TND6461/D
Rev. 0, September – 2024

Introducing onsemi's Premier Reference Image Sensor Module (PRISM) Designed to Optimize Camera Development

Publication Order Number:
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Vision systems are increasingly common in many applications, improving overall quality of life. Whether it is working behind the scenes to inspect food items for defects, filming gorgeous movies, scanning barcodes at the local grocer, or connecting families, friends and colleagues around the globe through video conferencing, these systems have become a part of our daily routine. Optimizing a camera design is a challenging task, involving many components which all need to work together seamlessly to achieve its task. Therefore, tools and processes that can optimize the development efforts can be critical steps in ensuring these designs are rapidly evolving to further improve.

onsemi prides itself in being a sensing leader in many of these industrial and commercial applications, and in turn is consistently working to make our partners and customers more efficient. We strive in making world−class sensors, but it's also imperative that we generate tools and build ecosystems to help in development with our sensors as well. In order to dramatically improve the development stage, a pre−optimized imaging sub−system is highly needed by the developer. **onsemi** has developed a Premier Reference Image Sensor Module (PRISM) ecosystem which tremendously reduces the prototype development cycle time, further minimizes the engineering burden, improves camera quality and ultimately provides quick time−to−market for our customers. It applies to early sensor evaluation, ecosystem development, system prototype building, system proof of concept program and fast conversion into mass production.

Basic Building Blocks of Camera

Even before beginning the development, selecting the perfect sensor for the application is key to success in the development phase. Below are the five building blocks needed for the evaluation and development of a camera

1. **Lens**: Focuses light into the sensor and must be matched perfectly to the sensors' optical format, achieving the desired field of view, depth of field and effective resolution of the sensor.
2. **Sensor**: Focuses light waves into the pixel array, many times optimizing for certain colors, and can have millions of pixels to be read out for processing.
3. **Interface**: The connection between the image sensor and the processor. Often overlooked, the speed and physical interface must be able to communicate with the image signal process (ISP) and/or system−on−chip (SoC).

4. **ISP/Processor**: The image signal processor processes raw data obtained from the image sensor to produce a desired outcome through either a visual image or an image used for a specific purpose through machine vision.
5. **Application Software**: After the image has been processed, it is then used for the desired objective of the end application.

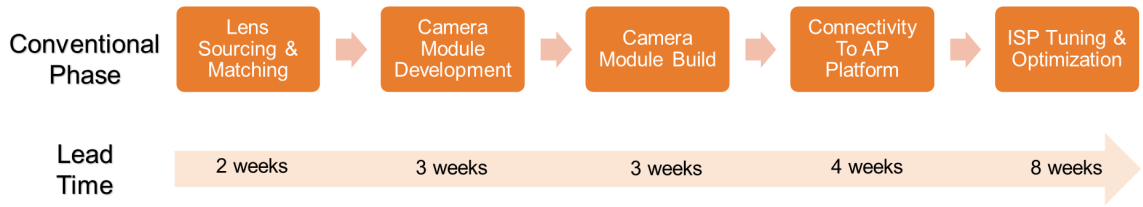

Figure 1. Building Blocks of a Camera with Example Development Times

onsemi's PRISM provides pre−tuned solutions that optimize lens, sensor and interface in a modular format. With PRISM's extended ecosystem, the system developer can easily integrate PRISM into an ISP/Processor and Application software. Before diving into the full detail of PRISM, this next section discusses the common camera design phase.

Traditional Camera Development Phases

A traditional camera design has five main phases of development. This section will briefly detail these phases and some of the main challenges that camera development engineers face.

1. **Evaluation**: In this phase, designers evaluate the image sensor using an evaluation tool, analyzing its performance and qualification. Key challenges include acquiring the necessary hardware and software for evaluation as well as having sufficient knowledge and experience with image sensors to properly qualify them. Furthermore, form−factor development for real−world testing can lengthen this phase.
2. **Prototype Development**: During the prototype phase, feedback is collected to optimize the system design. For this, developer needs to be aware of the key features, advantages and benefits of the chosen image sensors, as well as its realization and integration with the back−end processor
3. **Sensor/SoC Driver and Tuning**: This phase focuses on developing the sensor driver for the system−on−chip (SoC) to interface, control and operate the image sensor. By tuning the image sensor, it can be best characterized with proper parameter, image signal processor and other functionality in SoC. The tuning requires intimate knowledge of both sensor and image signal processor and is often one of the lengthier parts of a design, needing to perfect the image for the application.
4. **Application Development**: The application development phase allows the image sensor with SoC to achieve its desired image performance in the real use cases and scenarios. Application may require the image device to perform its limit in specific or sometimes harsh lighting conditions.

