

SSU9386 HIGH PERFORMANCE AIOT SYSTEM-ON-CHIP

PRODUCT BRIEF

CHIP OVERVIEW

The SSU9386 is a feature-rich, highly integrated, low power product, suitable for AIoT, mobile, and battery device, as well as high-resolution intelligent application.

The SSU9386 includes a 64-bit quad-core processor, high performance H.265/H.264/MJPEG video encoder, Intelligence Processing Unit (IPU) as well as high speed I/O interfaces like USB, Ethernet, and 12-bit ADC. These features in combination make the SSU9386 an ideal solution that facilitates design and development of high-performance, high-picture-quality, and low-cost products.

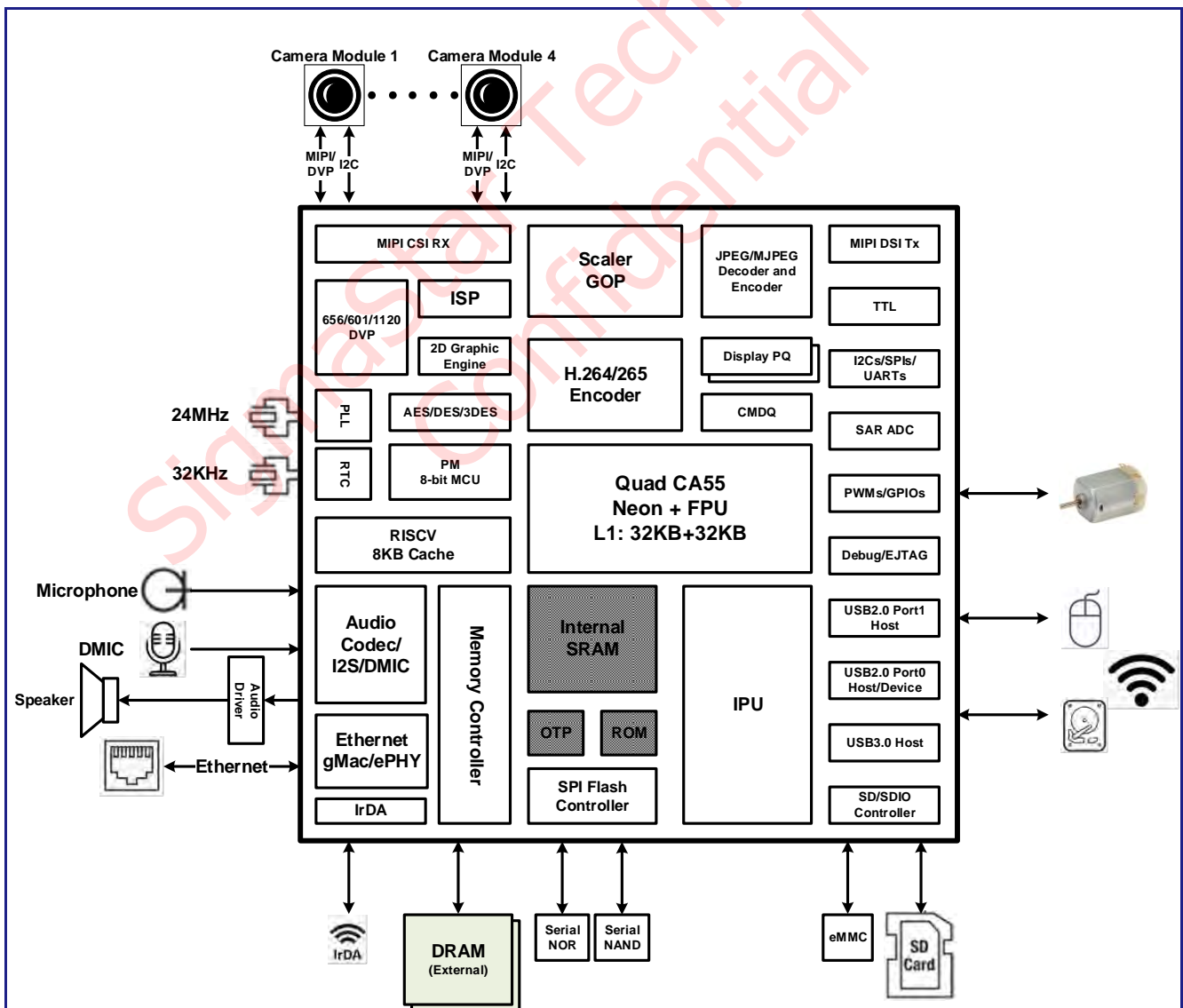
The programmable neural network inference engine featured in the SSU9386 allows customers to achieve a rich variety of intelligent applications with ease.

