# UNIVERSAL FLASH STORAGE ASSOCIATION

UFS™ FREQUENTLY ASKED QUESTIONS (FAQ)

WHAT IS UFS?

UFS (Universal Flash Storage) is a high performance storage interface designed for use in computing and mobile systems requiring low power consumption such as smart phones and tablets. Its high speed serial interface and optimized SCSI protocol enable significant improvements in throughput and system performance. UFS v2.0 defines bandwidth of up to 1.2 GB/s over two data lanes.
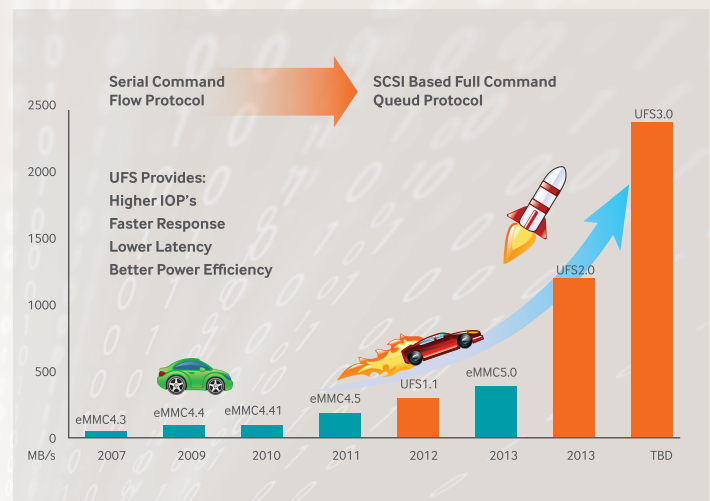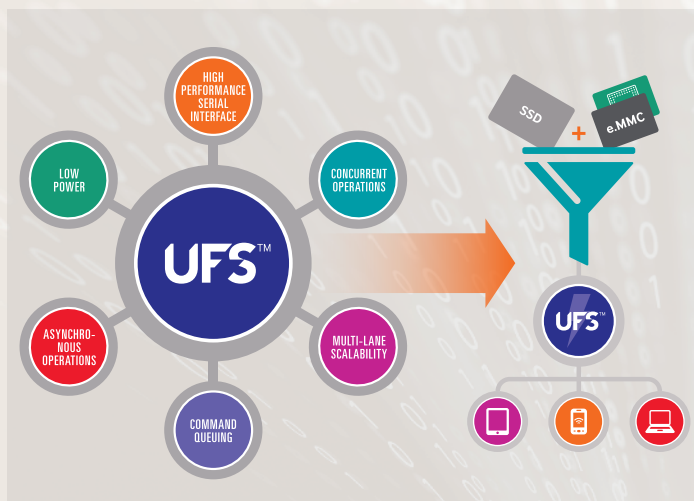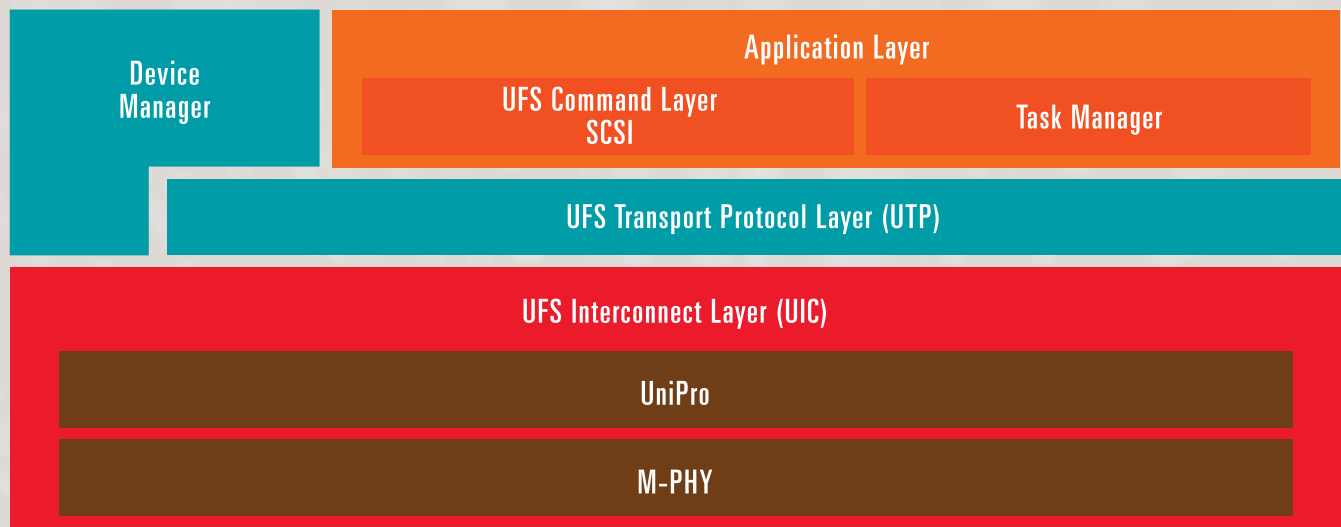

