

F9 Flash Memory Controller

F9

*hyperston*® 

# F9

## Flash Memory Controller

The Hyperstone F9 family of Flash Memory Controllers together with provided application and Flash specific firmware offers an easy-to-use turnkey platform for industrial, high-endurance CompactFlash cards or memory modules compatible to host systems with CompactFlash™, IDE or PATA interfaces.

- Designed to fully satisfy industrial reliability, endurance, and feature requirements
- **hyReliability™** Flash Management including superior wear leveling, read disturb management, and power fail management ensuring highest reliability and durability
- **hyMap®** Flash Translation Layer (FTL) offering second to none random write performance, minimal write amplification, and consequently highest endurance for random access heavy usage profiles
- Flexible 96-Bit/1K BCH ECC engine supporting all Flash Memory requirements
- Optimized 32-Bit RISC core, extended instruction set for Flash Memory handling
- Continuously updated Flash Memory chip support and long term availability
- High performance on-the-fly AES 128 and 256 encryption engine
- Custom features can be implemented with simple firmware upgrades
- Turnkey solution including firmware, manufacturing kit, test and development hardware, as well as reference schematics
- 16 GPIOs for customer specific applications supporting SPI, I<sup>2</sup>C and ISO7816 or additional flash CE
- Application Programming Interface (API) and Software Development Kit (SDK) to develop own Custom Firmware Extensions (CFE)

### Targeted Applications

- High reliability & industrial Compact Flash™ Cards (CFC)
- IDE Disk-on-Module (DoM)
- Multi-Chip-Package (MCP)
- PCMCIA or ATA PC cards
- Embedded Flash – Disk-on-Board

