Bluetooth®

SoC and Module Selector Guide

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.

Four Bluetooth®
Hardware Highlights

BG24

The ultra-low power BG24 features the largest Flash and RAM capacities in our portfolio and PSA Level 3 Secure Vault™ protection and AI/ML Acceleration. Available in WLCSP package for small form factor applications

BG22

The BG22 is the most energy-efficient SoC enabling 10+ years lifetime with a coin cell battery

BGM220S

The BGM220S is our smallest SiP module for accelerated time-to-market for small designs

BG21

The BG21 has the industry's longest range and is the only SoC with +20 dBm TX power

BG27

The BG27 is our most Battery Versatile SoC, available with DCDC Boost in WLCSP packaging for small form factor applications, from medical devices to wearables and beyond.

Learn more about our Bluetooth Development Kits here.

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 up to +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 up to +20 dBm.

SUPERIOR RECEIVER SENSITIVITY

For the most reliable and resilient connectivity, our hardware offers superb receiver sensitivity down to -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 hardware portfolio, radically minimizing software and hardware migration efforts when you develop new Bluetooth-enabled products.

Long-Term SDK Support Service

Maintaining software, security, and device certifications up to date requires constant development. However, technology evolution accelerates, narrowing down codebase maintenance windows. Our Long-Term SDK Support Service guarantees long-term support for up to 10 years through major bug fixes, security patches, and quality control regression testing for the SDK branch under contract.

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.
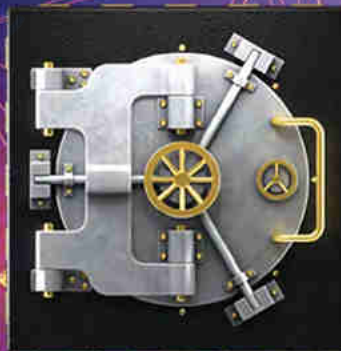
DEVELOPMENT

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.

🧠 Custom Part Manufacturing Service

Security is critical for IoT devices, but developing secure products is complex. Our new Custom Part Manufacturing Service (CPMS) simplifies the process by making it possible for IoT device makers and application developers to configure and order customized wireless hardware and MCUs directly from Silicon Labs. In addition to flash programming, CPMS also provides more advanced security provisioning such as secret key injection, anti-tamper configuration, secure boot, and debug lock configuration.