WHO IS BEHIND UFS?

The UFS standard has been developed and published by JEDEC™ Solid State Technology Association (www.jedec.org), the global leader in the development of standards for the microelectronics industry. JEDEC has over 4,000 participants, representing nearly 300 companies, working together in 50 JEDEC committees.

HOW DO MIPI M-PHY AND UNIPRO STANDARDS FIT INTO UFS?

UFS architecture is layered, and makes use of other industry-proven standards. In order to achieve the highest performance and most power efficient data transport, JEDEC UFS aligns with industry—leading specifications from the MIPI® Alliance (www.mipi.org) to form its Interconnect Layer. This collaboration continues with UFS v2.0, which references the M-PHY® Version 3.0 specification and the UniProSM Version 1.6 specification.

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	Application Layer	
Device Manager	UFS Command Layer SCSI	Task Manager

UFS Transport Protocol Layer (UTP)

UFS Interconnect Layer (UIC)

UniPro

M-PHY

WHERE WILL UFS BE USED?

UFS 2.0 will drive next generation mobile devices to new performance levels not available before, making its debut in high-end smartphones and tablets. UFS adoption is expected to migrate to mid-range phones and tablets, as well as other devices in which high-performance performance and low-power storage is desirable. For example, in ultra-portable laptops, UFS devices could improve battery life, while maintaining the same level of high performance, and reducing weight and size.

UFS MARKET PENETRATION FORECAST

Flagship
High-End

Mid-End
Mass

Low-End

- e.MMC
- UFS

2014   2015   2016   2017

Source: UFSA
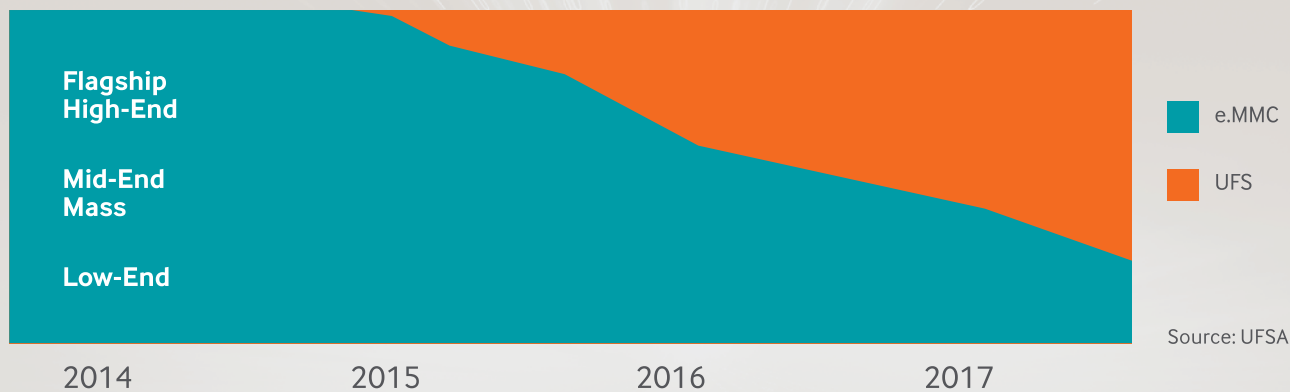
WHAT IS THE HISTORY OF THE UFS STANDARD?

