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Apollo MCU Datasheet

Doc. ID: DS-A1-1p00

Revision 1.00

March 2017

Features

Ultra-low supply current:

- EEMBC ULPBench score of 377
- 35 μ A/MHz executing from flash at 3.3 V
- 143 nA deep sleep mode at 3.3 V
- 419nA deep sleep mode with XTAL-assisted RTC at 3.3 V

High-performance ARM Cortex-M4F Processor

- Up to 24 MHz clock frequency
- Floating point unit
- Memory protection unit
- Wake-up interrupt controller with 12 interrupts

Ultra-low power memory:

- Up to 512 KB of flash memory for code/data
- Up to 64 KB of low leakage RAM for code/data

Ultra-low power interface for off-chip sensors:

- 10 bit, 13-channel, up to 800 kSps ADC
- Temperature sensor with $\pm 4^{\circ}\text{C}$ accuracy

Flexible serial peripherals:

- I²C/SPI masters for communication with sensors, radios, and other peripherals
- I²C/SPI slave for host communications
- UART for communication with peripherals and legacy devices

Rich set of clock sources:

- 32.768 kHz XTAL oscillator
- Low frequency RC oscillator – 1.024 kHz
- High frequency RC oscillator – 24 MHz
- RTC based on Ambiq's AM08X5/18X5 families

Wide operating range: 1.8-3.8 V, -40 to 85°C

Compact package options:

- 2.49 x 2.90 mm 41-pin CSP with 27 GPIO
- 4.5 x 4.5 mm 64-pin BGA with 50 GPIO

Applications

- Wearable electronics
- Wireless sensors
- Activity and fitness monitors
- Consumer medical devices

Description

The Apollo MCU family is an ultra-low power, highly integrated microcontroller designed for battery-powered devices including wearable electronics, activity & fitness monitors, and wireless sensors. By combining ultra-low power sensor conversion electronics with the powerful ARM Cortex-M4F processor, the Apollo MCU enables complex sensor processing tasks to be completed with unprecedented battery life. Weeks, months, and years of battery life are achievable while doing complex context detection, gesture recognition, and activity monitoring. The Apollo MCU takes full advantage of Ambiq Micro's patented Subthreshold Power Optimized Technology (SPOT) Platform, setting a new industry benchmark in low power design.

The Apollo MCU also integrates up to 512 KB of flash memory and 64 KB of RAM to accommodate radio and sensor overhead while still leaving plenty of space for application code. This microcontroller also includes a serial master and UART port for communicating with radios and sensors including accelerometers, gyroscopes, and magnetometers.

Typical Sensor Application Circuit for the Apollo MCU

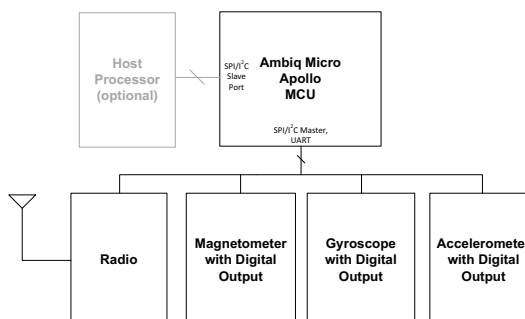


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1. Apollo MCUPackage Pins

1.1 Pin Configuration

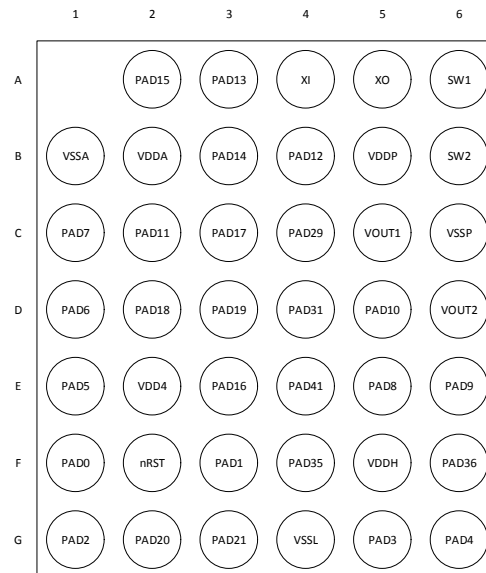


Figure 1. CSP Pin Configuration Diagram (Top View — Balls on Bottom)

