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Agenda

- MIPI Overview
- MIPI Touch Architecture
- Q & A
About MIPI Alliance

We are a global, collaborative organization comprised of over 280 member companies spanning the mobile and mobile-influenced ecosystems.

MIPI Alliance is leading innovation in mobile interface technology.
MIPI Alliance Member Ecosystem
Active Technical Working Groups

- Camera
- Debug
- Display
- Low Latency Interface
- Low Speed Multipoint Link
- PHY (C/D/M)
- Reduced Input Output
- RF Front End
- Sensor / I3C<sup>SM</sup>
- Software
- Test
- UniPro<sup>SM</sup>
MIPI Touch: Getting in Touch with Your Phone

MIPI Display Working Group
Presented by Dale Stolitzka, Samsung Display Co. & Display WG Chair

10 November 2016

Originally presented by David Johnson, Qualcomm Technologies, Inc.
MIPI Developers Conference, 14-15 September 2016
New

Announcing a MIPI Touch Interface architecture
Leveraging MIPI Specifications

Motivation for MIPI Touch
Current industry touch status

- Non-standard software or commands
- Multiple interfaces use a non-standard protocol
  - SPI
  - I²C-bus
- Not optimized
  - low-power mobile performance
  - low-cost pin-count interfaces
- Require more touch bandwidth
Standardizing touch

1. MIPI identified multiple usages for standard touch and stylus

2. Build MIPI Touch from within the MIPI ecosystem
Multi-touch
Requirements
Requirements

- Usages: Phones, tablets, automotive, appliances
- < 50 cm trace length
- FCC compliancy
- Improve time to market
- OS-agnostic approach
- Standard software
- PHY-agnostic approach
- Plus...

1. All members *Call for Proposals* (2016)
MIPI Touch bandwidth

- Lowest power
- Transports sufficient data
- Effective latency
- Low protocol burden

<table>
<thead>
<tr>
<th>Bus speed</th>
<th>Higher speed technologies</th>
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<tbody>
<tr>
<td>&gt; 40 Mb/s</td>
<td>MIPI I3C</td>
</tr>
<tr>
<td>&lt; 40 Mb/s</td>
<td>I3C</td>
</tr>
<tr>
<td>&lt; 10 Mb/s</td>
<td>I^2C-bus</td>
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<tr>
<td>&lt; 1 Mb/s</td>
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</table>
Power vs. bit rate requirement

![Bar chart showing power consumption for 1 Mb/s and 10 Mb/s bit rates. At 1 Mb/s, the power is 5uW (Standby 5uW, Active 1 nJ/bit). At 10 Mb/s, the power is also 5uW (Standby 5uW, Active 0.01 nJ/bit).]
System topology
MIPI Touch / topology

MIPI Touch software

MIPI Touch interface

OS

Apps

Instructions

Touch data'

AP

Commands

Touch data

TC/AFE
Topology inside the module

- Point-to-point or
- Multi-drop
Solution architecture
MIPI Touch architecture

- MIPI I3C
- I3C profile
- Touch commands
- I3C drivers
- OS Touch Driver Stack

2016

2017

Touch specific
MIPI Touch architecture keys

• Standardized command set
  – OS agnostic and OS independent
  – Reduced effort for software development
• A two-way street for sensing and feedback
• To support touch or pen data
• MIPI Touch uses the new MIPI I3C\textsuperscript{SM}
MIPI Touch leverages MIPI I3C

- Optimized for speed and power
- Pin-optimized using in-band interrupt eliminated GPIO interrupts
- Robust protocols for bus management
- Improved bandwidth
# Example touch commands

<table>
<thead>
<tr>
<th>Class</th>
<th>Example commands</th>
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<tbody>
<tr>
<td>Power</td>
<td>S/W Reset, Configure Normal / Idle / Sleep</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>Activate self-test, calibrate, Get diagnostics</td>
</tr>
<tr>
<td>RAW touch data</td>
<td>Get/set RAW tixel coordinate mapping, Read proprietary raw</td>
</tr>
<tr>
<td>Processed touch data</td>
<td>Get/set processed tixel coordinate mapping, Read standard processed touch reports, Get/set other commands</td>
</tr>
<tr>
<td>Mapping for proprietary registers</td>
<td>Get/set vendor specific information or data</td>
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Cross-functional support for MIPI Touch

<table>
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<tr>
<th>Group</th>
<th>Support</th>
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<tr>
<td>Software WG</td>
<td>Drivers and OS compatibility</td>
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<tr>
<td>Sensor WG</td>
<td>I3C Specification</td>
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<tr>
<td>USI (Universal Stylus Initiative)</td>
<td>Liaisons on active stylus and touch data commands</td>
</tr>
<tr>
<td>OS vendors and published information</td>
<td>OS compatibility and analysis of touch data structures</td>
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Planning
### Execution plan / schedule

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<thead>
<tr>
<th></th>
<th>2016 AUG</th>
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<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
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<td>Draft 0.7</td>
<td>Final Specification</td>
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Conclusions and call
Conclusions

• Standard open software
• Touch profiles simplifies design for touch
• Standard commands speed TTM
• MIPI I3C is optimized for speed/power
• MIPI I3C has in-band interrupts no extra “IRQ” pins
Next steps

• If not a member, join the MIPI Alliance
• Join the MIPI Display Working Group to engage with experts on touch specifications
• Start implementations of MIPI I3C
• Refer to the MIPI I3C webinar and white paper for more information (www.mipi.org)
Acknowledgements

The authors wish to thank the Display Working Group Touch team and in particular the following contributors and reviewers of this presentation’s content, Robert Gough and Nobu Suzuki, Intel Corporation, Peter Lefkin and Laura Nixon, MIPI Alliance, Paul Kimmelman, NXP, James Goel, and Radu Pitogo-Aron, Qualcomm Technologies, Inc., Dale Stolitzka, Samsung Display Co., Jeff Lukanc, Synaptics, Inc.
Q&A

Thank you!