



Bluetooth®

SoC and Module Selector Guide



3

Bluetooth® - Rapid Growth in IoT

5

Why the Silicon Labs Bluetooth® Portfolio is Ideal

7

Bluetooth® SoC and Module Selector Guide

11

Bluetooth® Application Examples

12

About Silicon Labs

Making IoT Products for the World's Fastest Growing Wireless Technology - Bluetooth®

Bluetooth offers developers and manufacturers one of the world's fastest growing wireless connectivity technologies. In fact, 5.4 billion Bluetooth-enabled IoT devices are expected to be shipped by 2023. However, succeeding in this intensely competitive market isn't easy; it takes more than a myopic focus on chip footprint or hardware specs.

Today's IoT products need to place an emphasis on protecting users' privacy against constantly evolving security threats while delivering great user-experiences through superior RF performance, smooth connectivity, long battery life, and

cutting-edge software functionalities. In addition to juggling these requirements, developers also need to launch products faster to the market via simplified development experience and maintain the installed-base securely, over-the-air, throughout the product lifecycle.

Powering hundreds of millions of Bluetooth-enabled IoT devices globally, [Silicon Labs' Bluetooth portfolio](#) makes it possible to build energy-efficient IoT devices and applications quickly and maintain the product lifecycle securely using over-the-air firmware updates.

The portfolio comprises five elements: hardware, software, security, development kits, and learning resources for Bluetooth Low Energy as well as Bluetooth Mesh.



HARDWARE

SoCs
and Modules



SOFTWARE

SDKs,
Stacks & Tools



SECURITY

Hardware
and Software



DEVELOPMENT

Kits
and Boards



SUPPORT

Knowledge Base &
Community

This guide provides you with a quick overview of our Bluetooth® hardware so you can make an informed decision when selecting the SoCs and modules for your next project.



Five Bluetooth® Hardware Highlights



The [BG22](#) is the most energy-efficient SoC enabling 10+ years lifetime with a coin cell battery



The [BG21](#) has the industry's longest range and is the only SoC with +20 dBm TX power



The [BG22](#) also has the highest RX Sensitivity of -107 dBm when extremely reliable and robust connectivity is required



The [BGM220S](#) is our smallest SiP module for accelerated time-to-market for small designs



The all-in-one [Wireless Xpress BGX220](#) offers an all-onboard module – firmware, cloud, security, and more

Why the Silicon Labs Bluetooth® SoCs and Modules are Ideal



HARDWARE

The broad range of Bluetooth SoCs (System-on-Chip) and modules Silicon Labs offers means there's an optimal solution for every IoT use-case. Our hardware is renowned for superior RF performance, equipping your products with the best connectivity, reliability, and user-experience available.



ULTRA-LOW ENERGY CONSUMPTION

Our innovative transmitter performance provides your IoT devices with +10 years of life from a single coin cell battery.



LONGEST RANGE

For IoT applications requiring extreme range, Silicon Labs hardware delivers the world's highest transmit power of +20 dBm.



SUPERIOR RECEIVER SENSITIVITY

For the most reliable and resilient connectivity, our hardware offers superb receiver sensitivity of -107 dBm.



MORE EFFICIENT DEVELOPMENT

Cut your development time and costs radically with our pre-certified Bluetooth modules with a state-of-the-art antenna and worldwide RF certifications.



SOFTWARE

Silicon Labs helps you keep your products ahead of the competition by continually developing our Bluetooth software development kits (SDK) at the forefront of the industry – delivering the latest protocols and high-quality implementations of all the essential features on Bluetooth Low Energy and Bluetooth Mesh.

The dynamic multiprotocol support, Apple HomeKit®, Wi-Fi coexistence, and direction finding are just a few highlights of our market-leading Bluetooth feature parity.

Thanks to our hardware-agnostic stacks, you can reuse your Bluetooth application software, APIs, and integrated development environment across our entire hardware portfolio, radically minimizing software and hardware migration efforts when you develop new Bluetooth-enabled products.



SECURITY

When you want your products to withstand the most sophisticated cyber-security attacks, you can trust our technology to safeguard your customers' privacy and your brand by implementing robust [security](#) at all levels:



Bluetooth® Stack

Our Bluetooth® stack implements the standard security features to protect your applications against the common wireless threats.



