apollo
by ambiq inc.

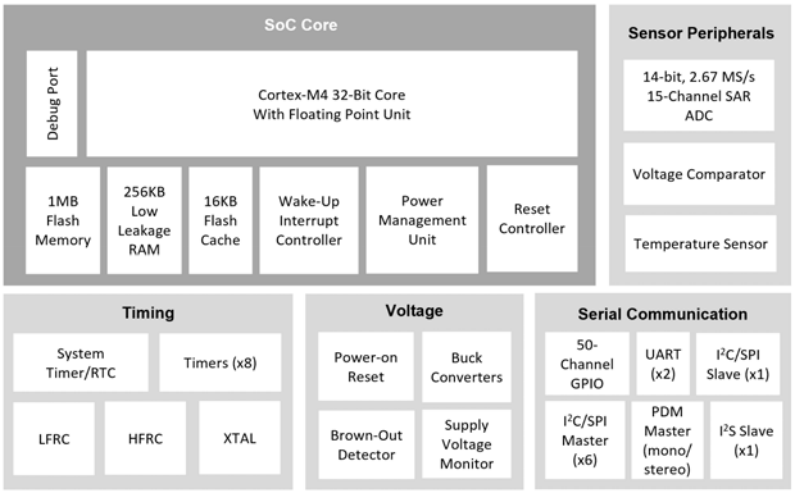
Apollo2 Low Power System on a Chip

Product Brief

The Apollo2 is an ultra-low power, highly integrated system on a chip (SoC) designed for battery-powered and portable, mobile devices. At the heart of the Apollo2 SoC is Ambiq's patented Subthreshold Power Optimized Technology (SPOT®) and a powerful Arm® Cortex®-M4 processor with floating point unit. This combination dramatically reduces energy consumption while still enabling abundant application processing power to add greater capability and extended life to battery-operated devices.

With unprecedented levels of energy efficiency, the Apollo2 can deliver always-on keyword detection and voice assistant integration, local voice control, complex sensor processing, gesture recognition and activity monitoring applications within the smallest power budget.

The Apollo2 SoC is the 2nd generation controller building upon Ambiq's Apollo SoC product line. The Apollo2 SoC integrates up to 1MB of flash memory and 256KB of RAM to accommodate radio and sensor overhead while still leaving plenty of space for application code and algorithms. In addition to flexible serial channels for radio and sensor communication, this system on a chip also includes dual Pulse-Density Modulation (PDM) inputs for applications that require digital microphones for near and mid-field always-on keyword detection, voice assistant integration, and voice control.



Block Diagram for the Ultra-Low Power Apollo2 SoC

Apollo2 AMAPHEVB (EVB)

Feature Highlights:

- An ideal solution for battery-powered applications requiring sensor measurement and data analysis.
- Can measure analog sensor outputs using an integrated ultra-low power 14-bit ADC and digital sensor outputs using the integrated serial master ports.
- A host processor can communicate with the Apollo2 SoC over its serial slave port using the I²C, SPI or I²S protocol.
- 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.
- ADC is uniquely tuned for minimum power with a configurable measurement mode that does not require SoC intervention.
- Supported by a complete suite of standard software development tools.

Features and Specifications

Ultra-Low Supply Current

- < 10 µA/MHz executing from flash at 3.3 V
- < 10 µA/MHz executing from RAM at 3.3 V
- < 3 µA deep sleep mode with RTC at 3.3 V

High-Performance Arm Cortex-M4 Processor

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

Ultra-low Power Memory

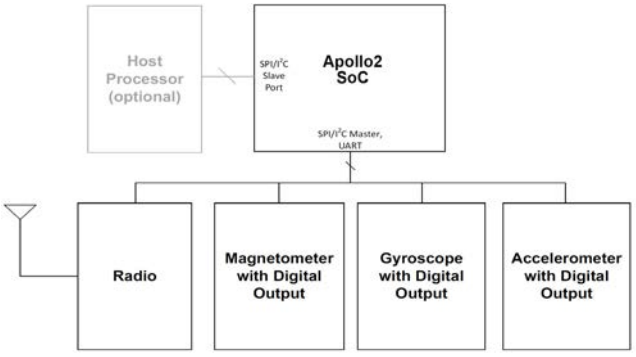
- Up to 1MB of flash memory for code/data
- Up to 256KB of low power RAM for code/data
- 16KB 2-way Associative Cache

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

- 6x I^2C/SPI masters with 128-byte bidirectional FIFO for communication with sensors, radios, and other peripherals
- 1x I^2C/SPI slave for host communications with 256-bytes LRAM area for FIFO/host support
- 2x UART modules with 32-location Tx and Rx FIFOs
- PDM for mono and stereo audio microphones
- 1x I^2S slave for PDM audio pass-through



Typical Sensor Application Circuit for the Apollo2 SoC

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

- Headsets, Earphones, Wireless Earbuds
- Mobile Accessories
- Hearing Aids
- Always-Listening, Voice-Activated Appliances
- Portable Voice Assistants
- Remote Controls
- Smart Cards
- Fingerprint Readers
- Wearable electronics including smart watches
- Smart meters
- Wireless sensors
- Activity and fitness monitors
- Consumer electronics

Package Options

- 4.5 mm x 4.5 mm 64-pin BGA with 50 GPIO
- 2.5 mm x 2.5 mm 49-pin WLCSP with 34 GPIO

Ordering Information

- AMAPH1KK-KBR (256KB RAM, 64-pin BGA)
- AMAPH1KK-KCR (256KB RAM, 49-pin WLCSP)
- AMAPHEVB (EVB)

AMAPH1KK-KBR

AMAPH1KK-KCR

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

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