Qualcomm

Qualcomm® Bluetooth Low Energy Selector Guide

Integrated single-mode and dual-mode Bluetooth connectivity SoCs for the Internet of Things

87-CE929-1 Rev. A

CSR102x SoC Product Family

The CSR102x product family is optimized for IoT applications including wireless remote controls, smart watches, home automation solutions, and beacons. Where balancing performance, battery life, and cost is critical, the CSR102x products bring extensive and flexible I/O capabilities designed to simplify integration and eliminate expensive interface components.

CSR1020

CSR1020A06-IQQX-R

- All purpose cost-optimized general platform
- 15x GPIO
- 1x AIO

- 80KB RAM; no flash
- QFN 36-lead package
- 5 x 5 x 0.65mm; 0.5mm pitch
- Pin compatible with CSR1024

CSR1021

CSR1021A06-IQQS-R

- High I/O count cost-optimized variant
- 37x GPIO
- 2x AIO

- 80KB RAM; no flash
- QFN 60-lead package
- 8 x 8 x 0.65mm; 0.5mm pitch
- Pin compatible with CSR1025

CSR1024

CSR1024A06-ILLP-R

- All-purpose upgradeable platform
- 15x GPIO
- 1x AIO

- 80KB RAM
- 256KB internal flash
- LGA 36-lead package
- 5 x 5 x 0.75mm; 0.5mm pitch

CSR1025

CSR1025A06-ILLQ-R

- High I/O count upgradeable platform
- 33x GPIO
- 2x AIO

- 80KB RAM;
- 256KB internal flash
- LGA 60-lead package
- 8 x 8 x 0.75mm; 0.5mm pitch

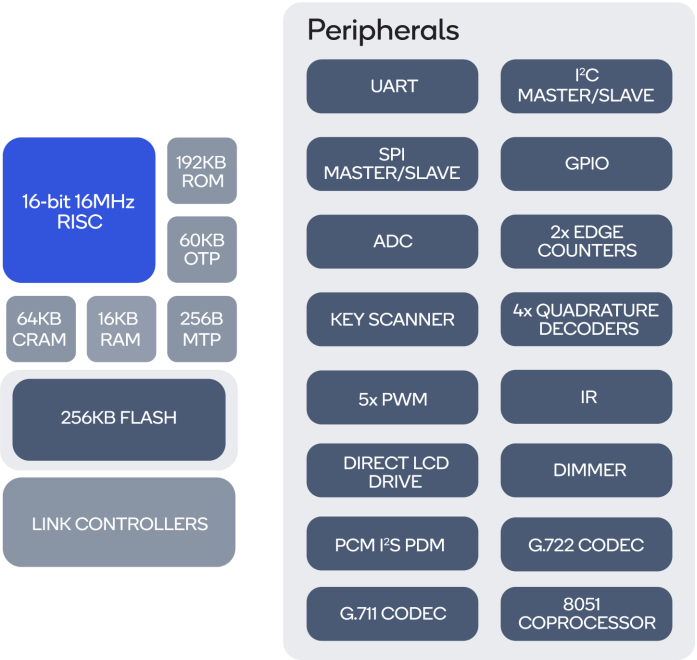
CSR102x Specifications

Bluetooth Version	Bluetooth v5.0 compliant with Bluetooth mesh support
MCU	80MHz embedded RISC co-processor
DSP	40MHz, 24-bit embedded DSP
Memory	8Mb internal ROM, 56KB RAM External SQIF support up to 64Mb
Bluetooth	TX/RX 9.0dBm RF transmit power w/ level control On-chip 6-bit DAC over a dynamic range >30 dB; -90 dBm receive sensitivity; Integrated channel filters (No external power amplifier or TX/RX switch required)
Interfaces	UART, I²C, SPI, USB 2.0, Up to 22x PIOs 22x AIOs (can be configured as digital I/O as required) SPI debug and programming interface, 7x PWM blocks: 4 dedicated to LED[3:0] 3 assignable to PIO 1x digital microphone channel (CSRB5342/5348)
Power Consumption	Standby: <0.15 mA, Operating: <1 mA
Operating Voltage	1.8V / 2.8V / 3.2V configurable LDO linear regulator
Operating Temperature	-30°C to +85°C

