Ambarella
AI envisioned™

H32AQ

Video SoC for Automotive

Key Features

Flexible Low-Power Platform
- Quad-core Arm® Cortex®-A53 CPU up to 756 MHz
- Multiple operating system (OS) support: ThreadX, Linux, ThreadX + Linux

Advanced Image Processing
- Multi-sensor support
- Multi-exposure line-interleaved HDR sensors with a dynamic range greater than 120 dB
- Hardware dewarping engine
- Electronic image stabilization (EIS)
- Superior low-light processing
- 3D motion-compensated temporal filtering (MCTF)
- RGGB / RCCB / RCCC / RGB-IR / monochrome sensor support

High-Efficiency Video Encoding
- H.265 and H.264 video compression
- Flexible multi-streaming capability
- 6MP30 video performance
- Multiple constant bit rate (CBR) and variable bit rate (VBR) control modes
- Smart H.264 and H.265 encoder algorithms

Target Applications
- Multi-channel drive recorders
- Single- / multi-channel electronic mirrors
- Driver monitoring systems (driver distraction / drowsiness detection)

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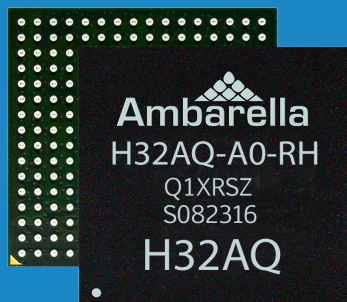
Overview

Ambarella's H32AQ system on chip (SoC) combines image / video processing, 6MP30 video encoding / decoding, and a quad-core processor in a single, low-power design, making it a leading choice to power the next generation of automotive cameras / video recorders. Fabricated in a 10 nm process technology, it achieves an industry-leading combination of low power and high performance. It is an ideal platform for implementing multi-channel digital video recorders, single or multi-channel electronic mirrors with recording capabilities, driver / in-cabin monitoring cameras, and more.

H32AQ uses a next-generation image signal processor (ISP) to deliver outstanding imaging in low-light conditions, while its high dynamic range (HDR) processing extracts maximum image detail in high-contrast scenes. H32AQ also implements a highly-efficient distortion correction block which allows support for ultra-wide angle and fisheye lenses. Its flexible hardware architecture allows processing of videos from multiple sensors simultaneously, enabling a lower overall system bill of materials (BOM) cost. H32AQ supports applications that require multiple encoded streams that are optimized for storage and streaming (WiFi / BLE).

H32AQ provides ample host CPU performance to implement application code and other lightweight computer vision algorithms such as localization and map building (SLAM) or neural networks (NNs).
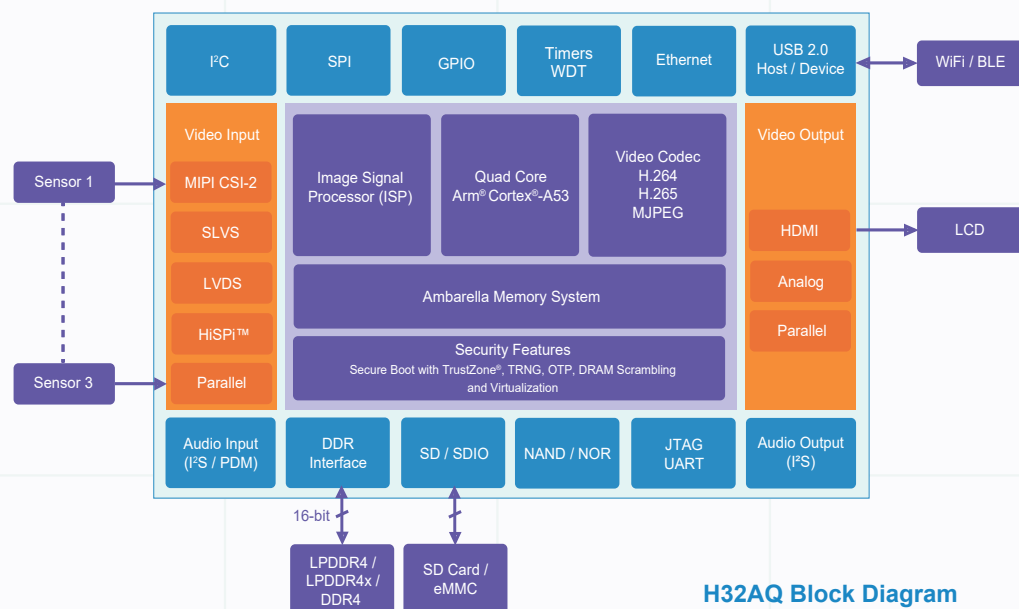
H32AQ Block Diagram

