The combination of the SSD market growth and the evolution of new interface technologies, high-density NAND flash, and mission-critical enterprise storage needs brings both challenges and opportunities. The Seagate® SandForce SF2600 and SF2500—the second generation of SandForce enterprise flash controllers—continue accelerating SSD deployment in I/O-intensive enterprise storage applications. These devices are designed to enable standard high-density NAND flash memory to reliably operate in SATA-, SAS- and PCIe-based enterprise storage applications without compromising performance. The SF2600/SF2500 controllers integrate Seagate DuraClass™ technology, architected to leverage advanced SLC and MLC NAND flash memory to deliver best-in-class performance, endurance, security and power efficiency. The SF2600/SF2500 controllers are single-chip solutions that do not require additional DRAM cache or other costly patches.

**Endurance and Longevity**

While new generations of NAND flash memory are being developed on smaller silicon geometries to reach higher densities and reduce the cost of flash memory, their overall endurance is dropping at a very high rate. Seagate DuraWrite™ data reduction technology optimizes writes to the flash memory and implements highly intelligent block management and wear leveling to increase the overall endurance and reliability of the complete SSD. With this technology, even MLC-based SSDs can operate in enterprise environments for 5+ years.

**Performance**

SSDs can greatly increase performance with advanced high-speed SATA, SAS, and PCIe interfaces being implemented in newer systems to remove performance bottlenecks. The SandForce flash controllers deliver performance that maximizes the throughput of a SATA 6Gbps interface with balanced read/write speeds, keeping the enterprise-class system performance highly effective. The SF2600 with non-S12B sector support also enables this level of performance in SAS environments.

**Security**

Data security is becoming a critical component in the digital age. The SF2600/SF2500 flash controllers feature high-level security protocols for the safety of data stored in flash memory. DuraClass technology automatically stores data in a highly secure AES-256 and AES-128 hardware encrypted format that double encrypts the data. The SF2600/SF2500 controllers also support TCG Enterprise security requirements.

**Data Protection and Reliability**

The SF2600/SF2500 flash controllers provide advanced data protection by combining a superior, high-level BCH ECC algorithm (with up to 55 bits/512-byte sector protection) and the unique RAISE™ (Redundant Array of Independent Silicon Elements) technology. RAISE technology provides the protection and reliability of RAID on a single drive without the 2× write overhead of parity.
Seagate SandForce SF2600 and SF2500 Enterprise Flash Controllers

**DuraClass™ Technology**
- DuraWrite™ extends the endurance of SSDs
- Intelligent block management and wear leveling
- Intelligent read disturb management
- Intelligent recycling for advanced free space management (garbage collection)
- RAISE™ (Redundant Array of Independent Silicon Elements)
- Intelligent data retention optimization
- Best-in-class ECC protection for longest data retention and drive life
- Power/performance balancing
- Thermal threshold management

**Host Interface**
- SATA 6Gb/s, 3Gb/s, and 1.5Gb/s support
- Native command queuing (up to 32 commands)
- S.M.A.R.T. command transport

**Max Capacity Supported**
- 512GB

**Performance (sustained)**
- Sequential read and write transfer: up to 500MB/s (@ 128KB blocks)
- Random read and write IOPS: up to 60,000 (@ 4KB blocks)

**Sector Size Support**
- SF2500: 512B
- SF2600: 520, 524, 528, 4K+DIF

**Flash Memory Support**
- MLC, eMLC, and SLC; 16 nm, 19 nm, 20 nm-class and 30 nm-class (Asynch, Toggle, ONFI2; up to 166 MT/s)

**Security**
- Data encryption: AES-256 and AES-128, TCG Enterprise (optional add-on feature)

**Reliability**
- ECC recovery: up to 55 bits correctable per 512-byte sector (BCH)
- Unrecoverable read errors: less than 1 sector per 10E17 bits read
- ECC on all internal memory; full end-to-end CRC protection; RAISE

**Operating Temperature**
- Commercial: 0°C to 70°C ambient
- Industrial: –40°C to 85°C ambient

**Package**
- 400-pin TFBGA – 14 × 14mm, 0.65mm pitch, 16-byte lanes
- 256-pin TFBGA – 14 × 14mm, 0.80mm pitch, 8-byte lanes

**Compliance**
- RoHS, Halogen-Free, Green

**Ordering Information**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Package</th>
<th>Capacity</th>
<th>Memory Type</th>
<th>IOPS (sustained)</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-2682VB1-SCJ</td>
<td>Enterprise SAS3</td>
<td>400-pin TFBGA</td>
<td>32GB to 512GB</td>
<td>MLC/eMLC/SLC</td>
<td>Up to 60,000</td>
<td>Commercial</td>
</tr>
<tr>
<td>SF-2682VB1-ICH</td>
<td>Enterprise SAS3</td>
<td>400-pin TFBGA</td>
<td>32GB to 512GB</td>
<td>MLC/eMLC/SLC</td>
<td>Up to 60,000</td>
<td>Industrial</td>
</tr>
<tr>
<td>SF-2582VB4-SCC</td>
<td>Enterprise SATA</td>
<td>400-pin TFBGA</td>
<td>32GB to 512GB</td>
<td>MLC/eMLC/SLC</td>
<td>Up to 60,000</td>
<td>Commercial</td>
</tr>
<tr>
<td>SF-2582VB1-ICH</td>
<td>Enterprise SATA</td>
<td>400-pin TFBGA</td>
<td>32GB to 512GB</td>
<td>MLC/eMLC/SLC</td>
<td>Up to 60,000</td>
<td>Industrial</td>
</tr>
<tr>
<td>SF-2581VB4-SPC</td>
<td>Enterprise SATA Boot</td>
<td>256-pin TFBGA</td>
<td>32GB to 512GB</td>
<td>MLC/SLC4</td>
<td>Up to 60,000</td>
<td>Commercial</td>
</tr>
</tbody>
</table>

1. One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to product capacity.
2. SATA interface with SAS enhancements behind SAS/SATA bridges
3. Random read and write performance @ 4KB blocks
4. SLC max capacity: 64GB

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Seagate SandForce SF2600 Enterprise Flash Controllers Block Diagram

**NAND Interface**
- Toggle, ONFI2
- Up to 166 MT/s
- 8 ch / 16 byte lanes
- 5x, 7x, 9x, 11x nm
- SLC / MLC / eMLC
- Up to 512 GB

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