Apollo330 **Plus Series** Ultra-Low Power SoCs

Product Brief

Apollo330 Plus System-on-Chip (SoC) is a groundbreaking solution engineered to redefine the boundaries of ultra-low-power performance in conventional edge and AI applications. Built upon Ambiq's renowned Subthreshold Power Optimized Technology (SPOT®), the Apollo330 Plus SoC sets a new standard for energy efficiency, enabling devices to operate for extended periods running more AI operations than ever before. This advanced SoC features an integrated Arm® Cortex®-M55 application processor running up to 250 MHz and a dedicated Arm Cortex-M4F network processor for low power radio communication, allowing for efficient and high-performance connectivity while consuming minimal active power.

Apollo330 Plus Series SoCs boast an array of peripherals and connectivity options designed to address the diverse needs of body-worn and ambient AI. *Apollo330B Plus* extends upon Apollo330 Plus with Bluetooth® Low Energy wireless connectivity. *Apollo330M Plus* further extends connectivity with the addition of Thread and Matter. Both SoCs facilitate seamless communication with a wide range of devices, enabling effortless data exchange and interoperability in diverse endpoints. Apollo330 Plus offers a rich set of peripherals for conventional edge and AI applications, empowering developers to create sophisticated sensor-based applications easily.

Innovative secureSPOT® 3.0 features based on TrustZone® technology further enhance Apollo330 Plus Series SoCs, ensuring the integrity and confidentiality of data transmitted and processed by connected devices. With hardware-based security mechanisms such as secure boot and secure firmware updates, these SoCs provides robust protection against unauthorized access and malicious attacks, enabling secure deployment in various applications.

Apollo330 Plus, Apollo330B Plus, and Apollo330M Plus[1]

Feature Highlights:

- Up to 250 MHz Arm Cortex-M55 application processor with turboSPOT® and Helium™ technology

- 48/96 MHz Arm Cortex-M4F network coprocessor and multi-protocol radio in wireless product options

- Enhanced memory performance with 32kB I-cache and 32kB D-cache, over 2MB of system RAM, and 2MB of embedded non-volatile memory for code/data

- Ultra-low power digital microphone PDM for truly always-on voice

- Wide range of integrated sensor interfaces including ADC, SPI, I2C, I3C, and UART

- Multiple package and connectivity options for diverse endpoints
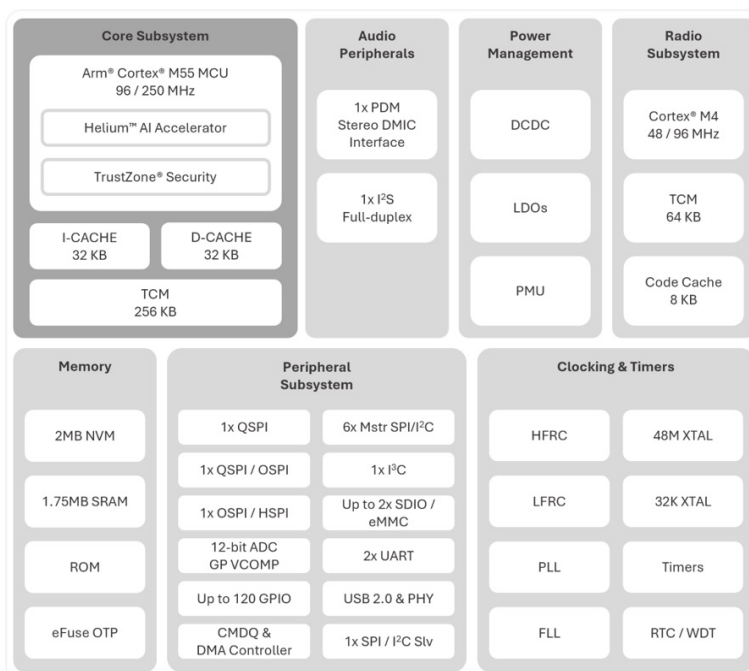
Block Diagram for the Ultra-Low Power Apollo330 Plus / Apollo330B Plus / Apollo330M Plus

Features and Specifications

Arm Cortex-M55 Processor with Helium Technology
- Up to 250 MHz clock frequency
- Helium (MVE) AI accelerator, up to 8 MACs per cycle
- Scalar floating-point: double, single, and half-precision arithmetic
- Supports TrustZone security extensions
- Integrated 32 kB Instruction Cache and 32 kB Data Cache
- Integrated 256 kB Instr./Data Tightly Coupled Memory (TCM)
- Memory Protection Unit (MPU)

Bluetooth Low Energy 5.4 (Apollo330B Plus and Apollo330M Plus)
- Low Energy Audio with Auracast™ broadcast audio with LC3 codec
- Direction Finding (single antenna)
- Advertising Extensions
- Long Range
- Periodic Advertising with Response (PAwR)
- Tx Power: Up to +14dBm output power
- Rx Sensitivity: -95/-98/-104dBm (2Mbps/1Mbps/125kbps)

802.15.4, Thread, and Matter (Apollo330M Plus)

secureSPOT 3.0 Security Features
- Arm TrustZone technology
- Secure boot
- OTP key storage
- PUF-based identity/sign/verify
- Secure over-the-air (OTA) updates
- Secure wired updates
- Key revocation

Ultra-Low Power Memory
- Up to 2MB of non-volatile memory for code/data
- 2MB 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 I^{3}C master interface
- 6x I^{2}C/SPI masters for peripheral communication
- Full-duplex I^{2}C/SPI slave for host communications
- Pin Config 1 (BGA): 2x QSPI at 96 MT/s + 1x HSPI at 250 MT/s
- Pin Config 2 (BGA): 1x QSPI at 96 MT/s + 2x OSPI at 96/192 MT/s
- Pin Config 3 (CSP): 1x QSPI at 250MT/s + 1x OSPI at 250 MT/s or 1x HSPI at 250 MT/s
- 2x UART modules with FIFOs and flow control
- 2x SDIO (v3.0) / eMMC (v4.51)
- 1x USB 2.0 FS/HS device controller
- Up to 120 GPIO

Audio Processing
- 1x PDM stereo DMIC interface
- 1x full-duplex multichannel I^{2}S port

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: 1.71-3.63V
- 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
- 5.3 x 5.3mm, BGA with 120 GPIO
- 4.0 x 4.0mm, CSP with 68 GPIO

Ordering Information

Product	Commercial SKU (-20°C to +70°C)	Industrial SKU (-40°C to +85°C)	Connectivity Type	Package
Apollo330 Plus	AP330NPA-CCR	AP330NPA-ICR	No Connectivity	CSP
Apollo330 Plus	AP330NPA-CBR	AP330NPA-IBR	No Connectivity	BGA
Apollo330B Plus	AP330BPA-CCR	AP330BPA-ICR	Bluetooth Low Energy	CSP
Apollo330B Plus	AP330BPA-CBR	AP330BPA-IBR	Bluetooth Low Energy	BGA[2]
Apollo330M Plus	AP330MPA-CCR	AP330MPA-ICR	Multi-Protocol	CSP
Apollo330M Plus	AP330MPA-CBR	AP330MPA-IBR	Multi-Protocol	BGA

[1] Product images shown are for illustration purposes only and may not be an exact representation of the products.
[2] Package option under consideration.

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

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