MIPI Testing Challenges & Test Strategies using Best-in-Class Tools

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Tektronix Inc.

Member-to-Member Presentations
March 9, 2011
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Agenda

• MIPI Testing Challenges
• MIPI Test Strategies
• Best-In-Class Test Tools
• Q &A
MIPI Technologies Overview (Protocol Stacks)

Key Physical-layer standards:
D-PHY, M-PHY, SlimBus, DigRF 3G

Key Protocol-layer standards:
CSI-2, DSI-1, DigRF 3G, DigRF 4G

source: www.mipi.org
**D-PHY/ M-PHY Testing Challenges**

No two MIPI devices are the same
- Variable Data Rates
- Variable lanes of Data traffic,
- Multiple different data formats
- Specification enables custom limits.

Higher data rates demand Signal Integrity
- Emphasis on Timing, Jitter and noise at Transmitter,
- Stress-testing & BER at Receiver.

<table>
<thead>
<tr>
<th>D-PHY</th>
<th>M-PHY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signaling Mode</td>
<td>Speed</td>
</tr>
<tr>
<td>LP</td>
<td>Upto 10Mbps</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>HS</td>
<td>80Mbps to Gbps</td>
</tr>
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</table>

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CSI/ DSI/ DigRF Testing Challenges

- Camera/ Display/ DriverIC/ BBIC
  - Stimulus missing components
  - Analyze with video/ data traffics.
- Integrated Board:
  - Correlated Analysis end-to-end

- RFIC/ BBIC
  - Stimulus with Ideal & non-Ideal
  - Analyze: RF Spectrum & Modulation, DigRF Protocol, DSP and uP of BBIC
- Integrated Board:
  - Correlated Analysis from DSP to DigRF to RF
MIPI Overall Testing Challenges

- Logo testing is not required for MIPI
  - MIPI is Chip-to-Chip/Chip-to-Peripheral interface, similar to a DDR bus.
  - Mobile Phones do not need compliance logo, unlike USB/SATA devices
- Characterization is significantly important for MIPI
  - Mobile OEMs select the suppliers based on characterization reports.

Conclusion:
MIPI Physical and Protocol Test Equipments, Setups and Software need to be “Very Flexible”
Physical Layer Test Strategies
D-PHY/ M-PHY/ DigRFv3

If you are looking for,

• **Debug, Analysis or Characterization:**
  • Fully-Flexible setup needed
  • Customizable tool set needed
  • Environment/ Temperature testing needed

• **Conformance Test, or Simple-Verification:**
  • Fully-Automated setup needed
  • 100% Test Coverage needed
  • Minimal hardware configuration needed
  • Multi-lane Automated setup needed
  • Latest specification test tools needed
Protocol Layer Test Strategies
CSI/ DSI/ DigRF

If you are looking for,

• Protocol Stimulus:
  • Customizable tool set needed - Scripting/ Remote control/ Pushbutton
  • Looping “Video” generation is needed

• Protocol Validation and Debug
  • Hardware that triggers on glitches is needed
  • Decoding DCS and LP commands needed
  • Different RGB Export Options needed
  • Tool to validate “Data traffic sharing” across 4 lanes needed
MIPI Overall Test Strategies

If you are working on or planning,

• One MIPI standard:
  • Test Coverage is important
  • Latest specification test tools needed
  • Minimal hardware configuration needed

• Two or more MIPI standards
  • Comprehensive tools, incl. Electrical, Protocol & RF, needed
  • Highly-Optimized, yet Future-Proof, hardware needed
  • Protocol Decode needed

• MIPI along with non-MIPI standards like USB/ HDMI
  • Re-Usable, across standards
  • Ease-of-Use, across standards
  • Scalable, for future standards
Tektronix Best-in-Class D-PHY Tx
Supported on 2.5GHz scope onwards

- Debug, Analysis & Characterization = “D-PHY Essentials”
  - Fully-Flexible
  - Based on the state-of-the-art DPOJET jitter & timing analysis

- Conformance or Simple-Verification = “D-PHYTX”
  - Fully-Automated
  - Latest CTS & Base Spec v1.0
  - 81% to 100% Test Coverage
  - Fully-Automated Temperature testing
Tektronix Best-in-Class M-PHY Tx
Supported on 6GHz scope onwards

• Debug, Analysis & Characterization = “M-PHY Essentials”
  • Fully-Flexible
  • Based on the state-of-the-art DPOJET jitter & timing analysis
  • Power Spectral Density are

• Industry 1st tools
  • Tektronix announced M-PHY Measurements & Decode tools, in September 2010.

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Press Release

Tektronix Introduces Industry’s First Test Tools for MIPI M-PHY Debug and Validation
Monday September 27, 9:00 am ET

Support for New High-Speed M-PHY Specification includes DPOJET toolset, and M-PHY DigRFv4 Decode for Tektronix Oscilloscopes

BEAVERTON, OR--(Marketwire - 09/27/10) - Tektronix, Inc., the world’s leading manufacturer of oscilloscopes, today introduced the industry’s first testing tools for the MIPI Alliance M-PHY standard, allowing customers to immediately get started with performance verification and debug for this important new specification using Tektronix DPO7000/DSA70000 Series oscilloscopes.

The announcement was made in conjunction with the MIPI Alliance All-Members meeting taking place this week in Athens, Greece. The M-PHY specification is an essential part of the MIPI Alliance’s vision for more efficient high-speed interfaces on mobile devices. Compared to the current D-PHY specification, M-PHY supports faster chip-to-chip...
Tektronix Best-in-Class M-PHY Rx Supported on AWG7122B onwards

- Debug & Characterization = “Jitter Tolerance MOI”
  - Pulse-Width Modulation (PWM) signaling is **Uniquely** supported by AWGs for all gears
  - Single-AWG unit re-usable to both M-PHY & USB3.

