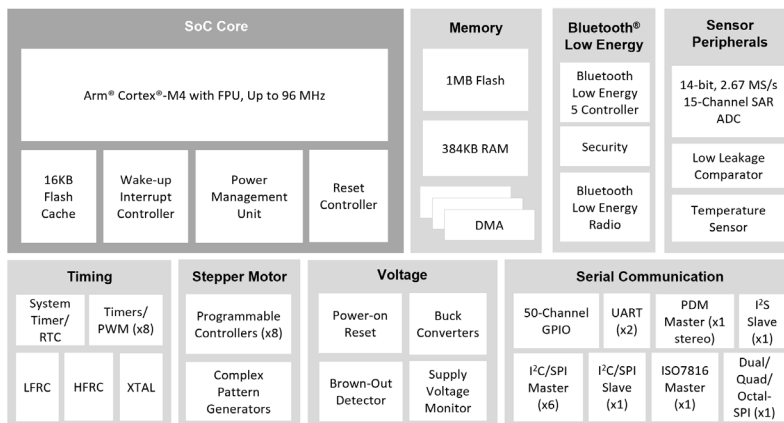![apollo by ambiq inc.]

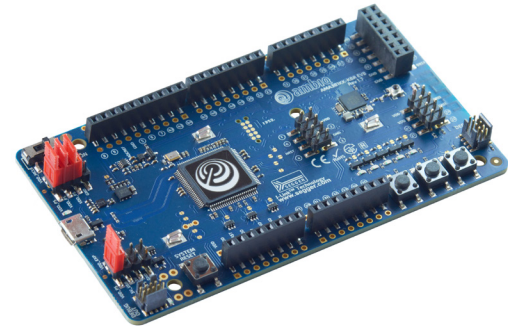# Apollo3 **Blue Thin** Low Power SoC

Product Brief

The Apollo3 Blue Thin is an ultra-low power, ultra-low profile, highly integrated system on a Chip (SoC) platform based on Ambiq's patented Subthreshold Power Optimized Technology (SPOT®) and designed for battery-powered and portable, mobile devices. The Apollo3 Blue Thin SoC sets a new standard in energy efficiency for battery powered devices with an integrated Arm® Cortex®-M4 processor with Floating Point Unit and turboSPOT® increasing the computational capabilities of the Arm Cortex-M4F core to 96 MHz while lowering the active power consumption to < 6 μA/MHz. This combination dramatically reduces energy consumption while still enabling abundant application processing power to add greater capability and extended life to battery operated devices.

The Apollo3 Blue Thin brings several new features to Ambiq's SPOT-based Apollo SoC family including an integrated DMA engine, QSPI interface, and advanced stepper motor control for ultra-low power analog watch hand management. With unprecedented energy efficiency and PDM microphone inputs, the Apollo3 Blue Thin also forms the core of Ambiq's Voice-on-SPOT® reference platform making it the perfect device for customers who want to add always-on voice assistant integration and command recognition to battery-powered devices. To increase design flexibility and enable connections to the phone and cloud, the Apollo3 Blue Thin provides a dedicated second core for the ultra-low power Bluetooth Low Energy 5 connectivity platform providing superior RF throughput and leaving plenty of resources available for user applications.

Apollo3 Blue AMA3B1KK-KBR EVB

Feature Highlights:

- As thin as 300 μm and perfect for contactless biometric cards, including payment, authentication, access, and more.

- An ideal solution for battery-powered applications requiring sensor measurement and data analysis.

- Serves as an applications processor for one or more sensors and has a fully integrated Bluetooth Low Energy 5 radio.

- A host processor can communicate with the Apollo3 Blue Thin SoC over its serial slave port using the I²C, SPI or I²S protocol.

- turboSPOT technology allows applications to meet critical timing as/when needed while still providing extremely high energy efficiency operation.

- Enables months and years of battery life for products only achieving days or months of battery life today.

- Implementation of the Cortex-M4F core delivers both greater performance and much lower power than 8-bit, 16-bit, and other comparable 32-bit cores.

- Supports highly optimized PWM pattern generation for complex, efficient stepper motor control operation.

- Supported by a complete suite of standard software development tools.

Block Diagram for the Ultra-Low Power Apollo3 Blue Thin SoC

Features and Specifications

Ultra-Low Supply Current

- 6 µA/MHz executing from flash or RAM at 3.3 V
- 1 µA deep sleep mode (Bluetooth Low Energy Off) with RTC at 3.3 V (Bluetooth Low Energy in SD)

High-Performance Arm Cortex-M4 Processor

- Up to 48 MHz nominal clock frequency with 96MHz performance turboSPOT Mode
- Floating Point Unit (FPU)
- Memory Protection Unit (MPU)
- Wake-up interrupt controller with 32 interrupts

Integrated Bluetooth® Low Energy Module

- RF sensitivity: -93 dBm (typical)
- Tx: Up to +3 dBm output power

Ultra-low Power Memory

- Up to 1MB of flash memory for code/data
- Up to 384KB of low power RAM for code/data
- 16KB 2-way Associative/Direct-Mapped Cache

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

- 14-bit ADC, 15 selectable input channels available
- Up to 2.67 MS/s sampling rate
- Voltage Comparator (VCOMP)
- Temperature sensor with ±3°C accuracy after calibration

Ultra-low Power Flexible Serial Peripherals

- ISO7816 Secure interface
- 1x 2/4/8-bit SPI master interface (MSPI)
- 6x I²C/SPI masters for peripheral communication
- 1x I²C/SPI slave for host communications
- 2x UART modules with 32-location Tx and Rx FIFOs
- PDM for mono and stereo audio microphones
- 1x I²S slave for PDM audio pass-through

Rich Set of Clock Sources

- 32.768 kHz Crystal (XTAL) oscillator
- Low Frequency RC (LFRC) oscillator (1.024 kHz)
- High Frequency RC (HFRC) oscillator (48 MHz)
- RTC based on Ambiq's AM08X5/18X5 family

Wide Operating Range

- 1.755-3.63 V, -40°C to 85°C

Applications

- Voice-on-SPOT compatible for always-listening keyword detect, audio command recognition and voice assistant integration in battery-powered devices including:
  - Bluetooth headsets, earbuds, and truly wireless earbuds
  - Remote and Gaming Controls
  - Smart home
- Wearables including smart watches and fitness/activity trackers
- Hearing aids, Digital Health Monitoring and Sensing Devices
- Smart Home Automation, Security and Lighting control applications

Package Option

- 3.25 mm x 3.37 mm, 66-pin WLCSP 300 µm with backside coating

Ordering Information

- AMA3B1KK-KCR-TB (384KB, 66-pin WLCSP)

AMA3B1KK-KCR-B0 WLCSP

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