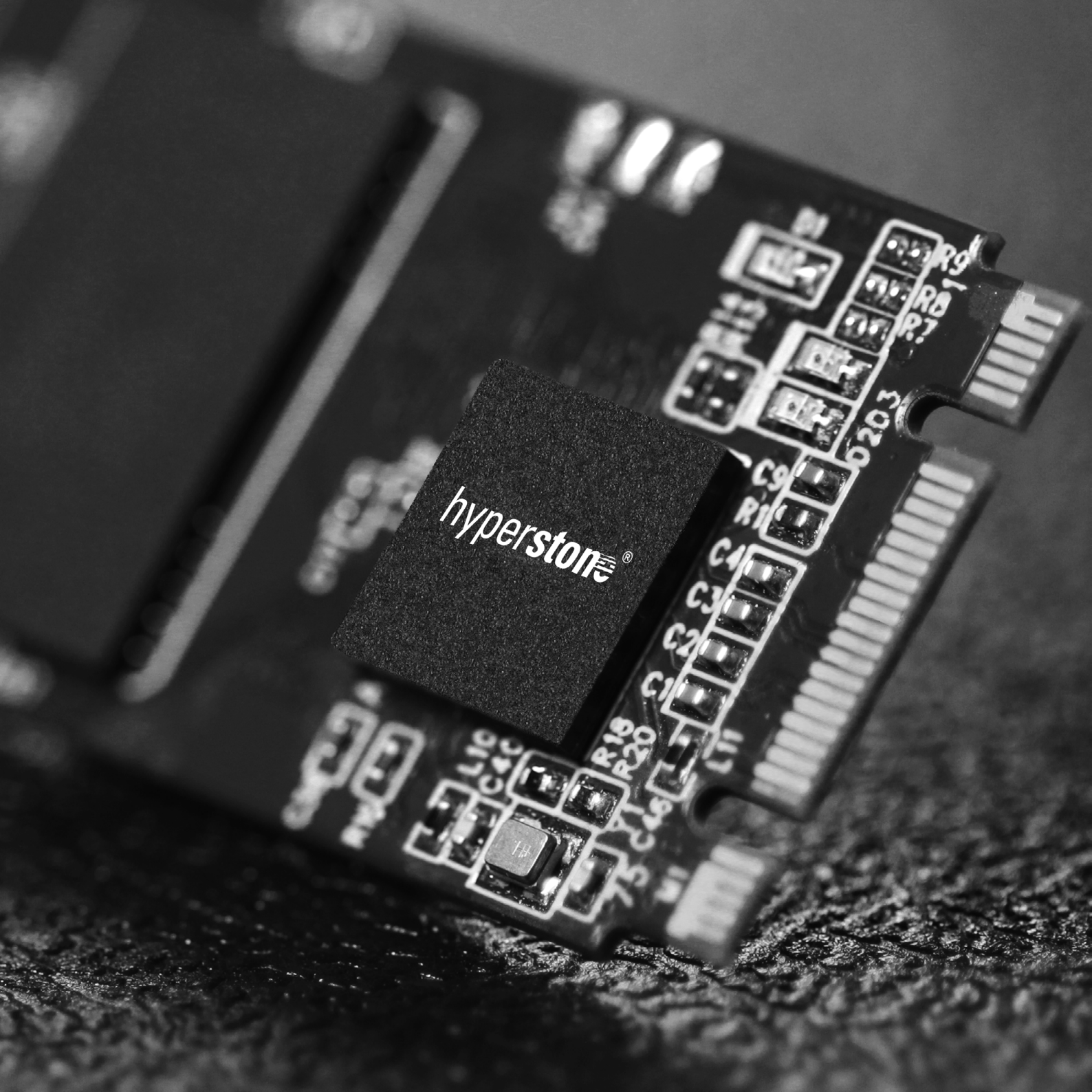


X1 SSD Flash Memory Controller

X1

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The Hyperstone X1 family of SATA SSD NAND flash controllers together with provided firmware, reference designs and tools offers an easy-to-use turnkey solution for industrial, high endurance and robust Solid State Drives, or modules compatible to host systems with SATA interface. The X1 family enables SATA storage systems with the latest flash memory, advanced security and highest reliability.

