Accelerating eMMC™ Adoption: From Spec to Silicon

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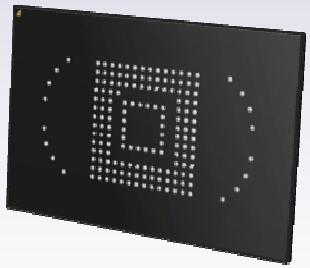
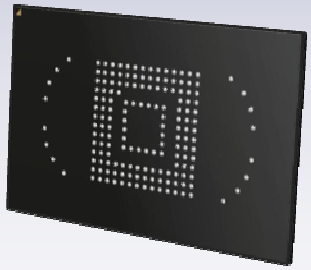
Agenda

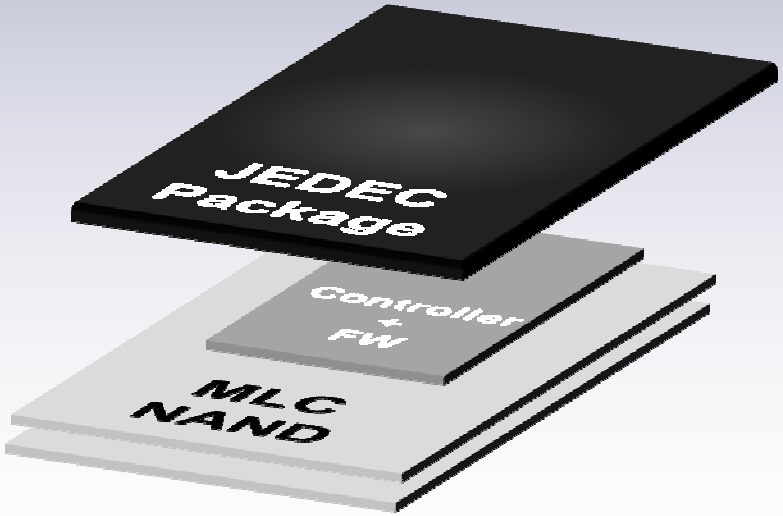
- Market Trends
- eMMC™ Spec. Evolution
- eMMC™ 4.4 Features
- eMMC™ 4.4 System Implementation
- Summary



eMMC™ Managed NAND Devices

- ***eMMC Flash Devices***
- MLC NAND Flash
- Embedded flash controller
- Embedded flash management firmware
- Standard package, interface and drivers





eMMC™ Market Drivers

- ***Managing raw MLC NAND flash becomes extremely complex***
  - MLC flash process and technology advancements
  - Powerful flash management technology required

- ***Raw MLC NAND sourcing***
  - Different vendors, proprietary technologies and form factors
  - Qualification logistics

- ***Design costs and complexities***
  - Redundant storage devices
  - Board “real estate” and complex memory architectures

Mobile Designs with eMMC™

- ***Simpler memory architecture design***
- Standard interface and form factor
- Flash management offloaded from host

- ***Scalable high capacity storage***
- One cross-platform storage architecture for multiple designs
- Currently up to 32GB*

- ***eMMC boot***
- Eliminating the need for separate boot device
- eMMC 4.4 specification standardizes a robust boot solution

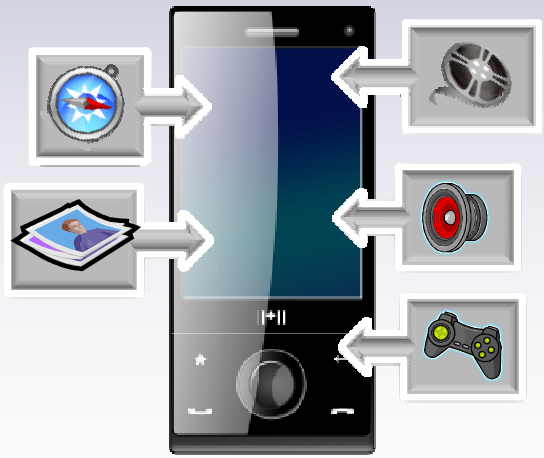
*1 gigabyte (GB) = 1 billion bytes. Some capacity not available for data storage.

eMMC™ Spec. Evolution

Feature	MMC4.2	eMMC4.3	eMMC4.4
Mass Storage	✓	✓	✓
Boot Support	✗	✓	✓
Sleep Mode	✗	✓	✓
Reliable Write	✗	✓	✓
DDR I/F	✗	✗	✓
1.2v I/O	✗	✗	✓
Partitioning	✗	✗	✓
Protection Modes	✗	✗	✓
HW Flash Lock	✗	✗	✓
Secure Erase	✗	✗	✓

