What is Memory MCP?

Multi Chip Package with different kinds of memory integrated together as one chip. Normally consisted of:

**LPDRAM with Non-volatile Flash chips, with eMMC or UFS chips**
Who Makes MCP?

- Memory chip integrators
- Original memory chip vendors
- Packaging house

for: handsets, tablet computer, e-reader, camera, games......
MCP Are Semi-custom

• Although JEDEC publish MCP pinout diagrams, electrical feature and function varies.
• Combination option also varies.
Similar Pinout, yet Different

LPDDR2/ Flash combo have different pinout from each vendor
MCP are Difficult to Test

- Hi frequency and high performance testing involves in signal integrity issues.
- Cross talk error between different memories.
- Combination of different memory creates confusion in testing and multiple skill sets.
What Kind of Test Wanted?

- Flexible for all derivatives.
- Test DRAM, Raw Nand, Managed Nand simultaneously.
- Does firmware pre-load for operating system.
- Provide ISP functions for main program.
- Verify assembly, cross talk.
- Automatic handler compatible.
How Are They Testing Now?

- Mostly by ATE type memory tester.
- Cost too much.
- Not flexible to change.
- Occupy too much space.
New Way of Testing MCP

• Chips are originally good.
• Only need to detect assembly faults.
• Functional test is sufficient.

*FPGA base tester with smart software would satisfy the requirement.*
New Tester Architecture
Hardware Platform with 3 Boards

- Base board - CPU system controller.
- FPGA board – high speed waveform generator.
- DUT board – DUT socket hosting.
System Block Diagram
Packaged Tester

Horizontal Option

Vertical Option
Gang together for handler
DRAM Testing

• Waveform generated by FPGA.
• Read back latched and compared at real time.
• Use different DRAM patterns for hard and soft failure detection.
• Add/Cont/Data bus for LPDDR1.
• Command bus for LPDDR2 and 3.
Non Volatile Testing

- Waveform generated by FPGA.
- Command bus structure.
- Separated voltage supply.
- Configured for legacy flash, toggle flash, and ONFI DDR flash.
eMMC Testing

Built-in eMMC host that does:
2. Auto detect and switch data rate.
3. Access to user area partitions for bootable and other programming.
4. FAT table or NTFS formatting.
UFS Testing

- Similar to eMMC.
- High speed Serde ready FPGA to accommodate serial interface for future UFS applications.
Expandable

- Horizontal option – multiple units can be ganged through Ethernet connection.

- Vertical version can be multiplied through stacking to fit available automatic handler.
Multiple Unit Operations

PC Host

- Download Test Script to all Test Units
- Send Start Test Command to all Test Units
- Monitor Status and Test Result from all Test Units
- Display Test Result and Message for each Test Unit

Test Units

- Run Test Script
- Send Test information to Host
- Test Complete?
  - No
  - Yes
    - Send Test Complete to Host and go to Idle State
Test Socket Options

semi-custom to custom. High precision sockets required.

Open frame MCP socket

Clam shell MCP socket
Tester Common Usage

- MCP assembly test.
- Component incoming QC.
- Manufacturing repair and RMA repair.
- Firmware pre-load.
- Die stack memory test.
Any Question?
Thanks You!