



# Qualcomm® Wi-Fi Connectivity Selector Guide

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





# QCA402/4 Wi-Fi SoCs

QCA4020/4 Wi-Fi 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.

## QCA4020/4 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, I<sup>2</sup>S, I<sup>2</sup>C, 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

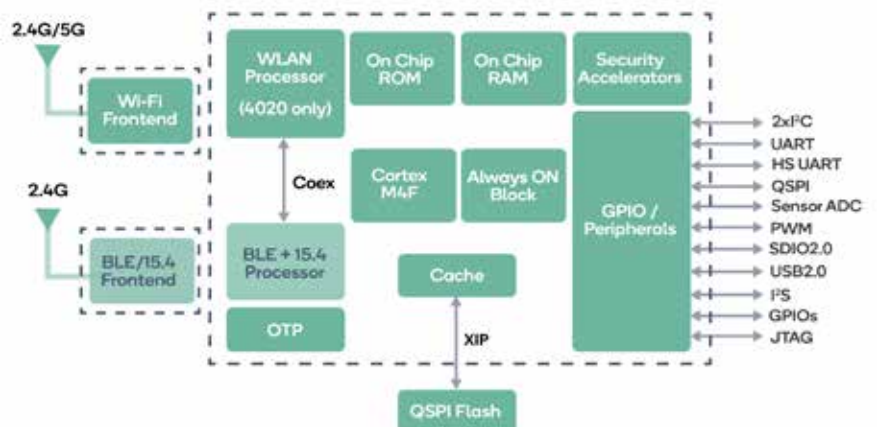
## Ordering Information

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

## QCA4020/4 Specifications

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

## QCA4020/4 Block Diagram



# QCA4020 Product Development Kit

Qualcomm

QCA4020

The 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

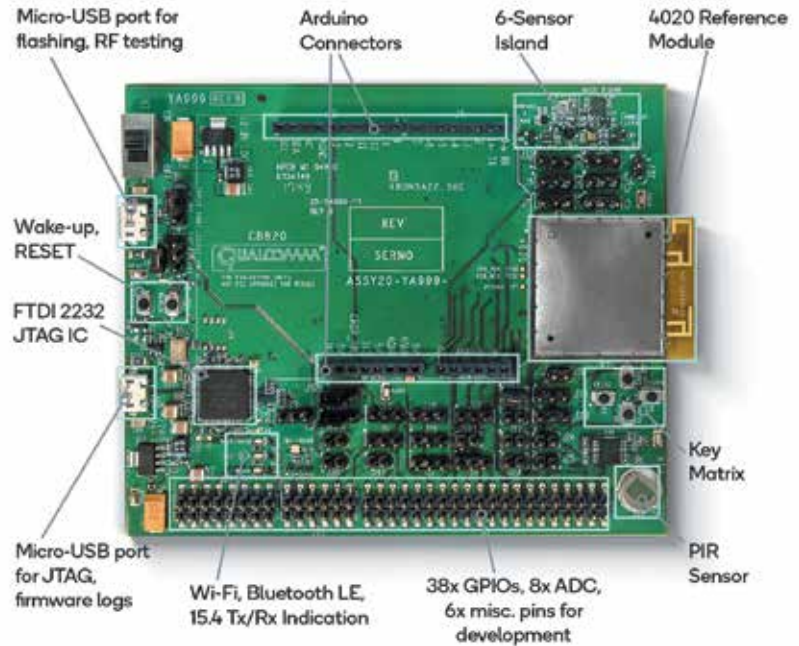
## Features

- 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



## QCA4020 Module Specifications

<b>Module Size</b>	28.57 x 33.5 mm 124-pin
<b>WLAN Tx/Rx</b>	Integrated WLAN PA and LNA with 17 dBm Pout and dedicated WLAN antenna
<b>Bluetooth LE &amp; 802.15.4 Tx</b>	Shared PA between 15.4 and Bluetooth LE for transmit 17 dBm Pout for 15.4 and 7 dBm Pout for Bluetooth LE
<b>Bluetooth LE &amp; 802.15.4 Rx</b>	Concurrent 15.4 and Bluetooth LE Rx Shared antenna between 15.4 and Bluetooth LE
<b>Voltage</b>	3.3V supply voltage
<b>Application I/O</b>	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
<b>Interfaces</b>	SDIO/SPI/UART interfaces to connect to external MCU/CPU interface
<b>Testing</b>	USB interface for RF testing, factory automation

