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Qualcomm®
Wi-Fi Connectivity
Selector Guide

**Integrated multi-mode Wi-Fi solutions
for simple, adaptive and seamless
connectivity for the Internet of Things**

QCA402x

QCA401x

QCA400x

QCA4531

QCA4020/24 Wi-Fi SoCs

Qualcomm® QCA4020 and Qualcomm® QCA4024 Wi-Fi System-on-Chips (SoCs) are low power host-less Internet of Things (IoT) platforms offering multiple radios, standards, protocols and connectivity framework support in a single-chip solution. These multi-mode intelligent connectivity solutions integrate dual-band Wi-Fi, Bluetooth 5 and 802.15.4 technologies.

QCA402x Features

- QCA4020 tri-mode SoC integrates Bluetooth 5 , dual-band Wi-Fi, and 802.15.4 technologies

- QCA4024 dual-mode SoC integrates Bluetooth 5 and 802.15.4

- Isolated low power processors for connectivity
    - 15.4 SW MAC, 15.4 and BLE drivers, coex management
    - Wi-Fi operations (QCA4020 only)

- Advanced hardware-based security featuring secure boot, trusted execution environment, encrypted storage, key provisioning and wireless protocol security

- Comprehensive set of peripherals and interfaces: SPI, UART, PWM, I2S, I2C, SDIO, ADC and GPIOs

- Integrated sensor hub for post-processing designed to enable low power sensor use cases

- Small package size allows for optimized form factors

Target Applications

- Internet of Things (IoT)
- Home Automation
- Smart Home
- IoT Hub
- Smart Cities
- Home Entertainment

Ordering Information

Product	Part Number
QCA4020 SOC	QCA-4020-0-217MSP
QCA4024 SOC	QCA-4024-0-6BCMQFN

QCA4020/24 Specifications

Package Type	**QCA4020 -** 11.2 x 11.2mm, 0.65mm pitch, 217-ball BGA **QCA4024 -** 18 x 8mm, 0.40mm pitch, 68-pin QFN
Application CPU	Arm Cortex-M4F @ up to 128MHz 32KB- L1 cache controller, XIP from external S-flash Internal Memory: 300+KB RAM reserved for applications
Connectivity/System CPU	Dedicated processor for Bluetooth LE LC and 15.4 MAC Dedicated processor for 802.11 a/b/g/n Isolated Memory: RAM, ROM
Low Power Bluetooth & 15.4 (Separate radios)	Bluetooth v5.0, PA =+4dBm/+10dBm (for Long Range) 802.15.4: 2006 compliant, 15.4e, 2.4GHz DSSS +4dBm/+21dBm (for Long Range)
Wi-Fi	**QCA4020 -** Dual Band, 1x1, HT20, MCS0-7, 2.4/5GHz, PA=+18dBm
Sensor Hub	Low power HW+App CPU, Interface: I^2C, SPI, ADC
Display	Segmented or character display with SPI or I^2C interfaces
Interfaces	I^2C, UART, SPI/Q-SPI, ADC (8ch, 12-bit 1Msps) PWM, SDIO2.0, USB2.0 HS, I^2S, GPIOs
Security	Secure boot, Secure Storage, HW Crypto Engine HW ECC, 16-bit true random number generator Trusted Execution Environment
Direct Battery Connection	1.8V-3.6V

QCA402x Block Diagram
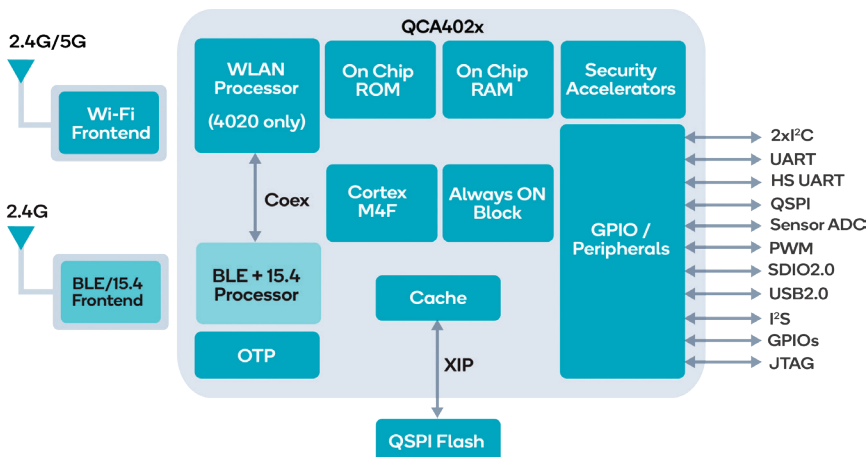
QCA4020 Product Development Kit