📡 RAIL

Silicon Labs RAIL (Radio Abstraction Interface Layer) provides an intuitive and easily-customizable radio interface that is designed to support proprietary or standards-based wireless protocols. RAIL allows customers to adopt the latest RF technology without sacrificing the previous development investment and future-proofs the code migration to future EFR32 ICs. The unified radio software API abstracts the significant number of hardware registers and complexity of the lower-level radio block, allowing customers to focus on their proprietary wireless application development instead of mastering device-specific details.
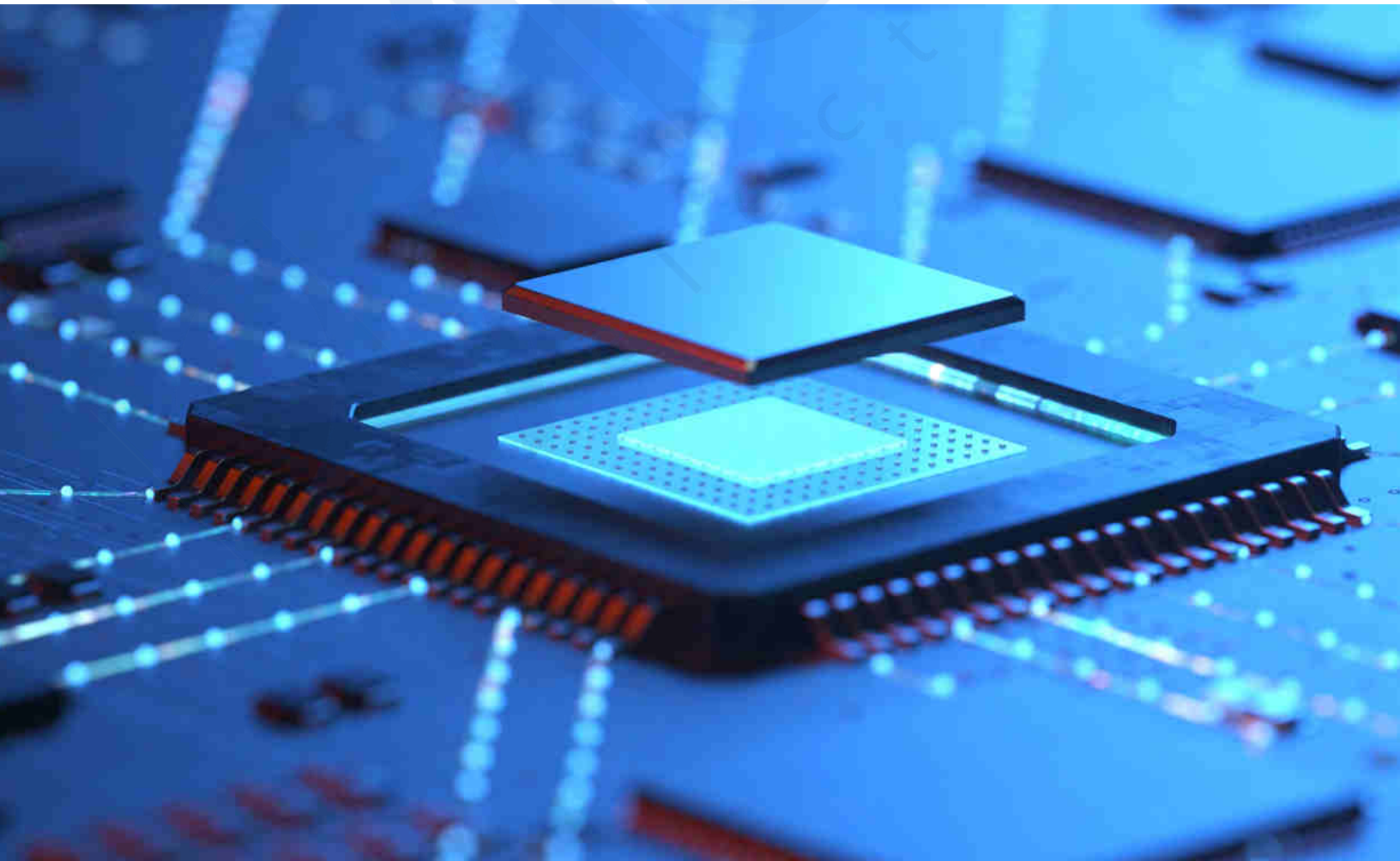
Bluetooth® Technology Leader

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	Target Applications
BG21	●○○○○	●●●●●	●●●●○	●●●●●	SoC	Industrial automation, general purpose
BGM210P	●○○○○	●●●●●	●●●●○	●●●●●	Module w/ antenna and certifications	Mains powered, lighting, long range, switches, dimmers
BG22	●●●●●	●●●○○	●●●●●	●●●●○	SoC	Battery powered devices, consumer, medical
BGM220P	●●●●●	●●●●○	●●●●●	●●●●○	Module w/ antenna and certifications	Battery powered devices, consumer, medical
BGM220S	●●●●●	●●●○○	●●●●●	●●●●○	Module w/ antenna and certifications	Battery powered devices, consumer, medical
BG24	●●●●○	●●●●●	●●●●○	●●●●●	SoC	Battery Powered devices, consumer and medical
BG27	●●●●○	●●●●○	●●●●●	●●●●○	SoC	Battery powered devices, consumer, clinical and portable medical devices

Develop Bluetooth® 5.x Applications with our EFR32BG22 Bluetooth SoCs and Modules

