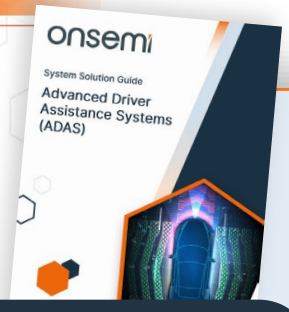
System Solution Guide - Preview

Advanced Driver Assistance Systems (ADAS)

onsemi.com

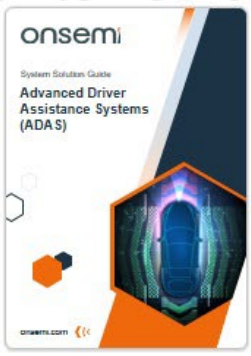
Table of Contents

Get Latest Version



Full Guide Preview

Get Latest Version



1

2

3

4

5

6

7

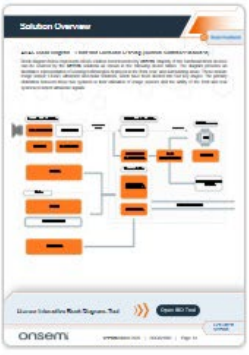
8

9

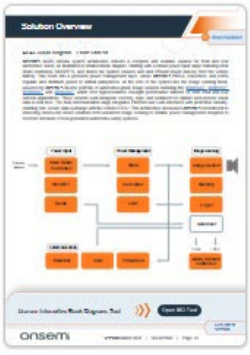
10

11

12



13



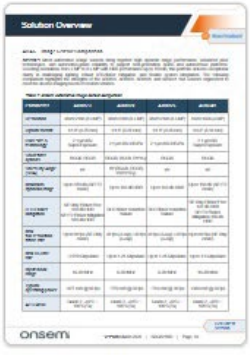
14

15

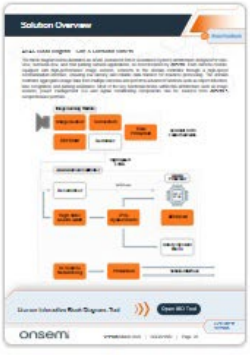
16

17

18



19



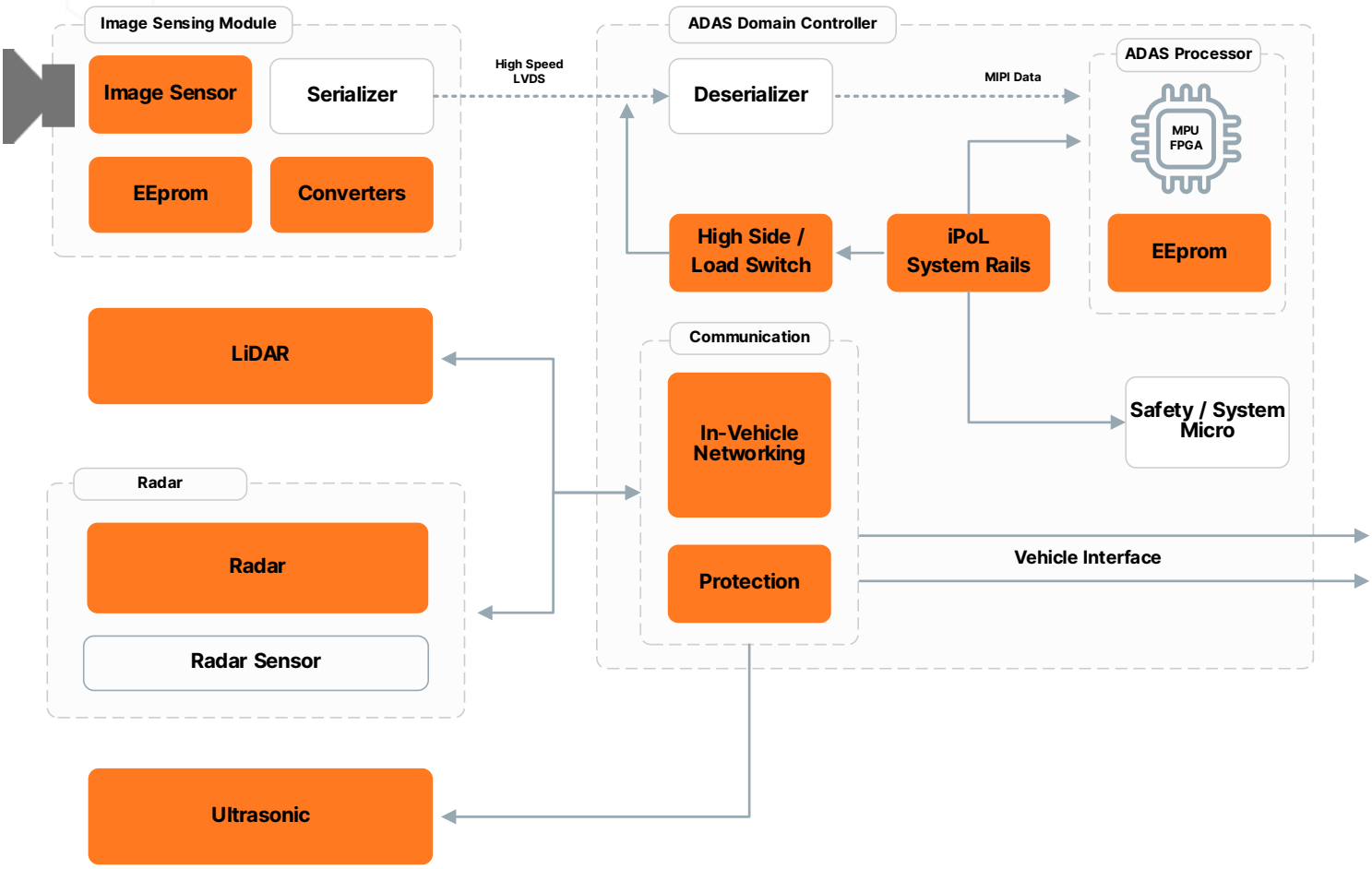
20

Solution Overview

Get Latest Version

ADAS Block Diagram – Front and Surround Sensing (Domain Controller included)

Block diagram below represents ADAS solution recommended by **onsemi**. Majority of the functional block devices can be sourced by the **onsemi** solutions as shown in the following device tables. The diagram provides an illustrative representation of sensing technologies deployed in the front, rear, and surrounding areas. These include image sensor, LiDAR, ultrasonic and radar solutions, which have been divided into four key stages. The primary distinction between these two systems is their utilization of image sensors and the ability of the front and rear systems to detect ultrasonic signals.



Use our Interactive Block Diagrams Tool

Open IBD Tool

Advancements in Automotive - ADAS Image Sensors

Resolution

High-Resolution Vision - a key to safer cars. The resolution of an image is critical for Advanced Driver-Assistance Systems (ADAS) in modern vehicles. These systems rely on cameras to perceive the road and its surroundings, and the sharper the image, the better the system performs. In the past, car cameras offered limited resolution, like the early VGA sensors with only 0.3 megapixels (MP). This restricted their ability to capture fine details, especially at a distance. **onsemi's** AR0823AT sensor represents a significant leap forward. This innovation boasts a resolution of 8.3 megapixels, a massive improvement that translates to sharper images and the ability to detect objects more precisely using a single camera. This high resolution unlocks a wider range of applications for ADAS. Different cameras are used for different functions: the AR0823AT is typically used for forward-view applications, while the AR0341AT is used for rear or surround-view applications.