Features

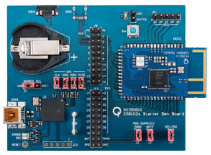
- Bluetooth 5.0 compliant stack with Bluetooth mesh support
- Direct 50Ω connection to antenna
- Low BoM count with single crystal operation
- Integrated channel filters
- 4x hardware link controllers
- Variety of integrated hardware accelerators and peripheral interfaces
- Wake-up from interrupt on any input pin in low power sleep modes
- Time-stamping hardware blocks
- Key matrix scanning block
- Integrated audio codecs & audio interfaces
- On-chip temperature and battery monitoring
- PWM hardware blocks for LED patterns and motor control
- Cryptographic accelerators & application security features
- Bluetooth low energy SDK with IDE and debugging tools

CSR102x Block Diagram



CSR102x

Development Boards and Kits



DK-CSR1025-10285

CSR102x STARTER Development Kit

The Qualcomm® CSR102x Starter Kit is a simplified, yet comprehensive kit designed for developers and designers who need to get prototypes of their products up and running and into production with reduced development time.

Applications: Heart rate sensor, Security tags

Contents

- Target board
- Mini-USB cable and flexible cable
- Prototyping leads
- Setup Guide
- Activation code for latest SDK

DK-CSR1025-10280

IOT Development Kit

The Qualcomm® IoT Development Kit introduces a multi-purpose development platform for prototyping a range of IoT applications and is intended for use with Bluetooth mesh and CSRmesh™ SDKs.

Applications: Lighting, Home automation, Sensor networks

Contents

- 3x IoT target boards
- Programmer board
- Mini-USB cable & flexible cable
- Setup Guide
- Activation code for latest SDK

DK-CSR1025-10284

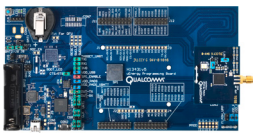
BLUETOOTH NODE Development Kit

The Qualcomm® Bluetooth Node Dev Kit is a small form factor design with integrated motion sensor, indication LED and button suitable for making tag applications a reality.

Applications: Beacon, Proximity tag, Footpod form factor

Contents

- Bluetooth node target board
- Setup Guide



DK-UENERGY-PB-10242

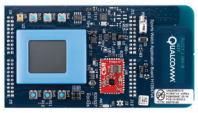
PROFESSIONAL Development Kit

The dev kit is based on a modular design that allows the processor to be swapped out via a pluggable module. The target board can be run from different power sources, and current can be measured from the board directly.

Applications: Auto keyless entry, Fitness & Health, Keyboards and mice, Beacons, Alert tags

Contents

- Professional target board
- Pluggable CSR1025 module
- Setup Guide
- Mini-USB cable & flexible cable
- Prototyping leads
- Activation code for latest SDK



DB-UENERGY-AB-10244

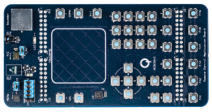
SPORT WATCH Application Board

The pluggable Qualcomm® Sport Watch application board includes NFC with payment support, GPS and multiple sensors.

Applications: Wearables

Contents

- Application plug-in board
- Setup Guide



DB-UENERGY-AB-10243

SMART REMOTE Application Board

The Qualcomm® Smart Remote pluggable application board includes a a microphone, IR transmitter and receiver, touchpad, motion sensor and other peripherals.

Applications: Accessories

Contents

- Application plug-in board
- Setup Guide

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

CSR101x SoC Product Family

The CSR101x product family consists of five product variants designed to develop devices that use Bluetooth low energy. The CSR101x series provides a built-in processor to run the customer application as well as the qualified Bluetooth single mode stack and radio. CSR101x chips can run directly from a 3V coin cell, and connect directly to a PCB antenna.

