CV2S

Computer Vision SoC for IP Cameras

Key Features

Flexible Low-Power Platform
- 64-bit quad-core Arm® Cortex®-A53 CPU up to 1 GHz
- Linux kernel version 4.14+ or later (64-bit)
- CVflow® vector processor for CNN / DNN algorithms
- Secure boot with TrustZone® and secure memory, TRNG, OTP, DRAM scrambling and virtualization
- Industry leading image sensor support
- 10 nm low-power CMOS process

4K Computer Vision Engine
- CNN- / DNN-based processing: detection, classification, tracking, and more
- Dedicated CVflow computer vision processor
- Tools for high- and low-level algorithm development
- Dedicated hardware for stereo processing
- CNN toolkit for easy porting with Caffe, TensorFlow, and ONNX

Advanced Image Processing
- More than 800 MPixel/s input rate
- Multi-exposure line-interleaved HDR
- Hardware dewarping engine support
- Electronic image stabilization (EIS)
- Six independent sensor inputs
- 3D motion-compensated temporal filtering (MCTF)
- Superior low light processing

High-Efficiency Video Encoding
- H.265 and H.264 video compression
- Flexible multi-streaming capability
- Up to 4KP60 video performance
- Multiple CBR and VBR bit rate control modes
- Smart H.265 and H.264 encoder algorithms
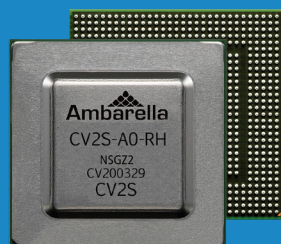
Overview

Ambarella's CV2S SoC combines image processing, 4KP60 video encoding, and CVflow® computer vision processing in a single, low-power design. The CV2S's CVflow architecture provides the deep neural network (DNN) processing required for the next generation of intelligent IP cameras. 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. In addition, CV2S also includes dedicated hardware for the stereo processing unit that can support stereo IP cameras.

The CV2S's CVflow architecture provides cutting-edge computer vision processing at full 4K resolution, enabling image recognition over long distances and with high accuracy. It includes efficient 4K encoding in both AVC and HEVC video formats, delivering high-resolution video streaming with very low bit rates to minimize cloud storage costs. The CV2S's next-generation 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.

CV2S includes a suite of advanced cybersecurity features such as secure boot with TrustZone® and secure memory, true random number generator (TRNG), one-time programmable memory (OTP), DRAM scrambling and virtualization, and a programmable secure level for each peripheral interface. To help customers easily port their own neural networks onto the CV2S SoC, Ambarella's software development kit offers a complete set of tools.
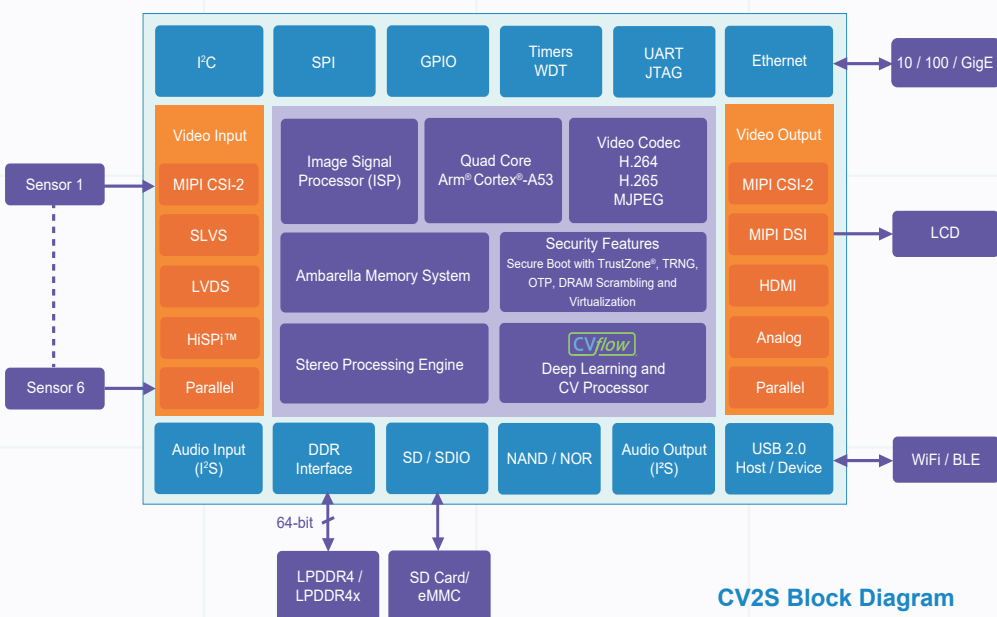
CV2S Block Diagram

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
- Ambarella image and video DSPs

Sensor and Video I/O
- Hexa sensor input with independent ISP configuration
- Dual 12-lane sub-LVDS / SLVS / HiSPi™ or hexa 4-lane SLVS
- Dual 8-lane MIPI or hexa 4-lane MIPI CSI-2
- 16-bit parallel LVCMOS
- BT.601 / 656 video in and 16-bit BT.601 out
- HDMI® 2.0 including PHY with CEC support
- PAL / NTSC composite SD video out
- 4-lane MIPI DSI / CSI-2 and FPD (VESA / JEIDA) out

Front End Sensor Processing
- 32 MPixels maximum resolution
- Lens shading correction
- Multi-exposure HDR (line-interleaved sensors)
- WDR with local tone mapping
- RGGB / RCCC / RCCB / RGB-IR (4x4) / mono sensor support

Image Processing
- 3D motion-compensated temporal filtering (MCTF)
- 3-axis electronic image stabilization (EIS)
- Adjustable AE / AWB / AF

- 180° and 360° fisheye lens and geometric distortion correction
- High quality polyphase scalers
- Digital PTZ and virtual cameras
- OSD engine, overlays, and privacy mask
- Crop, mirror, flip, 90° / 270° rotation
- DC-iris and P-iris
- Defective pixel correction
- Chromatic aberration correction
- Gamma compensation and color enhancement
- Backlight compensation

Intelligent Video Analytics
- CVflow vision processor for CNN / DNN edge analytics
- People counting and tracking
- Face detection, tracking, and recognition
- Human / pet / vehicle classification
- Object classification, recognition, and more
- Stereo processing unit for disparity map generation
- License plate recognition

Video Encoding
- H.265 (HEVC) MP L5.1, H.264 MP / HP L5.1, and MJPEG
- 4KP60 maximum encoding performance
- Up to 8 simultaneous stream encodes
- Flexible GOP configuration with I, P, and B frames

- Temporal scalable video codec (SVC-T) with 4 layers
- Dynamic region of interest (ROI)
- Multiple CBR and VBR rate control modules

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

Memory Interfaces
- LPDDR4 / LPDDR4x up to 1.8 GHz clock rate, 64-bit data bus
- Two SD controllers with SDXC SD™ card
- Boot from SPI or parallel SLC NAND with BCH / SPI NOR / USB / eMMC

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

Physical
- 10 nm low-power CMOS
- Operating temperature -25°C to +85°C
- HFC-BGA package with 716 balls, 19x19 mm, 0.65 mm pitch

CV2S Camera Development Platform

The CV2S 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

- CV2S main board with connectors for sensor / lens board and peripherals
- Sensor board: Sony, ON Semi, Omnivision, and others
- Datasheet, BOM, schematics, and layout
- SDK and reference application with C source code

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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