apollo
by ambiq inc.

Apollo4 Low Power System-on-Chip

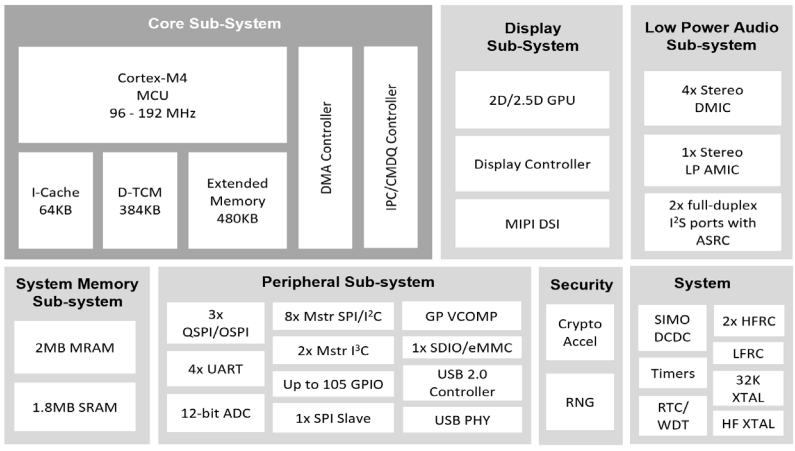
Product Brief

Ambiq, the leader in low power System-on-Chip (SoC) design, has once again raised the bar with the Apollo4 SoC. With the lowest dynamic and sleep mode power on the market, the Apollo4 SoC allows designers of next generation wearables and smart devices to take their innovative products to the next level.

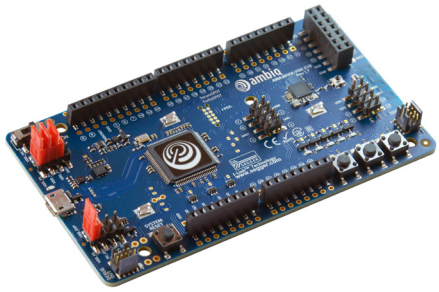
The Apollo4 SoC is the 4th generation system processor solution built upon Ambiq's proprietary Subthreshold Power-Optimized Technology (SPOT) platform. The Apollo4's complete hardware and software solution enables the battery-powered endpoint devices of tomorrow to achieve a higher level of intelligence without sacrificing battery life. The Apollo4 with its 32-bit Arm® Cortex®-M4 core with Floating Point Unit (FPU) is implemented on the TSMC® 22nm ULL process. The Apollo4 is available now with BGA and WLCSP.

With up to 2MB of MRAM and 1.8MB of SRAM, the Apollo4 has more than enough compute and storage to handle complex algorithms and neural networks while displaying vibrant, crystal-clear, and smooth graphics. If additional memory is required, an external memory is supported through Ambiq's multi-bit SPI and eMMC interfaces.

The Apollo4 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 SoC



Apollo EVB

Feature Highlights:

- Achieving an unmatched 3 µA/MHz from MRAM or SRAM with low power sleep modes
- Up to 192 MHz clock frequency with TurboSPOT™
- 2D/2.5D graphics accelerator and MIPI DSI 1.2 with up to two lanes at 500Mbps per lane delivering a feature-rich user interface
- Proprietary audio interfaces and an 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 BT/BLE 5/WiFi radios
- 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
- Microcontroller implemented with TSMC 22nm ULL process and Arm Artisan Physical IP

Features and Specifications

Ultra-Low Supply Current

- 3 µA/MHz executing from MRAM (with cache)
- 3 µA/MHz executing from SRAM
- Low power sleep mode with RTC and 8KB SRAM retention

High-Performance Arm Cortex-M4 Processor with FPU

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

Ultra-Low Power Memory

- Up to 2MB of non-volatile MRAM for code/data
- Up to 1.8MB 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 ±3°C accuracy

Ultra-Low Power Flexible Serial Peripherals

- 3x 2/4/8-bit SPI master interfaces
- 8x I^2C/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 640 x 480 resolution
- 4 layers with alpha blending
- Frame Buffer Decompression

Graphics

- 2D/2.5D graphics accelerator
- Full Alpha Blending
- Texture and Frame Buffer Compression

Audio Processing

- 1x stereo Low Power Analog microphones
- 4x stereo Digital microphones
- 2x full-duplex I^2S 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 – 192/384 MHz

Power Management

- Operating range: 1.71-2.2 V, –40°C to 85°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

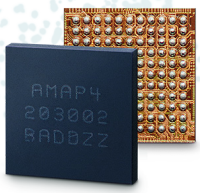
Package Options

- 5 mm x 5 mm, 146-pins BGA with 105 GPIO
- 3.9 mm x 3.9 mm, 121-pin WLCSP with 82 GPIO

Ordering Information

- AMAP42KK-KBR (BGA)
- AMAP42KK-KCR (WLCSP)

AMAP42KK-KBR



AMAP42KK-KCR

Note: General availability begins in late Q1, 2021.

ambiq

www.ambiq.com
sales@ambiq.com
+1 (512) 879-2850

6500 River Place Boulevard, Building 7, Suite 200, Austin, TX 78730
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