

NXP® 88MW32X 802.11N WI-FI® MICROCONTROLLER SOC

High integration and low-power operation in the 88MW320/322 WLAN microcontroller system-on-chip (SoC), making it an ideal solution for low-cost, high efficiency smart device, appliance, and energy applications.

PRODUCT OVERVIEW

Several features of the NXP 88MW320/322 SoC enable low system costs and high WLAN protocol processing. For example, the high degree of integration in the SoC requires only one 3.3 V power input, a 38.4 MHz crystal and SPI flash, while the RF path needs only a low-pass filter for antenna connection.

Proven and mature IEEE 802.11n/g/b NXP technology powers a full-featured WLAN subsystem in the SoC. This WLAN subsystem integrates a WLAN MAC, baseband, and direct-conversion RF radio with integrated PA, LINA and transmit/receive switch. It also integrates a CPU subsystem with integrated memory to run NXP WLAN firmware to handle real-time WLAN protocol processing to offload many WLAN functions from the main application CPU.

An Arm® Cortex®-M4F CPU that operates up to 200 MHz powers the 88MW320/322 application subsystem. The device supports an integrated 512 KB SRAM, 128 KB mask ROM and a QSPI interface to external flash. An integrated flash controller with a 32 KB SRAM cache enables execute in place (XIP) support for firmware from flash.

The SoC is designed for low-power operation and includes several low-power states and fast wake-up times. Multiple power domains and clocks can be individually shut down to save power. The SoC also has a high-efficiency internal PA that can be operated in low-power mode to save power. The microcontroller and WLAN subsystems can be placed into low-power states, independently, supporting a variety of application use cases. An internal DC-DC regulator provides the 1.8 V rail for the WLAN subsystem.

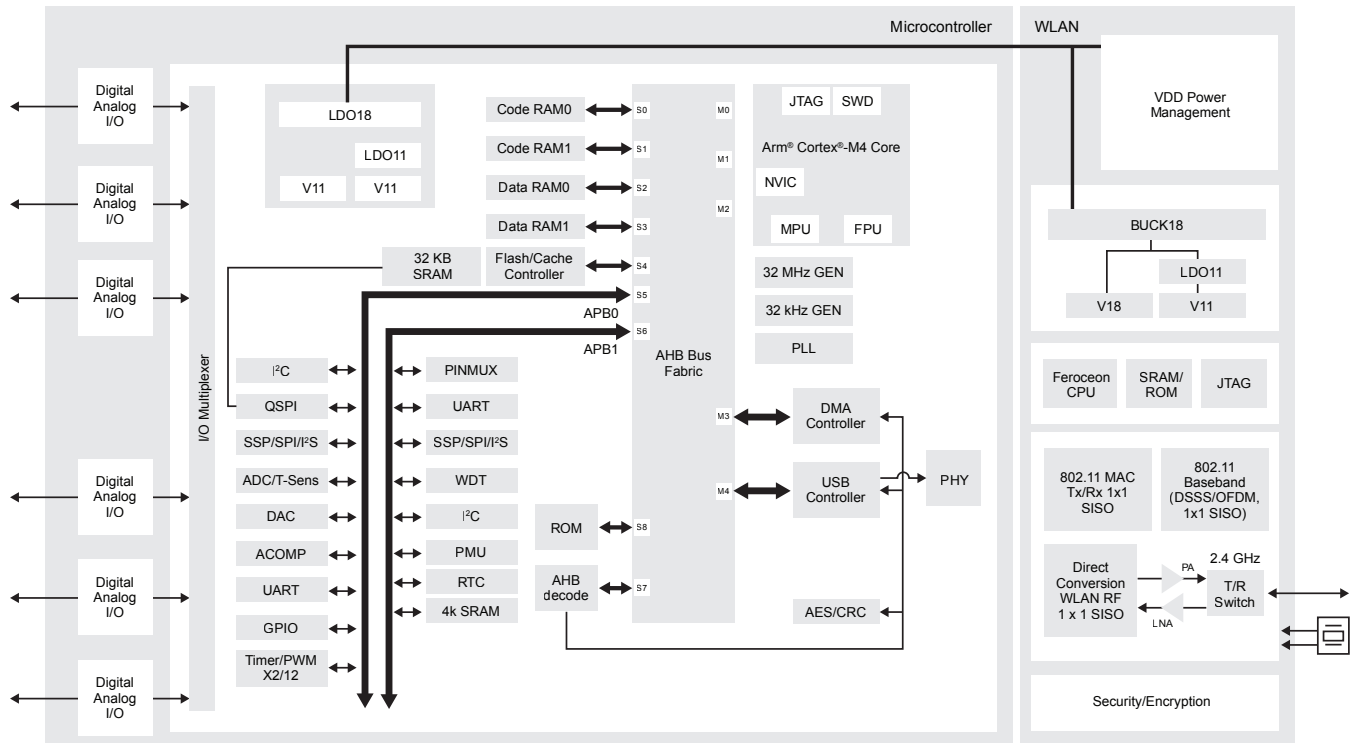


The SoC provides a full array of peripheral interfaces including SSP/SPI/I²S (3x), UART (3x), I²C (2x), general-purpose timers and PWM, ADC, DAC, analog comparator, and GPIOs. It also includes a hardware cryptographic engine, RTC, and watchdog timer.

The 88MW322 SoC includes a high-speed USB On-The-Go (OTG) interface to enable USB audio, video and other applications.

A complete set of digital and analog interfaces enables direct interfacing for I/O and avoids the need for external chips. The application CPU can be used to support custom application development and avoids the need for another microcontroller or processor.