Bluetooth® SoC Lineup

	BG21	BG22	BG24	BG27
Bluetooth features	5.x and mesh 1.1 (1M, 2M, LE Coded PHYs and AE)	5.x and Bluetooth mesh LPN (1M, 2M, LE Coded PHYs, AE and Bluetooth direction finding)	5.x and Bluetooth mesh 1.1 (1M, 2M, LE Coded PHYs, AE and Bluetooth direction finding hardware accelerator) Small 3.1x3.0mm CSP form-factor	5.4 and Bluetooth mesh 1.1 (1M, 2M, LE Coded PHYs, and AE)
Proprietary 2.4G	2(G)FSK, (G)MSK, OQPSK DSSS	2(G)FSK, (G)MSK, OQPSK DSSS	2(G)FSK, (G)MSK, OQPSK DSSS	2(G)FSK, (G)MSK, OQPSK DSSS
TX / RX (1M,GFSK)	+20 dBm / -97.5 dBm	+6 dBm / -98.9 dBm	+19.5 dBm/-97.6 dBm	+8 dBm/-99.2 dBm
TX Current (MCU + radio value)	9.3 mA (0 dBm) 33.8 mA (10 dBm)	4.1 mA (0dBm) 8.2 mA (6 dBm)	5mA (0 dBm) 19.1mA (10 dBm)	4.1 mA (0 dBm) 11.3 mA (8 dBm)
RX Current (1M, GFSK)	8.8 mA	3.6 mA	4.4 mA	3.6 mA
CPU / CLock Speed	Cortex M33 (80 MHz) Cortex M0+ (Security)	Cortex M33 (up to 76.8 MHz) Cortex M0+ for radio	Cortex-M33 (up to 78 MHz) Cortex M0+ for radio	Cortex M33 (up to 76.8 MHz) Cortex M0+ for radio Cortex M0+ (Security)
Flash (kB)	Up to 1024kB	Up to 512kB	Up to 1536kB	768kB
RAM (kB)	Up to 96kB	32kB	Up to 256kB	64kB
Sleep Current (EM2)	4.5 µA (16 kB RAM)	1.2 µA (8 kB RAM)	1.3 µA (16 kB RAM)	1.6 µA (64 kB RAM)
Active Current (EM0)	50.9 µA / MHz	27 µA / MHz	33.4 µA/MHz	29 µA/MHz
Security	Secure Vault - Mid Secure Vault - High	Secure Vault - Mid	Secure Vault - Mid Secure Vault - High	Secure Vault - Mid
Operating Voltage	1.71V - 3.8V	1.71V - 3.8V	1.71V - 3.8V	0.8V - 1.7V 1.8V - 3.8V
Packages (mm)	4×4 QFN32	4×4 QFN32 4×4 TQFN32 5×5 QFN40	5×5 QFN40 6×6 QFN48 3.1×3.0 WLCSP	5×5 QFN40 4×4 QFN32 2.3x.2.6 CSP

Bluetooth 5.x: As the Bluetooth standard evolves, Silicon Labs is regularly adding new features. For more information on supported Bluetooth capabilities, visit silabs.com/wireless/bluetooth

Bluetooth® Module Lineup

	BGM210P	BGM210L	BGM220P	BGM220S	BGM240P	BGM240S
Protocols	5.x and mesh 1.1 (1M, 2M, Coded PHY and AE)	5.x and mesh 1.1 (1M, 2M, Coded PHY and AE)	5.x and mesh 1.1 LPN (1M, 2M, Coded PHY, AE and Bluetooth direction finding)	5.x and mesh 1.1 LPN (1M, 2M, Coded PHY, AE and Bluetooth direction finding)	5.x and Bluetooth mesh (1M, 2M, LE Coded PHYs, AE and Bluetooth direction finding)	5.x and Bluetooth mesh (1M, 2M, LE Coded PHYs, AE and Bluetooth direction finding)
EFR32 SoC	BG21	BG21	BG22	BG22	BG24	BG24
Antenna	Built-in or RF pin	Built-in	Built-in	Built-in or RF pin	Built-in or RF pin	Built-in or RF pin
Max TX power	+10 / +20 dBm	+12.5 dBm	+8 dBm	+6 dBm	+10/ +20 dBm	+10 dBm
Sensitivity (1M)	-97 dBm	-97 dBm	-98 dBm	-98 dBm	-98.5 dBm	-97.0 dBm
Flash (kB)	1024	1024	512	512	1536	1536
RAM (kB)	96	96	32	32	256	256
GPIO	20	12	24, 25	25	26	32
Operating Voltage	1.8V - to 3.8V	1.8V – 3.8V	1.8V - to 3.8V	1.8V - to 3.8V	1.8V - to 3.8V	1.8V - to 3.8V
Operating Temp.	−40 to +125°	−40 to +125°	−40 to +105°	−40 to +105°	−40 to +105°	−40 to +105°
Dimensions W x L x H (mm)	12.9 x 15.0 x 2.2	15.5 x 22.5 x 2.2	12.9 x 15.0 x 2.2	6 x 6 x 1.3	12.9 x 15.0	7 x 7 x 1.18
Certifications	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea	CE, UKCA, FCC, ISED, MIC, KC	FCC, ISED, CE, UKCA, MIC, KC