5. **Production Readiness**: This phase transforms the engineering version to a production ready design. Production requires easy−to−produce designs in an assembly line, reliable qualification for long camera system lifetime and precision tooling for all the camera elements.

Depending on application this process can take anywhere from 20 weeks to 2 years to complete. Because of this, it's easy to understand why improving this phase is so critical. **onsemi** developed its PRISM ecosystem with this intent in mind.

PRISM Ecosystem and Its Tools

PRISM is a reference camera module system developed by **onsemi** for specific industrial and commercial image sensor applications.

The PRISM ecosystem provides the following benefits to users:

- An **onsemi** validated, tested reference module for highest−quality imaging. The pre−validated PRISM offers performance benchmark for the sensor and provides the related documents to support the customer to realize the performance benchmark.

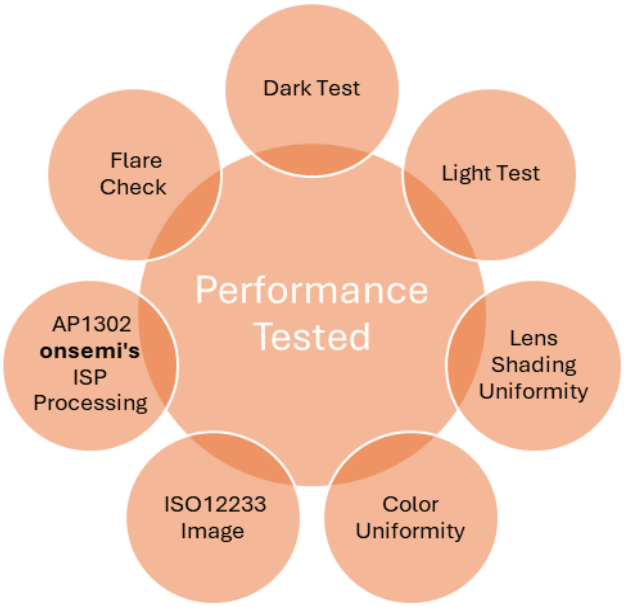

Figure 2. Example of the Performance Criteria the PRISM Team Works to Optimize

- Availability for every industrial/commercial sensor at an early sample phase. While the new sensor is introduced by **onsemi** into market and the module supplier in ecosystem is not yet ready with the new sensor, **onsemi** offers PRISM as prototype module as well as the reference design for the new sensor being introduced to market.
- Uses a universal standardized connector providing flexibility between sensors. The universal interface used in every module ensures all modules are compatible with each other in terms of connectivity.

- **onsemi** offers adapters to connect seamlessly with various SoC platforms. This enables the PRISM user has the system foundation to start the development upon the established PRISM−interfaced hardware and the pre−developed sensor drivers for quick time−to−market.
- Can be converted to Image Access System (IAS) from distributors for volume production. PRISM module shares the same interface and validation process used by IAS module that is owned and released by **onsemi**'s distribution partners. PRISM can be therefore quickly converted into IAS module with dedicated specification for target application or for mass−production version.

