5.9 MIPI—In Smart Agriculture

**In Precision Agriculture:**
- I3C over C/D/A-PHY physical interfaces to connect GPS sensors, electronic compass and actuators to AI application and CPU controlling pesticide and fertilizer dosage
- CSI-2 over C/D/A-PHY to enable machine-vision applications, checking crops for pest damage or disease
- RFFE within cellular communications module

**In Livestock Monitoring:**
- I3C over A-PHY to provide a shared, two-wire interface within livestock tracking devices connecting GPS and other sensors, to monitor animal health, activity and environmental impact; in-band interrupts used to enable low-power standby mode; and extended battery life
- RFFE within low-power, wide-area radio communications module

**In Smart Greenhouses:**
- I3C over A-PHY to connect heat, light, moisture, CO2 and other sensors, as well as actuators controlling temperature, airflow, irrigation and nutrient levels, ensuring optimal growth conditions
- A-PHY as a long-reach (≤15m), physical interface to connect sensors and actuators to a control unit
- DSI-2 over C/D-PHY for advanced, high-resolution control panel displays

**In Automated Agricultural Machinery:**
- I3C over A-PHY to connect the GPS, ultrasonic and other low-speed sensors, actuators and controls within the machine
- CSI-2 over C/D/A-PHY to connect high-resolution cameras, lidars and other high-speed sensors
- DSI-2 over C/D/A-PHY for connecting advanced, high-resolution displays
- A-PHY as a long-reach (≤15m), ultra-reliable physical interface, to enable safe operation in noisy EMI environments
- RFFE within cellular communications module

**Automated Agricultural Machinery Schematic**

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**Associated MIPI Specifications**
- Functionally safe and secure IoT device that will benefit from MIPI’s focus on safety and security
- IoT device with constrained power supply that will benefit from use of MIPI low-power interfaces
- IoT device with wide-area cellular connectivity that will benefit from MIPI’s 5G preparedness
- Size-constrained, tightly packaged IoT device, benefiting from MIPI’s low pin count, low wire count, low EMI interfaces

**Use of MIPI Specifications can aid product compliance to functional safety standards such as IEC 61508**

**Legend**
- MI-PHY®
- D-PHY
- C-PHY
- A-PHY
- CHIPS TO CHIPS/IPC
- MULTIMEDIA
- CONTROL & DATA
- DEBUG & TRACE
- HOST CONTROLLER INTERFACE SOFTWARE

IoT white paper: Enabling the IoT Opportunity