# QCA4024 Product Development Kit



The 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

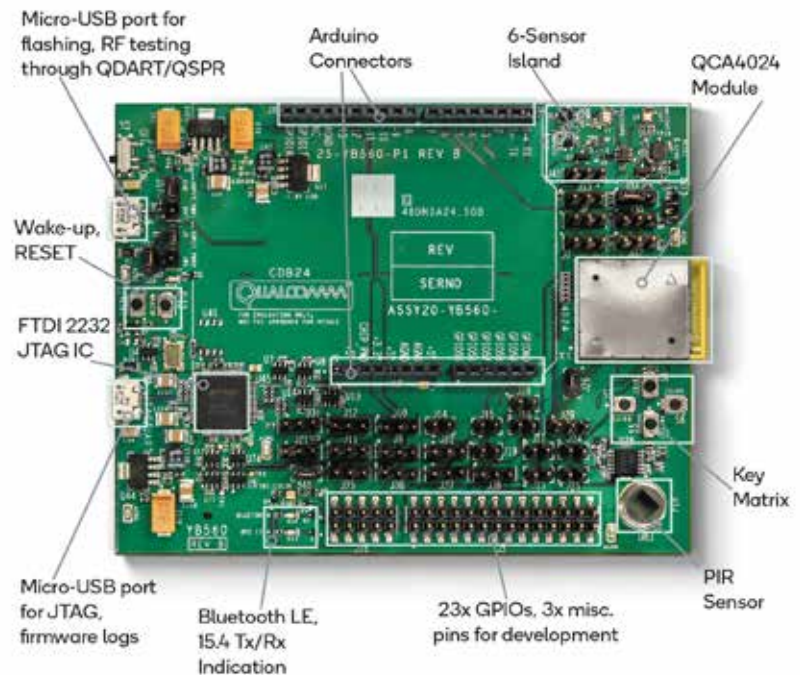
## Features

- 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



## QCA4024 Module Specifications

<b>Module Size</b>	19.4 x 25 mm 59-pin
<b>Bluetooth LE &amp; 802.15.4 Tx</b>	Shared PA between 15.4 and Bluetooth LE for transmit 17 dBm Pout for 15.4 and 7 dBm Pout for Bluetooth LE
<b>Bluetooth LE &amp; 802.15.4 Rx</b>	Concurrent 15.4 and Bluetooth LE Rx Shared antenna between 15.4 and Bluetooth LE
<b>Voltage</b>	3.3V supply voltage
<b>Application I/O</b>	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
<b>Interfaces</b>	SDIO/SPI/UART interfaces to connect to external MCU/CPU interface
<b>Testing</b>	USB interface for RF testing, factory automation



# QCA4010/2 Wi-Fi SoCs



QCA4010 is a one-stream (1x1) IEEE 802.11a/b/g/n single-band System-on-Chip (SoC) and QCA4012 is a dual-band SoC for the Internet of Things (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 10Mbps 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, Google Weave, Open Connectivity Foundation and AllJoyn from the AllSeen Alliance

## Target Applications

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

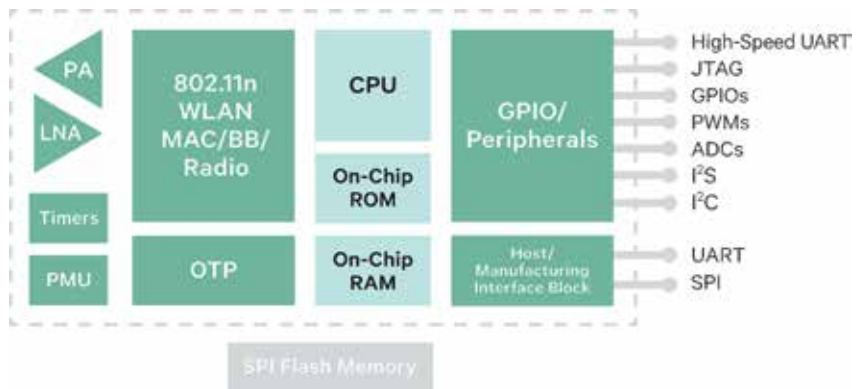
## Ordering Information

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

## QCA4010/2 Specifications

<b>Package Type</b>	9 x 9 x 0.9mm QFN Dual-Row 116-pin, 0.5mm pitch RoHS Compliant
<b>PCB Footprint</b> (solution area)	< 25 x 20mm SB, single sided + antenna + S-Flash
<b>WLAN Technology</b>	<b>QCA4010</b> - 802.11b/g/n <b>QCA4012</b> - 802.11a/b/g/n
<b>Antenna Design Options</b>	PCB printed or external antenna
<b>Interfaces</b>	SPI/SDIO, UART, HS-UART I <sup>2</sup> C, I <sup>2</sup> S, GPIOs, PWMs, ADCs
<b>Frequency Bands</b>	<b>QCA4010</b> - 2.4 GHz single-band <b>QCA4012</b> - 2.4/5 GHz dual-band
<b>Active Power Save</b>	Green Tx & Low Power Listen (LPL)
<b>Security Features</b>	WEP, WPA/WPA2-PSK, WPS2.0 with CCMP (AES) encryption SSL – application level security Integrated crypto accelerator
<b>Analog Input</b>	1.8V or 3.3V
<b>Network Throughput</b>	up to 10Mbps
<b>Operating Temperature</b>	Commercial: 0° to 85°C (C-Temp) Industrial: -40° to 115°C (E-Temp)

## QCA401x Block Diagram





## QCA4002/4 Wi-Fi SoCs

QCA4002 is a single-stream (1x1) IEEE 802.11n single-band System-on-Chip (SoC) and QCA4004 is a dual-band SoC for the Internet of Things (IoT). The QCA4002/4 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.