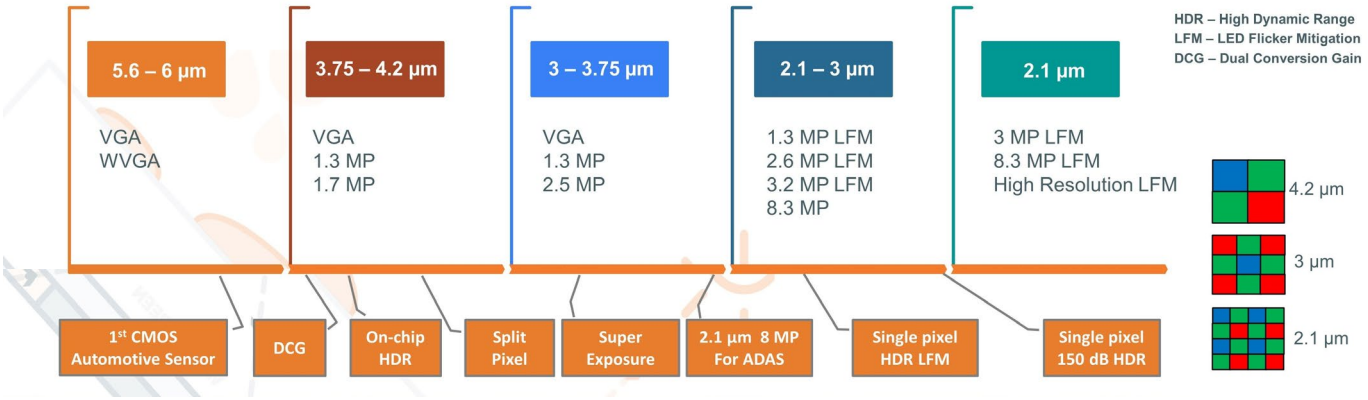
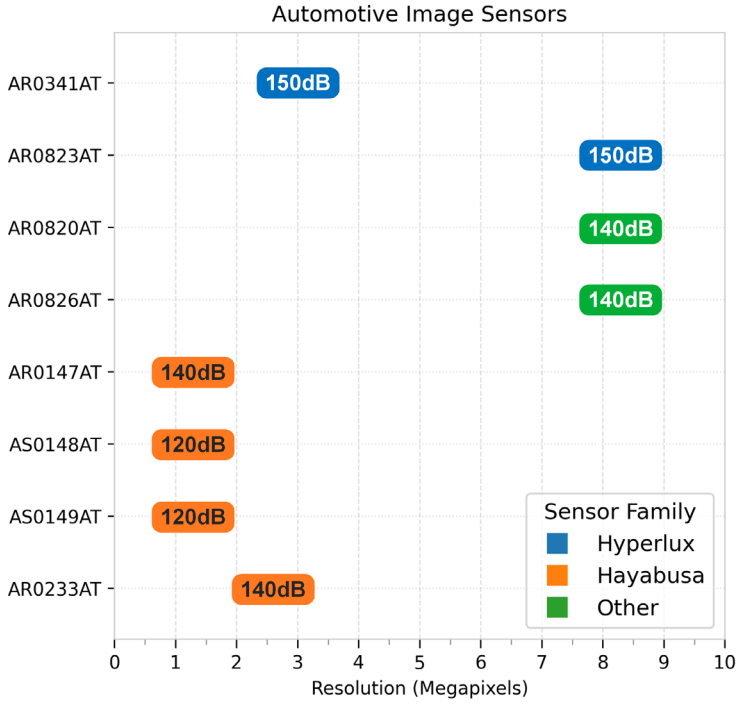


Figure 4: Development of image sensors from 2004 to the present

onsemi Automotive Portfolio

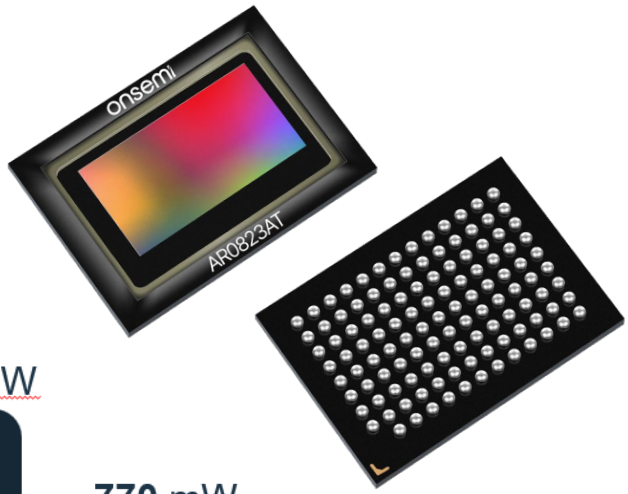
onsemi's automotive image sensors deliver industry-leading performance for advanced driver assistance systems and autonomous driving. Covering a wide resolution range from 1 megapixel to 8 megapixels, our portfolio ensures optimal imaging for everything from rear-view and suddorund cameras to high-resolution forward-facing systems. With sensor families like **Hyperlux** and **Hayabusa**, we provide tailored solutions combining exceptional image quality, low-light sensitivity, and cutting-edge HDR technology. Our sensors feature dynamic range capabilities up to 150 dB, enabling clear, accurate vision in extreme lighting conditions from bright sunlight to deep shadows ensuring safety, reliability, and superior situational awareness for next-generation vehicles.



