

# H32

Video SoC for Consumer Cameras

## Key Features

### Flexible Low-Power Platform

- Quad-core Arm® Cortex®-A53 CPU up to 1 GHz
- Multiple operating system (OS) support: ThreadX, Linux, ThreadX + Linux

### Advanced Image Processing

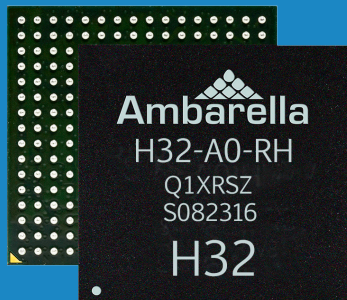
- Multi-sensor support
- Multi-exposure line-interleaved high dynamic range (HDR) sensors with a dynamic range greater than 120 dB
- Hardware dewarping engine
- Electronic image stabilization (EIS)
- Superior low-light processing
- 3D motion-compensated temporal filtering (MCTF)
- RGGB / RCCB / RCCC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

### High-Efficiency Video Encoding

- H.265 and H.264 video compression
- Flexible multi-streaming capability
- 8MP30 video performance
- Multiple constant bit rate (CBR) and variable bit rate (VBR) control modes
- Smart H.264 and H.265 encoder algorithms

### Target Applications

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

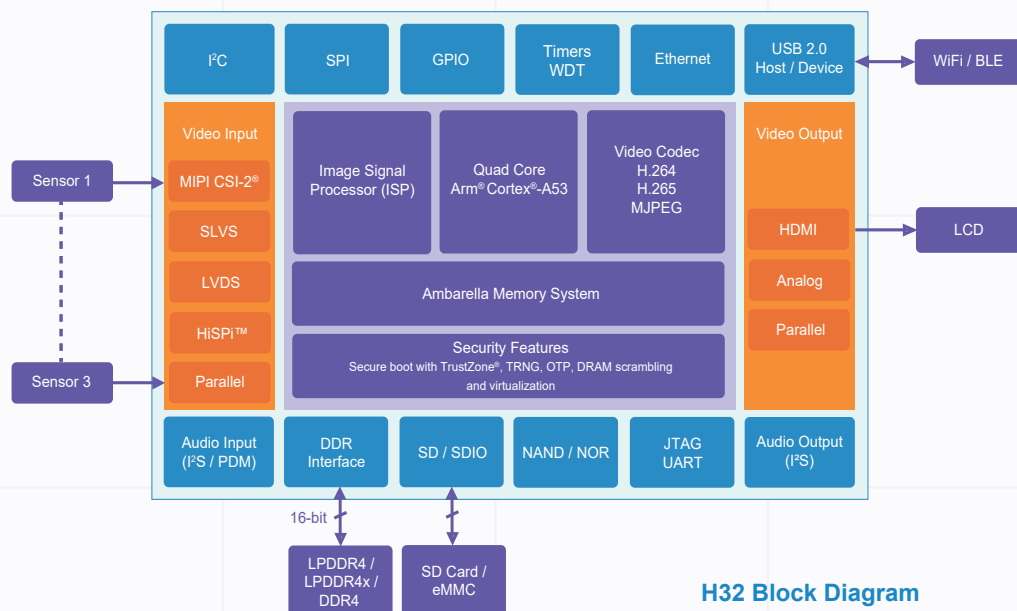


## Overview

Ambarella's H32 system on chip (SoC) combines image and video processing, 8MP30 video encoding / decoding, 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. H32 also 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 billing of materials (BOM) costs. 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 (NNs).



H32 Block Diagram

# 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
- 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 auto exposure (AE) / auto white balance (AWB)
- Lens distortion correction (LDC) for wide angle lenses
- Gamma compensation and color enhancement

- Vignetting compensation
- Dynamic range (WDR and HDR) engine
- On-screen display (OSD) engine, overlays, privacy mask
- Crop, mirror, flip, 90° / 270° rotation
- Defective 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 / Decoding

- H.265 MP L5.0, H.264 MP / HP L5.1 and MJPEG
- 8MP30 maximum encoding / decoding performance
- Simultaneous encoding and streaming
- Multi-stream and multi-channel encoding
- Still capture or picture in video (PIV)
- Flexible group of pictures (GOP) configuration with I, P, and B frames
- 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, 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 complimentary metal-oxide semiconductor (CMOS)
- Operating temperature -20°C to +85°C
- FC VFBGA package (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

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

## Software Development Kit

- 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

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