The Qualcomm® QCA4020 Product Development Kit features the QCA4020 tri-mode SoC integrating Bluetooth 5, dual-band Wi-Fi and 802.15.4-based technologies, including ZigBee and Thread. It is engineered to help developers and device manufacturers create unique IoT products that work in concert with a wide variety of other devices and cloud ecosystems. The kit is well suited for developing IoT applications such as smart cities, toys, home control and automation.

Development Kit Contents

- QCA4020 Reference Module and Development Board
- 2x Micro USB cables to connect to host PC and power supply
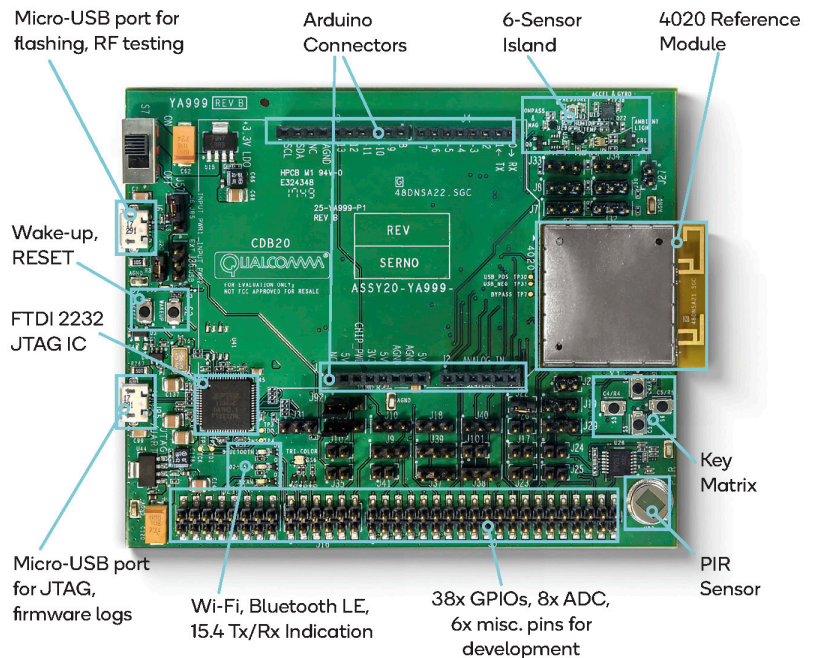- Set-up guide

Features

- QCA4020 tri-mode SoC with integrated Bluetooth 5, dual-band Wi-Fi, and 802.15.4 technologies
- On-board FTDI2232 IC for 4-wire JTAG debugging
- Various commercial and free IDE options for JTAG debugging and software development
- Arduino connector to extend kit and add shields
- Open schematics and layout files
- Eclipse based IDE for single-step JTAG debugging
- UART-AT commands to connect QCA4020 to MCU/CPU
- Eight sensors and actuators on-board
- Out-of-box drivers for sensors in demo applications
- Miscellaneous headers, test-points for power measurement, direct connect to battery, boot-configuration, and other measurements

Ordering Information

Product	Part Number
QCA4020 Product Development Kit	65-YA999-1

QCA4020 Development Board

Micro-USB port for flashing, RF testing · Arduino Connectors · 6-Sensor Island · 4020 Reference Module · Wake-up, RESET · FTDI 2232 JTAG IC · Micro-USB port for JTAG, firmware logs · Wi-Fi, Bluetooth LE, 15.4 Tx/Rx Indication · 38x GPIOs, 8x ADC, 6x misc. pins for development · Key Matrix · PIR Sensor