Bluetooth 5.x: As the Bluetooth standard evolves, Silicon Labs is regularly adding new features. For more information on supported Bluetooth capabilities, visit silabs.com/wireless/bluetooth
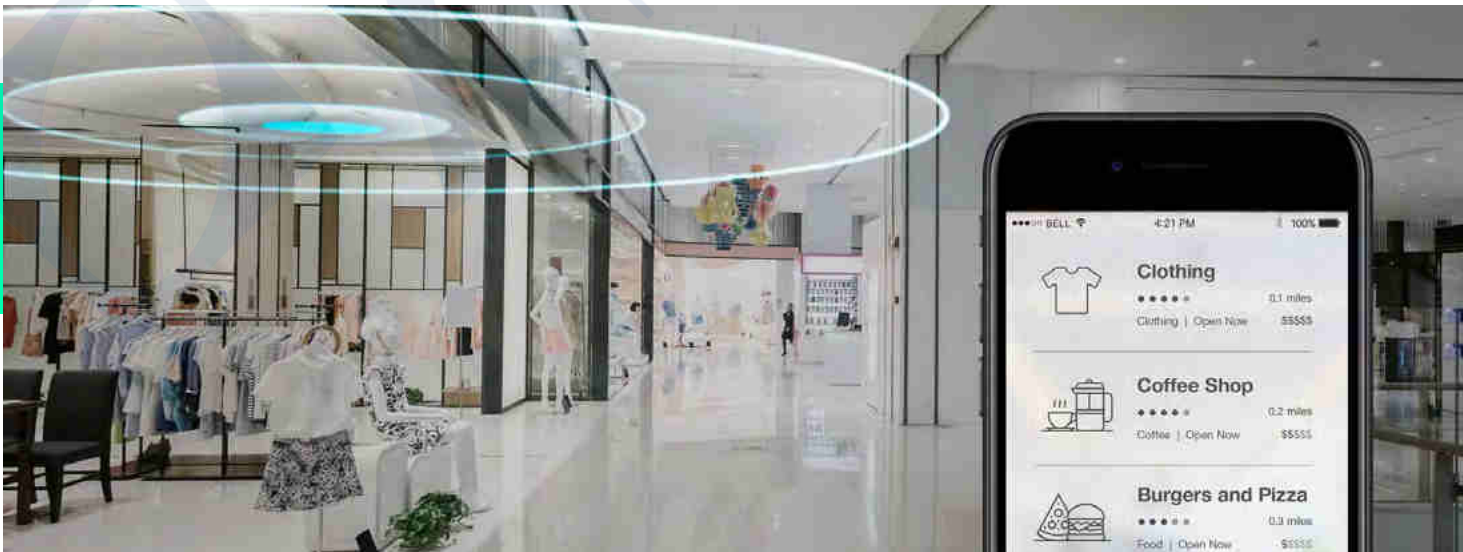
BLUETOOTH® APPLICATION EXAMPLES

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

The Silicon Labs portfolio features several modules and SoCs for building similar medical devices.