UFS standard version 1.0 was published in February 2011. A minor update, version 1.1 was published in June 2012.
UFS standard version 2.0 was published in September 2013.

WHAT ARE THE UFS FORM FACTORS?

Currently, the UFS standard defines multiple BGA form factors, intended to be soldered to the printed circuit board. The UFS standard includes card electrical signals, however, the card form factors dimensions are not yet defined by JEDEC.
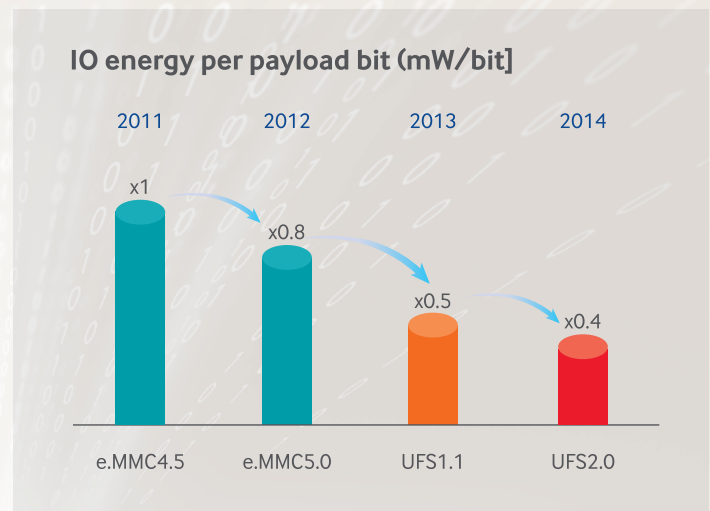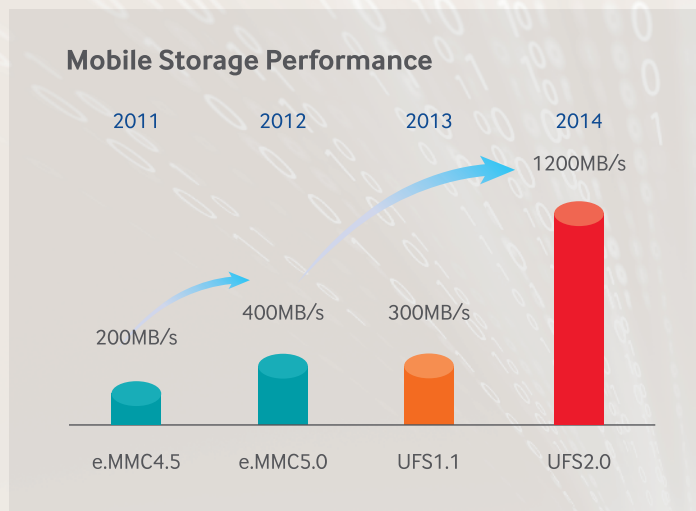
WHAT TECHNOLOGIES ARE COMPETITIVE WITH UFS?

