

# **SSD261Q**

## **Smart HD Display Controller**

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**Preliminary Product Brief**

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## 1. FEATURES

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### ■ High Performance Processor Core

- ARM Cortex-A53 Dual Core with max. clock rate 1.2GHz
- 32KB L1 I-cache and 32KB L1 D-cache
- 128KB L2 cache
- Neon and FPU

### ■ Video Input Interface

- One set of BT.601-like 12-bit parallel interface for Bayer or YUV422 data input, with data rate up to 150Mbps
- Two sets of BT.656 8/10-bit parallel interface for YUV422 data input, with data rate up to 300Mbps (DDR mode)
- Each BT.656 input can support both SDR and DDR mode with 1-to-1, 1-to-2, and 1-to-4 TDM mode
- One set of BT.1120 16-bit parallel interface for YUV422 data input, with data rate up to 600Mbps (DDR mode)
- BT.1120 input can support SDR and DDR mode with 1-to-1 and 1-to-2 mode
- Two sets of MIPI RX interface
- MIPI CSI-2 ver. 1.1 and D-PHY ver. 1.1
- MIPI RX virtual channel 1 to 4
- MIPI RX data rate up to 1.5Gbps
- MIPI RX supports special data input like TOF, PDAF, and Gyro data
- Supports max. 2-CH HDR Bayer or YUV video input

### ■ Image Signal Processor

- Supports up to 4K (3840x2160) pixels video recording and image snapshot
- Bad pixel compensation
- Noise Reduction (NR)
- Optical black correction
- Lens shading compensation
- Auto White Balance (AWB) / Auto Exposure (AE) / Auto Focus (AF)

- CFA color interpolation
- Color correction
- Gamma correction
- Wide Dynamic Range (WDR)
- Rotation with 90 or 270 degrees
- Mirror and flip
- High Dynamic Range (HDR) with two exposure frames
- Lens distortion correction and Fisheye mode
- Fully programmable multi-function scaling engines
- Graphics overlap process with RGB or Index mode and private region block mode
- Multiple read/write DMAs for flexible image processing
- Dual channels for Bayer and YUV data process

### ■ H.265/HEVC Encoder

- Fully compatible with ISO/IEC 23008-2 High Efficiency video coding
- Main Profile, Level 5.0 encode
- Supports I-frame and P-frame
- 1/4-pixel precision motion vectors
- Deblocking filter and Sample Adaptive Offset
- Picture/CTU/subCTU level rate control
- Region of Interest (ROI) encoding with custom QP map