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 sales to get product information, pricing or a quote.
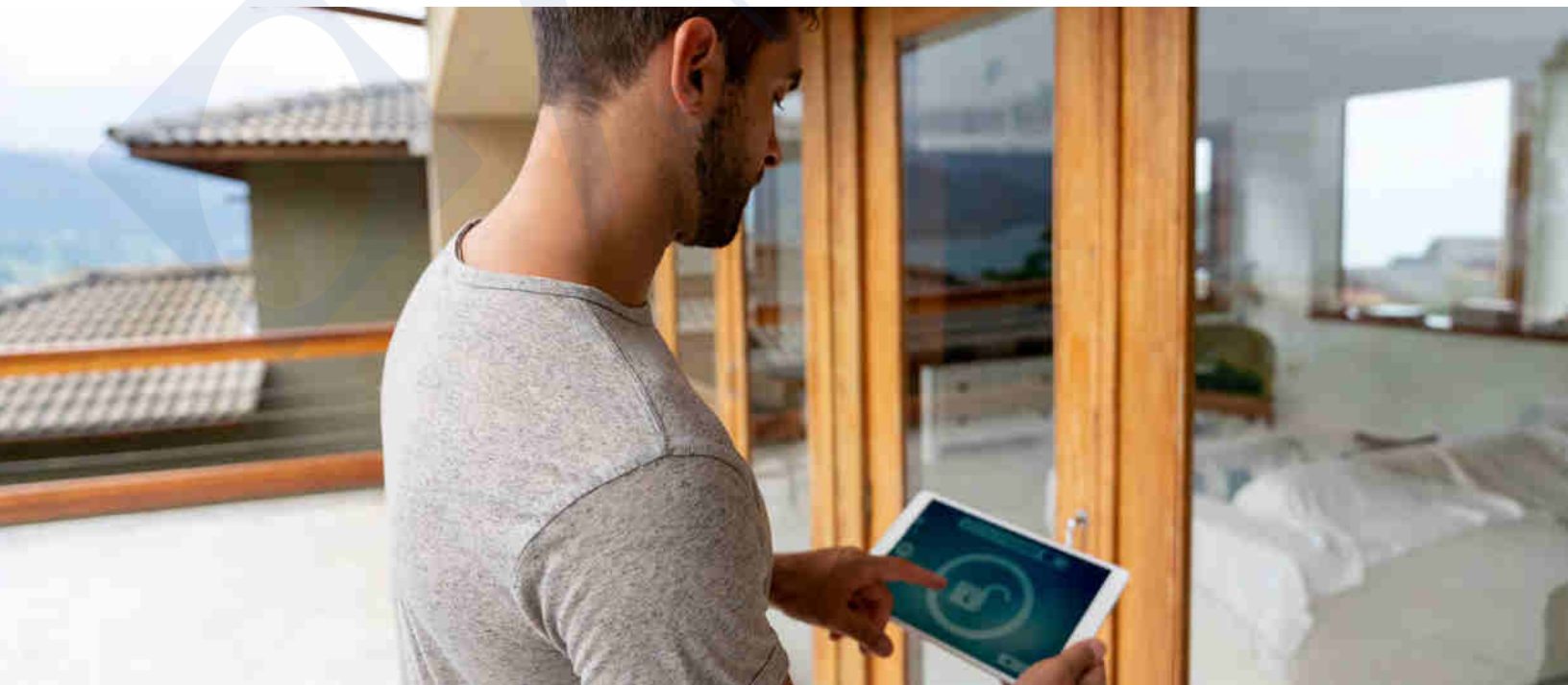
Bluetooth Development Kits

Our Bluetooth development kits are designed to help you get up and running as quickly as possible and are divided into three categories based on your development need. Silicon Labs offers kits for experimenting, prototyping, or developing your product.

Explorer Kit
Our entry-level kit offers five powerful development features, including an onboard debugger, traffic analyzer, virtual COM port, mobile tester app, and connectors for MikroE and Qwiic peripheral boards. It's also is fully supported by Simplicity Studio, the unified development environment for all Silicon Labs technology.

Development Kit
To simplify prototyping or field trials, our development kits support both a coin cell and a connector for external batteries or power supplies. The Arm Cortex-M series-based development kits also provide a 2.4 GHz chip antenna, a board controller, J-Link debugger, packet tracing, virtual COM, and various on-board sensors.

Pro Kit
Developing production products require additional development features such as an energy profiler and a network analyzer to optimize your code and RF design. This kit also includes an LCD display, Ethernet port, 8-channel logic, and a standardized interface for all Silicon Labs radio board products.

✅ Supported
— Not Supported
✅ Optional or not mounted

	Explorer Kit	Development Kit	Pro Kit
Debug Speed	1.6MHz	1.6MHz	8MHz
Debug USB	Full Speed	Full Speed	High Speed
Packet Trace Interface (PTI)	✅	✅	✅ 2x
Breakout Pads	✅	✅	✅
Pushbutton s & User LEDs	✅	✅	✅
Virtual COM	✅	✅	✅
Coin cell battery holder	—	✅	✅
On-board Sensors	—	✅	✅
Battery Pack Connector	—	✅	✅
Radio Board Connectors	—	—	✅
EXP Connectors	—	—	✅
Display	—	—	✅
Debuge OUT	—	—	EFM8/32, EFR32, EZR32
Debuge Ethernet	—	—	100 Mbit/s
Energy Monitor (AEM)	—	—	✅
3rd Party Hardware addons	✅	—	—

About Silicon Labs

SILICON LABS

Silicon Labs is the leading provider of silicon, software, and solutions for a smarter, more connected world. Our industry-leading wireless solutions feature a high level of functional integration. Multiple complex mixed-signal functions are integrated into a single IC or system-on-chip (SoC) device, saving valued space, minimizing overall power consumption requirements, and improving customer end products' reliability. We are the trusted partner for the world-leading consumer and industrial brands and small and medium sized companies. Our customers develop solutions for wide range of applications, from medical devices to smart lighting to building automation, and much more.