Implemented with the quad-core ARM Cortex-A55 CPU as well as an IPU, the SSU9386 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 SSU9386, powered by SigmaStar Technology, comes with a complete hardware platform and software SDK, allowing customers to speed up "Time-to-Market."

BLOCK DIAGRAM



FEATURES

- **High Performance Processor Core**
 - ARM Cortex-A55 Quad Core
 - 32KB L1 I-cache and 32KB L1 D-cache for each core
 - 128KB L2 cache for each core and 512KB L3 cache
 - Neon and FPU
 - Separate power domain for each core
 - Stand-alone voltage domain
- **Video Input Interface**
 - Supports 8/10/12-bit parallel interface for raw data input
 - Supports 8-bit CCIR656/601 interface
 - Supports 16-bit BT1120 interface
 - Supports MIPI interface with 6 data lanes and 4 clock lanes
 - Supports sensor interface with both parallel and MIPI
 - Supports max. 6M (2688x2564) pixels video recording and image snapshot
 - Static and adaptive bad pixel compensation
 - Crosstalk noise reduction
 - Temporal-domain Noise Reduction (3DNR)
 - Sharpening filters for image enhancement
 - Spatial-domain Noise Reduction (2DNR) for luma and chroma image
 - Filter to remove purple false color in highlight regions
 - Optical black correction
 - Symmetric/Asymmetric lens shading compensation
 - Auto White Balance (AWB) / Auto Exposure (AE) / Auto Focus (AF)
 - CFA color interpolation and demoiré filter
 - Color correction and color adjustment engine
 - Gamma correction
 - High Dynamic Range (HDR) with two exposure frames and de-ghost function
 - Frame buffer data compression and de-compression to save memory bandwidth
 - Wide Dynamic Range (WDR) with local tone mapping
 - Flip, Mirror, and Rotation with 90 or 270 degree
 - Fully programmable multi-function scaling engines
- **H.265/HEVC Encoder**
 - Supports max. 4K@30fps
 - Fully compatible with ISO/IEC 23008-2 High Efficiency video coding
 - Main Profile, Level 5.0 encode
 - Supports I-frame and P-frame
 - Supports resolution from 256x128 to 4096x4096
 - 1/4-pixel precision motion vectors
 - Deblocking filter and Sample Adaptive Offset (SAO)
 - Picture/CTU/subCTU level rate control
 - Region of Interest (ROI) encoding with custom QP map
- **H.264/AVC Encoder**
 - Supports max. 4K@30fps
 - Compatible with the ITU-T Recommendation H.264 specification
 - Baseline/Constrained Baseline/Main/High Profile, Level 5.1 encode
 - Supports resolution from 256x128 to 4096x4096
 - 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
- **JPEG/MJPEG Encoder/Decoder**
 - JPEG/MJPEG baseline encoding and decoding
 - Supports YUV422 or YUV420 input formats, YUV422 output formats
 - Max. 8192x8192 frame resolution
 - 1080p60 for encoding and decoding max. performance
 - Supports real-time mode and frame encode mode
- **Intelligence Processing Unit (IPU)**
 - Pure hardwired accelerator
 - Programmable 4/8/16-bit process
 - Supports RGB/YUV data format R/W DMA
 - Stand-alone voltage domain
 - Supports various video analysis functions like FD/FR, human detection, MD/OD, object tracking, etc.
 - Supports median filter for TOF
 - Supports 2D TOF filter
- **Co-Processor (RISCV)**
 - Supports RV32 base instruction set, and M/C extension
 - 6 Stage Pipeline, Single Issue, in-order dispatch, out-of-order execution
 - 8KB i-cache and 8KB d-cache
 - Up to 466MHz clock rate
 - Supports dynamic branch prediction
 - Supports memory property configuration
 - Supports JTAG debug
- **Co-Processor (8-bit MCU)**
 - Located in PM power domain
 - Supports 8KB internal PSRAM
 - Supports XDATA SRAM size up to 512Byte
 - Internal FRO clock up to 48MHz
- **Audio Processor**
 - Supports 3-channel ADC with single-end or differential mode