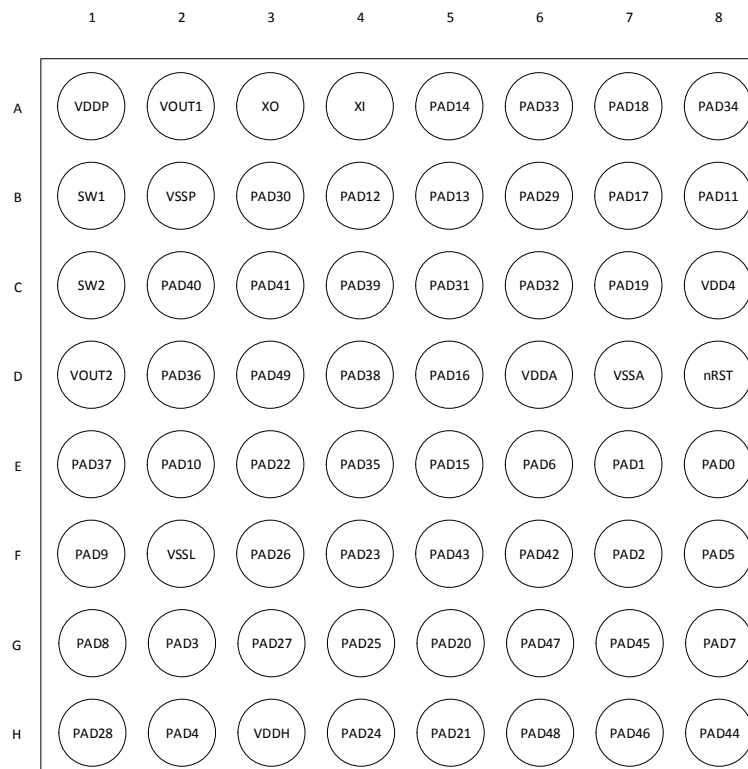


Figure 2. BGA Pin Configuration Diagram (Top View — Balls on Bottom)

1.2 Pin Connections

Table 1: Pin List and Function Table

BGA Pin Number	CSP Pin Number	GPIO Pad Number	Function Select Number	Pad Function Name	Description	Pin Type
POWER						
A1	B5	-	-	VDDP	VDD Supply for Buck Converters	Power
B2	C6	-	-	VSSP	Ground Connection for I/O Pads	Ground
D6	B2	-	-	VDDA	Analog Voltage Supply	Power
D7	B1	-	-	VSSA	Ground for Analog Supply	Ground
C8	E2	-	-	VDD4	Must be connected to VDDP	Power
F2	G4	-	-	VSSL		Ground
H3	F5	-	-	VDDH	VDD Supply for I/O Pads	Power
BUCK						
A2	C5	-	-	VOUT1	Buck Converter Voltage Output Supply 1	Power
B1	A6	-	-	SW1	Buck Converter 1 Inductor Switch	Power
C1	B6	-	-	SW2	Buck Converter 2 Inductor Switch	Power
D1	D6	-	-	VOUT2	Buck Converter Voltage Output Supply 2	Power
OSCILLATOR						
A3	A5	-	-	XO	32.768 kHz Crystal Output	XT
A4	A4	-	-	XI	32.768 kHz Crystal Input	XT
RESET						
D8	F2	-	-	nRST	External Reset Input	Input/Output
GPIO						
E8	F1	0	0	SLSCL	I ² C Slave Clock	Input
			1	SLSCK	SPI Slave Clock	Input
			2	UARTTX	UART Transmit	Output
			3	GPIO0	General Purpose I/O	Input/Output
			4	M0SCK	Loopback SPI Master 0 Clock	Output
			5	M1SCK	Loopback SPI Master 1 Clock	Output
			6	M0SCL	Loopback I ² C Master 0 Clock	Open Drain Output
			7	M1SCL	Loopback I ² C Master 1 Clock	Open Drain Output