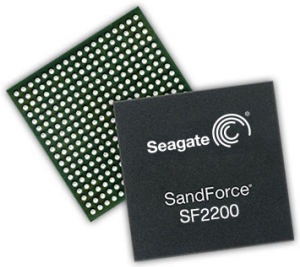
SandForce® SF2200 Client

FLASH CONTROLLERS
Data Sheet

Key Features

- Second-generation flash controller
- SATA 6Gb/s with NCQ support
- Automatic AES-256 and AES-128 hardware double encryption
- DuraClass™ technology delivers
  – Award-winning performance
  – Best performance per watt
- TCG Opal 2.0 and eDrive security (optional add-on)
- Supports the latest 16 nm, 19 nm, 20 nm-class, and 30 nm-class SLC and MLC flash memory
- Highly intelligent block management and wear leveling optimizes SSD longevity
- Single-chip solution eliminates external memory — saving cost, power, and space
- Power balancing settings to optimize performance and energy consumption
- Ultra-low power mode and DevSleep support
- Complete solution — ASIC, FW, turnkey reference designs, tools, documentation, and support



Today's award-winning SandForce Driven™ SSDs are well known for their performance and features. The Seagate® SandForce SF2200—the second-generation family of SandForce flash controllers—continue accelerating SSD deployment in enthusiast and mainstream client computing platforms. The SF2200 controllers are an ideal solution for portable storage applications where power consumption, boot-up time, application performance, responsiveness, and small form factor are important. The SF2200 controllers integrate Seagate DuraClass™ technology to leverage today's densest SLC and MLC NAND flash memory. They deliver best-in-class performance, endurance, security, and power efficiency in a DRAM-less, single chip solution. Configurations up to 512GB densities in standard 2.5-inch or 1.8-inch drive form factors, as well as ultra small form factors (e.g. MO-297A and mSATA), are all possible.

Endurance and Longevity

As each generation of flash memory evolves and silicon geometries shrink to lower the cost per GB, overall endurance is dropping at a very high rate. Currently the latest 1x/1y nm NAND flash memory has only around 3000 P/E cycles. 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, SSD manufacturers can offer their high-volume, client customers enterprise-class reliability and at least 5-year lifecycles.

Performance and Power Optimization

SandForce flash controllers deliver performance that maximizes the throughput of a SATA 6Gb/s interface with balanced read/write speeds. In extremely low-power environments, the SF2200 controllers can limit the number of simultaneously active flash devices to optimize power consumption and performance. It also supports an ultra-low power sleep mode and DevSleep to maximize battery life and meet the aggressive power requirements in the latest laptop and Ultrabook systems.

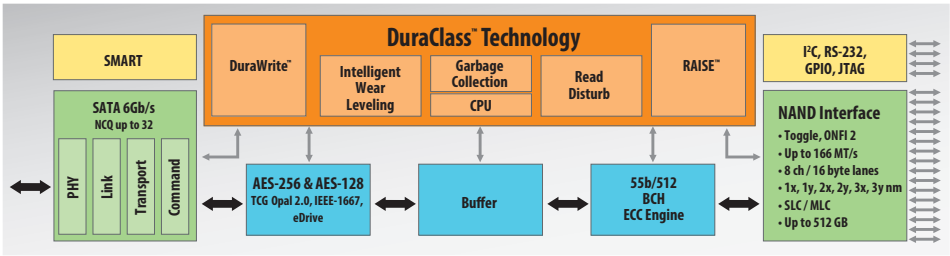
Client Computing Security

Data security is a critical component in the digital age. The SF2200 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 and can optionally support TCG Opal 2.0 and Microsoft eDrive security requirements. An optional disk-level password can be implemented prior to system boot, adding an extra level of data security assurance for business travelers carrying confidential information.

Data Protection and Reliability

The SF2200 Flash Controllers provide data protection with a combination of a superior, higher-level BCH ECC algorithm (with up to 55 bits/512 Byte sector protection) and the unique Seagate 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. This capability is transparent to end-users and provides peace-of-mind for mobile SSD OEMs knowing their customer's data is protected.

Seagate SandForce SF2200 Block Diagram



Seagate® SandForce® SF2200 Client 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[1]	
Performance	**Sequential read and write transfer:** up to 500MB/s (@ 128KB blocks) **Random read IOPS:** up to 60,000 (@ 4KB blocks) **Random write IOPS:** up to 60,000 burst/20,000 sustained (@ 4KB blocks) **Random 70/30 read/write mix IOPS:** up to 60,000 burst/60,000 sustained (@ 4KB blocks) **Random 50/50 read/write mix IOPS:** up to 60,000 burst/40,000 sustained (@ 4KB blocks) **PCMark Vantage:** up to 60,000 (HDD test suite score)	
Flash Memory Support	MLC from numerous top flash memory manufacturers SLC up to 128GB[1] of total capacity 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; Optional disk password; TCG Opal 2.0, IEEE-1667, Microsoft eDrive (optional add-on)	
Reliability	**ECC recovery:** up to 55 bits correctable per 512-byte sector (BCH) **Unrecoverable read errors:** less than 1 sector per 10E16 bits read ECC on all internal memory; full end-to-end CRC protection; RAISE	
Package	256-pin TFBGA – 14 x 14 mm, 0.80 mm pitch, 8 byte lanes	
Compliance	RoHS, Halogen-Free, Green	

Ordering Information

Part Number	Description	Package	Capacity[1]	Memory Type	IOPS (sustained)[3]
SF-2281VB4-SPC	Client SATA 6Gb/s SATA (8 channel)	256-pin TFBGA	24GB[5] to 512GB	MLC/SLC[2]	20,000
SF-2241VB4-SPC	Client SATA 6Gb/s SATA (4 channel)	256-pin TFBGA	24GB[5] to 128GB	MLC/SLC[4]	20,000

1 One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to product capacity.
2 SLC max capacity: 128GB
3 Random write performance @ 4KB blocks
4 SLC max capacity: 64GB
5 Based on currently available flash density

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