

### This course covers the Camera Serial Interface v3 (CSI-3)

#### Objectives

- The course starts with an overview of MIPI specification.
- Layers are described from bottom to top, starting with M-PHY, then UniPro and at last CSI-3.
- The startup sequence and the procedure to enter / exit Hibernate state are explained.
- Electrical characteristics of M-PHY are studied.
- CSI-3 packet format is described, including both Attributes PDU and CSI-3 packet header.
- The payload of image packet, including YUV, RGB and RAW data is explained, as well as raw data compression algorithms.
- The course also covers the test modes.
- Companies interested in attending this course must adhere to MIPI organization.
- This course has been designed for engineers in charge of SoC architecture, functional verification or silicon validation.

*A more detailed course description is available on request at [training@ac6-training.com](mailto:training@ac6-training.com)*

#### Course Environment

- Theoretical course
  - PDF course material (in English) supplemented by a printed version for face-to-face courses.
  - Online courses are dispensed using the Teams video-conferencing system.
  - The trainer answers trainees' questions during the training and provide technical and pedagogical assistance.
- At the start of each session the trainer will interact with the trainees to ensure the course fits their expectations and correct if needed

#### Target Audience

- Any embedded systems engineer or technician with the above prerequisites.

#### Evaluation modalities

- The prerequisites indicated above are assessed before the training by the technical supervision of the trainee in his company, or by the trainee himself in the exceptional case of an individual trainee.
- Trainee progress is assessed by quizzes offered at the end of various sections to verify that the trainees have assimilated the points presented
- At the end of the training, each trainee receives a certificate attesting that they have successfully completed the course.
  - In the event of a problem, discovered during the course, due to a lack of prerequisites by the trainee a different or additional training is offered to them, generally to reinforce their prerequisites, in agreement with their company manager if applicable.

## Plan

### **INTRODUCTION TO MIPI SPECIFICATIONS**

#### **M-PHY**

- Termination scheme
- Signaling schemes
- Pulse Width Modulation
- M-PHY type I modules
- Control symbols
- PHY state definition
- Transitions between states
- Configuration attributes
- Multilane Operation in UniPro
- Test modes
- Electrical characteristics, eye-diagrams
- Electrical interconnect
- Recommended test functionality
- Test pattern generation and verification
- Optical Media Converter

#### **UNIPRO**

- Stack overview
- Level 1 based on M-PHY
- Level 1.5: PHY adapter layer
- Level 2: link layer
- Level 3: network layer
- Level 4: transport layer,
- Device Management Entity
- Test suites

#### **DEVICE DESCRIPTOR BLOCK (DDB)**

- The three levels of conformity
- Underlying interconnect requirements
- The four types of Service Primitives: request, indication, response, and confirm
- DDB protocol support for Level 1 and Level 2 services

#### **CAMERA SERIAL INTERFACE (CSI-3)**

- Overview of CSI-3
- Reset and boot procedure
- Attribute description
- Implementing virtual channels, pixel channel, notification channel
- Configuration Protocol for Camera, control flow
- CAL, description of attributes
- CSI-3 packet header
- Interleaving the streams
- Image format, RGB, YUV, RAW
- Transmitting an image frame and attribute packets
- Compressing RAW data
- Transporting JPEG images

## Renseignements pratiques

**Duration : 3 days**

**Cost : 1750 € HT**