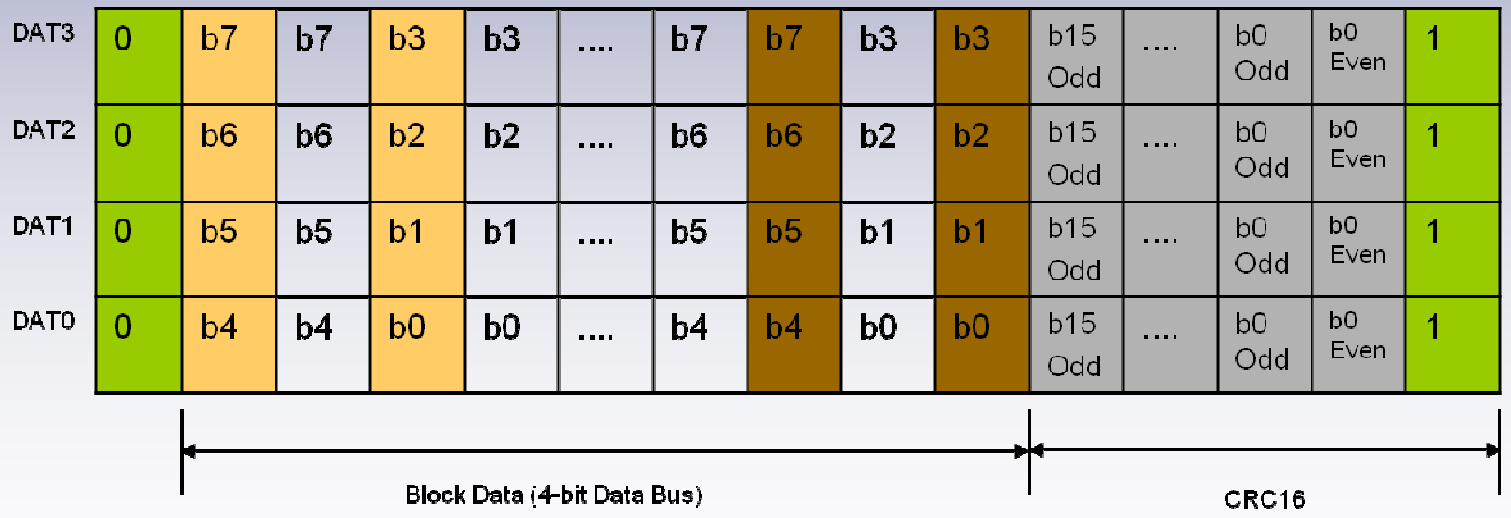
eMMC™ 4.4 at a Glance

- Bandwidth doubled to 104 MBps [DDR]
- Boot partition configuration and mgmt
- Flexible device partition and mgmt
- Flexible performance / endurance setting
- New security features



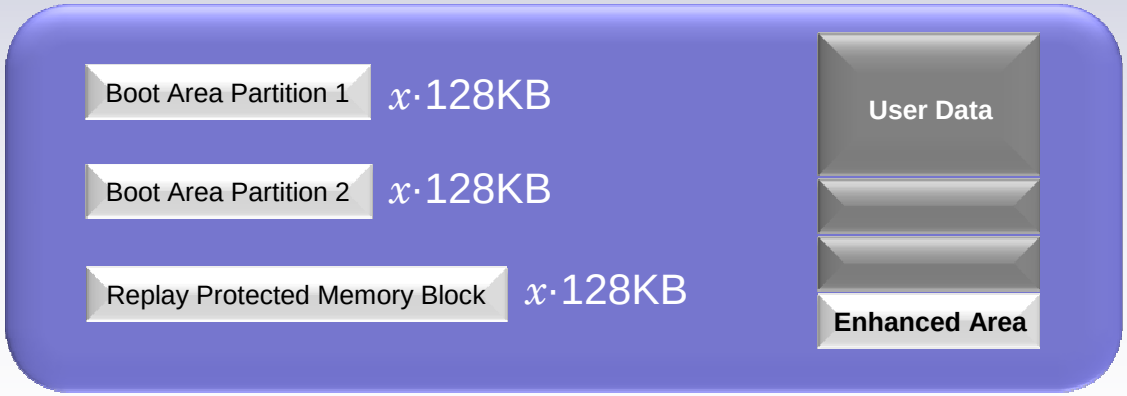
eMMC™ 4.4 Bus

- Bandwidth 104 MBps [DDR], 52MHz
- Data packing in DDR mode over 4 lanes, 8 lanes



