Qi Wang, Field Application Engineer
Synopsys

Power, Performance and Security
Advantages of UFS Leveraging
MIPI Specifications
Agenda

• Unique requirements of Mobile SoCs
  – Power, Performance and Security
• eMMC and UFS IP Solutions for Mobile SoCs
• Verification and Validation before silicon
• Summary
Unique Requirements of Mobile SoCs

- Power
- Performance
- Security

Synopsys
Emergence of Embedded Storage Solutions – UFS & eMMC

UFS for high-end and eMMC for mainstream

Source: Micron
Performance Evolution

Synopsys

Source: Micron
UFS Supports Major Power Saving Techniques

- MIPI M-PHY® specification is built for “bursty” transmission
- Fast exit & entry to Low-power mode allows significant power reduction over time
- “hurry up and shut down”
- UFS Power Mode State Machine
- M-PHY low-power state
  - HIBERN8
  - STALL (in HS)
  - SLEEP (in LS)
- MIPI UniPro℠ low power state
  - HIBERN8
  - SLEEP

Synopsys
UFS Supports Reference Clock Gating for More Power Savings

Example of a UFS host and device interconnect

Link state transitions and presence of reference clocks

Synopsys
UFS Supports Reference Clock Gating for More Power Savings

- New attribute to enable wide adoption of this low power feature
Other Low-Power Techniques

• Intelligent clock partitioning
  – Allows SoC designers to determine power profile

• Clock gating/context sensitive clock gating
  – Reduce dynamic power
  – Context-based gating of individual modules in the design

Synopsys

eMMC example -> up to 75% power reduction
Other Low-Power Techniques

• Multi-rail / power gating
  – Reduces leakage power
  – Only a portion of the entire UFS controller hierarchy will be on ‘always-on’ power domain; rest can be switched off
  – Deep power saving in HIBERN8 power state
Security Features

Encryption Capabilities That Meet Mobile/Android Needs

• Android supports full-disk encryption
  – The encryption algorithms are AES-CBC or ESSIV-AES-CBC

• Android supports file-based encryption
  – The encryption algorithms are AES-XTS or AES-CBC-CTS

Synopsys
Security Features

Encryption Capabilities That Meet Mobile/Android Needs

- UFS (and soon eMMC) supports AES-XTS, AES-CBC-CTS, AES-CBC, ESSIV-AES-CBC and AES-ECB
Addressing Design Challenges by Integrating High-Quality IP

eMMC & UFS Solutions

UFS v2.1 Complete Solution

- UFS Software Drivers
  - Linux, OS-less
- UFS Host
  - Fully Verified
- UniPro
  - Fully Verified, Flexible
- Silicon-Proven M-PHY

- UFSA compliance
- MIPI UniPro/M-PHY
- Interoperability
- Golden Host reference used by many vendors

SD6.0/eMMC5.1 Host Complete Solution

DesignWare SD/eMMC Host Controller

- AHB
- AXI
- AMBA

SD/eMMC HARD PHY

© 2017 MIPI Alliance, Inc.
Verification & Validation Before Silicon

Verifying UFS with VIP

FPGA-based Prototype for HW validation & early SW development
MIPI M-PHY v4.1 Proven in Silicon
Summary

• Available high-quality IP, verification IP and hardware validation solutions
• eMMC: mainstream mobile storage applications balancing performance & cost
• UFS: next-generation smart & powerful high-end devices for mobile & beyond
Synopsys® DesignWare® Mobile Storage IP Portfolio