CV22FS
Automotive Computer Vision SoC

Key Features

Computer Vision Engine CVflow®
• CNN- / DNN-based processing to enable detection, classification, tracking, and more
• Dense optical flow engine
• Tools for high- and low-level algorithm development
• CNN toolkit for easy porting with Caffe, PyTorch, TensorFlow, and ONNX

Advanced Image Processing
• Multi-exposure line-interleaved HDR
• Real time multi-scale / multi-FOV generation
• Hardware dewarping engine support
• Multiple camera support
• LED flicker mitigation
• 3D motion-compensated temporal filtering (MCTF)
• RGGG / RCCB / RCCC / RGB-IR / monochrome sensor support

High-Efficiency Video Encoding
• 8MP30 H.264 video encoding performance
• Flexible multi-streaming capability
• Multiple CBR and VBR bit rate control modes
• Smart H.264 encoder algorithms

Functional Safety
• Error correcting code (ECC) protection of on-chip memory on DRAM
• Central error handling unit (CEHU)
• Processing island targeted to meet ASIL C requirements; safety island targeted to meet ASIL D requirements

Target Applications
• Single- / multi-camera ADAS
• DMS and in-cabin solutions
• Single- / multi-channel electronic mirrors with BSD
• Parking assistance systems

Overview

Ambarella’s ASIL C-compliant CV22FS combines high-performance and power-efficient computer vision acceleration, superior image processing (ISP), and H.264 video compression in a single SoC. Ambarella’s highly efficient CVflow® computer vision processor delivers deep neural network (DNN) processing required by the next generation of intelligent automotive cameras.

The ISP provides outstanding imaging in low-light conditions while its high dynamic range (HDR) processing extracts maximum image detail in high-contrast scenes, enhancing the computer vision capabilities of the chip while delivering crisp video for driver viewing.

CV22FS delivers high-resolution video recording and streaming at very low bit rates with efficient encoding in H.264 video format. It 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.

Fabricated in advanced 10 nm process technology, the CV22FS achieves an industry-leading combination of high performance and low power for computer vision applications. It is an ideal platform for implementing single- and multi-camera advanced driver assistance systems (ADAS), driver monitoring systems (DMS) and in-cabin solutions, single- and multi-channel electronic mirrors with blind spot detection (BSD), and intelligent parking assistance systems.
General Specifications

Processor Cores
• Quad-core Arm Cortex®-A53 up to 1 GHz
  • 32 KB / 32 KB L1 cache, 1 MB L2 cache
  • Arm Cortex-R52 456 MHz with DCLS (dual-core lock step)
  • 32 KB / 32 KB I/D L1 cache, 1 MB of embedded SRAMs
  • NEON™ SIMD and FPU acceleration
  • AES / SHA1 / SHA2-256 crypto acceleration using Arm V8 extensions

Computer Vision Processor
• CVflow processor optimized for high-performance CNN / DNN execution
• Dense optical flow engine

Video Input
• Multi-sensor input with independent ISP configuration
• Three MIPI CSI-2 ports (one port with virtual channels)

Video Output
• Two MIPI CSI-2 / MIPI DSI ports
• OSD engine and overlays

CMOS Sensor / Image Processing
• Processing up to 480 MPixel/s
• Lens shading, fixed-pattern noise correction
• Multi-exposure HDR (line-interleaved sensors)

Video Encoding
• H.264 MP / HP L5.0
• 8MP30 maximum encoding performance
• Flexible GOP configuration with I and P 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, 32-bit data bus for data and 16-bit data bus for ECC, up to 4 GB capacity
• Two SD controllers
• Boot from SPI / SPI NAND with BCH / SPI NOR / USB / eMMC
• Single- / dual- / quad- / octal-SPI NOR and single- / dual- / quad-SPI NAND

Peripheral Interfaces
• Six CAN FD controllers
• Two Ethernet ports with data transfer rates of 10- / 100- / 1000-Mbps
• One USB 2.0 port configurable as device / host with PHY
• Multiple SSI / SPI, IDC, and UART
• Multiple GPIO ports, PWM, steppers, ADC
• Watchdog timer, general purpose timers, and JTAG
• Audio interface (I²S)

Physical
• 10 nm low power CMOS
• FC TFBGA package (14x14 mm, 0.65 mm pitch)
• Operating temperature -40°C to +125°C (T_J)
• Automotive qualified (AEC-Q100 Grade-2, ASIL C)

CV22FS Camera Development Platform

The CV22FS camera development platform contains the necessary tools, software, hardware, and documentation to develop a camera utilizing the powerful CVflow processor while supporting development of customized features.

Evaluation Kit
• CV22FS 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
• ISO 26262-compliant SDK, OS, and middleware
• Royalty-free libraries for ISP, dewater, and video recording
• Image tuning and manufacturing calibration tools
• Detailed documentation, including a programmer’s guide and more
• CNN / DNN training, profiling, and porting tools

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