General Specifications

Processor Cores
- Quad-core Arm® Cortex®-A53 up to 756 MHz
- 32KB / 32KB I/D and 1 MB L2 Cache
- NEON™ SIMD and FPU acceleration
- Ambarella image signal processor
- AVC / HEVC video codec

Video Input
- Single, dual, or triple sensor inputs with independent ISP configuration
- Sub-LVDS / MIPI CSI-2® / SLVS / HiSPi™
- 16-bit parallel LVCMOS (BT.601 / 656)

Video Output
- HDMI® 2.0 including PHY with CEC support
- PAL / NTSC composite SD video out
- 16-bit parallel LVCMOS (BT.601)

CMOS Sensor Processing / Image Processing
- Lens shading correction
- Multi-exposure HDR (line-interleaved sensors)
- 3D motion-compensated temporal filtering (MCTF)
- RGGB / RCCB / RCCC / RGB-IR / monochrome sensor support
- 3-axis electronic image stabilization (EIS)
- Adjustable auto exposure (AE) / auto white balance (AWB)
- Lens distortion correction (LDC) for wide angle lenses
- Gamma compensation and color enhancement

- Vignetting compensation
- Dynamic range (WDR and HDR) engine
- On-screen display (OSD) engine, overlays, privacy mask
- Crop, mirror, flip, 90° / 270° rotation
- Defective pixel correction
- Chromatic aberration correction

Video Encoding / Decoding
- H.265 MP L5.0, H.264 MP / HP L5.1 and MJPEG
- 6MP30 maximum encoding / decoding performance
- Simultaneous encoding and streaming
- Multi-stream and multi-channel encoding
- Still capture or picture in video (PIV)
- Flexible group of pictures (GOP) configuration with I, P, and B frames
- Multiple CBR and VBR control modules

Security Features
- Secure boot with TrustZone® and secure memory, TRNG, OTP, DRAM scrambling and virtualization

Memory Interfaces
- LPDDR4 / LPDDR4x / DDR4 up to 1.6 GHz, 16-bit data bus, and up to 1 GB capacity
- Three SD controllers

- Boot from SPI or SLC NAND with BCH / SPI NOR / USB / eMMC
- Single- / dual- / quad-SPI NOR and SPI NAND

Peripheral Interfaces
- 10 / 100 / 1000 Ethernet with RMII / RGMII
- USB 2.0 port configurable for host / device
- Multiple I²S / PDM, SSI / SPI, I²C, and UART
- Multiple GPIO ports, PWM, IR, and ADC
- Watchdog timer, multiple general purpose timers, and JTAG

Physical
- 10 nm low-power complimentary metal-oxide semiconductor (CMOS)
- Operating temperature -40°C to +105°C
- FC VFBGA package (288 balls, 11x12 mm, 0.65 mm pitch)
- Automotive qualified (AEC-Q100 Grade-2)

H32AQ Camera Development Platform

The H32AQ camera development platform contains the necessary tools, software, hardware, and documentation to develop a small form factor camera.

Evaluation Kit

- H32AQ main board with connectors for sensor / lens board and peripherals
- Sensor board: Sony, onsemi, OmniVision, and others
- Datasheet, BOM, schematics, and layout
- Reference application with C source code available with additional licensing

Software Development Kit

- ThreadX / Linux / 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, including a programmer's guide and more