QCA4020 Module Specifications

Module Size	28.57 x 33.5 mm 124-pin
WLAN Tx/Rx	Integrated WLAN PA and LNA with 17 dBm Pout and dedicated WLAN antenna
Bluetooth LE & 802.15.4 Tx	Shared PA between 15.4 and Bluetooth LE for transmit 17 dBm Pout for 15.4 and 7 dBm Pout for Bluetooth LE
Bluetooth LE & 802.15.4 Rx	Concurrent 15.4 and Bluetooth LE Rx Shared antenna between 15.4 and Bluetooth LE
Voltage	3.3V supply voltage
Application I/O	SPI master/slave, 8-channel PWM, SDIO master/slave, HSUART, I2C, 12-bit/8-channel 1-MSPS ADC, 4-wire JTAG debugging Extra GPIOs for application-specific use
Interfaces	SDIO/SPI/UART interfaces to connect to external MCU/CPU interface
Testing	USB interface for RF testing, factory automation

To learn more visit:
developer.qualcomm.com or **qualcomm.com**

QCA4024 Product Development Kit

The Qualcomm® QCA4024 Product Development Kit features the QCA4024 dual-mode SoC with integrated Bluetooth 5 and 802.15.4 technologies and is engineered to help developers and device manufacturers create unique IoT products that work in concert with a wide variety of other devices and cloud ecosystems. The kit is well suited for developing IoT applications such as smart cities, toys, home control and automation, appliances, networking and home entertainment.

Development Kit Contents

- QCA4024 Reference Module and Development Board
- 2x Micro USB cables to connect to Host PC and power supply
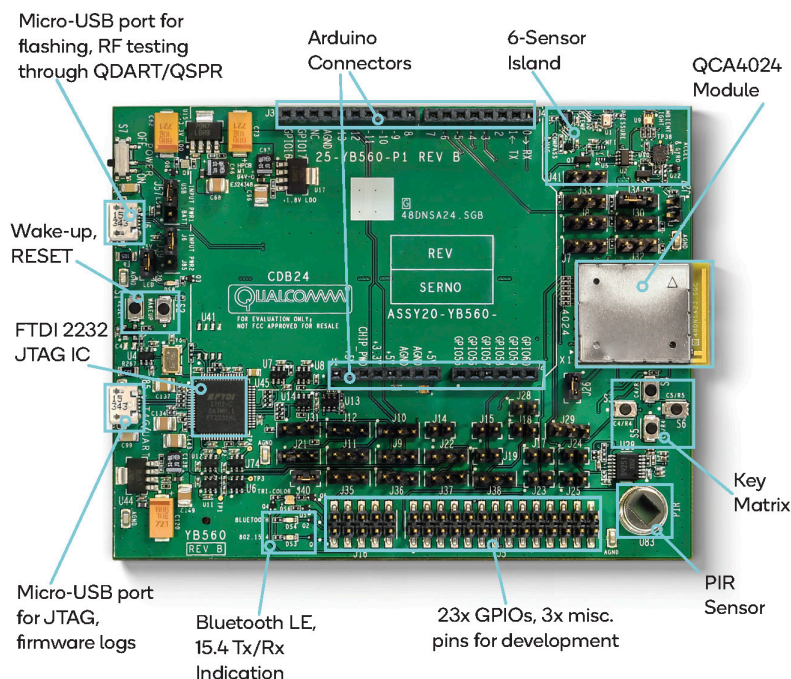- Set-up guide

Features

- QCA4024 dual-mode SoC with integrated Bluetooth 5 and 802.15.4 technologies
- On-board FTDI2232 IC for 4-wire JTAG debugging
- Various commercial and free IDE options for JTAG debugging and software development
- Arduino connector to extend kit and add shields
- Open schematics and layout files
- Eclipse based IDE for single-step JTAG debugging
- UART-AT commands to connect QCA4024 to MCU/CPU
- Eight sensors and actuators on-board
- Out-of-box drivers for sensors in demo applications
- Miscellaneous headers, test-points for power measurement, direct connect to battery, boot-configuration, and other measurements
- Plan for FCC/CE pre-certification