### QCA4002/4 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
- AllJoyn software ensures seamless communication between devices, enhancing ease-of-use for consumers

### Target Applications

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

### Ordering Information

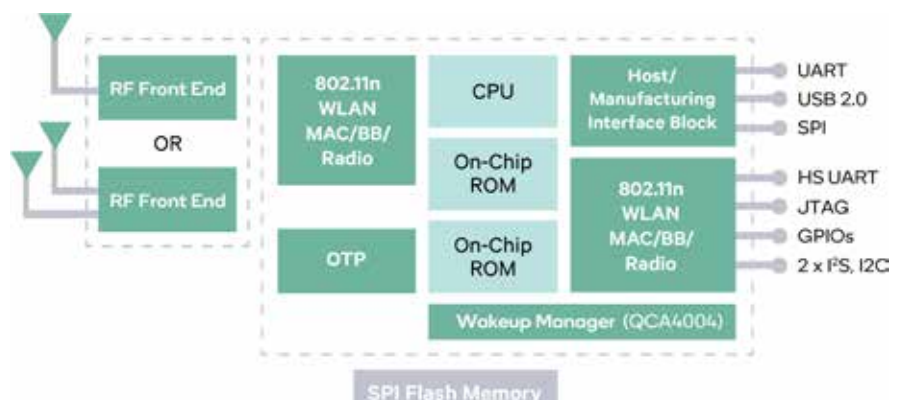
Product	Part Number
QCA4002 SOC	QCA-4002x-BL3A
QCA4004 SOC	QCA-4004x-BL3A

QCA4002 and QCA4004 are products of Qualcomm Technologies, Inc. and/or its subsidiaries.

### QCA4002/4 Specifications

<b>Package Type</b>	<b>QCA4004</b> - SB/DB 8 x 8 mm 68-pin QFN <b>QCA4002</b> - SB/DB 7 x 7mm 58-pin QFN
<b>PCB Footprint (solution area)</b>	<b>QCA4004</b> < 42 x 20 mm DB single sided + antenna + Diversity + S-Flash <b>QCA4002</b> < 25 x 20 mm SB single sided + antenna + S-Flash
<b>WLAN Technology</b>	802.11a/b/g/n
<b>Antenna Design Options</b>	UFL Chip or PCB printed
<b>Interfaces</b>	USB 2.0 for manufacturing test SPI/SDIO, UART, HS-UART, I <sup>2</sup> C, I <sup>2</sup> S, GPIOs
<b>Frequency Bands</b>	<b>QCA4004</b> - 2.4GHz/5GHz dual-band <b>QCA4002</b> - 2.4GHz single-band
<b>Active Power Save</b>	Green Tx & Low Power Listen (LPL)
<b>Security Features</b>	WPS, WPA, WPA2, WEP, SSL
<b>Power Source</b>	3.3V
<b>Network Throughput</b>	up to 10Mbps
<b>Operating Temperature</b>	Commercial: 0° to 85°C (case)

### QCA4002/4 Block Diagram



Materials are subject to change without notice.



# QCA4531 Wi-Fi SoC

The QCA4531 is a two stream (2x2) 802.11b/g/n single-band programmable Wi-Fi System-on-Chip (SoC) for the Internet of Things (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
- I<sup>2</sup>C 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, Google Weave, Open Connectivity Foundation and AllJoyn from the AllSeen Alliance
- Complete AllJoyn integration client and services implementation

## Target Applications

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

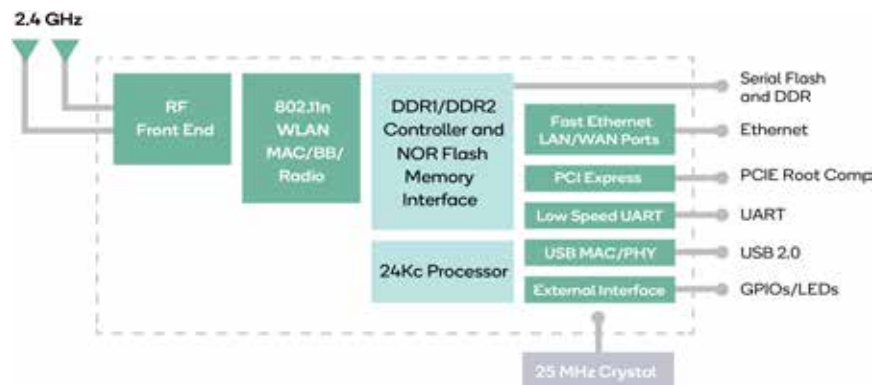
## Ordering Information

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

## QCA4531 SoC and Module Specifications

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

## QCA4531 Block Diagram

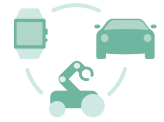


# Increasing connectivity with our IoT solutions.

## 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



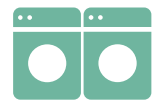
### Wi-Fi Repeater/Router



### Industrial



### Smart Appliances



### Smart Lighting



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