Software

The mbed TLS software execution layer allows your applications to use our advanced chip-level secure hardware capabilities.



Device-level

Our hardware implements robust security via secure boot with root of trust and secure loader, secure over-the-air update, crypto engine, true random number generator, and Silicon Labs' cutting-edge Secure Vault technology.

Silicon Labs Secure Vault technology enabled the world's first wireless SoCs to achieve [PSA Certified Level 3 certification](#).

Based on the strength of Secure Vault, Silicon Labs' received the 2020 Leadership in Engineering Achievement Program (LEAP) for connectivity award.



DEVELOPMENT

Silicon Labs SDKs work with C programming as well as GCC and IAR based compilers. For ultimate ease, you can download [Simplicity Studio](#), our unified development environment for all Silicon Labs technologies. When installed, it automatically customizes your development environment and SDKs based on the target hardware into an intuitive, end-to-end development experience. Simplicity Studio offers the most powerful utility toolbox at no cost.



SUPPORT

There is a complete set of in-depth [Bluetooth technical documents](#) and development resources to get you ahead fast. Silicon Labs is renowned for its ambitious community support and quick turnaround time.

Bluetooth® Technology Leader

As an Associate Member of Bluetooth SIG and the leading influencer in the standardization body, we drive the future of Bluetooth based on our world-class R&D and customer feedback. This in-depth knowledge of future use-cases and requirements allows us to develop better solutions, delivered to you in the industry forefront.



Bluetooth® SoC and Module Selector Guide

Silicon Labs offers a range of Bluetooth® wireless SoCs and modules to suit virtually every design requirement. To narrow down your selection, take a look at the product summaries below. Consider the design requirements you have in terms of range, security, dual-band capability, and low power credentials.

Another consideration is whether you wish to undertake your own wireless type approvals or benefit from one of our pre-certified Bluetooth® modules.

	Low Power	Range	Sensitivity	Security	Solution Type	Price Level	Target Applications
BG22	●●●●●	●●○○○	●●●●●	●●●●○	System on Chip	\$ \$ \$ \$ \$	Battery powered devices, consumer, tags, beacons, sensors
BGM220	●●●●○	●●●○○	●●●●○	●●●●○	Module w/ antenna and certifications	\$ \$ \$ \$ \$	Battery powered devices, consumer, medical
BG21	○○○○○	●●●●●	●●●●○	●●●●●	SoC	\$ \$ \$ \$ \$	Mains powered, lighting, long range, switches, dimmers
BGM210	○○○○○	●●●●●	●●●●○	●●●●●	Module w/ antenna and certifications	\$ \$ \$ \$ \$	Mains powered, lighting, long range, switches, dimmers
BG13	●●●●○	●●●●○	●●●●○	●●○○○	SoC	\$ \$ \$ \$ \$	PIR sensors, medical, door locks
BGM13	●●○○○	●●○○○	●●●○○	●●○○○	Module w/ antenna and certifications	\$ \$ \$ \$ \$	Industrial automation, general purpose
BG12	●●●●○	●●●●●	●●●○○	●●○○○	SoC	\$ \$ \$ \$ \$	Advanced BLE and mesh applications, multiprotocol
BGX220	●●●●○	●●●○○	●●●●○	●●●●○	Cable replacement module w/ antenna, certifications, and firmware	\$ \$ \$ \$ \$	Easy all-on-board IoT cable replacement

Develop Bluetooth® 5.2 Applications with our EFR32BG22 Bluetooth SoC

Bluetooth® SoC Lineup



BG12 (Series 1)



BG13 (Series 1)



BG21 (Series 2)



BG22 (Series 2)