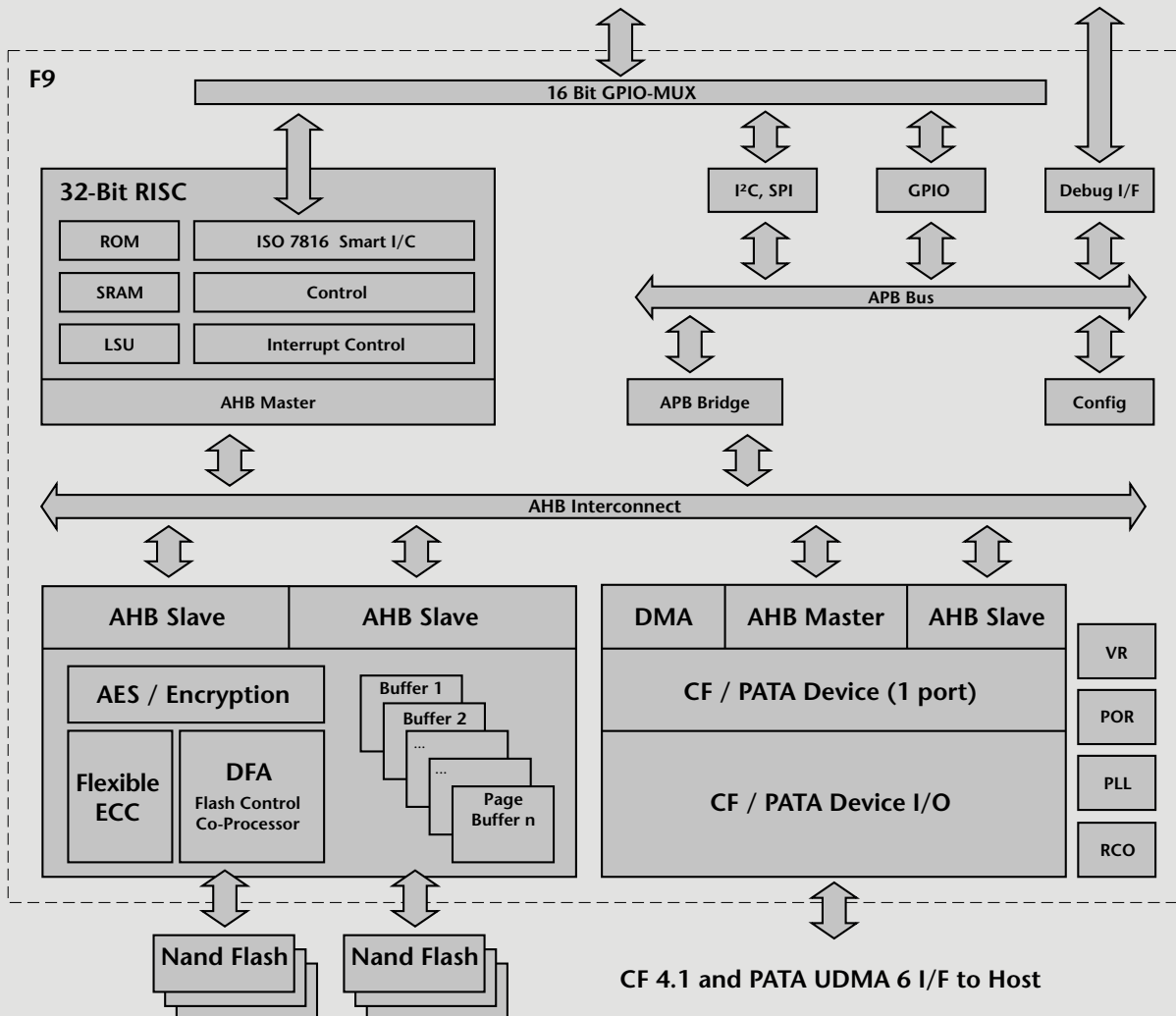
### Order Information

- F9-ILAT06 --- TQFP-128, 14x14x1.0mm, 8 CEs, RoHS, -40 to +85 °C
- F9-RAB07 --- TFBGA-144, 10.4x10.4x1.1mm, 16 CEs, 7816 UART, API, RoHS, -40 to +85 °C
- F9-RAB06 --- TFBGA-124, 9 x 9 x 1.2 mm, 8 CEs, RoHS, -40 to +85 °C
- F9-0ABD0 --- Tested Die / Wafer

### Compliance & Performance

- Fully compliant with CompactFlash™ 4.1, 5.0 and compatible to 6.1 specifications
- Sequential read up to 120 MB/s
- Sequential write up to 120 MB/s
- Secure Erase and Sanitize support
- S.M.A.R.T. and health monitoring
- -40 to +85 °C industrial grade version

## F9 Block Diagram



## Controller & CPU

- High performance 32-Bit Hyperstone RISC microprocessor
- Large internal RAM provides firmware flexibility
- Multiplexed GPIO options include up to 16 and 12 GPIOs - SPI, I<sup>2</sup>C, 8x CE or ISO7816 - for Die and F9-RAB07, respectively
- Interface logic to connect an NTC thermistor as a temperature sensor
- Unique ID for security applications
- AES-128 and AES-256 support with CBC and XTS modes, high performance on-the-fly encryption/decryption
- Hardware RNG
- Flexible clock frequency generation through internal oscillator and PLL
- Automatic power-down mode during wait periods for host data or Flash Memory operation completion, automatic sleep mode during host inactivity periods
- On-chip switching voltage regulator for 1.2V controller core power
- Supply voltage 3.3V ± 5%
- Application Programming Interface (API) and Software Development Kit (SDK)

