H22AQ
Video SoC for Automotive

Key Features

Flexible Low-Power Platform
- Quad-core Arm® Cortex®-A53 CPU up to 696 MHz
- Multiple OS Support: ThreadX, Linux, ThreadX + Linux
- 14 nm low-power CMOS process

Advanced Image Processing
- Multi-sensor support
- Multi-exposure line-interleaved HDR
- Hardware dewarping engine
- Electronic image stabilization (EIS)
- 3D motion-compensated temporal filtering (MCTF)
- Superior low-light processing

High-Efficiency Video Codec
- 8MP30 H.264 / H.265 video compression
- Flexible multi-streaming capability
- JPEG encoding for stills
- CBR and VBR control modes

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

Overview

Ambarella’s H22AQ SoC combines image / video processing, 8MP30 video encoding / decoding in a single, low-power design, making it a leading choice to power the next generation of automotive cameras / video recorders. Fabricated in a 14 nm process technology, it achieves an industry-leading combination of low power and high performance. H22AQ is an ideal platform for implementing multi-channel digital video recorders, single- or multi-channel electronic mirrors with recording, driver / in-cabin monitoring cameras, and more.

H22AQ implements a highly efficient 8MP30 AVC (H.264) / HEVC (H.265) encoder / decoder in hardware along with an industry-leading image signal processor (ISP). The H22AQ’s ISP provides outstanding imaging in low-light conditions while high dynamic range (HDR) processing extracts maximum image detail in high-contrast scenes. The flexible architecture allows encoding of multiple streams that are optimized for storage and video streaming over WiFi / BLE simultaneously. The highly-efficient distortion correction block in hardware supports cameras with ultra wide-angle lenses.

H22AQ also supports multi-sensor input, enabling recording systems that require two or more independent sensor inputs. To help customers implement their applications, Ambarella’s software development kit is available in RTOS (ThreadX) / Linux / and RTOS + Linux (dual OS).
### General Specifications

#### Processor Cores
- Quad-core Arm® Cortex®-A53 up to 696 MHz
- 32 KB / 32 KB I/D and 256 KB L2 cache
- NEON™ SIMD acceleration
- Ambarella image signal processor
- AVCC / HEVC video codec

#### Video Input
- Single or dual sensor inputs with independent ISP configuration
- MIPI CSI-2 / LVDS / SLVS / HiSP™
- 14-bit parallel LVCMOS (BT. 601 / 656)

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

#### Memory Interfaces
- DDR3 / DDR3L up to 732 MHz clock rate, 32-bit data bus, up to 2 GB capacity
- Two SD controllers
- Boot from SPI NOR / NAND flash / USB / eMMC

#### Peripheral Interfaces
- One USB 2.0 port device / host w/ PHY 2
- 10 / 100 / 1000 Ethernet with RMII / RGMII
- Audio interface including I2S and DMIC
- Multiple SSI / SPI, I2C / IDC, and UART
- Multiple GPIO ports, PWM, IR, and ADC
- Watchdog timer, multiple general-purpose timers, and JTAG

#### CMOS Sensor Processing / Image Processing
- RGGB and monochrome sensor support
- Multi-exposure HDR (line-interleaved sensors)
- Dynamic range (WDR and HDR) engine
- 3D motion-compensated temporal filtering (MCTF)
- Adjustable AE / AWB
- 3-axis electronic image stabilization (EIS)
- Lens distortion correction (LDC) for wide-angle lenses
- Crop, mirror, flip, 90° / 270° rotation
- Defective pixel correction
- Geometric lens distortion correction
- Chromatic aberration compensation
- Gamma compensation and color enhancement
- Black level correction
- Lens shading correction

#### Video Encoding / Decoding
- H.265 MP L5.1, H.264 MP / HP L5.1, and MJPEG
- 8MP30 maximum encoding / decoding performance
- Simultaneous recording and streaming
- Multi-stream and multi-channel encoding
- JPEG encoding for stills
- Multiple CBR and VBR control modes

#### Physical
- 14 nm low-power CMOS
- FC LFBGA package (369 balls, 14x14 mm, 0.65 mm pitch)
- Operating temperature -40°C to +105°C
- Automotive qualified (AEC-Q100 Grade-2)

---

### H22AQ Camera Development Platform

The H22AQ camera development platform contains the necessary tools, software, hardware, and documentation to develop a small form factor camera.

#### Evaluation Kit
- H22AQ main board with connectors for sensor / lens board and peripherals
- Sensor board: Sony, ON Semi, OmniVision, and others
- Datasheet, BOM, schematics, and layout
- Reference application with C source code

#### 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

---

www.ambarella.com/contact-us/

Copyright Ambarella International LP. All rights reserved. Ambarella and the Ambarella logo are trademarks of Ambarella International LP. All other brands, product names, and company names are trademarks of their respective owners. The information in this document is believed to be reliable, but may project preliminary functionality not yet available. Ambarella makes no guarantee or warranty concerning the accuracy and availability of said information and shall not be responsible for any loss or damage whatever nature resulting from the use of, or reliance upon it. Ambarella does not guarantee that the use of any information contained herein will not infringe upon patent, trademark, copyright, or other rights of third parties. Ambarella reserves the right to make changes in the product and / or its specifications presented in this publication at any time without notice.