- Designed to fully satisfy industrial requirements
- Power-efficient SATA SSD controller
- 32-Bit dual-core microprocessor with optimized instruction set and additional hardware accelerators for flash memory handling
- hyMap® customizable sub-page-based Flash Translation Layer (FTL) to enable second to none random write performance, minimal write amplification and consequently the highest endurance without external DRAM
- FlashXE® eXtended Endurance read-channel tuned and optimized for each flash, advanced ECC algorithms and soft-decoding capability, read-retry, RAID and data recovery features to ensure the lowest possible read error rates and maximum endurance
- Continuously updated flash memory support
- hyReliability™ flash management including superior wear leveling, read disturb management, dynamic data refresh and power fail management ensuring the highest reliability and endurance
- Advanced protection against radiation and soft-errors including end-to-end datapath protection, SRAM ECC and low-alpha package
- Advanced security and encryption features
- Custom firmware extensions and feature development through firmware API
- Turnkey solution including firmware, schematics, manufacturing kit, development hardware, test and health monitoring tools
- Outstanding support and long term availability

Targeted Applications

- High reliability & industrial Solid State Drives (SSD)
- Embedded modules including U.2, M.2, MO-297 and MO-300
- CFast cards
- System-in-Package (SiP) embedded flash drives (eSSD)
- Discrete on-board flash drive or disk-on-board (DoB) integration