 - Supports 2-channel DAC with single-end mode
 - ADC and DAC SNR over 96dB
 - Digital and analog gain adjustment
 - Supports 8-CH DMIC (1 clock + 4 data)
 - Supports I2S0 TDM mode with input max. 8-ch and output 2-ch
 - Supports I2S1 2-ch input and 2-ch output
 - I2S0/1 support Master or Slave mode and 4/6 wire mode
 - Supports SPDIF 2 channels
- **Video Output Interface**
 - Dual read DMAs and display channels
 - Picture quality enhancement (gamma, AWB, contrast, saturation, sharpness, brightness, 3x3 matrix)
 - Each display channel can output to MIPI/ Digital port, digital port including one of TTL/CCIR601/656
 - Supports MIPI DSI TX, RGB 16/18/24-bit, 2560x1600@60fps
 - TTL/Parallel-RGB interface, 16/24-bit, 1280x720@60fps
 - Simultaneous output display for MIPI/Digital port
 - Scale-down and write-back DMA
- **Advanced Color Engine**
 - Luma gain/offset adjustment
 - Supports 2D peaking with user definition filter
 - Horizontal noise masking
 - Local Contrast Enhancement (LCE)
 - Direct Luma Correction (DLC)
 - Black/White Level Extension (BLE/WLE)
 - IHC/ICC/IBC for hue, saturation, brightness and favorite color adjustment
 - Histogram statistics
- **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 2.0 (SDR25) x1, data bus 1/4-bit mode
 - eMMC 5.0 with 4/8 data bit and max. 200MHz clock rate, HS400 DDR mode
- **USB Interface**
 - USB3.0 Host
 - USB2.0 port0 configurable Host or Device
 - USB2.0 port1 Host
 - Host mode supports EHCI specifications
- **DRAM Memory**
 - External 16-bit x2 or 32-bit x1 DDR4/DDR3/DDR3L/LPDDR4/LPDDR3
 - Supports memory space up to 32Gb
 - Data rate up to 2133Mbps for DDR3, 3200Mbps for DDR4, and 2666Mbps for LPDDR4
- **Connectivity**
 - Built-in 10/100/1000M Ethernet MAC with RGMII/RMII
 - Built-in 10/100M Ethernet MAC and Ethernet PHY
 - Hash table with 256 entries
 - Broadcast/Multicast storm prevention
 - Supports both full-duplex and half-duplex operation
 - Supports IEEE 802.1Q VLAN tag detection for reception frames
 - Supports checking IPv4 header checksum and TCP, UDP, or ICMP checksum encapsulated in IPv4 or IPv6 datagram
 - Supports TCP Segmentation Offload (TSO) and UDP Fragmentation Offload (UFO)
 - GigaMAC supports IEEE1588v2 PTP
 - GigaMAC supports IEEE802.1 QoS
- **Security Engines**
 - Supports AES128/AES192/AES256/DES/3DES/RSA2048/SHA-1/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**
 - SPI NOR
 - SPI NAND with ECC
 - SD Card
 - eMMC
 - USB
- **Peripherals**
 - Dedicated GPIOs for system control
 - Supports 8x PWM inputs¹ and 20x PWM outputs (shared with GPIOs)
 - Up to six generic UARTs and one fast UART with flow control
 - Three generic timers and one watchdog timer
 - Two SPI interfaces, which can be configured as master or slave mode
 - Up to six I2C Masters
 - Built-in 10-bit SAR ADC with 2-channel analog inputs for different kinds of application
 - Built-in 12-bit SAR ADC with 24-channel analog inputs for different kinds of application
 - Supports 7x7 Keypad
 - Supports IrDA
 - Supports POR (Power On Reset)
 - Supports internal temperature sensor
- **Real Time Clock (RTC)**
 - Built-in RTC working with 32.768 KHz crystal
 - Alarm interrupt for wakeup
 - Tick time interrupt (millisecond)
 - Built-in regulator
 - Supports low leakage RTC mode for long battery application
- **Always on power domain (PM)**
 - Built-in LDO to provide both 0.9V and 1.8V power sources
 - Built-in RC FRO to generate clock source
 - Supports 8-bit MCU to control PM GPIO
 - Supports multiple GPIOs for power control and RTC events
- **Package**
 - BGA 19x19
 - Ball pitch and size: 0.65 and 0.3 mm
 - 4 or 6 Layer PCB
 - Moisture Sensitivity Level (MSL): 3

¹ 8-ch for duty measurement and 4-ch for pulse counting