	BG12 (Series 1)	BG13 (Series 1)	BG21 (Series 2)	BG22 (Series 2)
Bluetooth features	5.1 and mesh 1.0 (1M, 2M, LE Coded PHYs and AE)	5.1 and mesh 1.0 (1M, 2M, LE Coded PHYs and AE)	5.1 and mesh 1.0 (1M, 2M, LE Coded PHYs and AE)	5.2 and Bluetooth mesh LPN (1M, 2M, LE Coded PHYs, AE and Bluetooth direction finding)
Proprietary 2.4G	GFSK, 2-FSK/4-FSK, OQPSK, DSSS, FEC, BPSK/DBSK,OOK/ASK	2/4(G)FSK, OQPSK/(G)MSK, DSSS, BPSK/DBPSK TX, OOK/ASK	N/A	2/4(G)FSK, (G)MSK, OQPSK, DSSS
TX / RX (1M,GFSK)	+19 dBm / -94.8 dBm	+19 dBm / -95.8 dBm	+20 dBm / -97.5 dBm	+6 dBm / -99 dBm
TX Current (+0 dBm) (MCU + radio value)	8.5 mA	9.5 mA	9.3 mA	4.1 mA* 8.2 mA* (6 dBm)
RX Current (1M, GFSK)	10 mA	9.5 mA	8.8 mA	3.6 mA
CPU / CLock Speed	Cortex M4 (40 MHz)	Cortex M4 (38.4 MHz)	Cortex M33 (80 MHz)	Cortex M33 (up to 76.8 MHz) Cortex M0+ for radio
Flash (kB)	Up to 1024 kB	512	Up to 1024	Up to 512
RAM (kB)	Up to 256 kB	64	Up to 96	32
Sleep Current (EM2)	1.5 µA (16 kB RAM)	1.3 µA (16 kB RAM)	4.5 µA (16 kB RAM)	1.2 µA (8 kB RAM) -1.4 µA (32 kB RAM)
Active Current (EM0)	70 µA / MHz	87 µA / MHz	63.8 µA / MHz	25 µA / MHz
Security	AES256/128 Hardware Crypto Accelerator with ECC, SHA-1, SHA-2, TRNG	2x AES-128/256, ECC, SHA-1/224/256, TRNG	AES-128/256, SHA1/2, ECC, ECDSA and TRNG DPA countermeasures Secure boot with RTSL Secure debug with lock/unlock	AES-128/256, SHA-1/2, ECC, ECDSA and TRNG Secure boot with RTSL Secure debug with lock/unlock
Operating Voltage	1.8 to 3.8 V	1.8V to 3.6V	1.8V to 3.8V	1.71V to 3.8V
Packages (mm)	7x7 BGA125 (65 x GPIO) 7x7 QFN48 (31 x GPIO) 8x8 QFN68 (46 x GPIO)	7x7 QFN48 (31 x GPIO) 5x5 QFN32 (16 x GPIO)	4x4 QFN32 (20 x GPIO)	5x5 QFN40 (26 x GPIO) 4x4 QFN32, TQFN32 (18 x GPIO)

Bluetooth® Module Lineup



BGM13P



BGM13S



BGM210P



BGM210L



BGM220P



BGM220S

Protocols	5.1 and mesh 1.0 (1M, 2M, Coded PHY and AE)	5.1 and mesh 1.0 (1M, 2M, Coded PHY and AE)	5.1 and mesh 1.0 (1M, 2M, Coded PHY and AE)	5.1 and mesh 1.0 (1M, 2M, Coded PHY and AE)	5.2 and mesh 1.0 LPN (1M, 2M, Coded PHY, AE and Bluetooth direction finding)	5.2 and mesh 1.0 LPN (1M, 2M, Coded PHY, AE and Bluetooth direction finding)
EFR32 SoC	BG13	BG13	BG21	BG21	BG22	BG22
Antenna	Built-in or U.FL	Built-in or RF pin	Built-in or RF pin	Built-in	Built-in	Built-in or RF pin
Max TX power	+8 / +19 dBm	+8 / +18 dBm	+10 / +20 dBm	+12.5 dBm	+8 dBm	+6 dBm
Sensitivity (1M)	-94.8 dBm	-94.1 dBm	-97 dBm	-97 dBm	-98 dBm	-98 dBm
Flash (kB)	512	512	1024	1024	512	512
RAM (kB)	64	64	96	96	32	32
GPIO	25	30	20	12	24, 25	25
Operating Voltage	1.8V – 3.6V	1.8V – 3.6V	1.8V – 3.8V	1.8V – 3.8V	1.71V – 3.8V	1.71V – 3.8V
Operating Temp.	-40 to +85°	-40 to +85°	-40 to +125°	-40 to +125°	-40 to +105°	-40 to +105°
Dimensions W x L x H (mm)	13.0 x 15.0 x 2.2	6.5 x 6.5 x 1.4	13.0 x 15.0 x 2.2	15.5 x 22.5 x 2.2	13.0 x 15.0 x 2.2	6 x 6 x 1.3
Certifications	BT, CE, FCC, ISED, Japan, S-Korea and Taiwan	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea			