Ordering Information

Product	Part Number
QCA4024 Product Development Kit	65-YB560-1

QCA4024 Development Board

Micro-USB port for flashing, RF testing through QDART/QSPR

Arduino Connectors

6-Sensor Island

QCA4024 Module

Wake-up, RESET

FTDI 2232 JTAG IC

Key Matrix

Micro-USB port for JTAG, firmware logs

Bluetooth LE, 15.4 Tx/Rx Indication

23x GPIOs, 3x misc. pins for development

PIR Sensor

QCA4024 Module Specifications

Module Size	19.4 x 25 mm 59-pin
Bluetooth LE & 802.15.4 Tx	Shared PA between 15.4 and Bluetooth LE for transmit 17 dBm Pout for 15.4 and 7 dBm Pout for Bluetooth LE
Bluetooth LE & 802.15.4 Rx	Concurrent 15.4 and Bluetooth LE Rx Shared antenna between 15.4 and Bluetooth LE
Voltage	3.3V supply voltage
Application I/O	SPI master/slave, 6-channel PWM, SDIO master/slave, HSUART, I2C, 12-bit/5-channel 1-MSPS ADC, 4-wire JTAG debugging Extra GPIOs for application-specific use
Interfaces	SDIO/SPI/UART interfaces to connect to external MCU/CPU interface
Testing	USB interface for RF testing, factory automation

QCA4010/12 Wi-Fi SoCs

Qualcomm® QCA4010 is a one-stream (1x1) IEEE 802.11a/b/g/n single-band SoC and Qualcomm® QCA4012 is a dual-band SoC for the IoT. The QCA401x platform features a fully integrated micro-control unit (MCU) in a single-chip solution.

QCA401x Features

- Industry-leading 802.11n Wi-Fi solution
- Integrated on-chip application processor and memory (1.5MB)
- Advanced security features including anti-tampering, data integrity and root of trust
- Data rates up to 40Mbps TCP/IP throughput
- Integrated IPv4v6 networking stack
- Low power CPU for embedded applications
- Low power modes:
    - IEEE Sleep with low power consumption and optimal state transition times
    - Power optimized listen, receive, transmit and associated operating modes
    - Store and recall
- HTTP and DNS services
- Manufacturing tools for configuration and test
- Cost optimized RBOM with integrated PA and LNA
- Software support for Apple HomeKit and Open Connectivity Foundation

Target Applications

- Wearables
- Smart Appliances
- Sensors
- Remote Controls
- Medical Devices
- Home Security

Ordering Information

Product	Part Number
QCA4010 SOC	QCA-4010-0-116BDRQFN
QCA4012 SOC	QCA-4012-0-116BDRQFN

QCA4010/12 Specifications

Package Type	9 x 9 x 0.9mm QFN Dual-Row 116-pin, 0.5mm pitch RoHS Compliant
PCB Footprint (solution area)	< 25 x 20mm SB, single sided + antenna + S-Flash
WLAN Technology	**QCA4010** - 802.11b/g/n **QCA4012** - 802.11a/b/g/n
Antenna Design Options	PCB printed or external antenna
Interfaces	SPI/SDIO, UART, HS-UART I²C, I²S, GPIOs, PWMs, ADCs
Frequency Bands	**QCA4010** - 2.4 GHz single-band **QCA4012** - 2.4/5 GHz dual-band
Active Power Save	Green Tx & Low Power Listen (LPL)
Security Features	WEP, WPA/WPA2-PSK, WPS2.0 with CCMP (AES) encryption SSL – application level security Integrated crypto accelerator
Analog Input	1.8V or 3.3V
Network Throughput	up to 10Mbps
Operating Temperature	Commercial: 0° to 85°C (C-Temp) Industrial: -40° to 115°C (E-Temp)

QCA401x Block Diagram

To learn more visit:
developer.qualcomm.com or **qualcomm.com**
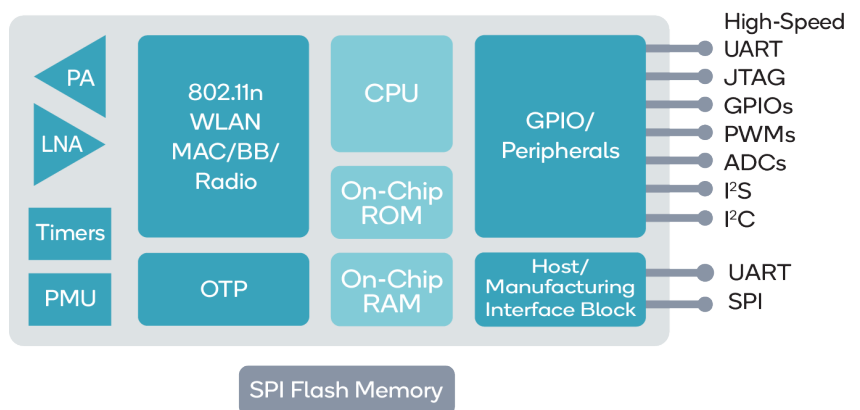
QCA4002/4 Wi-Fi SoCs