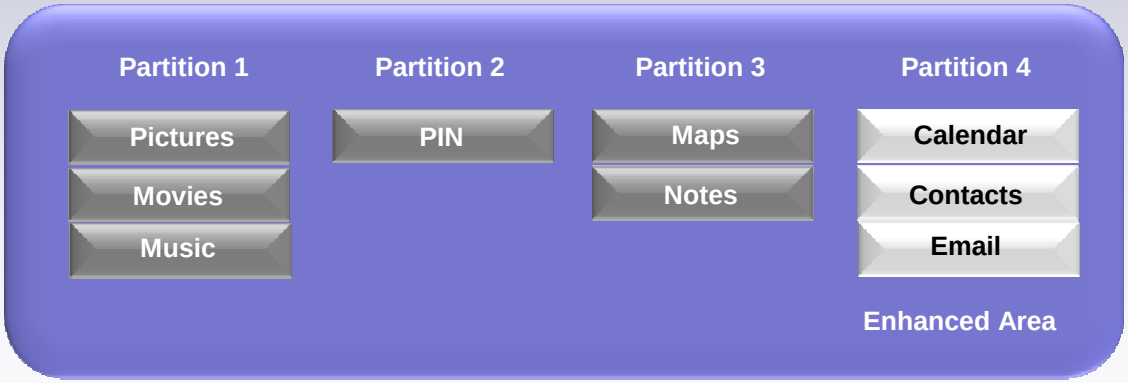
eMMC 4.4 Boot Partition

- Boot partition configuration and management
- Two boot partitions
- Size, Performance/Endurance specified at time of manufacture
- Multiple Boot mechanisms



eMMC™ 4.4 Partition Management

- Flexible device partition and management
- Hosts can partition device into multiple partitions of different sizes
- Specified at time of manufacturing



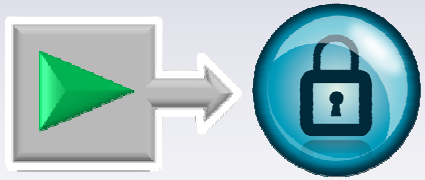
eMMC™ 4.4 Security

- ***Multiple modes of Security***
- ***Write protection***
- Password protection
- Power-on
- Temporary
- Permanent
- ***Security Management***
- Per Device
- Per Block

Scheme	Usage
Password	M-Commerce
Power On	Application-level
Temporary	Transactions
Permanent	Code, IDs
RPMB	Copyright Content

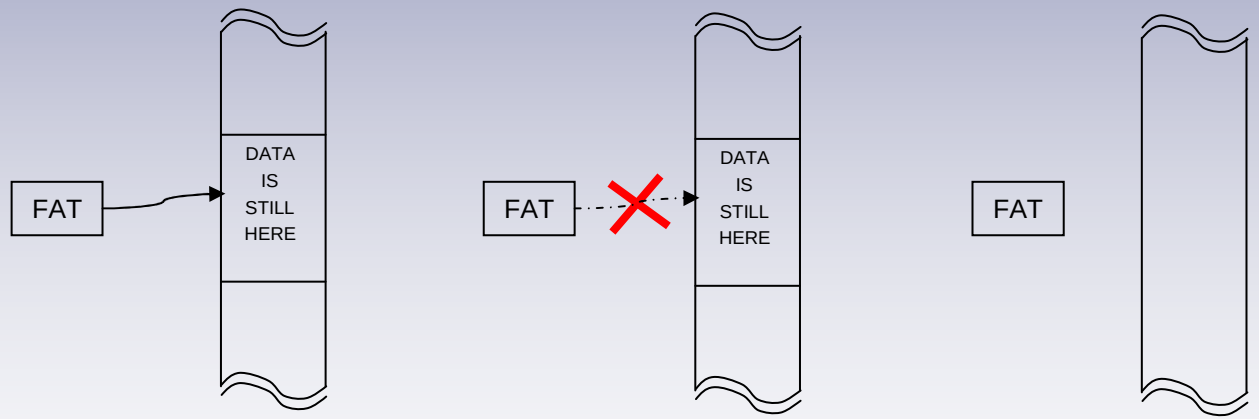
eMMC™ 4.4 Security

- ***Replay Protected Memory Block***
- Secure Secret Key installed at time of manufacture
- Message Authentication Code (MAC) = *ƒ*(Secret Key + Data)
- Access



*e*MMC™ 4.4 Security

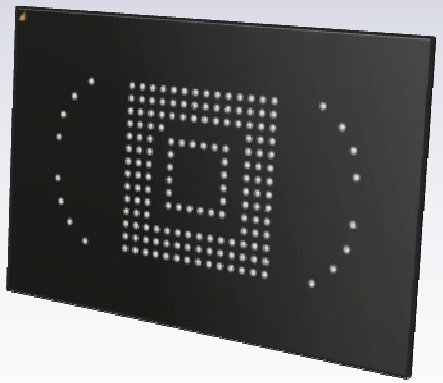
- **Secure Erase** – Delete contents of Erase Group(s) and copies NOW
- **Secure Trim** – Delete contents of Write Block(s) and any copies NOW
- Does not accept any commands until these actions are complete