88MW32X BLOCK DIAGRAM



APPLICATIONS

- Smart Home—smart outlet, light switch, security camera, thermostat, sprinkler controller, sensor, door lock, door bell, garage door, security system
- Industrial—building automation, smart lighting, Wi-Fi to other radio bridge, point of sale (POS) terminals
- Smart Devices—coffee pot, rice cooker, vacuum cleaner, air purifier, pet monitor, weighing scale, glucometer, blood pressure monitor, fitness equipment
- Smart Appliances—refrigerator, washer, dryer, oven range, microwave, dishwasher, water heater, air conditioner
- Smart Accessories—smart speakers, headset, alarm clock, gaming accessory, remote control
- Gateways—Bluetooth Smart Mesh and other radios to Wi-Fi/IP network

KEY FEATURES

- Highly integrated SoC requiring very few external components for a full system operation

- Multiple low-power modes and fast wake-up times
- Full-featured, single stream 802.11n/g/b WLAN
- High-efficiency PA with a low-power (10 dB) mode
- Cortex-M4F application CPU for applications with integrated 512 KB SRAM and 128 KB mask ROM
- Flash controller with embedded 32 KB SRAM cache to support XIP from external SPI flash
- Secure boot
- Full set of digital and analog I/O interfaces

POWER MANAGEMENT

- Power modes—active, idle, standby, sleep, shutoff, power-down
- Integrated high-efficiency buck DC-DC converter
- Independent power domains
- Brown-out detection
- Integrated POR
- Wake-up through dedicated GPIO, IRQ, and RTC

CHIP PACKAGE

- 88MW320—68-pin QFN, 8 x 8 mm
 - USB OTG not supported
 - 35 GPIOs
 - 2 GPTs
- 88MW322—88-pin QFN, 10 x 10 mm
 - USB OTG supported
 - 50 GPIOs
 - 4 GPTs

TEMPERATURE

- Commercial: 0° to 70° C
- Extended: -30° to 85° C
- Industrial: -40° to 105° C
- Storage: -55° to 125° C

PACKAGE FEATURE DIFFERENCES¹

Features	68-Pin	88-Pin
GPIO	35 total GPIO_0 to GPIO_10 GPIO_16 GPIO_22 to GPIO_33 GPIO_39 to GPIO_49	50 total GPIO_0 to GPIO_49
USB 2.0 OTG	—	1
GPT	2	4

¹All I/O features are muxed on GPIOs, except WLAN RF TX/RX, USB, reference clock, and reset functionality.

WIRELESS

- IEEE 802.11n/g/b, 1 x 1 SISO 2.4 GHz and HT20
- Integrated CPU, memory, MAC, DSSS/OFDM baseband, direct conversion RF radio, encryption
- Antenna diversity
- CMOS and low-swing sine wave input clock
- Low-power with deep sleep and standby modes
- Pre-regulated supplies
- Integrated T/R switch, PA, and LNA
- Optional 802.11n features
- One-time programmable (OTP) memory to eliminate need for external EEPROM

WLAN Rx Path

- Direct conversion architecture eliminates need for external SAW filter
- On-chip gain selectable LNA with optimized noise figure and power consumption
- High dynamic range AGC function in receive mode

WLAN Tx Path

- Integrated PA with power control
- Optimized Tx gain distribution for linearity and noise performance

WLAN Local Oscillator

- Fractional-N for multiple reference clock support
- Fine channel step

WLAN Encryption

- WEP 64- and 128-bit encryption with hardware TKIP processing (WPA)
- AES-CCMP hardware implementation as part of 802.11i security standard (WPA2)

- WPA3 SAE
- Enhanced AES engine performance
- AES-Cipher-Based Message Authentication Code (CMAC) as part of the 802.11w security standard
- WLAN Authentication and Privacy Infrastructure (WAPI)

IEEE 802.11 Standards

- 802.11 data rates of 1 and 2 Mbit/s
- 802.11b data rates of 5.5 and 11 Mbit/s
- 802.11g data rates 6, 9, 12, 18, 24, 36, 48, and 54 Mbit/s for multimedia content transmission
- 802.11g/b performance enhancements
- 802.11n compliant with maximum data rates up to 72.2 Mbit/s (20 MHz channel)
- 802.11d international roaming
- 802.11e quality of service
- 802.11h transmit power control
- 802.11i enhanced security
- 802.11k radio resource measurement
- 802.11n block acknowledgment extension
- 802.11r fast hand-off for AP roaming
- 802.11w protected management frames
- Fully supports clients (stations) implementing IEEE Power Save mode
- Wi-Fi direct connectivity

MICROPROCESSOR

Processor

- Arm Cortex-M4F, 32-bit
- 200 MHz main bus clock

Memory

- 128 KB ROM
- 512 KB RAM

Flash Controller

- Supports QSPI flash devices
- Memory-mapped access to QSPI flash devices
- 32 KB SRAM cache

Digital Interfaces

- 3 x I²S stereo
- 3 x SPI master/slave
- 2 x I²C master/slave
- 3 x UART
- 1 x USB OTG 2.0, high-speed
- 1 x QSPI
- Up to 50 GPIOs
- 2 x wake-up pins

Analog

- 2-step ADC with integrated PGA and configurable resolution/speed
 - 12-bit/2 MHz sample(s) for fast conversion
 - 16-bit/16 kHz sample/s with voice quality
 - 8 single channels or 4 differential channels
- 2-channel or 1 differential channel DAC, 10-bit/500 ksp/s
- 2 analog comparators with programmable speed/current
- On-die/off-chip temperature sensing and battery monitor
- Counters/Timers/PWM
- General-purpose timers (GPT) with LED PWM support
- Real-time clock (RTC)
- CM4 system tick
- Watchdog timer