ADAS - Front Image Sensors - Hyperlux™ AR0823AT

Key Benefits:

- 8.3 MP resolution (3840 × 2160), 2.1 µm pixel size, 1/1.8-inch optical format
- Up to 60 fps at full resolution (single exposure), 40 fps in HDR mode
- Up to 150 dB dynamic range (dual exposure HDR with LED flicker mitigation), >120 dB flicker-free HDR in single exposure mode
- Low-light sensitivity down to ~0.03 lux (SNR_5 at 33 ms, 80 °C)
- Typical power consumption: ~640–810 mW; max ~940 mW
- ISO 26262 compliant: ASIL-B hardware metrics, ASIL-D design flow
- AEC-Q100 Grade 2 qualified (–40 °C to +105 °C ambient)
- Dual MIPI CSI-2 output for simultaneous ADAS and viewing streams
- Supports RGGB and RCCB color filter arrays



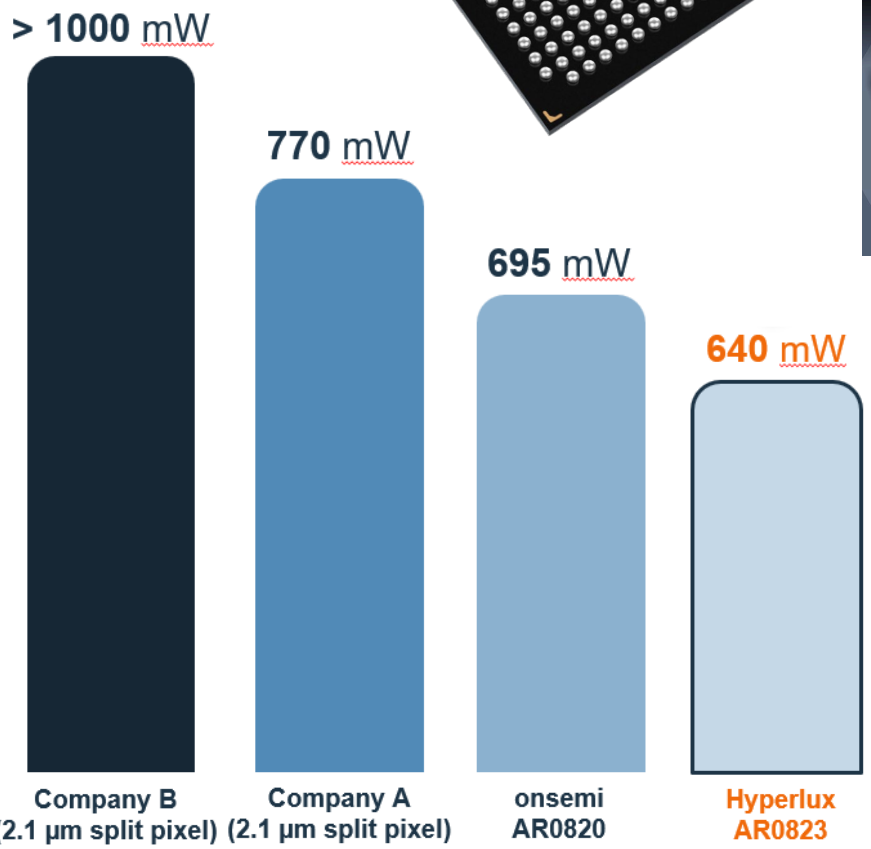


Figure 6: Typical Power Consumption: 8 MP, 30 fps, 125°C (T_j)