Feature Comparison	e.MMC 5.0	UFS 2.0
Operation	Half Duplex Parallel	Full Duplex Serial w/Multi-Lane Option
Bandwidth	400MB/s	1200MB/s (600MB/s x2 Lane)
Scalability	No. Fixed Bus Configuration	Yes. Multi-Lane Support
Command Queuing	No	Yes
Concurrent Operations	No	Yes
Relative Read/Write Latency*	1	0.5
Random Read/Write IOPs	1x	2~3x*
Variable Interface Power/Performance Gears	No	Yes

* Data derived from measurements of similar test conditions & NAND configurations with different controllers
  (values may vary with actual specific product)

Source: Samsung

Mobile Storage Performance

2011	2012	2013	2014
200MB/s	400MB/s	300MB/s	1200MB/s
e.MMC4.5	e.MMC5.0	UFS1.1	UFS2.0

IO energy per payload bit (mW/bit]

2011	2012	2013	2014
x1	x0.8	x0.5	x0.4
e.MMC4.5	e.MMC5.0	UFS1.1	UFS2.0

WHAT IS THE UFS ASSOCIATION (UFSA)?

The Universal Flash Storage Association (www.ufsa.org) was founded in 2010 as a California Nonprofit Mutual Benefit Corporation for:

- Logo, compliance and certification management
- UFS technology promotion
- UFS infrastructure enablement
- Technical input into JEDEC for future standards

The corporation and its members are committed to foster open competition in the development of products and services based upon Open Industry Standards.

UFS CERTIFICATION/COMPLIANCE

WHAT IS THE UFSA COMPLIANCE CERTIFICATION PROGRAM?

The UFSA Compliance Certification Program assures that any product licensed to use the UFS logo is compliant with the UFS Specification and will work properly with other compliant UFS products. Compliance certification by independent 3rd party "Authorized Test Centers" (ATCs) are required to assure the evaluation is unbiased, accurate and repeatable.

WHY IS UFS CERTIFICATION AND COMPLIANCE NECESSARY?

UFS signals run at GHz frequencies (more than 15x the maximum speed of e.MMC) and utilizes a complex protocol to support the multi-threaded environment that the latest mobile platforms require. Certification testing assures that the high speed electrical requirements and the complex functionality of UFS do not impact interoperability. Compliance testing compares the actual behavior of a product with what the UFS Specification requires. If a product passes all the Compliance tests then a Certificate of Compliance can be issued by the ATC. This is required in order to apply for a UFS Logo License.

WHERE CAN I GET MY PRODUCT TESTED FOR UFS COMPLIANCE?

Any UFSA Authorized Test Center (ATC) can perform the UFS Compliance tests. UFSA ATC's will be identified on the website: **www.ufsa.org**

WHAT TESTS ARE USED TO EVALUATE UFS COMPLIANCE?

The UFSA Compliance Committee selects a key subset of the JEDEC(RM) and MIPI defined tests for inclusion in the UFSA Compliance Test Specification so that compliance with the UFS Specification can be evaluated reliably in a reasonable amount of time and minimum cost. A Certificate of Compliance cannot be issued unless all of the required Compliance tests pass.

WILL ANYONE ELSE SEE THE RESULTS OF THE COMPLIANCE TESTING OF MY PRODUCT?

Only the company presenting their product for testing and the operators of the test equipment themselves (ATC) will receive the test results. UFSA will be notified by the ATC if a product has passed testing. If any issues are uncovered in the test procedures, e.g. a false negative, then those issues will be disclosed to the Compliance Committee so that they can be corrected. No information that would identify the product being tested or the company would be disclosed. If a logo license has been requested to UFSA, it is up to the presenting company to allow public advertisement on the UFSA website.

WHAT HAPPENS AFTER MY PRODUCT PASSES ITS COMPLIANCE TESTS?

Once a test report is issued by the ATC and the UFSA is notified that a product has passed testing, then a UFSA member may apply to the UFSA for a certificate and UFS logo license. The UFSA does not impose any licensing fees for use of the UFS Logo.

WHAT IS THE COST OF COMPLIANCE TESTING?

Each ATC is free to structure compliance test services that it feels best serve its customers. This can include a compliance test or characterization test. Problem diagnosis and troubleshooting services may be provided. The cost of such services is determined by each ATC.

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