



A12AQ - AEC-Q100 Qualified SoC for Automotive Cameras

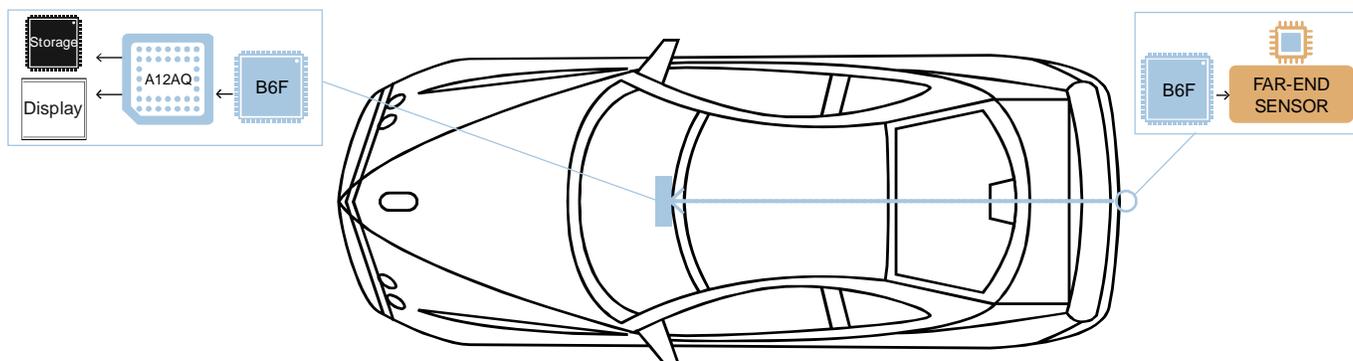
Overview

The AEC-Q100-qualified A12AQ SoC family provides an integrated single-chip solution for single-channel electronic mirrors and single/dual sensor video recording systems. The A12AQ'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. The chip also supports for wide-angle and fish-eye lens by performing distortion correction via dedicated hardware blocks.

The SoC implements a highly-optimized hardware H.264 encoder that enables digital video recording systems with streaming capability over WiFi and 4G/ LTE. The flexible video capture allows connection of two image sensors with independent resolutions and independent controls. The dual-channel video 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.

A12AQ is an ideal solution for single-channel mirror solutions that require a secondary analog/digital input from a backup camera to support picture and picture (PIP) and video recording or streaming capability. It also supports frame rate conversion to maintain constant output frame rate while dropping the input frame rate to maintain higher image fidelity in low-light scenes.

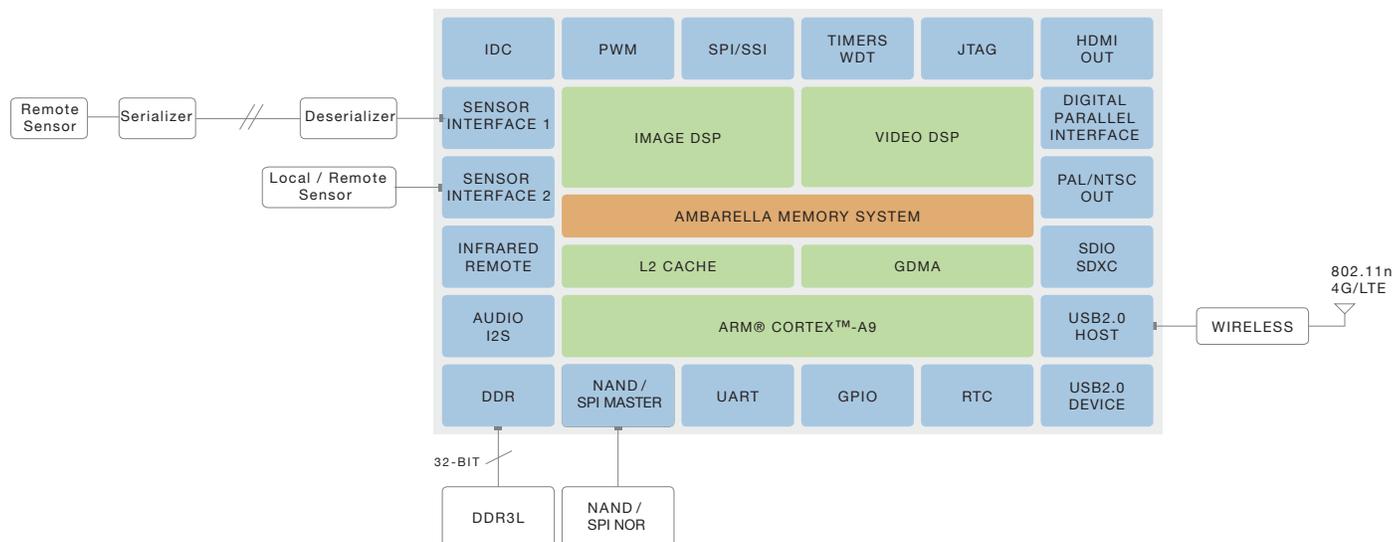
The SoC includes a high speed 550 MHz dual-core ARM® Cortex®-A9 CPU with Neon DSP extensions to provide powerful processing performance for customer applications including advanced driver assistance features, user interface, and wireless networking. The flexibility of the firmware/ hardware also allows implementation of proprietary communication protocols along with target and target less auto-calibration solutions.



A12AQ-based Single Channel eMirror System

Block Diagram

The diagram below illustrates a design based on the Ambarella A12AQ device.



Key Features

Superior Image Quality

- Advanced night vision for low-light conditions using smart exposure and temporal noise filtering
- 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

Video Input

- 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

Video Output

- Analog: On-chip video DAC for 480i/576i composite NTSC / PAL output
- 16-bit parallel output supporting RGB, YUV formats with embedded and external syncs
- HDMI 1.4b output with CEC and on-chip PHY

Powerful CPU for Advanced Driver Assistance

- Dual-core ARM® Cortex™-A9 @ up to 550 MHz
- 32 KB/ 32 KB I/D and 1 MB L2 Cache
- AES/ 3DES/ SHA-1/ MD5 Cryptography Engine
- Ambarella Image and Video DSPs

Recording File Formats

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

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

- 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 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
- Picture in picture support for dual channel electronic mirrors
- Frame rate conversion to maintain constant output frame rate during low light conditions

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

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 404 balls, 15x15 mm, 0.65 mm pitch

A12AQ Advanced HD Automotive Camera Development Platform

The A12AQ Automotive Camera Development Platform contains the necessary tools, software, hardware and documentation to develop a fully featured automotive camera system.

Evaluation Kit (EVK)

- A12AQ 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

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