Ambarella
AI envisioned

PRODUCT BRIEF

CV72AQ

4K AI Vision Processor

Key Features

Efficient Video Encoding
- H.265 and H.264 video compression
- Flexible multi-streaming capability
- 8MP90 / 4KP90 video performance
- Multiple constant bit rate (CBR) and variable bit rate (VBR) control modes
- Smart H.264 and H.265 encoder algorithms

3rd Generation Computer Vision Engine CVflow®
- Convolutional neural network (CNN) / deep neural network (DNN)-based processing: detection, classification, and more
- Accelerators for conventional computer vision (CV) operations
- Accelerators for nonlinear functions and transformer neural networks
- Oculii™ virtual aperture imaging (VAI) radar hardware acceleration
- CNN toolkit for easy porting of neural networks implemented in Caffe, TensorFlow, PyTorch, or ONNX frameworks

Advanced Image Processing
- Multi-exposure line-interleaved HDR
- Hardware dewarping engine
- Electronic image stabilization (EIS)
- Multiple camera support
- 3D motion-compensated temporal filtering (MCTF)
- Superior low-light processing
- RGGB / RCCB / RCCC / RGB-IR / monochrome sensor support

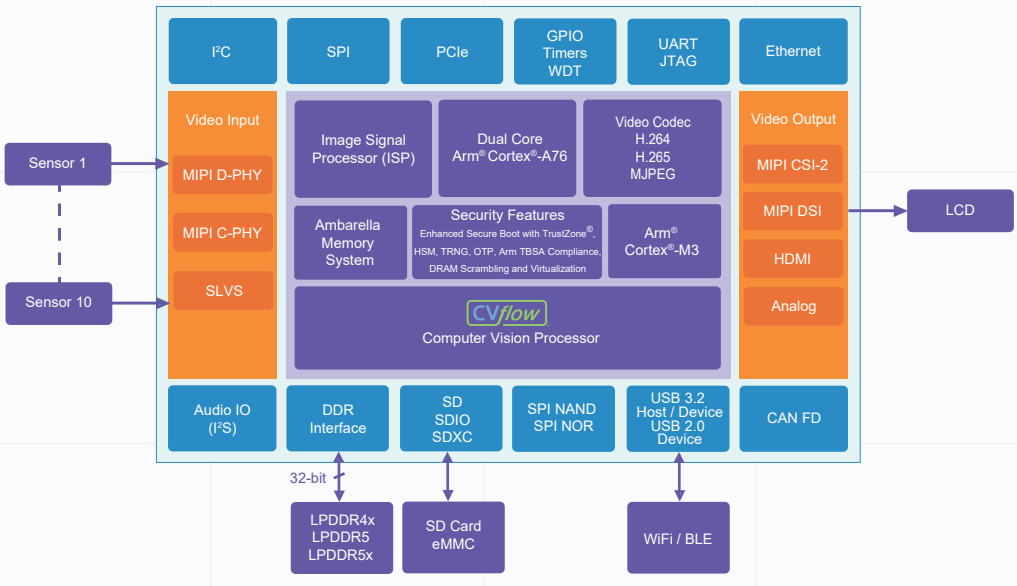
Target Applications
- Single- / multi-channel electronic mirrors
- Multi-channel drive recorders / data loggers
- Multi-camera advanced driver assistance systems (ADAS)
- Automatic parking assist (APA)

Overview

Ambarella's CV72AQ system on chip (SoC) provides 8MP90 / 4KP90 image processing, video encoding / decoding, and CVflow® computer vision processing in a single, low-power design. Fabricated in advanced 5 nm process technology, it achieves an industry-leading combination of low power and high performance in both human vision and computer vision applications. CV72AQ's third generation CVflow architecture provides the DNN processing required for the next generation of intelligent cameras for automotive applications.

CV72AQ's advanced image signal processor (ISP) provides outstanding imaging in low-light conditions, while high dynamic range (HDR) processing extracts maximum image detail in high-contrast scenes, further enhancing the computer vision capabilities of the chip. CV72AQ includes efficient encoding in both AVC and HEVC video formats, delivering high-resolution video recording and streaming with very low bit rates.

CV72AQ's CVflow architecture provides powerful computer vision processing while enabling highly accurate image recognition over long distances. The CVflow engine efficiently runs multiple neural networks (NN) in parallel while accelerating classical computer vision algorithms, providing powerful computer vision acceleration at minimal power consumption. Additionally, CV72AQ provides hardware acceleration for Oculii VAI radar software processing, thus enabling superior angular resolution, extended detection range, and accurate doppler measurements. To help customers easily port their own neural networks onto the CV72AQ SoC, Ambarella's software development kit (SDK) offers a complete set of tools for software and artificial intelligence (AI) implementation.