## Host Interface & Compliance

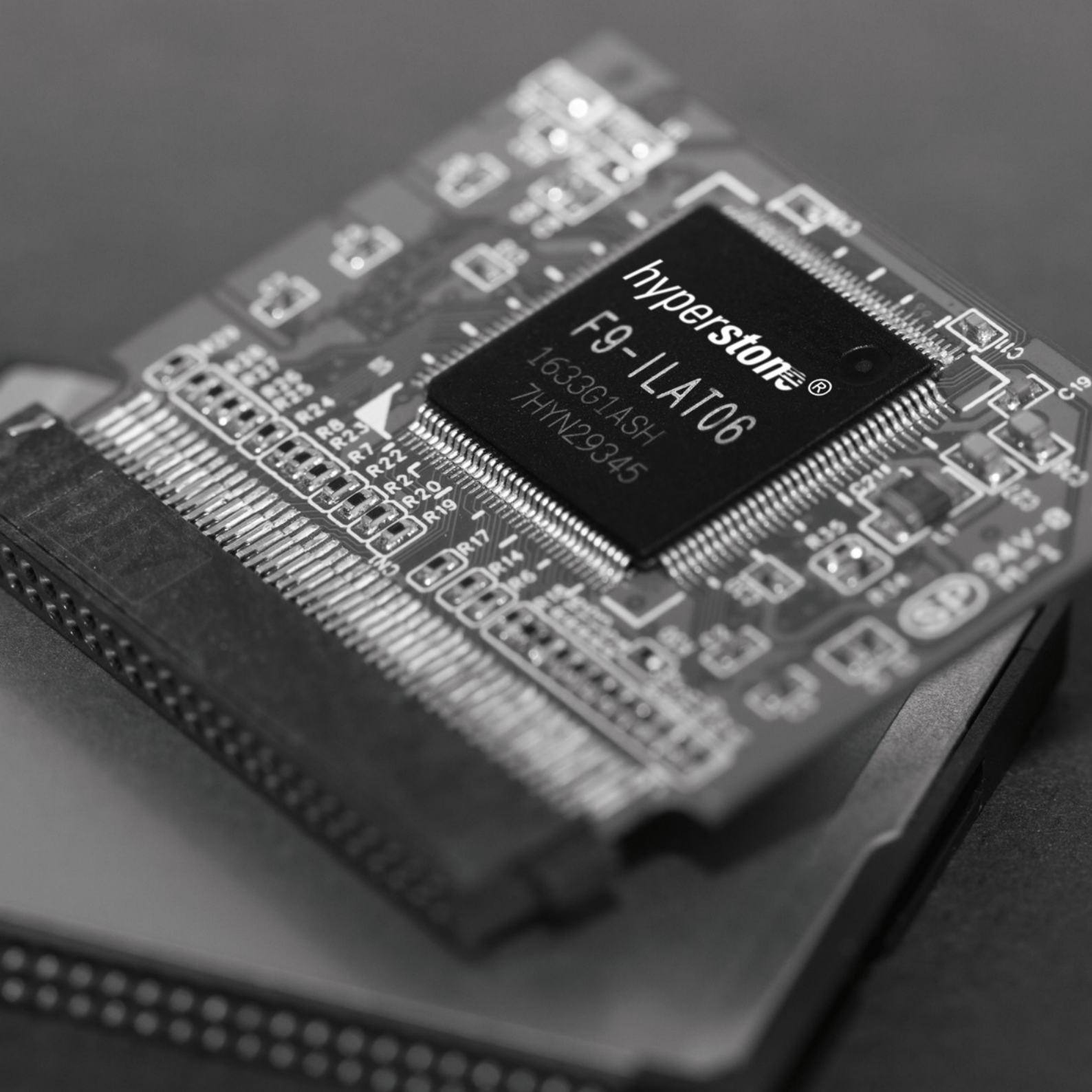
- PC-Card 8.0 (PC-Card ATA), CF 6.1 standard compatible
- ATA-7 standard compatible in True-IDE mode
- Fast ATA host-to-buffer transfer rates supporting PIO mode 6, MDMA mode 4, UDMA mode 6 in True-IDE mode
- 5V tolerant host interface I/O
- Compatible to PCMCIA specification version 2.1
- Automatic sensing of PC-Card or True-IDE host interface mode
- Configurable as removable and fixed drive
- S.M.A.R.T., Sanitize, and Secure Erase support
- Configurable Early-Acknowledge to avoid any data loss during power fail support is possible

## Flash Memory Interface

- Direct Flash Memory Access (DFA) co-processor incl. page buffers and interleaving capability
- DDR interface compliant with Toggle DDR and ONFI 2.3, compatible with all DDR Flash Memory devices
- Asynchronous SDR interface, ONFI 1.0 compliant, compatible with all legacy interface Flashes
- 2-Channels with data transfer rate to Flash up to 200 MB/s each
- Flexible 96-Bit/1K BCH ECC engine supporting all Flashes
- CRC for additional reliability
- Direct connection of up to 8 Flash Memory chip enables (CE) additional 8 CE multiplexed with GPIO
- Flash Memory power down logic and write protect control
- Supporting all Flash technologies including 3D Nand and pSLC modes
- On-chip voltage regulator for 1.8V Flash Memory I/O power

## Flash Memory Management

- hyReliability™ Flash Memory Management optimizing reliability, power fail safety, endurance, data retention, and performance
- hyMap® Flash Translation Layer offering second to none random write performance, minimal write amplification, and consequently highest endurance for random access heavy usage profiles (e.g. JEDEC Enterprise)
- Optimized for fast boot-up times
- Bad Block Management
- Static, Dynamic and Global Wear leveling to maximize system write endurance
- Intelligent garbage collection
- Read Disturb Management and Dynamic Data Refresh to maximize data retention
- Management of sudden power-fails
- Interleaving, cache, and multi-plane programming
- Firmware is stored redundantly for recovery and refresh
- In-Field Firmware update without user data loss
- Secure erase, fast erase and secure TRIM
- Health-Monitoring and S.M.A.R.T. support
- Customized firmware, optimizations and feature implementations possible upon request.



hyperstone®

F9-1LAT06

1633G1ASH  
7HYN29345

R7  
R22  
R20  
R19  
R17  
R14  
R6





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