Original State	Controller to erase data in background	**Secure Erase**: Complete erase before accepting any other command

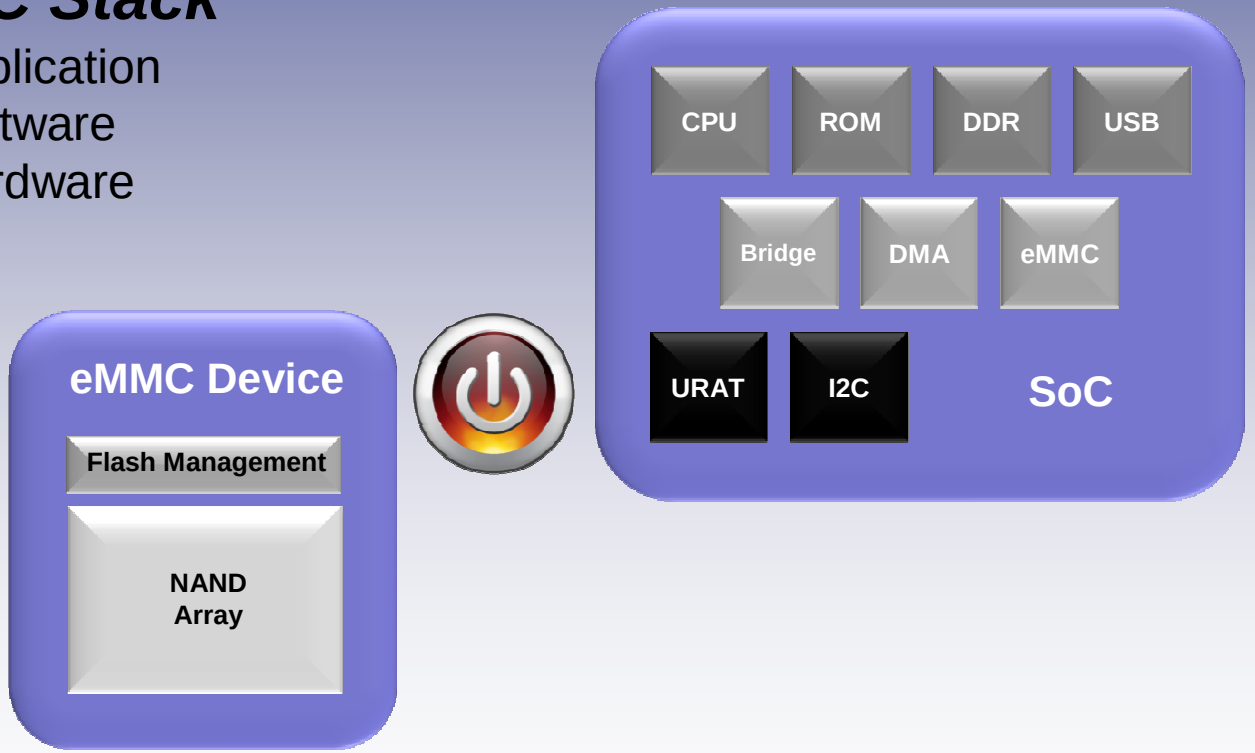
*e*MMC™ 4.4 Implementation

- ***eMMC spec leaves room for***
- Enhanced Area
- Performance/Endurance
- Reliable Write
- Security
- Power Failure Immunity



The eMMC™ Ecosystem

- ***eMMC Stack***
  - Application
  - Software
  - Hardware



Summary

- ***e·MMC provides a system architecture which solves many of today's concerns for embedded flash memory***
- Standard Package and Pin-Out
- Protection and Partitioning
- Faster bus bandwidth
- Standard Boot
- Reliable Write

- ***However e·MMC does not guarantee a reliable and robust system solution***
- Requires host-device inter-operability
- Requires advance flash management technology and system approach
- Requires superior eMMC implementation

Thank You!

SanDisk **Arasan**

Santa Clara, CA USA
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eMMC™ Spec. Evolution

- The motivation for *e*·MMC; more than a specification…an architecture
- Problems solved with *e*·MMC
  - standard package
  - standard pin-out
  - standard boot
  - standard command set
  - higher performance (increase bus bandwidth)
  - versions (4.3 -> 4.4)
- Problems not solved with *e*·MMC
  - Host-Device Interoperability as it relates to Optimal performance
    - System Performance (not all bus related)
  - System Endurance
  - System Reliability