- Debug & Characterization = "Bit-Error-Rate Detector"
  - Scope-Integrated Error-Detector available now
  - 8B/10B data with Hardware Serial trigger: 1.25 Gb/s to 6.25 Gb/s
Tektronix D-PHY Rx, &M-PHY Decode Supported on AWG7082 onwards

- Conformance or Simple-Verification of D-PHY Rx
  - 100% Coverage to Rx CTS
  - Quick and Easy setup using PG & AWG
  - Re-usable for Protocol tests too
    - PG3A is the Only 4 channel solution for CSI & DSI testing

- Protocol Decode = “MPHYVIEW”
  - M-PHY DlgRFv4 Automated Decode on Scopes available.
  - 4 Lanes Decode at a time
  - Filter and Search Capabilities
  - On-line & Offline Analysis

PGRemote Software

AWG7082C

PG3A

P331 Probe

D-PHY Coupler

DUT
Tektronix Best-in-Class CSI & DSI
Supported on TLA7K with PG3A

- Protocol Stimulus = “PGRemote”
  - Automated Software for Stimulus/Signal Generation
  - Only 4-lane, 1.5Gbps per lane stimulus solution
  - Continuous stream of video/picture data embedded along with commands in real-time
  - Protocol Customization support

- Protocol Validation & Debug = “CSI & DSI TLA Software”
  - Only 4-lane, 1.5Gbps per lane protocol solution
  - Supports both Video and Picture data
  - LP Command & Data Decode
Tektronix Best-in-Class DigRF Complete Solution from Baseband to RF

- Protocol Stimulus
  - AWG for Signal Generation
- Protocol Validation & Debug
  - RTSA RF&Modulation Analysis
  - TLA7K: DigRF/ Digital Analysis
- Debug, Analysis or Characterization
  - DPO7K/70K for Signal Integrity
- No other external hardware
- Fully-Flexible for,
  - Standard/ Propriety DigRF
  - DigRF SW is Customizable
Tektronix Best-in-Class HSI & SLIMbus Serial to Parallel Adapters for TLAs

- Protocol Validation & Debug = “HSI2TLA Adapter”
  - The Parallel data output allows the user to more easily setup a trigger and interpret the data.

- Protocol Validation & Debug = “SLIMBus2TLA Adapter”
  - Serial to Parallel data output
Tektronix is a Contributor Member of the MIPI Alliance
Tektronix is 1\textsuperscript{st} to Market for M-PHY testing, from Sept, 2010

### Tektronix MIPI Tools

<table>
<thead>
<tr>
<th>Standard</th>
<th>Physical Layer Transmitter</th>
<th>Physical Layer Receiver</th>
<th>Protocol Analysis &amp; Decode</th>
<th>Stimulus</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-PHY, DSI, CSI-2</td>
<td>1x DP07354 or DP070404B Oscilloscope</td>
<td>1x PG3ACAB PatternGenerator</td>
<td>1x TLA7012 or TLA7016 TLA</td>
<td>1x PG3ACAB or PG3AMOD</td>
</tr>
<tr>
<td></td>
<td>4x P7240, TAPxx, P6245 or P6249 probes, OR</td>
<td>1x P331 D-PHY Probe for PG</td>
<td>1x LA Module TLA78Bx</td>
<td>1x P331 D-PHY Probe for PG</td>
</tr>
<tr>
<td></td>
<td>3x P73xx with 020-3035-00 or TDP3500</td>
<td>1x PGremote SW</td>
<td>1x P6980 LA Probe</td>
<td>1x PGremote SW</td>
</tr>
<tr>
<td></td>
<td>1x TEKEXP Opt. D-PHYTX, or DPOJET Opt.D-PHY</td>
<td>1x AWG71082C or above</td>
<td>1x D-PHY to P6980 Adapter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No Fixtures required for Live-Setups</td>
<td>1x D-PHY Coupler</td>
<td>1x CSI or DSI SW for TLA (Free)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UNH Fixtures for Non-Live setups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-PHY, DigRFv4, DSI-2, CSI-3</td>
<td>1x DP070804 for GEAR1, 1x DP070804 for others</td>
<td>1x AWG71223 with option#6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1x P73xx, P73xx SMA, or P75xx Probes per Lane</td>
<td>1x SerialXpress SW</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1x Opt.M-PHY for Tx Debug, Analysis &amp;Validation</td>
<td>1x <strong>Early-Market AWG files Kit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1x Opt. M-PHYVIEW DigRFv4 Decode SW</td>
<td>for PRBS, PWM &amp; other patterns</td>
<td></td>
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</tr>
</tbody>
</table>

### Tektronix MIPI Solutions Portfolio

www.Tektronix.com/applications/computing/serial/recommended_equipment.html#mipi

**Notes:**
- Opt.M-PHYVIEW: M-PHY DigRFv4 Decode Solution

**Physical Layer Analysis**: D-PHY M-PHY

**Signal Generation**: D-PHY M-PHY

**Protocol & Digital Analysis**: CSI, DSI, Display, UNH, SLHbus
Additional References

www.Tek.com/MIPI

• D-PHY Datasheet
• D-PHY/ CSI/ DSI Application Note
• DigRF Application Note
• MIPI Fact Sheet
• M-PHY Essentials MOI
• D-PHY Essentials MOI
• MPHYVIEW DigRFv4 Decode Datasheet & Manual
• MIPI Alliance Video on Tek Solutions
Q &A
THANK YOU