

Bluetooth Low Energy

Product Brief v2.0

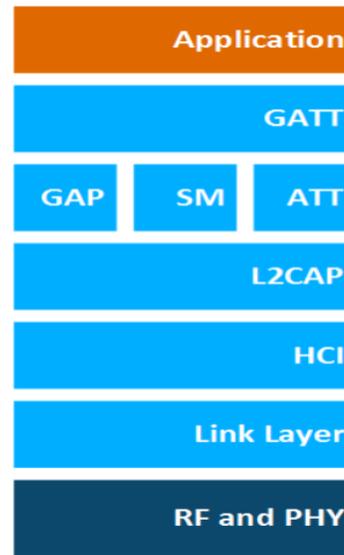
Overview

Bluetooth version 4.0 introduced Bluetooth with low energy functionality. Bluetooth low energy technology allows for short bursts of long-range radio connections, making it ideal for applications that depend on long battery life and don't need high throughput streaming data. Developers are now able to create sensors that can run on coin-cell batteries for months and even years. Bluetooth low energy technology is built on an entirely new development framework using GATT (Generic Attributes). Silicon Labs supports the latest version of the Bluetooth® Core Specification, Bluetooth™ LE 5.3. We currently do not support all 5.3 features, but we support all the errata published on 5.2 which is mandatory for 5.3 qualification. This enables customers to claim compliance with the latest Bluetooth spec.

Bluetooth Low Energy Architecture

The Bluetooth Low Energy architecture components are as follows:

- Physical Layer:** Controls radio transmission/receiving.
- Link Layer:** Defines packet structure, includes the state machine and radio control, and provides link layer-level encryption.
- HCI:** A Host-to-Controller interface (HCI) standardizes communication between the controller and the host.
- L2CAP:** Logical Link Control and Adaptation Protocol acts as a protocol multiplexer and handles segmentation and reassembly of packets.
- ATT:** Attribute protocol provides means to transmit data between Bluetooth low energy devices.
- SM:** Security Manager provides means for bonding devices, encrypting and decrypting data, and enabling device privacy
- GAP:** Generic Access Profile layer provides means for Bluetooth low energy devices to advertise themselves or other devices, make device discovery, open and manage connections, and broadcast data.
- GATT:** GATT is used to group individual attributes into logical services GATT also provides information about the attributes, that is, how they can be accessed and what security level is needed.



Bluetooth Low Energy Architecture

Key Features of Silicon Labs Bluetooth Low Energy Stack

Feature	Benefit
Core Features	Direction finding, Periodic Advertising with Responses (PAWR), Encrypted Advertising Data (EAD), Advertisement Extensions, Periodic Advertising, LE secure connections, 2M PHY, Long Range, AFH, LE Privacy 1.2 (peripheral), LE packet length extensions, Accept List (central side), GATT, & GATT Caching
Scalable AoA	Scale to AoA to few hundred devices simultaneously
Certificate Based Authentication and Pairing (CBAP)	Use certificates to authenticate devices before provisioning, thus saving cost and time. Also, prevents counterfeit devices from being provisioned into the network

Silicon Labs Bluetooth stack supports three modes:

Standalone mode: Bluetooth stack and the application run in an EFR32SoC or module

Network Co-Processor mode: Bluetooth stack runs on the EFR32, and the application runs on a separate host MCU. API is exposed over a serial interface such as UART.

Radio Co-Processor mode: Link layer of the Bluetooth stack runs on the EFR32, and the Host Layer of the stack, as well as the application runs on a separate host MCU or PC. Link Layer and Host Layer communicate via HCI.