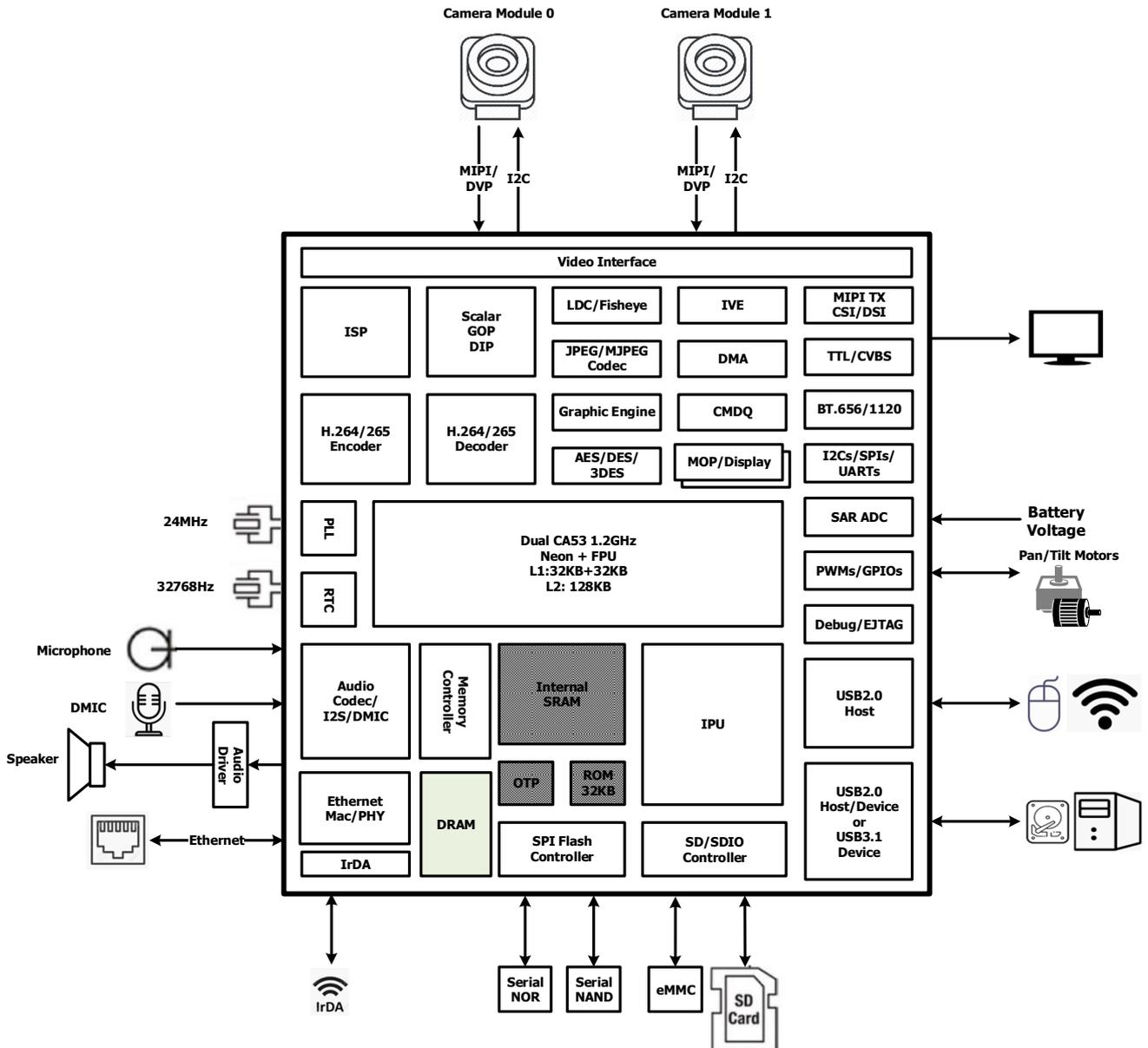
### ■ H.264/AVC Encoder

- Compatible with the ITU-T Recommendation H.264 specification
- Baseline/Constrained Baseline/Main/High Profile, Level 5.1 encode
- 1/4-pixel precision motion vectors
- In-loop deblocking filter
- CABAC/CAVLC support
- Error resilience tools
- Frame level and MB level rate control
- Region of Interest (ROI) encoding with custom QP map

- **H.265/HEVC Decoder**
  - Fully compatible with ISO/IEC 23008-2 High Efficiency Video Coding Main Profile
  - HEVC Main Profile, Level 5.0 decode
  - Supports resolution from 8x8 to 3840x3840
  - I/P/B slices
  - Prediction Unit (PU): 64x64 to 4x4
  - Transform Unit (TU): 32x32 to 4x4
  - 1/4 motion compensation with 8-tap filters
  - High performance CABAC decoding
  - In-loop deblocking filtering
  - Sample adaptive offset (SAO)
  - Error concealment
- **H.264/AVC Decoder**
  - Compatible with the ITU-T Recommendation H.264 specification
  - Baseline/Constrained Baseline/Main/High Profile, Level 5.1 decode
  - Supports resolution from 8x8 to 3840x3840
  - Variable block size (16x16, 16x8, 8x16, 8x8, 8x4, 4x8 and 4x4)
  - CABAC/CAVLC support
  - In-loop deblocking filter
  - Error detection, concealment and error resilience tools
- **JPEG/MJPEG Encoder/Decoder**
  - JPEG/MJPEG baseline encoding or decoding
  - YUV422 or YUV420 format
  - Max. 3840x3840 frame resolution
  - Supports real-time mode and frame encode mode
- **Video Codec Performance**
  - 4K@20fps H.265/H.264 encoding or decoding
  - 4K@20fps JPEG/MJPEG encoding
  - 4K@20fps JPEG/MJPEG decoding
- **Intelligence Processing Unit (IPU)**
  - Clock rate over 800MHz
  - Programmable 8/16-bit process
  - Supports RGB/YUV data format R/W DMA
- **Intelligent Video Engine (IVE)**
  - Supports 30 functions (CSC/Filter/Erode/Dilate/SAD/3x3/DOT, etc.) for video analysis
  - Max. resolution 1920x1080
  - Read/Write DMA
- **Audio Processor**
  - Two stereo ADCs with max. 4-CH single-ended or differential microphone inputs
  - One stereo DAC with max. 2-CH single-ended lineout
  - Supports 8K/16K/32KHz sampling rate audio recording
  - ADC and DAC SNR over 92dB
  - Digital and analog gain adjustment
  - One I2S interface with input max. 8-ch and output 2-ch TDM mode
  - I2S master or slave mode with 16- or 32-bit data and 8/16/32/48/96/192K sampling rate
  - Supports 4-CH DMIC (1 clock + 2 data)
  - I2S digital audio input
- **Video Output Interface**
  - Dual read DMAs and display channels
  - Supports 16 preview windows and 1 PIP window rotation and overlap
  - Picture quality enhancement (gamma, AWB, contrast, saturation, sharpness, brightness, 3x3 matrix)
  - Each display channel can output to MIPI/TTL
  - TTL/Parallel-RGB interface, 16/24-bit, 1280x720@60fps
  - Serial-RGB interface, 8/16-bit, 800x480@60fps
  - MIPI DSI TX, RGB 16/18/24-bit, 2560x1600@60fps
  - Scale-down and write-back DMA
- **SPI NOR/NAND Flash Interface**
  - Compliant with standard, dual and quad SPI flash memory components
  - Max. 108MHz clock rate
- **SD/eMMC Interface**
  - SD card 2.0 x1 and SD card 3.0 (SDR104 or SDR50/DDR50) x1, data bus 1/4-bit mode
  - SDIO 3.0 (SDR25) x1 and SDIO 3.0 (SDR50) x1, data bus 1/4-bit mode
  - eMMC ver4.3 with 4/8 data bit and max. 50MHz clock rate
- **USB Interface**
  - One USB2.0 Host
  - One USB2.0 port configurable as Host or Device or as USB3.1 Gen1 device