Qualcomm® QCA4002 is a single-stream (1x1) IEEE 802.11n single-band SoC and Qualcomm® QCA4004 is a dual-band SoC for the IoT. The QCA400x SoCs are optimized for low system cost, and minimize the number of components required to achieve a reliable Wi-Fi link. In addition, the QCA4004 can operate in a pure hostless mode of operation.

QCA400x Features

- IEEE 802.11n 1x1 single or dual-band 2.4GHz/5GHz
- Single or dual Rx front end for receive diversity
- Integrated on-chip processor and memory
- Cost optimized RBOM with integrated PA and LNA
- Full security support: WPS, WPA, WPA2, WEP
- SPI and UART host interface
- Data rates up to 10Mbps
- Integrated IPv4/IPv6 networking stack
- Green Tx power savings and Low power Rx listen
- Low power modes:
  - IEEE Sleep with low power consumption and optimal state transition times
  - Power optimized listen, receive, transmit and associated operating modes
  - Suspend mode (QCA4004) for hostless mode of operation with very low power consumption
  - Store and recall
- HTTP, DNS services
- Manufacturing tools for configuration and test

Target Applications

- Remote Controls
- Home Automation
- Smart Appliances
- Energy Management
- Smart Lighting
- Home Security

Ordering Information

Product	Part Number
QCA4002 SOC	QCA-4002x-BL3A
QCA4004 SOC	QCA-4004x-BL3A

QCA4002/4 Specifications

Package Type	**QCA4004 -** SB/DB 8 x 8 mm 68-pin QFN **QCA4002 -** SB/DB 7 x 7mm 58-pin QFN
PCB Footprint (solution area)	**QCA4004** < 42 x 20 mm DB single sided + antenna + Diversity + S-Flash **QCA4002** < 25 x 20 mm SB single sided + antenna + S-Flash
WLAN Technology	802.11a/b/g/n
Antenna Design Options	UFL Chip or PCB printed
Interfaces	USB 2.0 for manufacturing test SPI/SDIO, UART, HS-UART, I2C, I2S, GPIOs
Frequency Bands	**QCA4004 -** 2.4GHz/5GHz dual-band **QCA4002 -** 2.4GHz single-band
Active Power Save	Green Tx & Low Power Listen (LPL)
Security Features	WPS, WPA, WPA2, WEP, SSL
Power Source	3.3V
Network Throughput	up to 10Mbps
Operating Temperature	Commercial: 0° to 85°C (case)

QCA400x Block Diagram
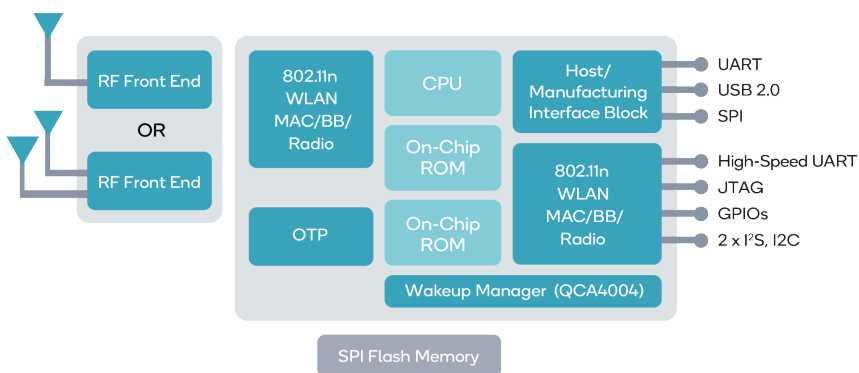
QCA4531 Wi-Fi SoC

The Qualcomm® QCA4531 is a two stream (2x2) 802.11b/g/n single-band programmable Wi-Fi SoC for the IoT. This low-cost turnkey solution combines high performance connectivity capabilities with a user-programmable Linux OpenWrt environment and is designed to serve either as a feature-rich IoT node or as a hub to support an IoT ecosystem.

