

SA220/SA220C

Brief Datasheet

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Data **2022-02-21**

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1 Overview

SA220/SA220C is a professional AI SoC with neural network acceleration for Video Automotive product. It supports maximum 4M@30fps + 1080P@30fps high-level quality digital video recording.

The neural network processing unit (NPU) provides a maximum of 0.5 TOPS computing performance on deep neural network inferences. The typical application includes ADAS + BSD or ADAS + DMS, and so on.

The 32-bit RISC processor with FPU, provides rich general computing resources in developing customize application.

The integrated high-performance ISP with 3D de-noising provides the excellent performance in low-light applications. And two digital cameras can be processed simultaneously.

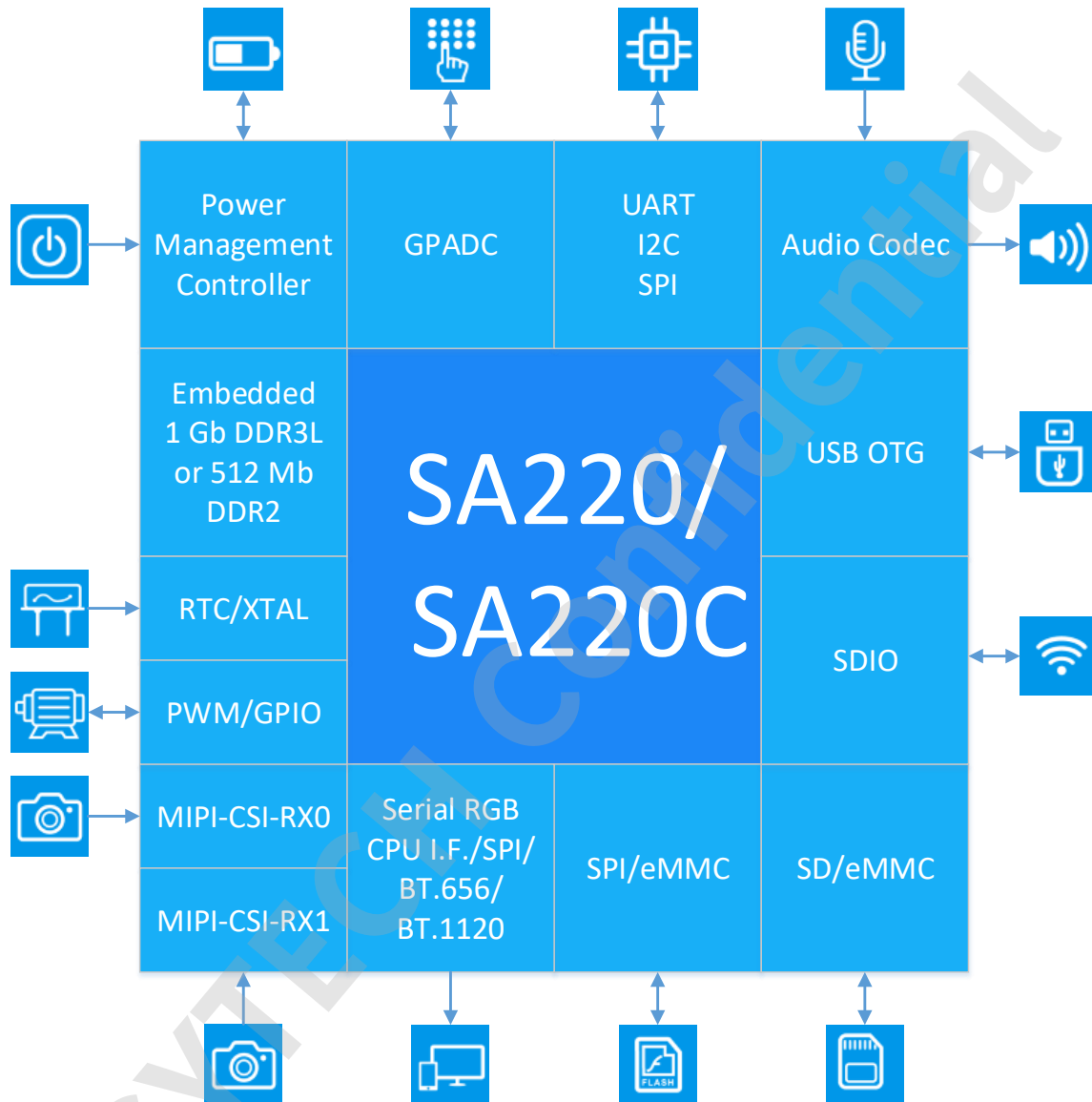
The display processing unit supports graphic and video overlays with scaling ratio, which accelerates the GUI and Video compositing. It supports flexible output interface for LCDs.

The highly integrated SoC supports plenty of peripheral interfaces, such as USB, SPI, UART, I2C, SDIO, GPADC, PWM, and an integrated Audio Codec, which provides much possibility on different application.

