

# SandForce SF-2300 Industrial Flash Storage Processors



The industrial market, with its extremely demanding applications, provides many opportunities for solid state drives (SSDs). Their superior ruggedness and reliability over hard disk drives (HDDs) enables them to perform optimally in harsh environmental conditions. The LSI® SandForce® SF-2300 Flash Storage Processors (FSP) are specially designed to fulfill industrial-grade SSD requirements and enable standard high-density NAND flash memory to reliably operate in industrial storage applications without compromising performance. The SF-2300 FSPs integrate the LSI DuraClass™ technology, architected to leverage advanced SLC and MLC NAND flash memory to deliver best-in-class performance, endurance, security, and power efficiency while supporting the industrial temperature operating range (-40° C to 85° C). The SF-2300 FSP is a single chip solution that does not require an additional DRAM cache, enabling custom small form factor SSDs to be built.

## Features

- Second-generation solution enables standard flash memory to operate in industrial storage environments
- SATA 6 Gb/s with NCQ (SAS and PCIe\* with a third-party bridge)
- Best-in-class, consistent read and write performance (up to 500 MB/s & 20 K random write IOPS) for industrial applications
- AES-128\*, ATA, and optional TCG Opal security protocols for automatic encryption at the drive level ensures the best secure data protection
- Secure erase for sensitive data
- Supports the latest 20 nm-class and 30 nm-class SLC, MLC, and eMLC flash memory with Asynch/Toggle/ONFi2 interfaces
- Industrial temperature range for harsh environments
- Up to 512 GB capacity
- LSI DuraClass™ technology provides best-in-class endurance, performance, and power efficiency
- LSI DuraWrite™ architecture enables industrial SSD deployment using the MLC flash without sacrificing performance
- Single chip, DRAM-less solution for small form factor support, and lowest BOM cost

## Endurance and Longevity

While new generations of NAND flash memory are being developed on smaller silicon geometries to reach higher densities, overall endurance is dropping at a very high rate. The LSI DuraWrite™ architecture 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 be configured to operate in industrial environments for 10+ years.

## Performance

SSDs greatly outperform traditional HDDs, with advanced high-speed SATA, SAS, and PCIe interfaces being implemented in newer systems to remove performance bottlenecks. The LSI SandForce Flash Storage Processors deliver performance that maximizes the throughput of a 6 Gb/s SATA interface with balanced read/write speeds.

## Security

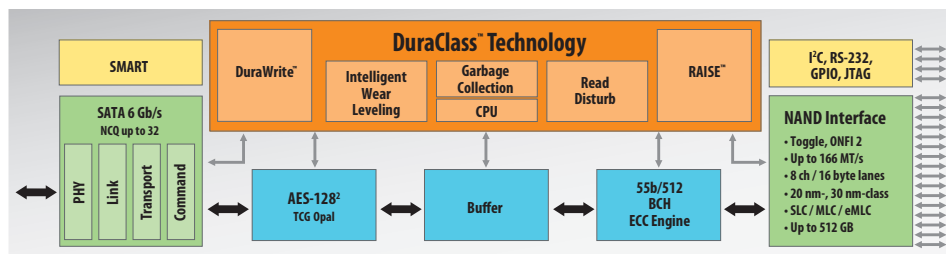
Data security is a critical component in industrial applications. The SF-2300 FSPs feature high-level security protocols to protect the security of data stored in flash memory. DuraClass technology automatically stores data in a highly secure AES-128\* hardware encrypted format. The SF-2300 FSP also supports TCG Opal security requirements.

## Data Protection and Reliability

The SF-2300 Flash Storage Processor provides up to 100x greater data protection than leading enterprise HDDs. This is achieved by combining a superior, higher-level BCH ECC algorithm (with up to 55 bits/512 byte sector protection) with the unique LSI 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.

\* AES-256 support will be added in the future. Please contact your SSD manufacturer or LSI representative for specific availability information.

SF-2300 Block Diagram



## SF-2300 Industrial Flash Storage Processor

|                        |                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 “recycling” for advanced free space management (garbage collection)</li> <li>RAISE (Redundant Array of Independent Silicon Elements)</li> </ul> | <ul style="list-style-type: none"> <li>Intelligent data retention optimization</li> <li>Best-in-class ECC protection for longest data retention and drive life</li> <li>Industrial temperature range</li> <li>Power/performance balancing</li> <li>Thermal threshold management</li> </ul> |
| Host Interface         | SATA 6 Gb/s, 3 Gb/s, and 1.5 Gb/s support<br>Native command queuing (up to 32 commands)<br>SMART command transport                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                            |
| Max Capacity Supported | 512 GB <sup>1</sup> (using 32 Gb or 64 Gb/die components)                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                            |
| Performance            | <b>Sequential read and write transfer:</b> Up to 500 MB/s (@ 128 KB blocks)<br><b>Random read IOPS:</b> Up to 60,000 (@ 4 KB blocks)<br><b>Random write IOPS:</b> Up to 60,000 bursts/20,000 sustained (@ 4 KB blocks)<br><b>PCMark Vantage:</b> Up to 60,000 (HDD test suite score)                                                                     |                                                                                                                                                                                                                                                                                            |
| Flash Memory Support   | MLC, eMLC, and SLC<br>20 nm-class and 30 nm-class (Asynch, Toggle, ONFi2; up to 166 MT/s)                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                            |
| Security               | <b>Data encryption:</b> AES-128/256; TCG Opal (optional add-on feature)                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                            |
| Reliability            | <b>ECC recovery:</b> Up to 55 bits correctable per 512-byte sector (BCH)<br><b>Unrecoverable read errors:</b> Less than 1 sector per 10 <sup>17</sup> bits read<br>ECC on all internal memory; full end-to-end CRC protection; RAISE                                                                                                                     |                                                                                                                                                                                                                                                                                            |
| Operating Temperature  | <b>Industrial:</b> -40° C to 85° C                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                            |
| Package                | 400-pin TFBGA – 14 x 14 mm, 0.65 mm pitch, 16 byte lanes                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                            |
| Compliance             | RoHS, Halogen-Free, Green                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                            |

## Ordering Information

| Part Number    | Description     | Capacity <sup>1</sup> | Memory Type  | IOPS (burst/sustained) <sup>3</sup> | Temperature |
|----------------|-----------------|-----------------------|--------------|-------------------------------------|-------------|
| SF-2382VB1-ICB | Industrial SATA | 32 - 512 GB           | MLC/eMLC/SLC | Up to 60,000/20,000                 | Industrial  |

1. 1 GB = 1 billion bytes 2. AES-256 support will be added in the future. Please contact your SSD manufacturer or LSI representative for specific availability information. 3. Random write performance @ 4 KB blocks



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