CSR1010	CSR1010A05-IQQM-R	
• All-purpose general platform • 12x GPIO • 3x AIO	• 128KB memory • QFN 32-lead package • 5 x 5 x 0.6mm; 0.5mm pitch	
CSR1010D	CSR1010A05-DQQM-R	
• Extended temp variant for lighting • 12x GPIO • 3x AIO	• 128KB memory • QFN 32-lead package • 5 x 5 x 0.6mm; 0.5mm pitch	
CSR1011	CSR1011A05-IQQA-R	
• High I/O count variant • 32x GPIO • 3x AIO	• 128KB memory • QFN 56-lead package • 8 x 8 x 0.9mm; 0.5mm pitch	
CSR1012	CSR1012A05-IQQP-R	
• Small form factor & Li-poly powered products • 12x GPIO • 3x AIO	• 128KB memory • QFN 32-lead package • 4 x 4 x 0.65mm; 0.4mm pitch	
CSR1013	CSR1013A05-IUUM-R	
• Ultra-thin, ultra-small form for wearables • 12x GPIO • 1x AIO	• 128KB memory • WLCSP 34-bump package • 2.43 x 2.56 x 0.35mm; 0.4mm pitch	

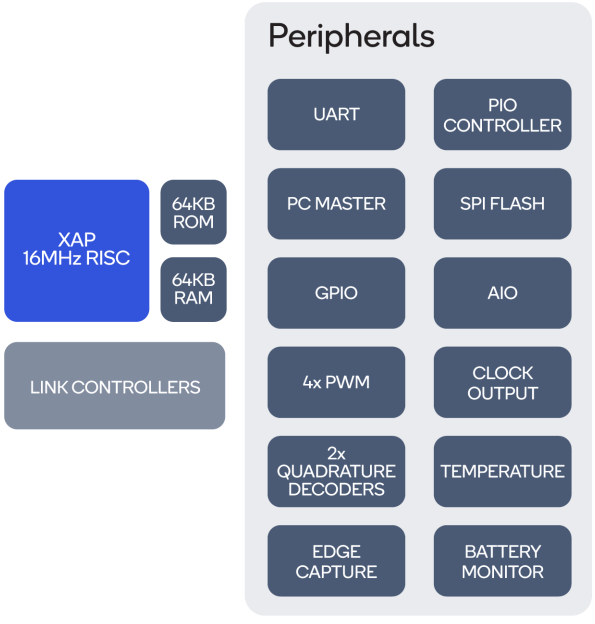
CSR101x Specifications

MCU	16MHz 16MIPS XAP application processor (RISC) with hardware link controller
Bluetooth Version	Bluetooth v4.1 specification compliant
Memory	128KB Memory: 64KB RAM & 64KB ROM
Bluetooth TX/RX	+9.5dBm max RF transmit power -93dBm receive sensitivity No external power amplifier or TX/RX switch required
Interfaces	UART, I²C, PIO controller, 4x PWM modules 2x hardware quadrature decoders 12x or 32x re-assignable GPIOs plus dedicated WAKE pin 10-bit SAR ADC/DAC with 1x or 3x AIO 32kHz or 16MHz clock output
Current Consumption	<20mA peak current 5µA in deep sleep 900nA in dormant mode
Operating Voltage	1.8 to 4.3V
Operating Temperature	-40°C to +85°C -30°C to +105°C (CSR1010D)

Features

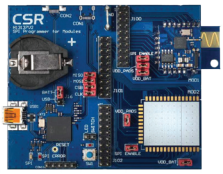
- Bluetooth 4.1 low energy radio with direct single-ended 50Ω antenna connection
- 50kB of user app space
- Switch-mode power supply and linear regulators
- Up to 4.4V direct supply connection for Li-poly batteries
- Wake-up interrupt and watchdog timer
- Time-stamping hardware
- 1 µA integrated key scanning hardware
- Peripheral (I^2C) and debug interfaces (SPI)
- Integrated Bluetooth 4.1 qualified stack
- On-chip temperature and battery monitoring
- PWM hardware blocks for LED patterns and motor control
- Master and slave operation, including encryption
- Software development kit with C compiler and debug tools

