

CV2A

Automotive Computer Vision SoC

Key Features

Computer Vision Engine CVflow®

- Convolutional neural network (CNN)- / deep neural network (DNN)-based monocular processing to enable classification, tracking, and more
- Tools for high- and low-level algorithm development
- CNN toolkit for easy porting with Caffe, PyTorch, TensorFlow, and ONNX

Stereo Processing Engine

- Enabling generic obstacle detection, terrain modeling, and more

High-Efficiency Video Encoding

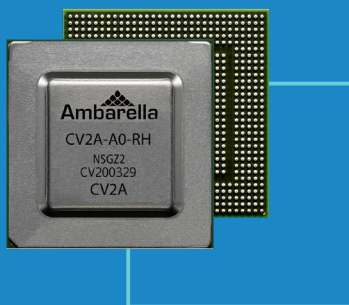
- H.265 and H.264 video compression
- Flexible multi-streaming capability
- 8MP60 video performance
- Multiple constant bit rate (CBR) and variable bit rate (VBR) control modes
- Smart H.264 and H.265 encoder algorithms

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

- Multi-channel drive recorders
- Aftermarket advanced driver assistance system (ADAS)
- Driver / in-cabin monitoring systems (DMS / CMS)
- Single- / multi-channel electronic mirrors

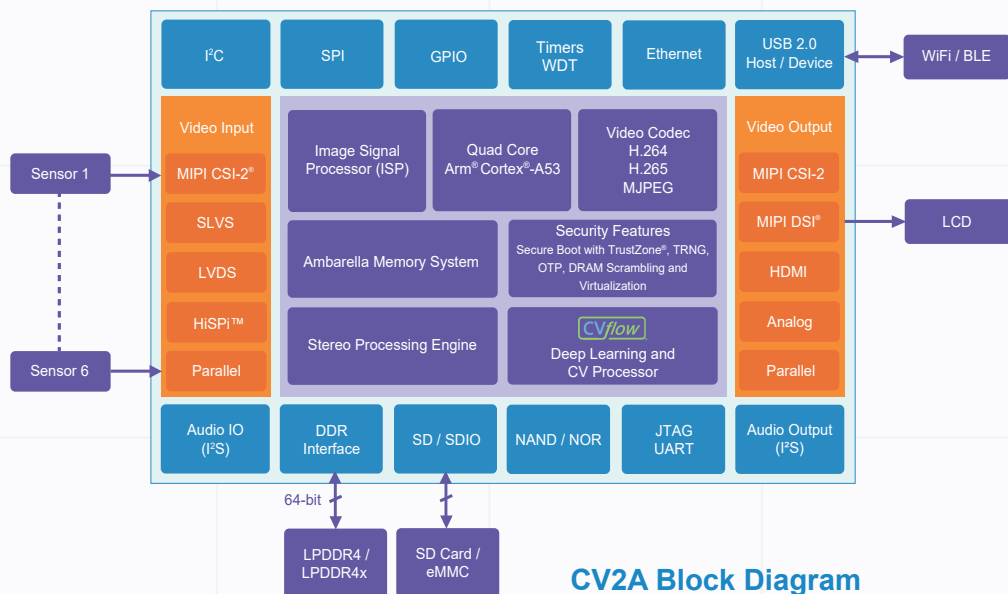


Overview

Ambarella's CV2A system on chip (SoC) combines image processing, 4KP60 / 8MP60 video encoding / decoding, and CVflow® computer vision processing in a single, low-power design, making it an ideal choice to enable the next generation of intelligent automotive devices. The CV2A's CVflow DNN engine and a dedicated stereo vision accelerator enable efficient implementation of mono and stereo algorithms for a wide range of use cases, including dash cameras, aftermarket ADAS devices, and more. Fabricated in advanced 10 nm process technology, it achieves an industry-leading combination of low power and high performance in both human vision and computer vision applications.

CV2A implements a highly efficient 8MP60 AVC (H.264) / HEVC (H.265) encoder in hardware along with an industry-leading image signal processor (ISP). The CV2A's 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. The flexible architecture allows encoding of multiple streams that are optimized for storage and video streaming over WiFi / BLE simultaneously. The chip also supports ultra-wide angle and fisheye lenses by performing distortion correction of the video in hardware.

The CV2A's CVflow architecture provides computer vision processing at full 8MP resolution to enable image recognition over long distances and with high accuracy. The CVflow core allows the implementation of algorithms such as forward collision warning, lane departure warning, driver monitoring, and more. To help customers easily port their own neural networks onto the CV2A SoC, Ambarella's software development kit (SDK) offers a complete set of tools.



CV2A Block Diagram

General Specifications

Processor Cores

- Quad-core Arm® Cortex®-A53 up to 1 GHz
- 32 KB / 32 KB I/D and 1 MB L2 Cache
- NEON™ SIMD and FPU acceleration
- AES / SHA1 / SHA2-256 crypto acceleration

Computer Vision Processor

- CVflow processor with parallel architecture to boost performance of the low-level portion of perception algorithms
- Stereo matching
- Feature matching

Video Input

- Hexa sensor input with independent ISP configuration
- Sub-LVDS / MIPI CSI-2® / SLVS / HiSPi™
- 16-bit parallel LVC MOS (BT.601 / 656)

Video Output

- 16-bit parallel LVC MOS (BT.601)
- HDMI® 2.0 including PHY with CEC support
- PAL / NTSC composite SD video
- MIPI DSI® / CSI-2 and FPD (VESA / JEIDA)

CMOS Sensor / Image Processing

- Image / video processing up to 8MP60
- Lens shading, fixed-pattern noise correction
- Multi-exposure HDR (line-interleaved sensors)
- 3D motion-compensated temporal filtering (MCTF)

- RRGB / 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° fisheye lens and geometric distortion correction
- On-screen display (OSD) engine and overlays
- Gamma compensation and color enhancement
- Vignetting compensation
- 3-axis electronic image stabilization (EIS)
- Crop, mirror, flip, 90° / 270° rotation

Video Encoding / Decoding

- H.265 MP L5.1, H.264 MP / HP L5.1, and MJPEG
- 8MP60 maximum encoding / decoding performance
- Up to eight simultaneous stream encodes
- Flexible group of pictures (GOP) configuration with I, P, and B frames
- Multiple CBR and VBR rate control modules

Security Features

- Secure boot with TrustZone®, TRNG, OTP, DRAM scrambling and virtualization

Tools for Development

- CNN toolkit to ease the porting of CNNs trained using frameworks such as Caffe, TensorFlow, or ONNX
- Compiler, debugger, and profiler for both Arm and microcode development

Memory Interfaces

- LPDDR4x / LPDDR4 up to 1.8 GHz clock rate, 64-bit data bus, up to 4 GB capacity
- Two SD controllers
- Boot from SPI / parallel SLC NAND with BCH / SPI NOR / USB / eMMC
- Single- / dual- / quad-SPI NOR and SPI NAND

Peripheral Interfaces

- One USB 2.0 port configurable as device / host with PHY
- Audio interface including I²S
- Multiple SSI / SPI, IDC, and UART
- Multiple GPIO ports, PWM, steppers, IR, ADC
- Watchdog timer, general purpose timers, and JTAG

Physical

- 10 nm low-power complimentary metal-oxide semiconductor (CMOS)
- HFC-BGA package (716 balls, 19x19 mm, 0.65 mm pitch)
- Operating temperature -40°C to +105°C

CV2A Camera Development Platform

The CV2A 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

- CV2A 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

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