Other Bluetooth® SoCs and Modules

[EFR32BG1 Series 1 SoCs](#)

[EFR32BG1 Series 1 Modules](#)

Xpress Modules for Easier and Faster Bluetooth® Development

The Xpress modules include a built-in Bluetooth firmware, making development easier, faster, and less costly – no in-depth Bluetooth expertise is needed. The Xpress streaming service facilitates low-overhead data stream and remote command execution. The Xpress modules run the Silicon Labs Bluetooth stack, while the firmware layer above it abstracts Bluetooth-specific interactions, and presents a pre-configured high-level serial interface, Xpress Command API. The API supports Bluetooth 5.2 capabilities including the 2M PHY and LE coded 'long range' PHY. Bluetooth Xpress modules can operate as an I²C master, executing write, read, and read/write transactions over an I²C bus.

[BGX13 Wireless Xpress Modules \(Series 1\)](#)

[BGX220 Wireless Xpress Modules \(Series 2\)](#)



Explore our
[Bluetooth portfolio](#)
on [silabs.com](#).

The Bluetooth® Xpress BGX220P evaluation board enables you to go from out of box to communicating across a Bluetooth low energy wireless link in less than a minute.

BLUETOOTH® APPLICATION EXAMPLES

Global medical monitoring company Nonin Medical has led the industry with its range of personal finger-tip pulse oximetry devices for the past 30 years. Supplied to health facilities and homes, the non-intrusive devices provide a way to continuously and remotely monitor patients for a decrease in blood oxygen levels. The company enjoys a long-term relationship with Silicon Labs and for the most recent product, the 3230 Bluetooth-enabled oximeter, Nonin selected the Silicon Labs Bluegiga BLE module.

"We selected the Silicon Labs pre-certified module so we could get our new product to as many geographical markets as possible in the shortest time. The modules allow us to quickly intergrate them into our designs, and the ultra-low power capabilities are also very important for our healthcare users."

Christine Horton, VP Global Marketing, Nonin Medical



Silicon Labs portfolio features several chips for building similar medical devices including the BGM13 Bluetooth Modules and BGX13 Bluetooth Modules

OnAsset provides supply chain monitoring and tracking solutions to a diverse range of global logistics, pharmaceutical manufacturers, and specialist transportation companies. OnAsset's asset trackers are used to monitor and track high value, fragile, and mission-critical assets anywhere in the world. Applications range from life-saving vaccines to human organs. The ability to constantly know the asset's location, what the shipping conditions are, and what environmental elements the assets might be exposed to are critical to these customers. During development of OnAsset's SENTRY tracking solution, the Silicon Labs EFR32 Bluetooth LE SoC outperformed other alternatives.



"Silicon Labs' product in conjunction with our designs outperformed every other competitor product."

Adam Crossno, CEO, OnAsset Intelligence

Allegion is a manufacturer of mechanical building locks and entry systems for residential and commercial buildings. The company has been working closely with Silicon Labs as it works to address the growing opportunity for IoT-connected products. Allegion is particularly interested in the opportunity to develop a new range of products that allow delivery personal access into homes without the homeowner having to be there.

Provisioning remote access control both to open or lock a door or external gate on a limited basis, a function that can be paired up with a camera, is also targeted for use in schools. School administrators need a simple solution to achieve this without having to walk around the facility and check every lock. With time-to-market challenges paramount, Allegion worked with Silicon Labs to specify and select a pre-certified module that would significantly speed the development cycle by removing much of the compliance and certification process.

"We found the Silicon Labs' offering of both SoC and pre-certified module solutions extremely valuable to us. Decreasing time to market but maintaining the highest levels of safety and security was another reason why we selected Silicon Labs."

Ryan Kincard, Global Hardware Architect, Allegion



**Contact Alcom to
get product
information, pricing
or a quote.**