**S5L**

**IP Camera SoC**

**Key Features**

Flexible Low-Power Platform
- 64-bit quad-core Arm® Cortex®-A53 CPU up to 1.0 GHz with L2 cache
- Linux kernel version 4.9 or later (64-bit)
- Linux SDK for standards-based development
- 14 nm low-power CMOS process

Advanced Image Processing
- Up to 480 Mpixel/s input rate
- Multi-exposure line-interleaved HDR
- Hardware lens distortion correction
- Electronic image stabilization (EIS)
- Dual independent sensor inputs
- 3D motion-compensated noise reduction (MCTF)

High-Efficiency Video Encoding
- H.264 and H.265 video compression
- Flexible multi-streaming
- Up to 4KP30 + 480p30 video performance for H.265
- Smart H.264 and H.265 encoder algorithms

**Overview**

The Ambarella S5L IP camera SoC integrates an advanced image signal processor (ISP), H.265 and H.264 encoders capable of up to 4KP30 video, and a quad-core Arm® Cortex®-A53 CPU up to 1 GHz for implementing custom applications. The low-power S5L is suitable for a wide range of IP camera designs, offering advanced imaging features such as high dynamic range (HDR) processing, motion-compensated 3D noise reduction, dual video input (VIN), and lens distortion correction.

The flexible S5L software development kit (SDK) provides a Linux-based framework and development environment that includes image-tuning tools and a rich set of application programming interfaces (APIs), enabling a range of product customization and differentiation options in areas such as sensor and lens tuning, analytics, and network applications.
**S5L IP Camera Development Platform**

The S5L camera development platform contains the necessary tools, software, hardware, and documentation to develop an IP camera while supporting development of customized features.

**Processor Cores**
- Quad-core ARM® Cortex®-A53 up to 1.0 GHz
- 32 KB / 32 KB I/D and 256 KB L2 cache
- NEON™ and FPU acceleration
- AES / 3DES / SHA-1 / MD5 cryptography engine
- Ambarella image and video DSPs

**Evaluation Kit (EVK)**
- S5L main board with connectors for sensor / lens board and peripherals
- Sensor board: Sony, onsemi, OmniVision, Panasonic, and others
- Datasheet, BOM, schematics, and layout
- IP camera reference application with C and C++ source code

**Software Development Kit (SDK)**
- Linux 4.9 or later with 64-bit kernel including patches, drivers, tools, and application source code
- Latest Linaro GCC Toolchain for 64-bit Arm Cortex ArmV8
- Royalty-free libraries for ISP, 3A, dewarp, and codecs
- Image tuning and manufacturing calibration tools
- Detailed documentation with programmer’s guide and application notes

**Memory Interfaces**
- DDR3 / DDR3L / LPDDR3 up to 1 GHz and 32-bit or 16-bit data bus
- Two SD controllers with SDXC SD™ card
- NAND flash and SLC with ECC
- Boot from SPI-NOR, SPI-EEPROM, NAND flash, USB, or eMMC

**Peripheral Interfaces**
- 10 / 100 / 1000 Ethernet with RMII / RGMII
- Two USB ports: one for host and one for host / device
- Multiple I²S, SSI / SPI, I²C, and UART
- Many GPIO ports, PWM, steppers, IR, and ADC
- Watchdog timer, multiple general purpose timers, and JTAG

**Physical**
- 14 nm low-power CMOS
- Operating temperature -20°C to +85°C
- FC LFBGA package with 369 balls, 14x14 mm, 0.65 mm pitch rate

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**General Specifications**

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**Sensor and Video I/O**
- Single or dual sensor input (LVDS / MIPI®, with independent ISP configuration
  - Single 8-lane sub-LVDS / SLVS / HiSPI™ or dual 4-lane MIPI
  - 14-bit parallel and LVCMS sensors
- BT.601 / 656 / 1120 video in and BT.656 / BT.1120 out
- 24-bit RGB out, HDMI® 1.4b with PHY out
- PAL / NTSC composite SD video out

**Front End Sensor Processing**
- 480 MHz maximum pixel rate
- Lens shading
- Multi-exposure HDR (line-interleaved sensors)
- Wide dynamic range (WDR) local exposure

**Image Processing**
- 3D motion-compensated noise reduction (MCTF)
- 3-axis electronic image stabilization (EIS)
- Adjustable AE / AWB / AF
- 180° fisheye lens distortion correction
- High-quality polyphase scalers
- Digital pan / tilt / zoom (PTZ) and virtual cameras
- OSD engine, overlays, and privacy mask
- Crop, mirror, flip, and 90° / 270° rotation
- DC-iris and P-iris
- Defect pixel correction
- Geometric and chroma lens distortion correction
- Gamma compensation and color enhancement
- Backlight compensation

**Intelligent Video Analytics**
- Advanced third-party analytics options:
  - Face detection and tracking
  - Intelligent motion detection
  - Tampering / intrusion detection and people counting
  - License plate recognition
  - Object recognition and more

**Video Encoding**
- H.265 (HEVC) MP L5.1, H.264 BP / MP / HP L5.1 and MJPEG
- 4KP30 + 480p30 maximum encoding performance
- Up to 8 simultaneous stream encodes
- SmartAVC and SmartHEVC low bit rate streaming
- Flexible OP configuration with I, P, and B frames
- Temporal scalable video codec with 4 layers (SVC-T)
- Dynamic region of interest (ROI) with 32 free-form regions
- Multiple constant bit rate (CBR) and variable bit rate (VBR) control modes

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