

# SandForce® SF2600 and SF2500 Enterprise

## FLASH CONTROLLERS Data Sheet

### Key Features

- Second-generation solution enables standard flash memory to operate in enterprise storage environments.
- SATA 6Gb/s with NCQ (SAS and PCIe with a third-party bridge)
- Maintains highest level of balanced read and write performance (up to 60K IOPS and 500MB/s)
- AES-256 and AES-128, ATA, and optional TCG Enterprise security protocols for automatic encryption at the drive level ensures the best secure data protection.
- Non-512B sector support for SAS environments
- Supports latest 16 nm, 19 nm, 20 nm-class and 30 nm-class SLC, MLC, and eMLC flash memory with Asynch/Toggle/ONFi2 interfaces
- Enhanced ECC for longest data retention and drive life
- DuraClass™ technology provides best-in-class endurance, performance and power efficiency
- DuraWrite™ architecture enables enterprise SSD deployment using the MLC flash without sacrificing performance.
- Up to 512GB capacity
- Single- chip, DRAM-less solution for small form factor support and lowest BOM cost for any enterprise SSD



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 6Gb/s interface with balanced read/write speeds, keeping the enterprise-class system performance highly effective. The SF2600 with non-512B sector support also enables this level of performance in SAS environments.

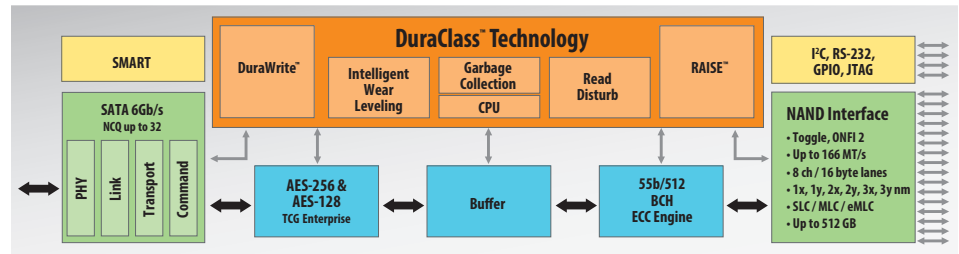
### Security

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 2x write overhead of parity.

Seagate SandForce SF2500 Block Diagram



**Seagate® SandForce® SF2600 and SF2500 Enterprise Flash Controllers**

DuraClass™ Technology	<ul style="list-style-type: none"> <li>• DuraWrite™ extends the endurance of SSDs</li> <li>• Intelligent block management and wear leveling</li> <li>• Intelligent read disturb management</li> <li>• Intelligent <i>recycling</i> for advanced free space management (garbage collection)</li> </ul>	<ul style="list-style-type: none"> <li>• RAISE™ (Redundant Array of Independent Silicon Elements)</li> <li>• Intelligent data retention optimization</li> <li>• Best-in-class ECC protection for longest data retention and drive life</li> <li>• Power/performance balancing</li> <li>• Thermal threshold management</li> </ul>
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 <sup>1</sup>	
Performance (sustained)	<b>Sequential read and write transfer:</b> up to 500MB/s (@ 128KB blocks) <b>Random read and write IOPS:</b> up to 60,000 (@ 4KB blocks)	
Sector Size Support	<b>SF2500:</b> 512B <b>SF2600:</b> 520, 524, 528, 4 K+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	<b>Data encryption:</b> AES-256 and AES-128, TCG Enterprise (optional add-on feature)	
Reliability	<b>ECC recovery:</b> up to 55 bits correctable per 512-byte sector (BCH) <b>Unrecoverable read errors:</b> less than 1 sector per 10E17 bits read ECC on all internal memory; full end-to-end CRC protection; RAISE	
Operating Temperature	<b>Commercial:</b> 0°C to 70°C ambient <b>Industrial:</b> -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**

Part Number	Description	Package	Capacity <sup>1</sup>	Memory Type	IOPS (sustained) <sup>3</sup>	Temperature
SF-2682VB1-SCJ	Enterprise SAS <sup>2</sup>	400-pin TFBGA	32GB to 512GB	MLC/eMLC/SLC	Up to 60,000	Commercial
SF-2682VB1-ICH	Enterprise SAS <sup>2</sup>	400-pin TFBGA	32GB to 512GB	MLC/eMLC/SLC	Up to 60,000	Industrial
SF-2582VB4-SCC	Enterprise SATA	400-pin TFBGA	32GB to 512GB	MLC/eMLC/SLC	Up to 60,000	Commercial
SF-2582VB1-ICH	Enterprise SATA	400-pin TFBGA	32GB to 512GB	MLC/eMLC/SLC	Up to 60,000	Industrial
SF-2581VB4-SPC	Enterprise SATA Boot	256-pin TFBGA	32GB to 512GB	MLC/SLC <sup>4</sup>	Up to 60,000	Commercial

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



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