Ambarella
AI envisioned™

CV28A

Automotive Computer Vision SoC

Key Features

Computer Vision Engine CVflow®

- Convolutional neural network (CNN)- / deep neural network (DNN)-based processing: detection, classification, tracking, and more
- Accelerators for conventional computer vision (CV) operations
- CNN toolkit for easy porting with Caffe, TensorFlow, and ONNX
- Tools for high- and low-level algorithm development
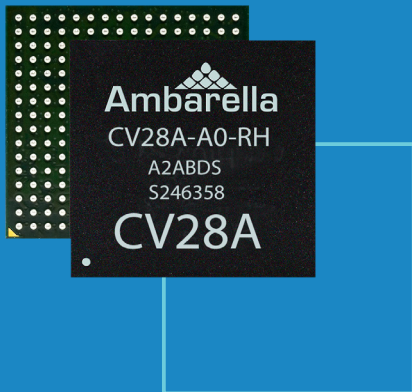
Advanced Image Processing

- 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

High-Efficiency Video Encoding

- H.265 and H.264 video compression
- Flexible multi-streaming capability
- 8MP30 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
- Aftermarket advanced driver assistance systems (ADAS)
- Single- / dual-channel electronic mirrors
- Driver / in-cabin monitoring systems (DMS / CMS)

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CV28A-A0-RH
A2ABDS
S246358
CV28A

Overview

Ambarella's CV28A system on chip (SoC) combines image processing, 8MP30 video encoding / decoding, and CVflow® computer vision processing in a single, low-power design, making it an ideal choice to power the next generation of intelligent automotive devices. The CV28A's CVflow architecture provides the DNN processing platform required for implementing computer vision algorithms on the camera. 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.

CV28A implements a highly efficient 8MP30 AVC (H.264) / HEVC (H.265) encoder in hardware along with an industry-leading image signal processor (ISP). The CV28A's ISP delivers 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 16-bit double data rate (DDR) interface and high system integration enable small form factor designs and reduce bill of materials (BOM) costs. The CVflow core allows 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 CV28A SoC, Ambarella's software development kit (SDK) offers a complete set of tools.
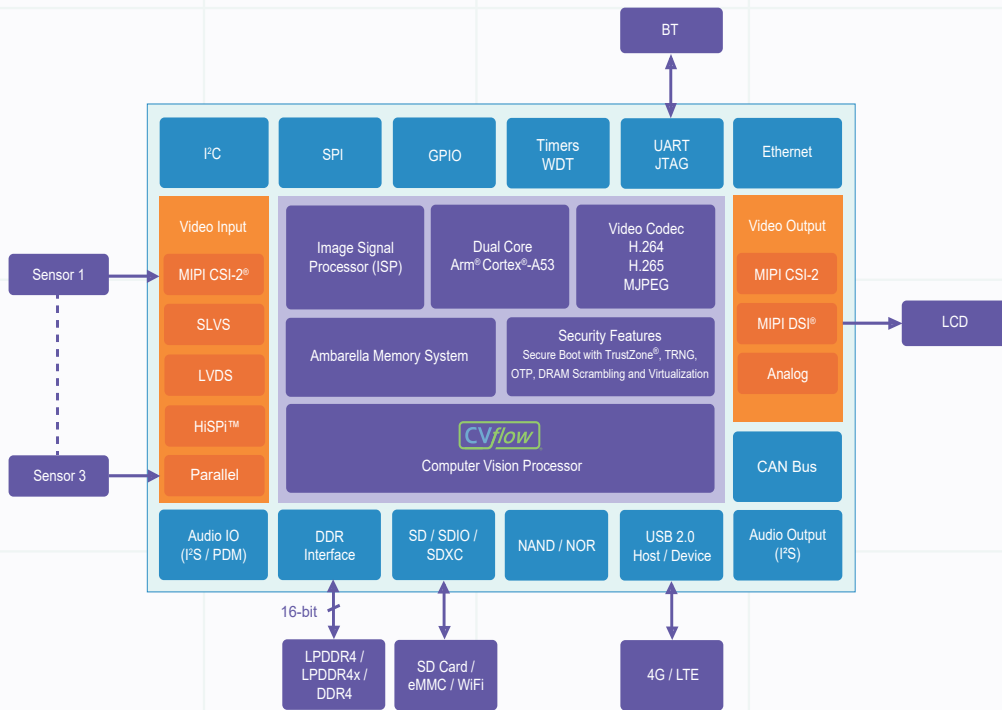
CV28A Block Diagram

General Specifications

Processor Cores
- Dual-core Arm® Cortex®-A53 up to 1 GHz
- NEON™ SIMD and FPU acceleration
- AES / SHA1 / SHA2-256 crypto acceleration
- Ambarella ISP and video codec

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

Video Output
- PAL / NTSC composite SD video out
- 4-lane MIPI DSI® / CSI-2 and FPD (VESA / JEIDA) out

CMOS Sensor Processing / Image Processing
- 8MP30 maximum input resolution
- Lens shading, fixed-pattern noise correction
- 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) / auto focus (AF)
- High dynamic range (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
- 8MP30 maximum encoding / decoding performance
- Up to eight simultaneous stream encodes
- Flexible group of pictures (GOP) configuration with I, P, and B frames
- Temporal scalable video codec (SVC-T) with four layers
- Dynamic region of interest (ROI)
- Multiple CBR and VBR control modules

Computer Vision Processor
- CVflow processor with parallel architecture to boost performance of the low-level portion of perception algorithms

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

Tools for Development
- CNN toolkit to ease the porting of CNNs trained with Caffe, TensorFlow, or ONNX
- Compiler, debugger, and profiler for both Arm and microcode development

Memory Interfaces
- LPDDR4 / LPDDR4x / DDR4 up to 1.6 GHz, 16-bit data bus
- Three SD controllers: SD / SDIO / SDXC
- Boot from SPI or parallel SLC NAND with BCH / SPI NOR / USB / eMMC

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

Physical
- 10 nm low-power complimentary metal-oxide semiconductor (CMOS)
- FC VFBGA package (288 balls, 11x12 mm, 0.65 mm pitch)
- Operating temperature -20°C to +85°C or -40°C to +105°C

CV28A Camera Development Platform

The CV28A 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

- CV28A 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