



# Apollo4 Plus Low Power SoC

## Product Brief

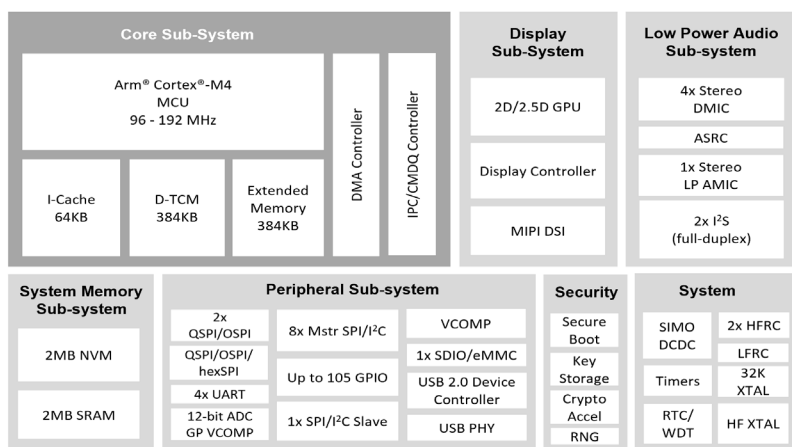


Ambiq®, a leader in low power System-on-Chip (SoC) design, introduces the Apollo4 Plus SoC, bringing enhanced graphics performance, additional on-chip memory and increased memory performance to the Apollo4 SoC product family. Apollo4 Plus enables designers of next generation wearables and smart devices to deliver even more stunning user interface (UI) effects and overall user experience to take their innovative products to the next level.

The Apollo4 Plus SoC is built upon Ambiq's proprietary Subthreshold Power-Optimized Technology (SPOT®) platform. The Apollo4 Plus complete hardware and software solution enables the battery-powered endpoint devices of tomorrow to achieve a higher level of intelligence without sacrificing battery life. The Apollo4 Plus is available in BGA package option.

With up to 2MB of MRAM and 2.75MB of SRAM, the Apollo4 Plus has more than enough compute power and storage to handle complex algorithms and neural networks while displaying vibrant, crystal-clear, and smooth graphics. If additional memory is required, external memory is supported through Ambiq's high-bandwidth multi-bit SPI and eMMC interfaces.

The Apollo4 Plus is purpose-built to serve as both an application processor and a coprocessor for battery-powered endpoint devices, including smartwatches, children's watches, fitness bands, animal trackers, far-field voice remotes, predictive health and maintenance, and the smart home.



Block Diagram for the Ultra-Low Power Apollo4 Plus SoC



Apollo4 Plus Evaluation Board

### Feature Highlights:

- Achieving an unmatched 4  $\mu$ A/MHz from MRAM with low power sleep modes
- Up to 192 MHz clock frequency with turboSPOT®
- 2D/2.5D graphics accelerator with enhanced anti-aliasing and dithering support
- MIPI DSI 1.2 with up to two lanes at 500Mbps delivering a feature-rich user interface
- Enhanced memory performance with 4.75MB total on-chip memory, additional data caching, and a 2x increase in external memory interface bandwidth
- Ultra-low power analog microphone ADC for truly always-on voice processing
- Serves as an applications processor with a fully integrated audio subsystem and interface to other communication devices
- Includes an extensive set of digital and analog peripheral interfaces with integrated ADCs and digital sensor processing using the integrated serial master ports
- 8 PDM channels, 2 stereo I²S channels with ASRC, and an ultra-low power ADC for analog mics
- PSA-L1 certified

## Features and Specifications

### Ultra-Low Supply Current

- 4  $\mu$ A/MHz executing from MRAM (with cache)
- Low-power sleep and deep sleep modes with selectable levels of RAM/cache retention

### High-Performance Arm Cortex-M4 Processor with FPU

- Up to 192 MHz clock frequency
- Floating Point Unit (FPU)
- Memory Protection Unit (MPU)

### Security Features

- Secure Boot
- Secure over-the-air (OTA) updates
- Secure wired updates
- Key Recovation

### Ultra-Low Power Memory

- Up to 2MB of non-volatile MRAM for code/data
- Up to 2.75MB of low power RAM for code/data

### Ultra-Low Power Interface for On- and Off-Chip Sensors

- 12-bit ADC, 11 selectable input channels
- Up to 2.8 MS/s sampling rate
- Temperature sensor with  $\pm 3^{\circ}\text{C}$  accuracy

### Ultra-Low Power Flexible Serial Peripherals

- 2x 2/4/8-bit SPI master interfaces
- 2/4/8/16-bit SPI master interface
- 8x I<sup>2</sup>C/SPI masters for peripheral communication
- 1x SPI slave for host communications
- 4x UART modules with flow control
- 1x USB 2.0 HS/FS device controller
- 1x SDIO (SD3.0)/1x eMMC (v4.51)

### Display

- MIPI DSI 1.2 with 2 data lanes up to 500 Mbps
- Up to 500 x 500 resolution
- 4 layers with alpha blending
- Frame Buffer Decompression

### Graphics

- 2D/2.5D graphics accelerator
- Full Alpha Blending
- Texture and Frame Buffer Compression
- Anti-Aliasing
- Dithering
- Vector Graphics

### Audio Processing

- 1x stereo Low Power Analog microphones
- 4x stereo Digital microphones
- 2x full-duplex I<sup>2</sup>S ports with ASRC

### Rich Set of Clock Sources

- 16-52 MHz and 32.768 kHz Crystal (XTAL) oscillators
- 1 kHz Low Frequency RC (LFRC) oscillator
- 2x High Frequency RC (HFRC) oscillator

### Power Management

- Operating range: 1.71-2.2 V,  $-20^{\circ}\text{C}$  to  $60^{\circ}\text{C}$
- SIMO buck
- Multiple I/O voltages supported

### Applications

- Smart watches/bands
- Wireless sensors and IoT
- Activity and fitness monitors
- Children's watches
- Animal trackers
- Motion and tracking devices
- Alarms and security system
- Far-field voice remotes
- Consumer medical devices
- Predictive maintenance
- Smart home

### Package Options

- 5 mm x 5 mm, 146-pins BGA with 105 GPIO

### Ordering Information

- AMAP42KP-KBR (BGA)



AMAP42KP-KBR

Product images shown are for illustration purposes only and may not be an exact representation of the products.



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