Ambarella

A9AQ Automotive Multi-Camera Electronic Mirror and Surround View SoC

Overview

The AEC-Q100-qualified A9AQ SoC family provides an integrated single-chip solution for single and multi-camera electronic mirror, surround view, and video recording systems. The A9AQ's combination of advanced image processing, High Dynamic Range (HDR), 3D Noise filtering, smart auto exposure, and high-resolution capability provide superior visibility even in low light or high contrast scenes. LED flicker mitigation dramatically reduces artifacts introduced by LED headlights and traffic signs.

The A9AQ's multi-channel image processing removes the need for a dedicated ISP chip in every camera module, enabling highly compact camera modules while improving video quality, reducing power consumption, and lowering system cost. The A9AQ integrates a four-channel B6 de-serializer, removing the need for external de-serializer chips in multi-channel camera systems.

The SoC includes a high speed 800MHz dual-core ARM® Cortex®-A9 CPU with Neon DSP extensions to provide powerful processing performance for customer applications including advanced driver assistance features, user interface, and wireless networking.

For multi-camera parking assistance applications, the A9AQ's on-chip H.264 encoder enables simultaneous recording of multiple camera streams as well as video streaming to smartphones over WiFi or through in-car 4G hotspots. It provides realistic 3D HD scene rendering using a dedicated image processing engine which provides de-warping and seamless stitching of video from multiple cameras.

A9AQ System Overview Diagram
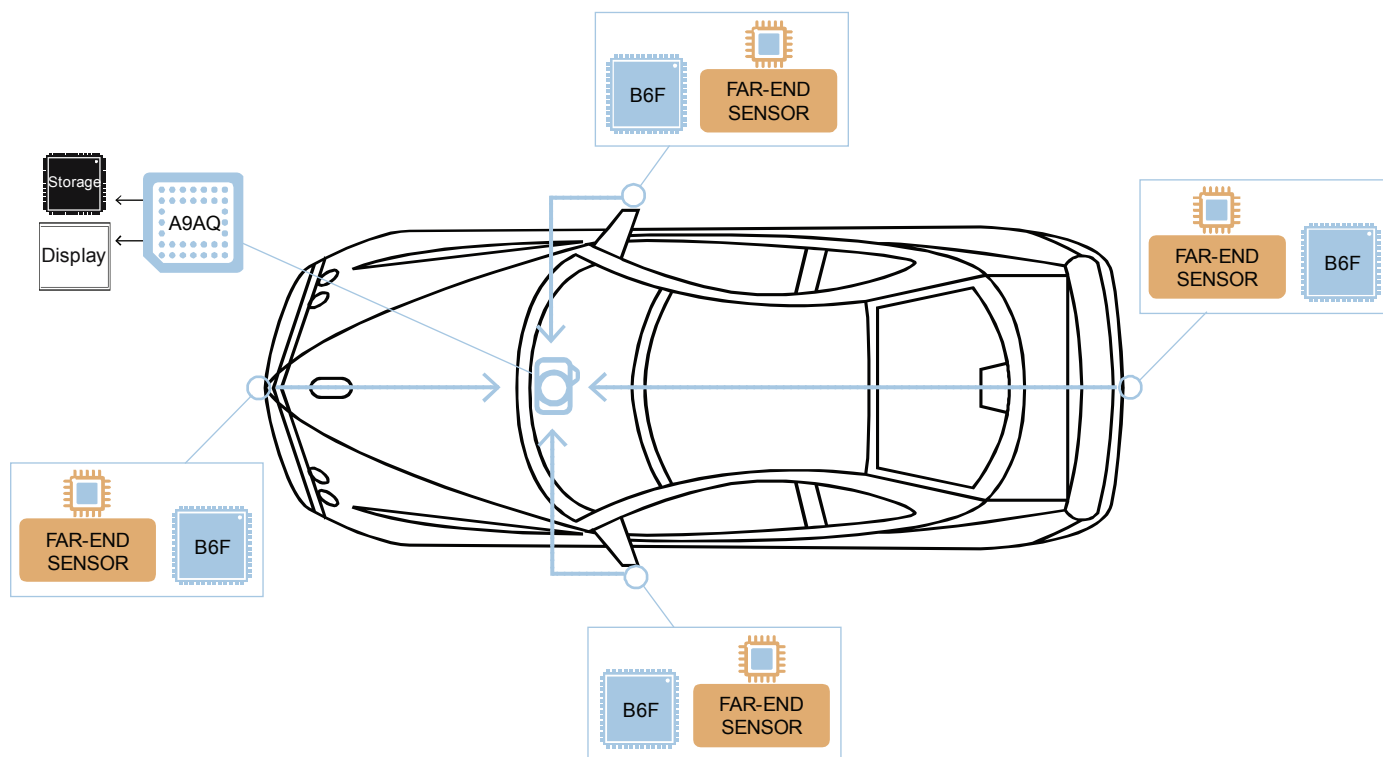
Automotive surround-view video application with an Ambarella A9AQ SoC and four B6F serializer chips.
(Note that more inputs are possible with additional B6N de-serializers.)