Benefited by the advanced architecture and dynamic frequency scaling strategy, the whole system can achieve low power consumption.

With the stable and user-friendly SDK, customers can rapidly proceed into mass production.

2 Application



Note: Embedded 1 Gb DDR3L for SA220, 512 Mb DDR2 for SA220C.

- Advanced Driving Assistance System (ADAS)
 - Forward Collision Warning (FCW)
 - Lane Departure Warning System (LDWS)
 - Lead Vehicle Start Alert (LVSA)
 - Pedestrian Collision Warning (PCW)
- Driver Monitoring System (DMS)
 - Fatigue Driving Detection (Closed-eyes or Yawning)
 - Distracted Driving Monitoring (Eye Glance)
 - Driving Behavior Monitoring (Smoking or Phone Calling)
 - Face Detection and Recognition
- Various peripheral interfaces for connecting CTP, Wi-Fi, BT, GPS and G-Sensor

3 Features

Processor

- 32-bit RISC CPU 1 GHz, 32 KB I Cache, 32 KB D Cache, and 128 KB L2 Cache
- Integrated FPU

AI Engine

- NPU@0.5TOPS neural network acceleration

Video Codec

- H.264/H.265 video encoding with maximum resolution of 2880 x 1620
 - SA220: Maximum performance of 4M@30fps + 1080P@30fps
 - SA220C: Maximum performance of 1080P@30fps + 1080P@30fps
- H.264 BP/MP/HP, supporting I/P frames
- H.265 MP, supporting I/P/B frames
- 4K@30fps real-time JPEG decoding and encoding
- JPEG decoding and encoding with maximum resolution of 8160 x 4320

Display and Video Processing

- 2 graphics layers and 16 sprite layers
- 1 video layer, supporting 1/32x to 32x scaling
- Supports blending and colorkey function
- Multiple video and graphics formats
- Supports configurable curve adjustment for saturation
- Video post-processing
- Gamma correction and color space conversion
- Bit blit, stretch blit, mask blit
- Video graphics overlay
- Video multi-region covered or mosaicked
- Image rotator, supporting 0/90/180/270 degree rotation and H/V flip
- 360°, 180°, and normal fisheye correction
- Lens distortion correction

ISP

- Maximum performance of 5M@30fps
- Sensor build-in WDR
- 2F-frame base/line base/DCG WDR
- Local tone mapping
- 3A (AE, AF, and AWB) algorithms function
- BLC, DPC, LSC, WBC, Gamma, CCM
- Demosaicing
- 2D and 3D de-noise and sharpness
- Scaling up and scaling down
- YUV422, YUV420 output
- H/V flipping for YUV output
- 3-channel output
- 4 size-adjustable overlays, 8 regions mosaic, and 64 rectangles with different color, supporting ARGB format input

Video Output Interface

- Single display output
- 8-bit Serial RGB 800 x 480@60Hz
- 8/9/16-bit i8080 800 x 480@60Hz
- 3/4-wire SPI interface
- ITU-R BT.601/BT.656/BT.1120 1080P@60Hz

Video Input Interface

- Two digital camera inputs
- DVP
 - 8/10-bit DVP interface
 - BT.656 interface with multi-channel
- MIPI-CSI2 RX
 - Maximum 5-Mega pixel resolution
 - 1 x 4-lane MIPI-CSI or 2 x 2-lane MIPI-CSI, up to 1.5 Gbit/s bit rate

Audio Interface

- Two single-ended Line-in/MIC inputs
- Two single-ended PWM DAC outputs: one is analog output, the other is PWM output multiplexed with GPIO

Memory Interface

- SDRAM interface
 - SA220: Embedded 1 Gb 16-bit DDR3L
 - SA220C: Embedded 512 Mb 16-bit DDR2
- SPI NOR/NAND Flash or eMMC interface
 - Standard/Dual/Quad SPI mode
 - Programmable data item size (4 to 32 bits)
 - SPI HOST ECC function
 - eMMC V4.5 interface
- SD2.0 Card interface
- Booting from the SPI NOR, SPI NAND, SD Card or eMMC

Security

- Hardware-based AES, DES and 3DES symmetric key algorithms
- Hardware-based RSA1024/2048/3072/4096 public key algorithm
- Hardware-based MD5/SHA1/SHA224/SHA256/SHA512 hash algorithm
- Hardware-based HMAC-MD5/SHA1/SHA224/SHA256/SHA512 hash algorithm
- 64 Kbits OTP storage space
- Secure boot

Peripheral Interface

- POR
- Internal RTC
- One USB2.0 host/device port
- Five UART interfaces
- One SPI interface
- Four I2C interfaces
- One SDIO3.0 interface
- One IR-RX interface
- Integrated 1-channel 12-bit GPADC
- 10-channel PWM Output/Input