CV72AQ Block Diagram

General Specifications

Processor Cores
- Dual-core Arm® Cortex®-A76 up to 1.2 GHz
  - 64 KB / 64 KB L1 cache and 256 KB L2 cache per Cortex-A76 core
  - 1024 KB L3 cache per dual-core Cortex-A76
  - NEON™ SIMD and floating point unit (FPU) acceleration
- Arm Cortex-M3 up to 576 MHz

Computer Vision Processor
- CVflow processor with parallel architecture to boost performance of the low-level portion of perception algorithms
- Accelerators for conventional CV operations
- Accelerators for nonlinear functions and transformer neural networks
- Oculii VAI radar hardware acceleration

Video Input
- 1x MIPI C-PHY® / D-PHY
  - C-PHY mode (1–3 lanes) or D-PHY mode (1–4 lanes)
- 2x MIPI D-PHY (2–4 or 1–8 lanes each)
- 2x SLVS (2–4 or 1–8 lanes each)
- Up to ten cameras using MIPI virtual channels

Video Output
- HDMI® 2.0 including PHY with consumer electronic control (CEC) support
- PAL / NTSC composite SD video
- 2x MIPI DSI / CSI-2
- On-screen display (OSD) engine and overlays

CMOS Sensor / Image Processing
- Processing up to 8MP90 / 4KP90 (720 MPixel/s)
- Multi-exposure HDR (line-interleaved sensors)
- 3D motion-compensated temporal filtering (MCTF)
- RGGB / RCCB / RCCC / RGB-IR / monochrome sensor support
- Adjustable auto exposure (AE) / auto white balance (AWB)
- Advanced dynamic range (WDR and HDR) engine
- Chromatic aberration correction
- 180° and 360° fisheye lens and geometric distortion correction
- Gamma compensation and color enhancement
- Vignetting compensation
- 3-axis electronic image stabilization (EIS)
- Crop, mirror, flip, and 90° / 270° rotation

Video Encoding / Decoding
- H.265 (HEVC) MP L6.1, H.264 (AVC) MP / HP L6.1, and MJPEG
- 8MP90 / 4KP90 maximum encoding / decoding performance
- Flexible group of pictures (GOP) configuration with I, P, and B frames
- Multiple CBR and VBR control modules

Security Features
- Enhanced secure boot with TrustZone and secure memory, hardware security module (HSM), TRNG, OTP, Arm TBSA compliance, DRAM scrambling and virtualization

Tools for Development
- Computer vision toolkit to ease the porting of CNNs trained using frameworks such as Caffe, PyTorch, TensorFlow, or ONNX, as well as traditional computer vision code using Ambarella primitive language
- Compiler, debugger, and profiler for both Arm and microcode development

Memory Interfaces
- LPDDR4x up to 3.6 Gbits/s/pin, 32-bit data bus, up to 8 GB capacity
- LPDDR5(x) up to 5.6 Gbits/s/pin, 32-bit data bus, up to 16 GB capacity
- Three SD controllers
- Single- / dual- / quad- / octal-SPI NOR and single- / dual- / quad-SPI NAND
- Boot from SPI NAND / SPI NOR / USB / eMMC

Peripheral Interfaces
- Two Gigabit Ethernet ports
- 1-lane PCIe Gen 3
- 1x USB 3.2 host / device and 1x USB 2.0 device only with PHY
- 2x I^2S input and output interfaces, 1x DMIC
- 2x CAN FD interface
- Multiplexed 5x UART and 4x I/F of SSI / IDC
- Multiple GPIO ports, PWM, IR, and ADC
- Watchdog timer, general purpose timers, and JTAG

Physical
- 5 nm low-power complimentary metal-oxide semiconductor (CMOS) technology
- 16 mm x 16 mm FC TFBGA package with 0.65 mm ball pitch
- Operating temperature -40°C to +105°C (T_C)

CV72AQ Camera Development Platform

The CV72AQ camera development platform contains the necessary tools, software, hardware, and documentation to develop a camera utilizing the powerful CVflow processor while supporting the development of customized features.

Evaluation Kit
- CV72AQ main board with connectors for sensor / lens board and peripherals
- Sensor board: Sony, onsemi, Omnivision, and others
- Datasheet, BOM, schematics, and layout
- SDK and reference application with C source code available with additional licensing

Software Development Kit
- Royalty-free libraries for ISP, dewarp, and video recording
- Image tuning and manufacturing calibration tools
- Detailed documentation, including a programmer's guide and more
- CNN / DNN model preparation, porting, and profiling tools

www.ambarella.com/contact-us/

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