Why Low Power Matters

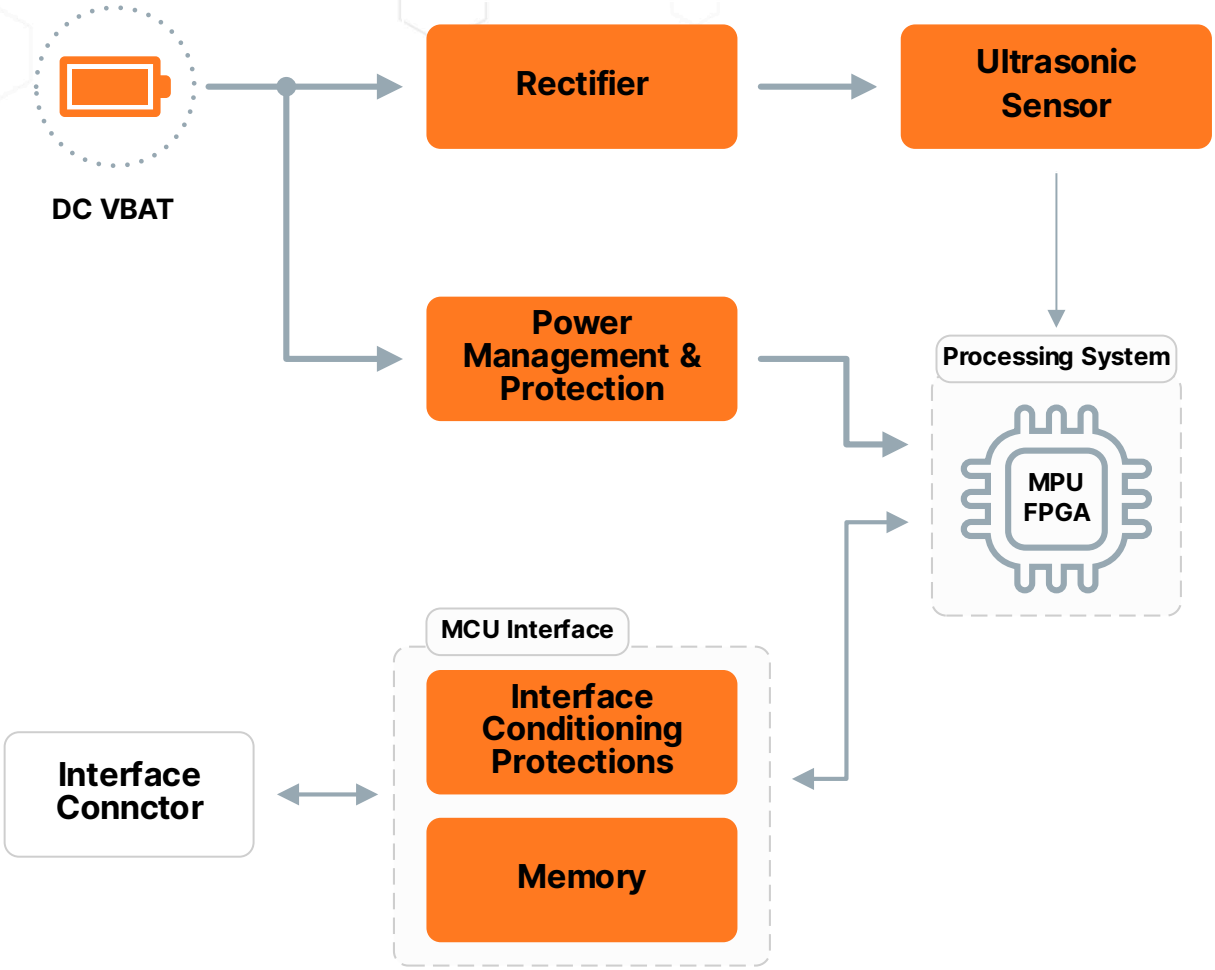
Lower power consumption reduces thermal load, simplifies system design, and **extends vehicle battery life**, making AR0823AT the ideal choice for next-generation ADAS platforms. In addition, lower power enables more compact and cost-effective cooling solutions, which helps reduce overall system complexity and weight. This efficiency is especially critical for electric and hybrid vehicles, where every watt saved contributes to longer driving range and improved sustainability.

