



# H32

## Video SoC for Consumer Cameras

### Overview

Ambarella's H32 SoC combines image / video processing, 8MP30 video encoding, and a quad-core processor in a single, low-power design making it an ideal choice for aftermarket dash cameras, wearable products, and action cameras. Fabricated in a 10 nm process technology, H32 achieves an industry-leading combination of low-power and high-performance in image and video processing applications.

H32 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. The chip implements a highly-efficient distortion correction block which allows support of ultra-wide angle and fisheye lenses. Its flexible hardware architecture allows processing of videos from multiple sensors simultaneously, enabling a lower overall system BOM cost. H32 supports applications that require multiple encoded streams that are optimized for storage and streaming (WiFi / BLE).

H32 provides ample host CPU performance to implement application code and other lightweight computer vision algorithms such as localization and map building (SLAM) or neural networks.



The H32 chip targets automotive camera designs

### Key Features

#### Flexible Low-Power Platform

- Quad-core Arm® Cortex®-A53 CPU up to 1 GHz
- Multiple OS Support: ThreadX, Linux, ThreadX + Linux
- 10 nm low-power CMOS process

#### Advanced Image Processing

- Multi-sensor support
- Multi-exposure line-interleaved HDR sensors with a dynamic range greater than 120 dB
- Hardware dewarping engine
- Electronic image stabilization (EIS)
- Superior low-light processing
- 3D motion-compensated temporal filtering (MCTF)
- RGGB / RCCB / RCCC / RGB-IR / monochrome sensor support

#### High-Efficiency Video Encoding

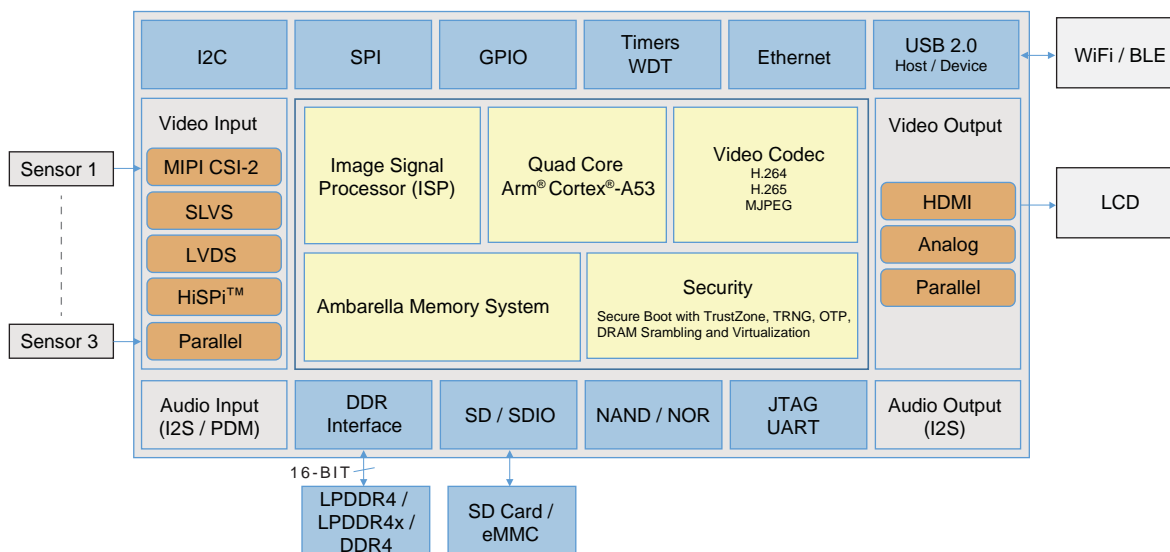
- H.265 and H.264 video compression
- Flexible multi-streaming capability
- 8MP30 video performance
- Multiple CBR and VBR control modes
- Smart H.264 and H.265 encoder algorithms

#### Target Applications

- Multi-channel drive recorder
- Aftermarket ADAS
- Wearable cameras
- Action / sports cameras
- Driver monitoring system (driver distraction / drowsiness detection)

### Block Diagram

The diagram below illustrates a design based on the Ambarella H32 device.



## General Specifications

### Processor Cores

- Quad-core Arm® Cortex®-A53 up to 1 GHz
- 32KB / 32KB I/D and 1 MB L2 Cache
- NEON™ SIMD and FPU acceleration
- Secure boot with TrustZone®, TRNG, OTP, DRAM scrambling and virtualization
- Ambarella image signal processor
- AVC / HEVC video codec

### Video Input

- Single, dual, or triple sensor inputs with independent ISP configuration
- Sub-LVDS / MIPI CSI-2 / SLVS / HiSPi™
- 16-bit parallel LVCMOS (BT.601 / 656)

### Video Output

- HDMI® 2.0 including PHY with CEC support
- PAL / NTSC composite SD video out
- 16-bit parallel LVCMOS (BT.601)

### CMOS Sensor Processing / Image Processing

- Lens shading correction
- Multi-exposure HDR (line-interleaved sensors)
- 3D motion-compensated temporal filtering (MCTF)
- RGGB / RCCB / RCCC / RGB-IR / monochrome sensor support
- 3-axis electronic image stabilization (EIS)
- Adjustable AE / AWB
- Lens distortion correction (LDC) for wide angle lens
- LED flicker compensation for LED sources
- Gamma compensation and color enhancement
- Vignetting compensation
- Dynamic range (WDR and HDR) engine
- OSD engine, overlays, privacy mask
- Crop, mirror, flip, 90° / 270° rotation
- Defect pixel correction
- Chromatic aberration correction

### Computer Vision Applications

- User authentication (face detection / recognition)
- Driver monitoring system (driver distraction / drowsiness detection)
- License plate detection / recognition
- Lane departure warning / lane keeping
- Forward collision warning

### Video Encoding

- H.265 MP L5.0, H.264 MP/HP L5.1 and MJPEG
- 8MP30 maximum encoding performance
- Simultaneous encoding and streaming
- Multi-stream and multi-channel encoding
- Still capture (picture in video or PIV)
- Flexible GOP configuration with I, P, and B frames
- Multiple CBR and VBR rate control modules

### Memory Interfaces

- LPDDR4 / LPDDR4x / DDR4 up to 1.6 GHz, 16-bit data bus, and up to 1 GB capacity
- Three SD controllers
- Boot from SPI SLC NAND with BCH / SPI NOR / USB / eMMC
- Single- / dual- / quad-SPI NOR and SPI NAND

### Peripheral Interfaces

- 10 / 100 / 1000 Ethernet with RMII / RGMII
- USB 2.0 port configurable for host / device
- Multiple I²S / PDM, 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 -20°C to +85°C
- FC VFBGA package with 288 balls, 11x12 mm, 0.65 mm pitch

## H32 Consumer Applications Development Platform

The H32 consumer applications development platform contains the necessary tools, software, hardware, and documentation to develop a small form factor camera.

### Evaluation Kit (EVK)

- H32 main board with connectors for sensor / lens board, peripherals
- Sensor board: OmniVision, Sony, and others
- Datasheet, BOM, schematics, and layout
- Reference application with C source code

### Software Development Kit (SDK)

- ThreadX / Linux / ThreadX + Linux with patches, drivers, tools, and application source code
- Royalty-free libraries for ISP, 3A, dewarp, and codecs
- Image tuning and manufacturing calibration tools
- Detailed documentation, including a programmer's guide and more

**Contact** [www.ambarella.com/about/contact/inquiries.html](http://www.ambarella.com/about/contact/inquiries.html)

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