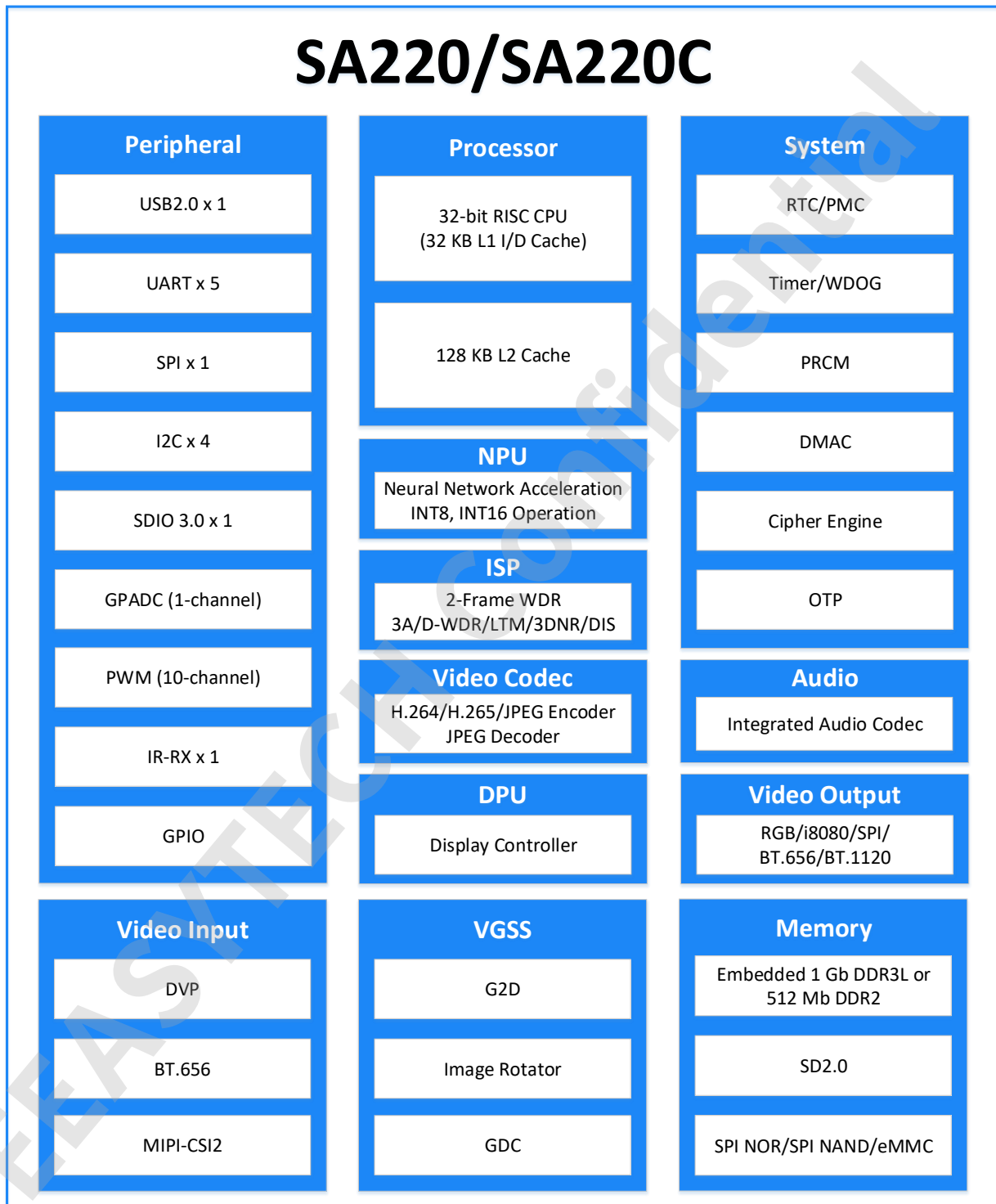
SDK and PC Tool

- Linux 4.19/RTOS
- PC-Tools for firmware burning and upgrade via USB, SD Card or UART
- PC-Tools for ISP image quality tuning
- PC-Tools for NPU model converting, fine-tuning of quantization, and compiling

Physical Specifications

- Power consumption
 - T.B.D
- Temperature range
 - Ambient temperature: -20°C – 70°C
 - Storage temperature: -40°C – 125°C
- Operating voltage
 - 0.9 V core voltage
 - 3.3 V/1.8 V I/O voltage (±10%)
 - 1.35 V for DDR3L (only for SA220), 1.5 V/1.8 V for DDR2 (only for SA220C)
- Package
 - QFN88
 - Body size of 9 mm x 9 mm
 - Lead pitch of 0.35 mm, lead width of 0.18 mm, lead length of 0.4 mm

4 Block Diagram



Note: Embedded 1 Gb DDR3L for SA220, 512 Mb DDR2 for SA220C.