Figure 3. Full Portfolio of PRISM with New Sensor Introduction

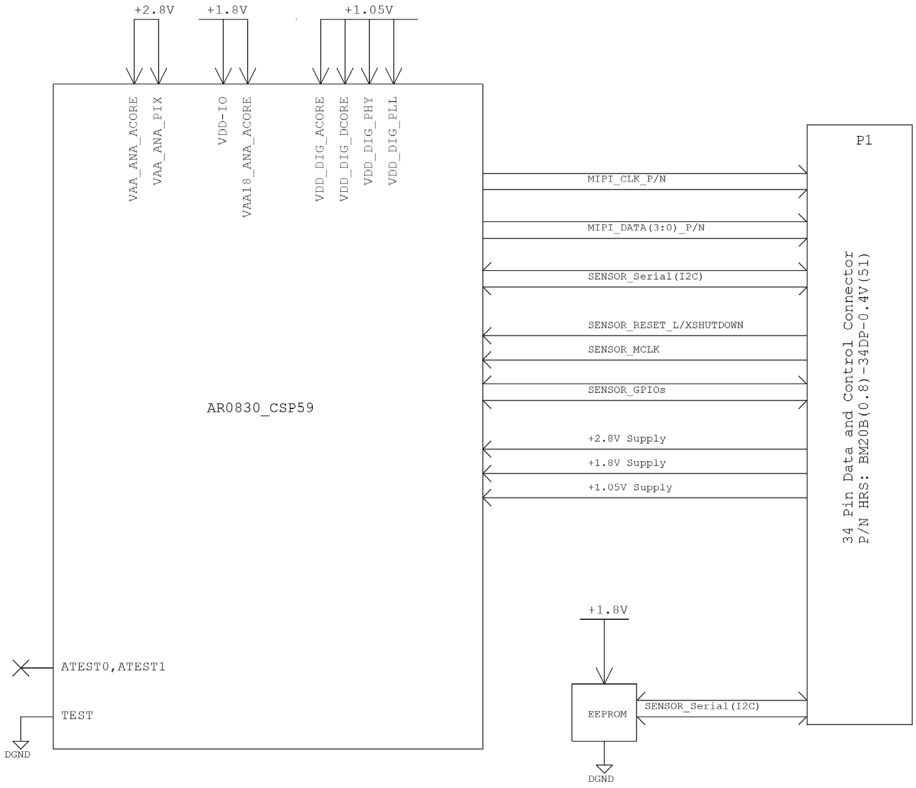

Figure 4. Example of PRISM Block Diagram

Figure 4 shows a small part of the PRISM documentation package. This includes the datasheet, mechanical drawing, schematics, PCB layout, Gerber and BOM for the module as well as the optical BOM and sensor initial setting for EEPROM .

onsemi's Ecosystem with PRISM

PRISM brings the user into **onsemi**'s ecosystem with the various adaptors that **onsemi** developed for different SOC/AP platforms.

It provides the user with further benefits:

- Single system to connect into AP/SOC platform and **onsemi**'s DevWare through PRISM's Demo3 Adaptor for debugging.
- Quick hands−on with major SOC/AP platform for quick and easy program development
- Connect to pre−tuned ISPs. This reduced R&D time in ISP tuning and optimizing.

