CV28M

Computer Vision SoC for IP Cameras

Key Features

Flexible Low-Power Platform
• CVflow® computer vision engine
• 64-bit dual-core Arm® Cortex®-A53 CPU up to 1 GHz
• Linux kernel version 4.14 or later (64-bit)
• Linux SDK for standards-based development
• Secure boot with TrustZone® and secure memory, TRNG, OTP, DRAM scrambling and virtualization
• Industry-leading image sensor support
• 10 nm low-power CMOS process

CVflow Computer Vision Engine
• CNN / DNN inference acceleration for detection, classification, and more
• CNN toolkit for easy porting with Caffe, TensorFlow, and ONNX
• Accelerators for conventional CV operations
• Tools for high- and low-level algorithm development

Advanced Image Processing
• Up to 320 MPixel/s input rate
• Multi-exposure line-interleaved HDR
• Superior low-light processing
• 3D motion-compensated temporal filtering (MCTF)
• Hardware dewarping engine
• Electronic image stabilization (EIS)
• Up to three independent sensor inputs

High-Efficiency Video Encoding
• H.265 and H.264 video compression
• Flexible multi-streaming capability
• Up to 4KP30 video performance
• Multiple CBR and VBR bit rate control modes
• Smart H.264 and H.265 encoder algorithms

Overview

Ambarella’s CV28M SoC combines state-of-the-art computer vision technology with image processing in a single, low-power design. Fabricated using advanced 10 nm process technology, CV28M achieves an industry-leading combination of low power and high performance in both human and computer vision applications.

Meeting the demands of the next generation of intelligent IP cameras, CV28M’s CVflow® architecture provides deep neural network (DNN) computer vision processing and 4KP30 video encoding, enabling a multitude of computer vision applications on the edge. Efficiently encoding in both AVC and HEVC video formats, CV28M minimizes cloud storage costs by streaming high-resolution video at low bit rates.

To further enhance its computer vision capabilities, CV28M uses a next-generation image signal processor (ISP) to deliver outstanding imaging in low-light conditions, while its high dynamic range (HDR) processing extracts maximum image detail in high-contrast scenes.

CV28M includes a suite of advanced security features to implement on-device physical security, including secure boot with TrustZone®, TRNG, OTP, DRAM scrambling and virtualization. To help customers easily port their own neural networks onto the CV28M SoC, Ambarella’s software development kit offers a complete set of tools.

CV28M 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 image signal processor and video codec  

| Sensor and Video I/O | • 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  
|                     | • PAL / NTSC composite SD video out  
|                     | • 4-lane MIPI DSI / CSI-2 and FPD (VESA / JEIDA) out  

| Sensor Processing | • 320 MPixel/s maximum pixel rate  
|                  | • Lens shading correction  
|                  | • Multi-exposure HDR (line-interleaved sensors)  
|                  | • WDR with local tone mapping  

| Image Processing | • 3D motion-compensated temporal filtering (MCTF)  
|                 | • 3-axis electronic image stabilization (EIS)  
|                 | • Adjustable AE / AWB / AF  
|                 | • 180° fisheye lens distortion correction  
|                 | • High-quality polyphase scalers  
|                 | • Digital PTZ and virtual cameras  

| Intelligent Video Analytics | • CVflow vision processor for CNN / DNN edge analytics  
|                           | • People counting and tracking  
|                           | • Face detection and recognition  
|                           | • Human / pet / vehicle classification  
|                           | • Object classification, recognition, and more  
|                           | • License plate recognition  

| Video Encoding | • H.265 MP L5.1, H.264 MP / HP L5.1, and MJPEG  
|               | • 4KP30 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 / 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  
|                      | • Watchdog timer, multiple general-purpose timers, and JTAG  

| Physical | • 10 nm low-power CMOS  
|         | • Operating temperature -25°C to +85°C  
|         | • FC VFBGA package (288 balls, 11x12 mm, 0.65 mm pitch)  

CV28M Camera Development Platform

The CV28M 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**
- CV28M 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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