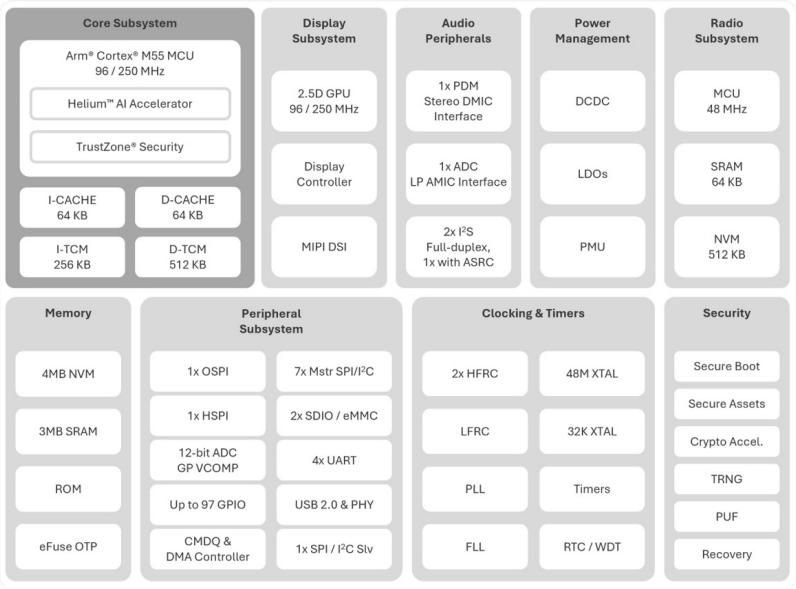
Apollo510**B** Ultra-Low Power SoC

Product Brief

Introducing Apollo510B System-on-Chip (SoC), a cutting-edge wireless solution engineered to revolutionize the landscape of ultra-low-power performance in conventional edge and AI applications. Leveraging Ambiq's advanced Subthreshold Power Optimized Technology (SPOT®), Apollo510B delivers exceptional energy efficiency, operating on minimal power while providing unparalleled performance. Equipped with an Arm® Cortex®-M55 application processor running at up to 250MHz and a dedicated 48MHz network processor for radio communication, this SoC enables efficient and high-performance computing, empowering developers to design innovative devices with ease.

Apollo510B offers seamless connectivity through Bluetooth® Low Energy 5.4 and a rich set of peripherals for body-worn and ambient AI applications. This enables effortless communication and interfacing with various devices, facilitating interoperability and data exchange in diverse endpoints. Additionally, the SoC incorporates advanced security features in secureSPOT® 3.0 with TrustZone® technology, such as secure boot and secure firmware updates, ensuring the integrity and confidentiality of data transmitted and processed by connected devices, making it an ideal choice for secure deployment in various applications.

Designed to meet the evolving needs of conventional edge and AI devices, the Apollo510B represents a significant leap forward in energy efficiency, performance, and security. With its unparalleled combination of ultra-low power operation, high-performance computing capabilities, and robust security features, this wireless SoC is designed to drive innovation and enable the next generation of smart and connected devices.



Block Diagram for the Ultra-Low Power Apollo510B

Apollo510B SoC

Feature Highlights

- Up to 250 MHz Arm Cortex-M55 application processor with turboSPOT® and Helium™ technology
- 48 MHz network coprocessor and Bluetooth Low Energy 5.4 radio
- Enhanced memory performance with 64kB I-cache and 64kB D-cache, 3.75MB of system RAM, and 4MB of embedded non-volatile memory for code/data
- Ultra-low power ADC and stereo digital microphone PDM interfaces for truly always-on voice
- High-fidelity telco-quality audio
- High-speed USB 2.0
- Wide range of integrated sensor interfaces including ADC, SPI, I²C, and UART

Features and Specifications

Arm Cortex-M55 Processor with Helium Technology

- Up to 250 MHz clock frequency
- Helium (MVE) vector integer, floating point
- Scalar half, single, and double-precision floating-point
- Supports TrustZone security extensions
- Integrated 64 kB Instruction Cache and 64 kB Data Cache
- Integrated 768 kB Instr./Data Tightly Coupled Memory (TCM)
- Memory Protection Unit (MPU)

Bluetooth Low Energy 5.4

- Low Energy Audio with Auracast™ broadcast audio
- Direction Finding (single antenna)
- Long Range
- Tx Power: Up to +6dBm output power
- Rx Sensitivity: -94/-97/-103dBm (2Mbps/1Mbps/125kbps)

secureSPOT 3.0 Security Features

- Arm TrustZone technology
- Secure boot
- OTP key storage
- PUF-based identity/sign/verify
- Secure over-the-air (OTA) updates
- Key revocation

Ultra-Low Power Memory

- Up to 4MB of non-volatile memory for code/data
- 3.75MB of TCM and system RAM for code/data

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

- 12-bit ADC, 11 selectable input channels
- Up to 1.7 MS/s sampling rate
- Integrated temperature sensor

Ultra-Low Power Flexible Serial Peripherals

- 1x 2/4/8-bit SPI master interfaces
- 1x 2/4/8/16-bit SPI master interface supporting 1.2 V
- 7x I²C/SPI masters for peripheral communication
- I²C/SPI slave for host communications
- 4x UART modules with FIFOs and flow control
- 1x USB 2.0 HS/FS device controller
- 2x SDIO (SD3.0) / eMMC (v4.51)

Display

- MIPI DSI 1.2 up to 768 Mbps
- QuadSPI display interface (up to 125MHz DDR)
- Up to 640 x 480 resolution at 60 FPS
- 4 layers with alpha blending
- Frame buffer decompression

graphiqSPOT 2.0 Graphics Features

- 2D/2.5D GPU with vector graphics (VG) acceleration
- 96 MHz / 250 MHz operating modes
- Anti-aliasing hardware acceleration
- Rasterizer / full alpha blending / texture mapping
- Texture / frame buffer compression (TSC4, 6, 6A and 12)
- Dithering and radial/conical fill support

Audio Processing

- 1x Low power audio ADC with PGA
- 1x PDM stereo DMIC interface
- 2x full-duplex multichannel I²S port (1x with ASRC)

Rich Set of Clock Sources

- PLL for precise clocking applications
- 48 MHz and 32.768 kHz Crystal (XTAL) oscillators
- Low Frequency RC (LFRC) oscillator
- High Frequency RC (HFRC) oscillator

Power Management

- Operating range: 1.71-2.2 V
- Single Inductor Multiple Outputs (SIMO) Buck Converter
- Multiple I/O voltages supported

Applications

- Smartwatches/bands
- Smart home devices
- Body-worn and ambient AI
- Wireless sensors and industrial edge
- Smart remotes
- Patient health monitoring
- Hearing assist
- Condition monitoring
- Factory predictive maintenance
- Livestock monitoring
- Asset tracking

Package Options

- 5.6 x 5.6 x 0.8 mm BGA with 97 GPIO

Ordering Information

-20°C to +70°C:

- AP510BFA-CBR (Bluetooth Low Energy, BGA)

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

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