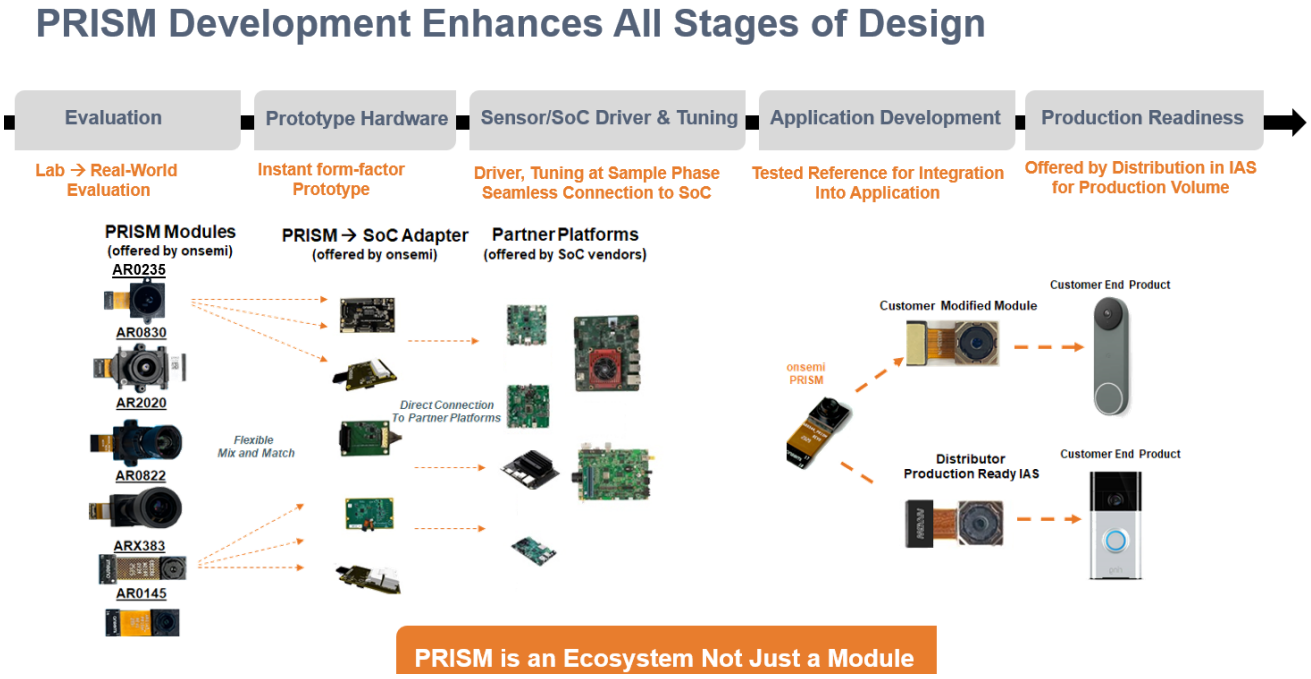

Figure 5. The Full Imaging Sub−System is Fulfilled by onsemi's PRISM and its Linkage to Imaging Ecosystem

How PRISM Solves the Challenges

PRISM solves the traditional challenges that the user would encounter throughout the whole camera development phase. It provides a pre−validated imaging sub−system, a fundamental prototype camera with key image features and a universal interface to connect to major ISPs/SOCs, a pre−tuned image camera upon major ISPs/SOCs that are suited to target applications and a camera module that is close to qualification to mass production needs.

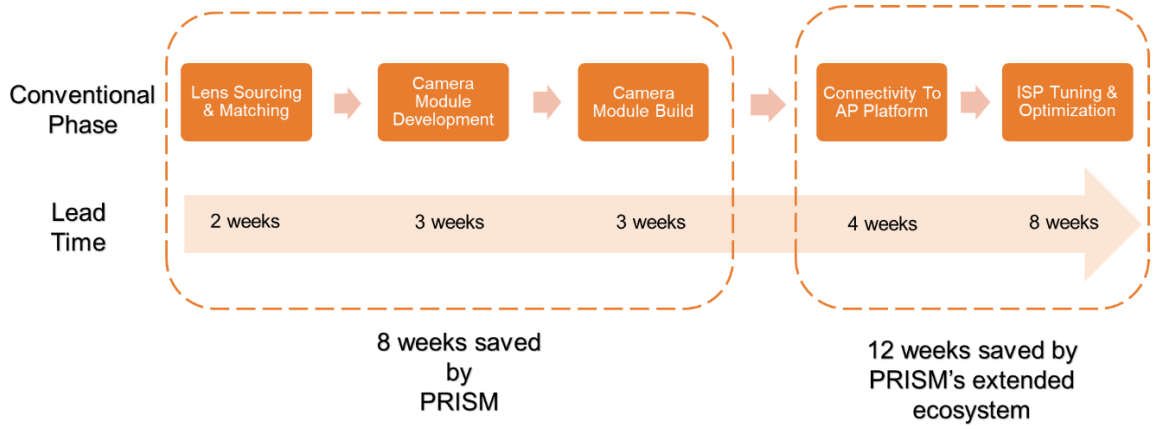

Figure 6. Conventional Image Sensor Development Flow Versus PRISM – Example as Reference

For more information visit our Premier Reference Image Sensor Modules pages or contact sales

Premier Reference Image Sensor Modules

- PRISM1M−AR2020CSSC130110−GEVB
- PRISM1M−AR0830CSSC130110−GEVB
- PRISM1M−ARX383CSSM130110−GEVB
- PRISM1M−AR0145CSSM130110−GEVB
- PRISM1M−AR0235CSSM130110−GEVB
- PRISM1M−AR0822NPSC130110−GEVB

*PRISM modules are only available for prototype development

ADDITIONAL INFORMATION

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