Key Features

Highly Integrated Multi-Camera ECU
- Eight camera input ports, including four-channel integrated de-serializer
- Multiple-channel 1MP or 2MP or single-channel 4K Ultra HD image processing (Up to 550 Mpixel/sec combined)
- Up to four video outputs, including integrated two-channel serializer

Superior Image Quality
- Advanced night vision for low light conditions
- Advanced LED Flicker mitigation
- Wide Dynamic Range (WDR) and High Dynamic Range (HDR)
- Automotive multi-channel Smart Auto Exposure and Auto White Balance

Advanced Features
- Multiple hardware and software fail-safe mechanisms to prevent "frozen image" errors
- WiFi and 4G/LTE connectivity support

General Specifications

Image Sensor Interface
- Four Ambarella B6 SERDES inputs with up to 3 Gbps/lane
- Four direct sensor VIN ports
- Support for SLVS, MIPI CSI-2, LVCMOS, 16-bit parallel
- CCIR.601 video input with external sync signals and BT.1120/CCIR.656 style with embedded sync codes

Powerful CPU for Advanced Driver Assistance
- Dual-core ARM® Cortex™-A9 @ up to 800 MHz
- 32 KB / 32 KB I/D and 1 MB L2 Cache
- AES / 3DES / SHA-1 / MD5 Cryptography Engine
- Ambarella Image and Video DSPs

Peripheral Interfaces
- One USB 2.0 port configurable as Device or Host
- Two CAN / CAN-FD ports
- Two Ethernet MACs with IEEE 802.3-compliant GMII/MII Gigabit (10/100/1000-Mbps) interfaces
- Multiple I2S, SSI/SPI, IDC, and UART
- Multiple PWM, Stepper, and ADC channels
- Numerous GPIO ports, PWM, steppers, IR, ADC
- Watchdog Timer, multiple general-purpose timers, JTAG

High-Performance Automotive Video Engine
- Ultra HD 4K @ 30fps
- Simultaneous encode of multiple high-resolution streams in multi-camera systems
- Night Vision with super-resolution oversampling, 3D noise filters, and dynamic tone mapping
- Real-time geometric distortion correction (de-warp) filter
- Advanced LED flicker mitigation
- Advanced automotive dynamic range (HDR/WDR) engine with local exposure, highlight and tone adjustment
- Multi-channel automotive smart auto exposure (AE) with scene detection, object detection, and dynamic AE
- Continuous looping, motion detection, and event-based / emergency video

Recording File Formats
- Audio: AAC (Two-channel LC, HEAAC, HEAAC v2), ADPCM / LPCM / PCM
- Video File: MP4, MOV, AVI, TS
- Photo File: JPG

Advanced Video and Display Processing
- MP / HP H.264 Level 5.1 and MJPEG encode
- Crop, mirror, flip, scale functions and LCD rotation
- Alpha-blending OSD; text, overlays
- Up to 4 simultaneous video outputs
- Analog, MIPI DSI/CSI, HDMI, Digital VOUT, Ambarella B6 Tx outputs supported

Memory Interfaces
- LPDDR2, LPDDR3, LPDDR4, DDR3 and DDR3L up to 600 MHz
- 16-bit/32-bit data bus, up to 2 Gbyte capacity
- Two SD controllers with SDXC SD™ card support; one port supports up to UHS-1 speed
- NAND flash, SLC with ECC
- Boot from SPI-NOR, SPI-EEPROM, NAND flash, USB or eMMC

Physical
- 28-nm low-power CMOS
- AEC-Q100 grade 2 (-40 ˚C to +105 ˚C operating temperature range)
- TFBGA package with 577 balls, 14x14 mm, 0.5 mm pitch and 17x17 mm, 0.65 mm pitch options

A9AQ Advanced HD Automotive Camera Development Platform

The A9AQ Automotive Camera Development Platform contains the necessary tools, software, hardware and documentation to develop a fully featured automotive camera system.

Evaluation Kit (EVK)
- A9AQ main board with connectors for sensor/lens board, peripherals
- Camera modules or Sensor boards: Omnivision, Sony, and others
- Data sheet, BOM, schematics, and layout
- Reference application with C source code

Software Development Kit (SDK)
- Dual-OS ThreadX/Linux with patches, drivers, tools, and application source code
- Royalty-free libraries for ISP, 3A, dewarp, and codecs
- Image tuning and manufacturing calibration tools
- Detailed documentation with programmer's guide, application notes

Contact **www.ambarella.com/about/contact/inquiries.html**