QCA4531 Features

- 802.11n 2x2 improves range and quality of service
- MIPS 24Kc processor operating at up to 650MHz clock rate
- Advanced power management with dynamic clock switching for ultra-low power modes
- DDR2 NAND SPI flash memory manager
- I²C for connecting to digital sensors and Apple HomeKit MFi chip
- 12 customizable GPIOs
- Commercial & industrial temperature options
- OpenWrt QDSK and open source ATH9K drivers
- Low cost system BOM including:
  - Integrated LNA and +20 dBm PA
  - QFN package and 4-layer PCB design
  - 3.3V external power source
- External 16-bit DDR1, operating at up to 200MHz, DDR2 operating at up to 300MHz (600 M transfers/sec)
- Software support for Apple HomeKit and Open Connectivity Foundation

QCA4531 Specifications

|	
Package Type	12 x 12mm QFN Dual-Row 156-pin halogen-free, RoHS compliant
Module Size	44.3 x 33.5 x 6.2mm, 4 layer PCB (including PCB antenna & 2x 1-PEX connectors)
WLAN Technology	802.11b/g/n
Antennas	2x 2.4GHz outputs
Interfaces	1x DDR, PCIE, UART, I²C, USB 2.0 Host 12x GPIOs JTAG 1+4 (5-port) Fast Ethernet switch
Frequency Band	2.4GHz
Channel Bandwidth	20 or 40MHz
Power Source	3.3V nominal
Throughput	2x2 802.11n - 190Mbps (TCP/IP)
Default Memory	64MB DDR; 1GB NAND SPI flash 1x 4MB NOR flash
Operating System	OpenWrt, Embedded Linux
Operating Temperature	Commercial: -20° to +70°C Industrial: -20° to +85°C

Target Applications

- Energy Management
- Smart Home
- Wi-Fi Repeater
- Smart Appliances
- Residential Lighting
- IoT Gateway

Ordering Information

Product	Part Number
QCA4531 (C-Temp)	QCA4531-BL3A
QCA4531 (I-Temp)	QCA4531-BL3B

QCA4531 Block Diagram

To learn more visit:
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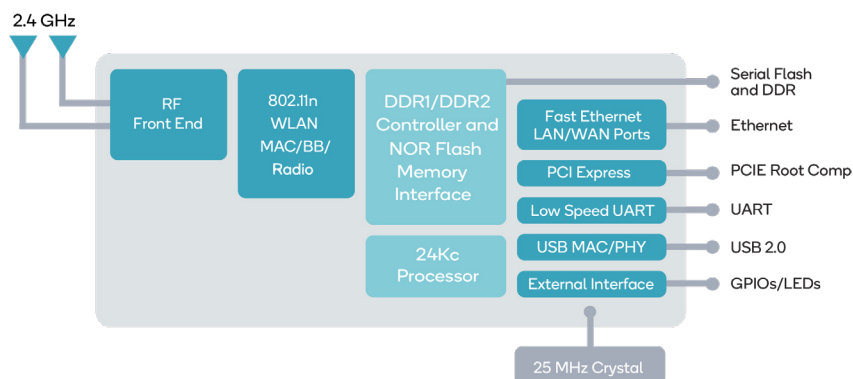
Increasing connectivity with our IoT solutions.

Meeting the expanding needs of IoT.

The IoT has enormous beneficial opportunities for customers and consumers—but its evolution has been affected by product development challenges, such as rapidly changing requirements, consumer expectations, pricing and heavy competition. And it continues to be. As widespread consumer adoption of connected devices increases, so does the pressure on customers to create differentiated, high-end devices that are powerful, yet power-efficient, and interoperable, yet highly secure.

Internet of Things (IoT)

Energy Management

Home Automation

Wi-Fi Repeater/Router

Industrial

Smart Appliances

Smart Lighting

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