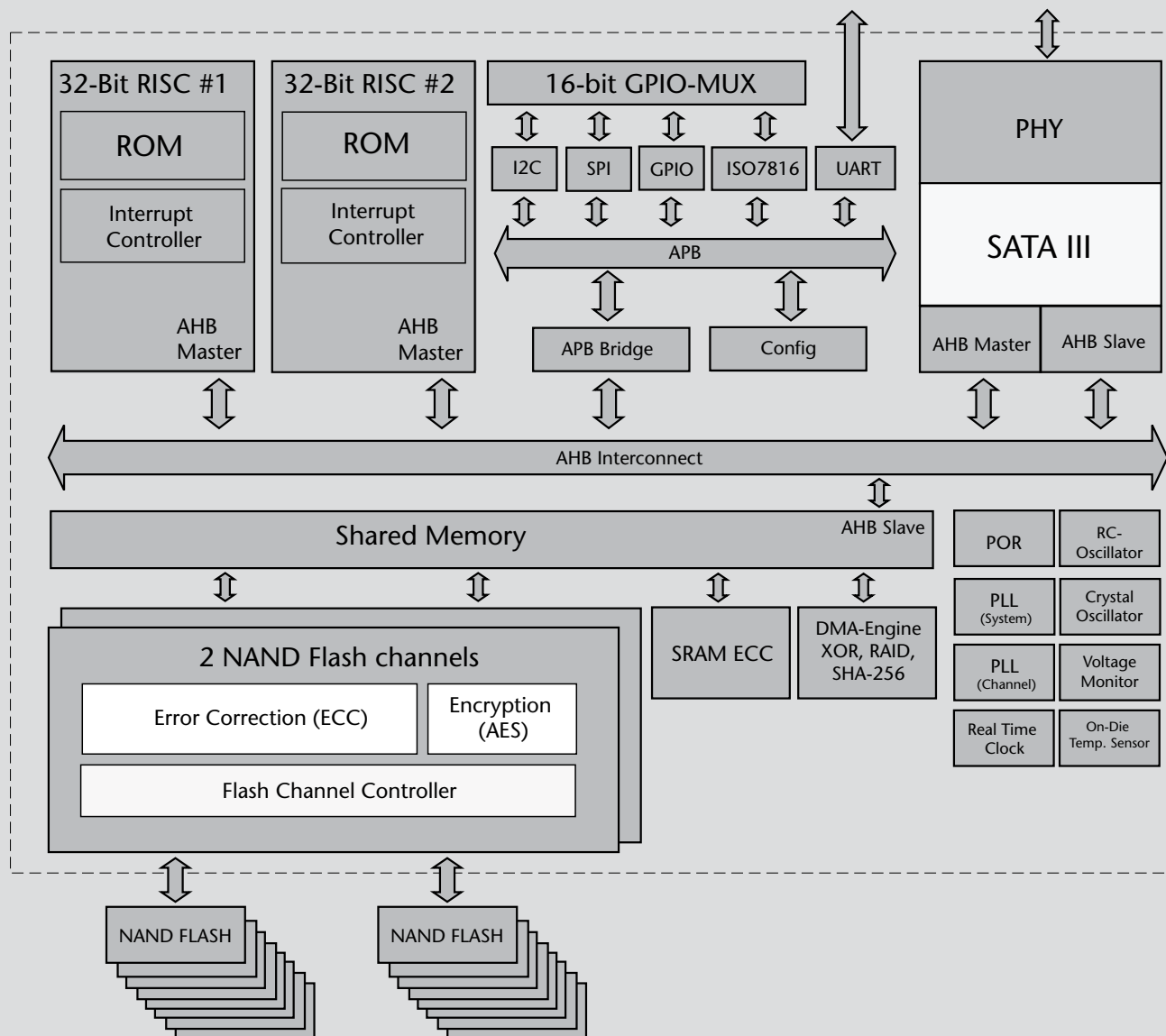
Order Information

- X1-RAB07 --- TFBGA-144, 10.4 x 10.4 x 1.2 mm, 16 CEs, -40 to +85 °C
 - X1-RAB06 --- TFBGA-124, 9.0 x 9.0 x 1.2 mm, 16 CEs, -40 to +85 °C
 - X1-LAB06 --- TFBGA-124, 9.0 x 9.0 x 1.2 mm, 8 CEs, 0 to +70 °C
 - X1-0ABD0 --- Probed Die, 16 CEs, -40 to +85 °C
- Additional package options and temperature ratings such as 105 °C can be made available on request -

Performance

- SATA Gen3 (6.0 Gb/s) transfer speed (backward compatible to 1.5Gb/s and 3Gb/s)
- Sequential read up to 550 MB/s,
- Sequential write up to 500 MB/s
- Random write IOPS: 80,000 fresh-out-of-the-box, 20,000 in steady-state (4K)
- Random read IOPS: 40,000

X1 Block Diagram



Controller & CPU

- High performance dual-core microprocessor based on the Hyperstone architecture
- 16 GPIO pins provide flexibility in the connection of extra logic (via ISO 7816, I2C and SPI)
- On-die temperature sensor and support for an optional external sensor
- Automatic power-down during wait periods for host data or flash memory operation completion, automatic sleep mode during host inactivity and real-time-clock (RTC)
- Supply voltage monitoring for full power-down robustness
- End-to-end (E2E) datapath protection and SRAM ECC for SEU robustness
- Performant AES-128 and AES-256 with CBC and XTS modes, FIPS 197 compliant
- SHA-256 hashing engine and random number generator
- Secure-Boot features and TCG Opal Support
- Low power consumption

Host Interface & Compliance

- Serial ATA 3.3 compliant / CFast 2.0 standard compliant
- ATA-8 standard compatible
- S.M.A.R.T and health monitoring
- -40 to +85 °C industrial grade version
- SATA partial, slumber and device sleep power modes

Flash Memory Interface

- Legacy, Toggle-1/Toggle-2, ONFI NV-DDR and NV-DDR2 modes
- Two independent flash channels, data transfer up to 400 MB/s per channel
- Up to 16 flash memory chip selects for any flash page size and program sequence
- Continuously updated flash memory support for all available technologies including SLC, pSLC, 2D MLC, 3D MLC, pMLC, 3D TLC and next generation NAND flashes

- Flash memory power down logic and write protect control
- Firmware storage in flash, loaded into controller by boot ROM
- FlashXE® eXtended Endurance read-channel optimized for each flash, advanced ECC algorithms using 1KB to 4KB code-words and soft-decoding, read-retry, RAID and data recovery features to ensure the lowest possible read error rates and maximum endurance

Flash Memory Management

- hyReliability™ flash management: superior wear leveling, read disturb management and power fail management to ensure the highest reliability and endurance
- hyMap® customizable sub-page-based Flash Translation Layer (FTL) mapping enables second to none random write performance, minimal write amplification, and consequently the highest endurance for usage profiles with emphasis on random access (e.g. JEDEC Enterprise)
- Flexible pre-format settings for SLC caching, over-provisioning, RAID protection and performance tuning including optimization for fast boot-up times
- Advanced thermal management features to maximize performance and data protection at extended temperatures
- Static, dynamic and global wear-leveling
- Bad block management, intelligent garbage collection and support for interleaving, cache, and multi-plane programming
- Read disturb management and dynamic data refresh
- Best-in-class power-fail management
- Firmware is stored redundantly for recovery and refresh and in-field firmware update without user data loss
- Secure erase, fast erase and secure TRIM
- Custom firmware extensions and feature development through firmware API including advanced security support and smartcard chip enablement
- Customized firmware, optimizations and feature implementations possible upon request



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