## Key Specifications

**Application Processor Core**

* 1.2GHz ARM Cortex-A7 quad-core, each core with 32KB I-cache, 32KB D-cache
* 512KB L2 cache
* Neon acceleration and double precision FPU
* Embedded Trace data interface (16KB ETB) for ARM-DS5 debugger
* DVFS control

**MCU core**

* 400MHz ARM Cortex-M7 CPU, 16Kbyte I-cache, 16KB D-cache
* 128KB ITCM and 64KB DTCM
* Double precision FPU

**CEVA DSP core**

* 4 x high performance CEVA XM4 Cores at 800MHz
* 32KB PTCM, 32KB I-Cache and 128K DTCM for each DSP core
* 2M-Byte shared on-chip SRAM

**Video Codec Format**

* H.264 BP/MP/HP encoding and decoding
* H.265 MAIN/MAIN10 @L5.0 High-tier encoding and decoding
* MJPEG/JPEG Extended Sequential encoding and decoding

**Video Codec Performance**

* Software configurable video codec, either as encoder or as decoder
* Real-time multi-stream H.264/H.265 encoding or decoding:
  + H.264: 1080P@60fps
  + 4Kx2K@30fps+1080p@30fps
* MJPEG/JPEG encoding/decoding at 4Kx2K@30fps
* MJPEG/JPEG encoding and decoding

**ISP**

* Input Video resolution ranging from 4152x2174@ 60fps to 480x240
* Both spatial denoising and temporal denoising
* Adjustable 3A functions
* Digital WDR and tone mapping support
* Lens Shading correction
* Green Imbalance correction
* Bayer RAW data input with max 20bit-width
* 3 different resolution video outputs from the single source

**Audio Encoding/Decoding**

* I2S interface for external audio input
* Software support for Voice/music encoding/decoding complying with multiple protocols such as G.711, ADPCM, G.726 and MP3.

**Security Engine**

* AES and DES encryption and decryption algorithms implemented by using hardware
* RSA1024/2048/4096 signature verification algorithm implemented by using hardware
* Hash MD5, SHA-1, SHA-256, SHA-512 and SHA-512/256 tamper proofing algorithms implemented by using hardware
* ARM TrustZone solution for hardware-based security
* Security CPU solution for secure boot and secure storage.

**Video Interfaces**

* Video input
  + 2 BT-656 or BT-1120 digital parallel input interfaces, up to 1080p@60fps
  + 8 MIPI CSI-RX input ports, 2 data-lane for each port, up to 4Kx2K@30fps
  + 1 HDMI 1.4 RX interface up to 4Kx2K@30fps
* Video output
  + 1 DisplayPort output interface up to 4Kx2K@30fps
  + 1 BT-1120 digital parallel output interface up to 1080p@60fps, sharing pins with BT-1120 input interface
  + 1 MIPI CSI-TX output interface up to 4Kx2K@30fps

**Baseband**

* 2T4R with 2.5MHz/5MHz/10MHz/20MHz/40MHz bandwidth
* BPSK/QPSK/16QAM/64QAM/256QAM modulation
* LDPC encoder with 1/2, 2/3, 3/4 code rate
* Max down link rate at 100Mbps
* 2.4G/5.8G uplink/downlink communication
* One AP support max to four nodes

**Analog**

* One 8-1 10bit SAR ADC
* Two 10bit SAR ADCs
* Four 12bit DACs
* Eight 12bit ADCs

**Peripherals**

* 9 UARTs
* 2 Watch dog timers
* 20 timers，10 of which have PWM output
* 4 CAN bus interface
* 5 I2C interfaces, can be configured as either master or slave by software
* 4 SPI masters(2x1-1, 2x1-5), 2 SPI slave
* 4 I2S 4bit interfaces
* 147 GPIO, shared with other functions.
* 2 AXI DMA controller
* One AHB DMA controller
* USB 3.0 DRD controller and PHY.
* USB 3.0 /Type-C / DisplayPort combo interface
* 10/100/1000M Ethernet RGMII interface
* 2-lane PCIe 2.0, can be configured as EP or RC mode

**External Memory Interfaces**

* DDR4/DDR3/LPDDR3 interface
  + 32/64-bit DDR4 interface up to DDR4 2400
  + 32/64-bit DDR3 interface up to DDR3 2133
  + 32/64-bit LPDDR3 interface up to LPDDR3 2133
* SPI NOR flash interface
  + 1-/2-/4-wire mode
  + 3-byte or 4-byte address mode
  + Maximum capacity of 256 MB
* eMMC 5.1 interface with 64GB max capacity
* Secure Boot from internal ROM with eMMC flash or SPI NOR flash.

**Physical Specification**

* Power consumption
  + 5W typical power consumption in the 4Kx2K scenario
  + Multiple power domains for power saving
* Operating voltages
  + 0.9V core voltage
  + 1.8V I/O voltage
  + 1.2V/1.2V/1.5V for DDR4/LPDDR3/DDR3
  + 3.3V I/O voltage
* Package
  + FCBGA
  + Body size of 19mm x19mm
  + Ball pitch of 0.65mm

## Functional Diagram



As an all-in-one SOC chip designed for various applications such as drone, intelligent surveillance, ADAS and car driving recorder, Sirius integrates ARM Cortex-M7 based MCU subsystem for real-time system control, high performance computing array for machine vision, multi-standard 4K image/video codec and high performance COFDM based wireless transceiver for wireless audio/video streaming.

The maximum working frequency of the ARM Cortex-M7 CPU can be up to 400MHz. TCM (Tightly Coupled Memory) and all the common peripherals are integrated in the MCU subsystem. All these abundant features can meet the most industrial control system such as drone flight control, robot control and etc.

The quad-core ARM Cortex-A7 CPU together with quad CEVA XM4 DSP cores build up a high performance computing array. Two Sirius chips can also be connected via PCIe interface and form a bigger computing array if higher performance is desired. Customized OpenCV API and various basic building blocks inside deep neuro networks (like Faster-RCNN or YOLO) are ported on this computing array. Intelligent machine vision applications can be easily implemented by using the SDK associated with Sirius hardware platform.

The video subsystem is comprised of 8-way MIPI ports, a 4K UHD ISP (Image Signal Processor), multi-standard video codecs, one video display module and various video/audio output ports such as DisplayPort, MIPI or BT-1120. The powerful ISP module can handle 8 1080p@30fps or 2 4Kx2K@30fps Bayer RAW 14-bit input data in real-time. Three types of image/video standard are supported by three dedicated hardware codecs: MJPEG/JPEG, H.264 and H.265.

The baseband modem in Sirius is a bi-directional communication IP for the purpose of remote control and high definition video transmission or bi-directional high definition video transmission. One AP can support max to four nodes for the bi-directional reliable transmission with long distance and high throughput. This IP supports RF transceiver named AR8003s provided by Artosyn which can support 2.4G and 5G bands.

## Example Application Solution

* All-in-one Drone solution for remote control, wireless UHD video streaming and intelligent machine vision for automatic object detection and obstacle avoidance



* UHD (4Kx2K@30fps) wired/wireless security camera



* Wireless HDMI transmitter/receiver dongle



* High end car driving recorder

