An Introduction to MIPI I3C® v1.1 and What’s Next
What is MIPI I3C?

- Innovative new 2-Wire interface for sensing and beyond
- Key features address historical pain points
  - In-band Interrupt, Dynamic Addressing, Multi-Master, Standardized Commands, Time Control, Hot-Join, Error Detection and Recovery
  - Plus...

I2C Compatibility

Low Power

High Data Rates

Host Controller
  May be SDR-Only

I3C Main Master

Out-of-Band Interrupt

I3C Bus (SDA & SCL)

Legacy I2C Device(s)

I2C Slave

I3C Device(s)
  May be SDR-Only

I3C Secondary Master

I3C Smart Device(s) / Hub(s) / Engine(s)
  May be SDR-Only

Energy Consumption

mW/MBps per megabit for I3C Data Modes (1000fF)

Assumptions:
1. All symbols in each mode have equal probability for use.
2. Energy consumption is the energy delivered by pull-up devices to the bus (which includes drivers and receivers).
MIPI I3C for Ubiquitous Low Speed Interfacing

- Anywhere sensors are used, MIPI I3C belongs
- Aimed toward historical I²C, SPI and UART applications in...
MIPI I3C Vision

- Too Many I/Os!
- Fragmented Interfaces!

IC Compatibility
- In-band Interrupt
- Common Command Codes
- Reduced Signal Count
- Reduced Interface Power
Current Status

- MIPI I3C v1.0 and MIPI I3C Basic v1.0 Specifications are released
- Interoperability confirmed via multiple MIPI sponsored plugfests
- Master and Slave IP available from all major providers
- Test/Analysis equipment available
- Standardized Host Controller Interface (MIPI I3C HCI\textsuperscript{SM} v1.0)
- Linux Kernel support for I3C subsystem
- 5G Ready
- MIPI I3C v1.1 is Sensor WG approved and in formal review process!
Why Adopt MIPI I3C v1.1?

- More clearly written document
- Higher speeds through new HDR mode and multi-lane (Effective Bit Rates in Mbps)
- Configurable, pattern-based Slave Reset
- Grouped Addressing, Device to Device(s) Tunneling, Comprehensive Multi-Mastership...
# I3C Basic vs I3C v1.0 vs I3C v1.1 (1/2)

<table>
<thead>
<tr>
<th>Feature</th>
<th>I3C Basic</th>
<th>I3C v1.0</th>
<th>I3C v1.1</th>
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</thead>
<tbody>
<tr>
<td>12.5 MHz SDR (Master w/Stall, Slave and Legacy I²C Slave Compatibility)</td>
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<tr>
<td>1.0V Operation for 100pf $C_{load}$</td>
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<tr>
<td>Slave Reset</td>
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<tr>
<td>Set Static Address as Dynamic Address CCC (SETAASA)</td>
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<tr>
<td>1.2V-3.3V Operation for 50pf $C_{load}$</td>
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<tr>
<td>In-band Interrupt (w/MDB)</td>
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<td>X</td>
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<tr>
<td>Dynamic Address Assignment</td>
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<td>X</td>
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<tr>
<td>Error Detection and Recovery</td>
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<td>X</td>
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<tr>
<td>Common Command Codes (Required / Optional)</td>
<td>Yes / No</td>
<td>X</td>
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<td>Secondary Master</td>
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<td>Hot-Join Mechanism</td>
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<tr>
<td>Feature</td>
<td>I3C Basic</td>
<td>I3C v1.0</td>
<td>I3C v1.1</td>
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<td>Synchronous Timing Control</td>
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<tr>
<td>Asynchronous Timing Control (Modes 0-3)</td>
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<td>HDR-DDR</td>
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<td>HDR-TSL/TSP</td>
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<td>HDR-BT (Multi-lane Bulk Transport)</td>
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<td>Grouped Addressing</td>
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<tr>
<td>Device to Device(s) Tunneling</td>
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<tr>
<td>Multi-lane for Speed (Dual/Quad for SDR and HDR-DDR)</td>
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<td>Monitoring Device Early Termination</td>
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Looking Ahead at Capabilities...

• **Beyond the Mobile Industry**
  – Internet of Things (IoT)
  – High Performance Compute / Servers
  – Automotive

• **For Usages Beyond Sensing**
  – As part of its Charter, the Sensor WG carries the responsibility to ensure MIPI I3C “maintains a relevant feature set and scope”
  – The following notable usages, among others, have been instrumental in evolving I3C forward:
    • MIPI Camera Control Interface (CCI™)
    • MIPI Touch over I3C
    • MIPI Debug for I3C
    • System Manageability
What is Next for MIPI I3C?

- Sensor WG ramping up discussion on the next evolution of MIPI I3C
- Considering multiple capabilities / improvements
  - Long reach
  - Specification development improvements
  - Automotive requirements
  - Speed increases
  - New multi-lane uses
  - New PHY approaches
  - Standardized connectors
  - Feature refinements
- Reaching out to Industry partners and forming liaisons
- Join us now to ensure that MIPI I3C evolves to meet the needs of new industries and usages!
ADDITIONAL RESOURCES

• MIPI Sensor WG
  – https://www.mipi.org/groups/sensor

• MIPI I3C Spec
  – https://www.mipi.org/specifications/i3c-sensor-specification

• Whitepaper: Introduction to the MIPI I3C Standardized Sensor Interface
  – http://resources.mipi.org/i3c-sensor-specification-whitepaper-from-mipi-alliance

• MIPI I3C Frequently Asked Questions
  – https://www.mipi.org/resources/I3C-frequently-asked-questions
Any Questions?