Solution Overview

Get Latest Version

ADAS Block Diagram - Ultrasonic Parking Distance Measurement

The NCV75215 ultrasonic sensor disrupts the market by offering a powerful value proposition for manufacturers seeking top-of-the-line ultrasonic distance measurement. Forget the frustration of conventional sensors with their inaccuracies – the NCV75215 boasts high-sensitivity and low-noise operation. This translates to real-world benefits for drivers using parking assist systems equipped with this sensor. Imagine parking with confidence, thanks to real-time, ultra-precise distance readings that effortlessly guide you into tight spots. But the NCV75215's value proposition extends far beyond the realm of parking. The sensor is engineered for robust operation, featuring built-in noise and temperature monitoring to ensure reliable performance in any environment even harsh conditions won't faze it.



Additionally, its EEPROM memory allows for configuration and user data storage, making it a highly adaptable solution. This adaptability makes the NCV75215 a champion not only for parking assist systems, but also for applications in robotics, industrial automation, and any scenario demanding precise object detection. In essence, the NCV75215 is more than just a sensor – it's a key to innovation and enhanced functionality.

Use our Interactive Block Diagrams Tool Open IBD Tool

Frequently Asked Questions (FAQ)

What is the onsemi ADAS System Solution Guide for automotive system design?

1

The onsemi ADAS System Solution Guide is a comprehensive reference for designing advanced driver assistance systems. It explains ADAS applications, sensing technologies, system architectures, and market trends, and provides detailed block diagrams, image sensor selections, power management solutions, and system-level recommendations. The guide helps OEMs and Tier-1 suppliers design scalable, reliable ADAS platforms using onsemi's imaging, sensing, and power technologies.

How does onsemi Super-Exposure pixel technology mitigate LED flicker in ADAS image sensors?

2

onsemi Super-Exposure pixel technology integrates overflow storage directly within each pixel, allowing the sensor to capture the complete LED pulse cycle during a single exposure. This design prevents missed LED pulses while avoiding pixel saturation in bright scenes. As a result, the sensor delivers flicker-free imaging together with very high dynamic range, ensuring correct color, brightness, and object recognition in challenging automotive lighting conditions.

Why is ultra-high dynamic range up to 150 dB important for ADAS image sensors?

3

Ultra-high dynamic range up to 150 dB allows ADAS cameras to simultaneously capture extreme bright and dark regions within the same scene. This capability is critical for situations such as driving out of tunnels, facing direct sunlight, or operating at night with strong headlights. High HDR preserves fine details and color accuracy across the entire image, ensuring dependable lane detection, object classification, and pedestrian recognition under all lighting conditions.

What sensing technologies are combined in ADAS to achieve full vehicle environment perception?

4

ADAS systems combine cameras, radar, LiDAR, and ultrasonic sensors to build a comprehensive perception of the vehicle's surroundings. Cameras deliver high-resolution visual information, radar accurately measures distance and object speed, LiDAR provides precise depth and spatial data, and ultrasonic sensors handle short-range detection. Sensor fusion across these technologies improves reliability, redundancy, and performance in diverse weather and lighting situations.

Why are high-resolution image sensors critical for front and surround ADAS camera applications?

5

High-resolution image sensors enable ADAS systems to detect smaller and more distant objects with greater accuracy, improving perception using fewer cameras. Increased resolution enhances lane marking visibility, traffic sign recognition, and object classification while extending detection range. This allows OEMs to support advanced safety features with simplified system architectures, faster decision-making, and improved overall vehicle safety without increasing camera count.

Advanced Driver Assistance Systems

Get Latest Version

onsemi™

Intelligent Technology. Better Future.

Register now to unlock all System Solution Guides and get additional exclusive benefits!

- Join the conversation on community forum.
- Utilize Elite Power Simulator & other developer tools.
- Watch exclusive webinars and seminars.

Open full System Solution Guide