CSR101x Block Diagram



CSR101x

Development Boards and Kits



DK-CSR1010-10169

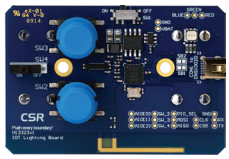
CSR101x STARTER Development Kit

The Qualcomm® CSR101x Starter Development Kit is a simplified yet comprehensive kit designed for developers and designers who need to get prototypes of their Bluetooth low energy products up and running fast, and then move quickly to production.

Applications: Supports multiple applications

Contents

- Target board
- Mini USB cable
- Setup Guide, SDK & other docs on CD-ROM
- Activation code for latest SDK



DK-CSR1010-10184

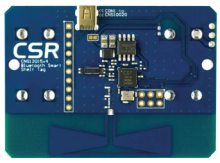
CSRmesh™ Development Kit

The CSRmesh development kit introduces a development platform for developers and product designers who want to rapidly prototype networking of Bluetooth low energy products using the CSRmesh protocol.

Applications: Lighting, Home automation, Sensor networks

Contents

- 3x Target boards
- 1x USB-SPI programmer
- 2x Connecting cables
- 3x AA alkaline batteries
- Setup guide
- Activation code for latest SDK



DK-CSR1010-10232

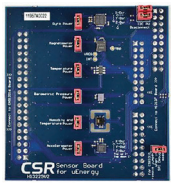
PROXIMITY BEACON Development Kit

The Qualcomm® Proximity Beacon development kit provides a simplified yet comprehensive development platform for product designers who want to rapidly develop and prototype Bluetooth beacons in real world use cases.

Applications: Industrial, Retail, Home automation

Contents

- 3x Beacon development boards
- 3x plastic beacon enclosures
- USB programmer & interface cables
- Example beacon applications
- Activation code for latest SDK



DK-ENV_SENS-10224

ENVIRONMENTAL SENSOR Board

The Qualcomm® Environmental Sensor board is designed to help developers create next generation MEMS-enabled Bluetooth devices. This plug-in expansion board is designed to work with the CSR101x Starter Development Kit or the CSR1011 development board and provides Gyroscopic, Magnetic, Temperature, Pressure, Humidity and Acceleration MEMS sensors.

Applications: Home automation, Wearables

Contents

- Target board which includes the following sensors:
- Accelerometer (Analog Devices ADXL 362)
- Temperature (STMicroelectronics STTS751)
- Pressure (Saw Components T5400)
- Magnetometer (Aichi Steel AMI304E)
- Humidity (Sensirion SHT21)
- Angular rate (InvenSense ITG3050)

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

CSRB534x Bluetooth Stereo Series

The CSRB534x series of Bluetooth Stereo dual-mode SoCs (System-on-Chip) features a rich Bluetooth v4.1 compliant platform and offers a powerful, versatile and cost-effective solution, making it ideal for a variety of next generation wireless and VR (virtual reality) gaming accessories and embedded modules.

CSRB5341

- Entry level, low cost platform
- 22x Digital I/O; 22x AIO
- No Li-Ion battery charger

CSRB5341A11-IQQU-R

- 8Mb internal ROM, 56KB RAM
- External SQIF support up to 64Mb
- QFN 88-lead package
- 10 x 10 x 0.9mm; 0.4mm pitch

CSRB5342

- QFN Mid range platform with battery charging
- 22x Digital I/O; 22x AIO
- Li-Ion battery charger

CSRB5342A11-IQQU-R

- 8Mb internal ROM, 56KB RAM
- External SQIF support up to 64Mb
- QFN 88-lead package
- 10 x 10 x 0.9mm; 0.4mm pitch

CSRB5342

- BGA Mid range platform with battery charging
- 22x Digital I/O; 22x AIO
- Li-Ion battery charger

