S2L
IP Camera Processor

Key Features

Flexible Low-Power Platform
• Arm® Cortex®-A9 CPU
• Flexible Linux SDK for standards-based development
• 28 nm low-power CMOS process

Advanced Image Processing
• Up to 14 MPixel resolution
• Multi-exposure line-interleaved HDR
• Hardware dewarp for 180° panorama
• Improved motion-compensated temporal filtering (MCTF) with advanced sharpening

High-Efficiency Video Encoding
• Up to 5M@30fps H.264 high-profile encoding
• SmartAVC™ streaming as low as 600 Kbps for 1080p30
• Flexible multi-streaming

Overview

The Ambarella S2L IP camera processor is a system on chip (SoC) solution that integrates an advanced image signal processor (ISP), an H.264 encoder capable of up to 5MP30 video, and a powerful Arm® Cortex®-A9 CPU for user applications. Targeting IP camera designs, the S2L supports high dynamic range (HDR) and motion-compensated 3D noise reduction to accommodate challenging lighting conditions, while the multi-streaming H.264 encoder with SmartAVC delivers superb video quality at low bit rates.

The S2L family is supported by a flexible Linux-based IP camera software development kit (SDK) to enable development of differentiated products in areas such as sensor and lens tuning, analytics, and network connectivity.

S2L Block Diagram
## General Specifications

### Processor Cores
- Arm® Cortex®-A9
- 32 KB / 32 KB I/D and 128 KB L2 cache
- NEON™ and FPU acceleration
- AES / 3DES / SHA-1 / MD5 cryptography engine
- Ambarella image and video DSPs

### Sensor and Video I/O
- Dual-port RGB Bayer interface to popular sensors
  - Primary port: 8 lanes of SLVS / MiPi® / HiSPI™
  - Secondary port: 2-lane SLVS / MIPI / HiSPI
- 16-bit parallel
- BT.601 / 656 / 1120 video in and BT.656 / 1120 video out
- 24-bit RGB out, HDMI® 1.4a with PHY out
- PAL / NTSC composite SD video out

### Front End Sensor Processing
- 14 MPixel maximum resolution
- 480 MHz maximum pixel rate
- Lens shading and fixed pattern noise correction
- Multi-exposure high dynamic range (HDR) (line-interleaved sensors)
- Wide dynamic range (WDR) local exposure

### Image Processing
- 3D motion-compensated noise reduction (MCTF)
- Adjustable AE / AWB / AF
- 180° fisheye dewarping with multi-window modes
- High-quality polyphase scalers
- Digital pan / tilt / zoom (PTZ) and virtual cameras
- On-screen display (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 (LDC)
- 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.264 codec BP / MP / HP level 5.1 and MJPEG
- 14 MPixel maximum resolution
- 5M@30fps encoding performance
- Up to 4 simultaneous stream encodes
- SmartAVC low bit-rate streaming
- Flexible GOP configuration with I, P, and B frames
- Temporal scalable video codec with 4 layers (SVC-T)
- Dynamic region of interest (ROI)
- Multiple constant bit rate (CBR) and variable bit rate (VBR) control modes

### Memory Interfaces
- DDR3 / DDR3L up to 800 MHz, 32-bit data bus
- Three 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 Ethernet with RMII / MII
- Two USB 2.0 ports with device and device / host with PHY
- Multiple I²S, SSI / SPI, I²C, and UART
- Multiple PWM, Stepper, and ADC channels
- Many GPIO ports, PWM, Steppers, IR, and ADC
- Watchdog timer, multiple general purpose timers, and JTAG

### Physical
- 28 nm low-power CMOS
- <500 mW for 1080p30, including DDR
- Operating temperature -20°C to +85°C
- LFBGA package with 404 balls, 15x15 mm, 0.65 mm pitch

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### S2L IP Camera Development Platform

The S2L IP camera development platform contains the necessary tools, software, hardware, and documentation to develop an IP camera while supporting development of customized features.

#### Evaluation Kit (EVK)
- S2L main board with connectors for sensor / lens board and peripherals
- Sensor board: Aptina, OmniVision, Panasonic, Sony, and others
- Datasheet, BOM, schematics, and layout
- IP camera reference application with C source code

#### Software Development Kit (SDK)
- Linux 4.9.X kernel 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 with programmer’s guide and application notes

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