Overview

Ambarella’s CV22AQ SoC combines image processing, 8MP30 video encoding, and CVflow™ computer vision processing in a single, low-power design. The CV22AQ’s CVflow architecture provides the DNN (Deep Neural Network) processing required by the next generation of intelligent automotive 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. It is an ideal platform for implementing ADAS, electronic mirror, surround view, and drive recorder solutions.

The CV22AQ’s CVflow architecture provides computer vision processing at full 4K or 8-Megapixel resolution, enabling image recognition over long distances and with high accuracy. It includes efficient encoding in both AVC and HEVC video formats, delivering high-resolution video streaming with very low bit rates. The CV22AQ’s next-generation ISP (Image Signal Processor) provides outstanding imaging in low-light conditions while HDR (High Dynamic Range) processing extracts maximum image detail in high contrast scenes, further enhancing the computer vision capabilities of the chip. It includes a suite of advanced security features to prevent hacking, such as secure boot, TrustZone™ and I/O virtualization. A complete set of tools is provided to help customers easily port their own neural networks onto the CV22AQ SoC. Please see the list of possible applications in the CV22AQ Applications section on the second page of the product brief.

Key Features

8-Megapixel Computer Vision Engine
- CNN / DNN-based processing: detection, classification, tracking, and more
- Computer Vision Processor
- Tools for high and low-level algorithm development
- CNN toolkit for easy porting with Caffe, TensorFlow, and ONNX
- Open SDK

Advanced Image Processing
- Up to 576 MPixels input rate
- Multi-exposure line-interleaved HDR
- Hardware de-warping engine support
- Electronic Image Stabilization (EIS)
- Support for multiple cameras
- LED flicker mitigation
- 3D motion compensated noise reduction (MCTF)
- Superior low light processing

High-Efficiency Video Encoding
- H.265 and H.264 video compression
- Flexible multi-streaming capability
- 8MP30 video performance
- Multiple CBR and VBR bit rate control modes
- Smart H.264 and H.265 encoder algorithms

Viewing and Sensing in the Same System
- 1, 2, and 3 channel electronic mirror with computer vision features (Blind Spot Detection)
- AVM (Around View Monitor) with computer vision features
- EuroNCAP features addressed

Block Diagram

The diagram below illustrates a design based on the Ambarella CV22AQ device.
**General Specifications**

**Processor Cores**
- Quad-core ARM® Cortex®-A53 up to 756 MHz
- 32 KB / 32 KB I/D and 1 MB L2 Cache

**Sensor and Video I/O**
- Single or dual sensor input with independent ISP configuration
- Single 8-lane sub-LVDS / SLVS / HiSpi™ or dual 4-lane SLVS
- Single 8-lane MIPI or dual 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 (VESAr / JEIDA) out

**CMOS Sensor Processing / Image Processing**
- 8 MPixels @ 30 fps maximum input resolution
- Lens shading, fixed pattern noise correction
- Multi-exposure HDR (line-interleaved sensors)
- 3D motion compensated noise reduction (MCTF)
- RGGB / RGBLR / Monochrome / RCCB sensor support
- Adjustable AE / AWB / AF
- LED flicker compensation for LED sources
- Dynamic range (WDR and HDR) engine
- Chromatic aberration correction
- 180° fisheye lens and geometric distortion correction
- 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**
- H.265 (HEVC) MP L5.1, H.264 MP/HP L5.1, and MJPEG
- 8MP30 maximum encoding performance
- Up to 8 simultaneous stream encodes
- Flexible GOP configuration with I, P, and B frames
- Multiple CBR and VBR rate control modules

**Computer Vision Processor**
- [CVflow](#) processor with parallel architecture to boost performance of the low-level portion of perception algorithms

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

**Memory Interfaces**
- LPDDR4x, LPDDR4 up to 1.4 GHz clock rate, 32-bit data bus
- Up to 4-Gbyte capacity
- NAND flash, SLC with ECC
- Boot from SPI-NAND / NOR, SPI-EEPROM, NAND flash, USB, or eMMC

**Peripheral Interfaces**
- One USB 2.0 port configurable as Device/Host with PHY
- Audio interface including I2S
- Multiple SSI/SPI, IDC, and UART
- Multiple PWM, Stepper, and ADC channels
- Multiple GPIO ports, PWM, Steppers, IR, ADC
- Watchdog Timer, multiple general purpose timers, and JTAG

**Physical**
- 10 nm low-power CMOS
- FBGA package with 441 balls, 16x16 mm, 0.65 mm pitch
- Operating temperature -40°C to + 105°C
- Automotive qualified (AEC-Q100 Grade-2)

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**Contact**

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