CSRB5342A11-IBVE-R

- 8Mb internal ROM, 56KB RAM
- External SQIF support up to 64Mb
- BGA 105-ball package
- 6 x 6 x 1.0mm; 0.5mm pitch

CSRB5348

- High end, Industrial temperature grade platform
- 22x Digital I/O; 22x AIO
- Li-Ion battery charger

CSRB5348A11-IBVE-R

- 8Mb internal ROM, 56KB RAM
- External SQIF support up to 64Mb
- BGA 105-ball package
- 6 x 6 x 1.0mm; 0.5mm pitch

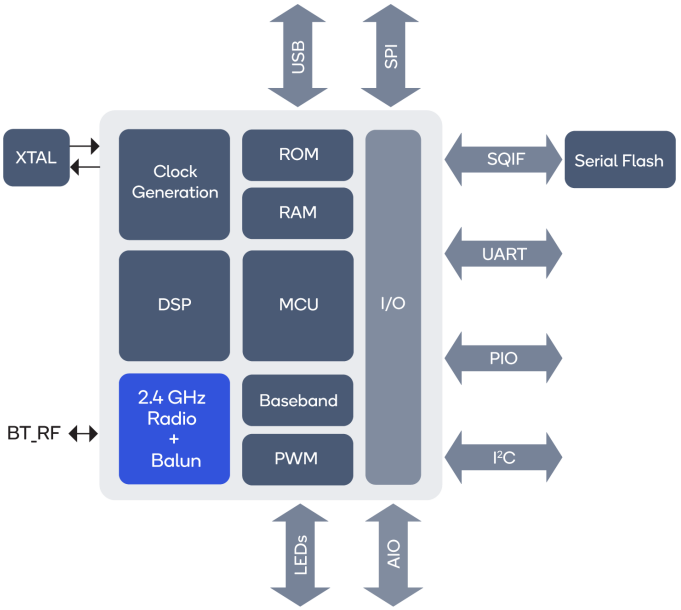
CSRB534x Specifications

Bluetooth Version	Bluetooth v4.1 specification compliant
MCU	80MHz embedded RISC co-processor
DSP	40MHz, 24-bit embedded DSP
Memory	8Mb internal ROM, 56KB RAM External SQIF support up to 64Mb
Bluetooth TX/RX	9.0dBm RF transmit power with level control from on-chip 6-bit DAC over a dynamic range >30 dB; -90 dBm receive sensitivity Integrated channel filters No external power amplifier or TX/RX switch required
Interfaces	UART, I²C, SPI, USB 2.0, Up to 22x PIOs 22x AIOs (can be configured as digital I/O as required) SPI debug and programming interface, 7x PWM blocks: 4 dedicated to LED[3:0] 3 assignable to PIO 1x digital microphone channel (CSRB5342/5348)
Power Consumption	Standby: <0.15 mA, Operating: <1 mA
Operating Voltage	1.8V / 2.8V / 3.2V configurable LDO linear regulator
Operating Temperature	-20°C to +70°C (CSRB5341/5342) -40°C to +85°C (CSRB5348)

Features

- Integrated application processor with internal ROM, a power management subsystem and LED drivers in a SoC IC
- Programmable DSP for exclusive use of customer applications
- 22 programmable digital I/O & 22 analog I/O
- Optional serial flash interface
- On-chip balun (50Ω impedance in TX and RX modes)
- Integrated 1.35V switch-mode regulator
- All internally required regulators integrated on chip
- Integrated Li-Ion battery charger with instant-on (CSRB5342/48 only) or dry-cell battery technology (CSRB5341)
- Dedicated SDK includes xIDE & market leading Bluetooth stack
- OTA/USB updates for future proofing products
- 7 hardware PWM controllers, 4 on dedicated LED pads
- Keyscan hardware
- Requires minimum external components

CSRB534x Block Diagram



CSRB534x

Development Boards and Kits

DK-CSRB5341-10229

CSRB5341 Development Kit

Qualcomm® CSRB5341 Dev Kit is a compliant platform for development of next-gen wireless gaming controllers and more. Designed to provide for low latency control and ultra-low power operation with enhanced connection topologies for improved smart device and accessory support.