- USB2.0 Host mode supports EHCI specifications
- USB2.0 Device mode supports 7 endpoints (3 for UVC and 3 for CDC)
- USB 3.1 Gen1 Device mode supports 8 endpoints
- **DRAM Memory**
  - Embedded 2Gb 16-bit DDR3(L) memory with max. clock rate 1066MHz
  - Data rate up to 2133Mbps
  - Supports memory space up to 2Gb
- **Connectivity**
  - Built-in 10/100M Ethernet MAC x2 and Ethernet PHY x1
  - One USB 2.0 Host Controller
  - One SDIO 3.0 Host Controller
- **Security Engines**
  - Supports AES128/AES192/AES256/DES/3DES/RSA/SHA-I/SHA-256
  - Supports secure booting
  - FIPS 140-1 compliant random number generator
  - Embedded OTP (One Time Programmable) memory to store secure and calibration data
- **Boot Options**
  - ROM (32KB)
  - SPI NOR
  - SPI NAND
  - SD Card
  - eMMC
  - USB2.0 device mode
- **Peripherals**
  - Dedicated GPIOs for system control
  - Supports up to 11 PWM outputs (shared with GPIOs)
  - Up to four generic UARTs and one fast UART with flow control
  - Three generic timers and one watchdog timer
  - Up to three SPI masters
  - Up to six I2C Masters
    - Supports 1to4 mode x1
    - Supports 1to2 mode x2
  - Built-in 10-bit SAR ADC with 4-channel analog inputs for different kinds of application
  - Supports IrDA
  - Supports RTC with 32768Hz crystal I/F
  - Supports POR (Power On Reset)
  - Supports internal temperature sensor
  - Supports ISP sensor clock 12MHz, 24MHz, 37.125MHz
- **Operating Voltage Range**
  - VDD: 0.92V~0.95V
  - CPU VDD: 0.95V~1.03V
  - IPU VDD: 0.87V~0.93V
  - I/O: 1.8/3.3V
  - DRAM: 1.5/1.35
  - Power Consumption: TBD.
- **Package**
  - 331-ball BGA, 13mm x 13mm
  - Moisture Sensitivity Level: 3

## 2. BLOCK DIAGRAM



### **3. GENERAL DESCRIPTIONS**

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The SSD261Q products are highly integrated multimedia System-on-Chip (SoC) products for high-resolution intelligent video recording and playback applications.

The chip includes a 64-bit dual-core RISC processor, advanced Image Signal Processor (ISP), high performance H.265/H.264/MJPEG video codec, Intelligence Processing Unit (IPU) as well as high speed I/O interfaces like USB, and Ethernet. These features in combination make the SSD261Q an ideal solution that facilitates design and development of high-performance, high-picture-quality, and low-cost products.

The powerful SigmaStar proprietary ISP integrated in the SSD261Q provides various WDR, advanced NR, and image enhancement and correction algorithms aimed to produce images of optimal quality. The programmable neural network inference engine and the IVE featured in the SSD261Q allow customers to achieve a rich variety of intelligent applications with ease.

Implemented with the dual-core ARM Cortex-A53 CPU as well as an IPU, the SSD261Q enables fast startup, real-time performance, and connections with various peripheral interfaces.

Efficient computing resources are available to help customers develop industry and consumer applications. Advanced low-power, low-voltage architecture and optimized design flow are implemented to fulfill long time usage applications. Hardwired AES/DES/3DES cipher engines are integrated to support secure boot, authentication, and video/audio stream encryption in security system.

The SSD261Q, powered by SigmaStar Technology, comes with a complete hardware platform and software SDK, allowing customers to speed up "Time-to-Market."