to 6TB ECC 3DS LRDIMM, 768GB ECC RDIMM

**Available for EXPANSION**
2x PCI-E 3.0 x16 & 1x PCI-E 3.0 x4

**EXTERNAL I/O SUPPORT**
Dual 10Gbase-T and Dedicated IPMI port

**DRIVE BAYS**
32 EDSFF-S NVME bays

**POWER SUPPLY**
Redundant 1600W Power Supplies, 80PLUS Titanium

**Due to the complexity of integration, this product is sold as a completely assembled system only.**

---

2019 Storage Developer Conference. © Insert Your Company Name. All Rights Reserved.
BigTwin™ E1.S SuperServer

• 4 nodes in 2U multi-node server
• 10 E1.S EDSFF drives per node
• Plus 2 M.2 drives per node
• Dual 2nd Gen Intel® Xeon® Scalable processors per node
• Up to 6TB memory in 24 DIMMs per node
• Intel® Optane™ DC persistent memory support
• Performance optimized CPU:drive ratio

Front View

Performance Optimized
Thank You

For more information, visit www.supermicro.com or contact marketing@supermicro.com
Disclaimer
Super Micro Computer, Inc. may make changes to specifications and product descriptions at any time, without notice. The information presented in this document is for informational purposes only and may contain technical inaccuracies, omissions and typographical errors. Any performance tests and ratings are measured using systems that reflect the approximate performance of Super Micro Computer, Inc. products as measured by those tests. Any differences in software or hardware configuration may affect actual performance, and Super Micro Computer, Inc. does not control the design or implementation of third party benchmarks or websites referenced in this document. The information contained herein is subject to change and may be rendered inaccurate for many reasons, including but not limited to any changes in product and/or roadmap, component and hardware revision changes, new model and/or product releases, software changes, firmware changes, or the like. Super Micro Computer, Inc. assumes no obligation to update or otherwise correct or revise this information.

SUPER MICRO COMPUTER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE CONTENTS HEREOF AND ASSUMES NO RESPONSIBILITY FOR ANY INACCURACIES, ERRORS OR OMISSIONS THAT MAY APPEAR IN THIS INFORMATION.

SUPER MICRO COMPUTER, INC. SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. IN NO EVENT WILL SUPER MICRO COMPUTER, INC. BE LIABLE TO ANY PERSON FOR ANY DIRECT, INDIRECT, SPECIAL OR OTHER CONSEQUENTIAL DAMAGES ARISING FROM THE USE OF ANY INFORMATION CONTAINED HEREIN, EVEN IF SUPER MICRO COMPUTER, Inc. IS EXPRESSLY ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

ATTRIBUTION
© 2019 Super Micro Computer, Inc. All rights reserved.