Applications: Wireless gaming controllers, TV remote controls, VR accessories, toys and modules

Contents

- CSRB534x development board
- CSRB5341 QFN example board
- Micro and mini USB leads
- Setup Guide

DK-CSRB5342-10230

CSRB5342 Development Kit

Qualcomm® CSRB5342 Dev Kit Compliant platform for development of next-gen wireless gaming controllers and more. Designed to provide for low latency control and ultra-low power operation with enhanced connection topologies for improved smart device and accessory support.

Applications: Wireless gaming controllers, TV remote controls, VR accessories, toys and modules

Contents

- CSRB534x development board
- CSRB5342 BGA example board
- Micro and mini USB leads
- 560mAh Li-ion battery
- Setup Guide

DK-CSRB5348-10203

CSRB5348 Development Kit

Qualcomm® CSRB5348 Dev Kit Compliant platform for development of next-gen embedded systems and modules with industrial grade temperature requirements. Designed to provide for low latency control and ultra-low power operation with enhanced connection topologies for improved smart device and accessory support.

Applications: Embedded modules. Industrial and home automation, EPOS, data loggers, barcode readers, metering devices and systems with large interface requirements.

Contents

- CSRB534x development board
- CSRB5348 BGA example board
- Micro and mini USB leads
- 560mAh Li-ion battery
- Setup Guide

Where to Buy

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Qualcomm Technologies International, Ltd. works with some of the world's leading module manufacturers to create pre-certified solutions that reduce time to market and meet technical qualifications and quality requirements. Our third party module suppliers will be able to help you with all pricing, detailed features and purchasing inquiries.

Contact Module Suppliers: https://developer.qualcomm.com/hardware/bluetooth/ble-module-suppliers

Qualcomm® Bluetooth Mesh

Qualcomm Bluetooth mesh is a protocol designed to run over existing Bluetooth low energy compatible devices, helping to add mesh networking capability for a security focused Bluetooth wireless network for IoT. Bluetooth mesh networking supports many-to-many (m:m) device communications and helps developers and system integrators create IoT solutions where tens, hundreds, or thousands of devices need to securely communicate with one another.

Features

- Designed to ensure that all levels of the technology are comprehensively specified with an extensive stack solution that helps define the low-level radio up to the high-level application layer
- Reliability: Supports inherently self-healing networks with no single points of failure
- High capacity for scalability of industrial grade solutions:
  - Up to 32,000 nodes
  - Up to 127 hops per message
  - High speed radio
  - Small packet size
- Designed to provide industrial-grade security features for protection against known attacks
- Multicast support for groups, ideal for lighting
- Designed to directly control, configure and interact with many Bluetooth low energy devices from a mobile device
- Supports a wide variety of control and automation applications, retail advertising, commercial and industrial opportunities, and new IoT use cases like lighting, indoor positioning and asset tracking.
- Use CSR102x IoT Development Kit for Qualcomm Bluetooth Mesh

Qualcomm Bluetooth Mesh Capabilites

Messages are sent to individual devices; groups; or all devices.

For example:

"Switch-on living room lights"
"Lower thermostat"
"Switch-off all devices"

Multiple controllers supported:

- Android and iOS devices, smart home hubs and smart wearables
- Cloud connected devices

The underlying principles of CSRmesh and Qualcomm Bluetooth mesh are the same, although there are changes in the Protocol stack and packet structure. The table below helps to highlight the differences.

Learn more about Qualcomm Bluetooth Mesh

https://www.qualcomm.com/solutions/networking/features/csr-mesh

Qualcomm Bluetooth Mesh is a product of Qualcomm Technologies, Inc. and/or its subsidiaries.

To Learn More Visit:

Qualcomm.com or developer.qualcomm.com

Bluetooth®

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