Silicon Labs' Bluetooth Low Energy HW support

		
<p>High Performance device for Bluetooth LE and Bluetooth mesh applications that require advance features and more Flash and RAM</p>	<p>Industry-leading, energy efficient device for Bluetooth LE applications</p>	<p>Optimized for line-powered devices including LED bulbs, and gateways for Bluetooth LE and Bluetooth mesh</p>
<ul style="list-style-type: none"> • 1536kB Flash • 256kB RAM • TX power 19.5dBm • -105.7dBm @ 125kbps • -97.6dBm @ 1Mbit/s • -94.8dBm @ 2Mbit/s • RX current 4.4mA @ 1Mbps • TX current 5.0mA @ 0dBm • 1.3 μA Sleep current (16kB) • Robust peripheral set • AI/ML hardware accelerator • Secure Vault High • QFN40 5x5 (26) • QFN48 6x6 (32) 	<ul style="list-style-type: none"> • 512kB Flash • 32kB RAM • TX power 6dBm • -106.7dBm @ 125kbps • -98.9dBm @ 1Mbit/s • -96.2dBm @ 2Mbit/s • RX current 3.6mA @ 1Mbps • TX current 4.1mA @ 0dBm • 1.26μA Sleep current (16kB) • Lowest Power Bluetooth LE • Secure Vault Mid • QFN40 5x5 (26) • QFN32 4x4 (18) • TQFN32 4x4 (18) 	<ul style="list-style-type: none"> • 1024kB Flash • 96kB RAM • TX power 20dBm • -104.9dBm @ 125kbps • -97.5dBm @ 1Mbit/s • -94.4dBm @ 2Mbit/s • RX current 8.8mA @ 1Mbps • TX current 9.3mA @ 0dBm • +135 Junction Temperature • Secure Vault High • Line-Powered Bluetooth LE • QFN32 4x4 (20)

Bluetooth LE Target Applications

- [ESL](#)
- [Medical](#)
- [Direction Finding](#)
- [Smart Home](#)
- [Smart Tags](#)
- [Sensors](#)
- [Switches](#)
- [Building Automation](#)
- [HVAC](#)

Bluetooth LE Software / Tools

Silicon Labs Bluetooth Low Energy SDK helps you build smooth, reliable, and secure wireless connectivity for your IoT applications.

Software and Tools features

- Supports Bluetooth™ LE 5.3
- Wi-Fi Coexistence
- Simplicity Studio IDE
- GATT Configurator
- Network Analyzer
- Direction Finding Tool suite
- Bluetooth NCP Commander
- Proprietary Radio Configurator
- Energy Profiler
- Tool Chain – GCC and IAR

Links: [Bluetooth Low Energy SDK](#)

Learning Center

[Ready for Bluetooth 5.4?](#)

Learn more about the latest specification

[Bluetooth Direction Finding](#)

Bluetooth Location Services: AoA/AoD

[Why EFR?](#)

Silicon Labs EFR32 Features

[Silicon Labs Secure Vault accreditations](#)

Product security certifications

[Bluetooth SoC and Module Selector Guide](#)

Bluetooth Low Energy Selector Guide

[Case Study: Rethinking Epilepsy Management](#)

EFR32 Portable Medical Device

[Bluetooth Beacons](#)

Bluetooth Beacons and Advertising

Silicon Labs' Bluetooth LE Development Kits

Silicon Labs' Bluetooth development kits are divided into three categories based on your development need:

- Rapid Prototyping
- Proof of Concept
- Advanced RF Development

For more information on the portfolio, check the link:

<https://www.silabs.com/bluetooth-kits>

Technical Resources

[Bluetooth Low Energy xG24 Technical Library](#)

Data Sheets, App Notes, and more

[Bluetooth Low Energy xG21 Technical Library](#)

Data Sheets, App Notes, and more

[Bluetooth Low Energy xG22 Technical Library](#)

Data Sheets, App Notes, and more

[Bluetooth Low Energy API Documentation](#)

Bluetooth Low Energy API documentation

Smart. Connected. Energy-Friendly.



IoT Portfolio

www.silabs.com/products



Quality

www.silabs.com/quality



Support & Community

www.silabs.com/community

Disclaimer: Silicon Labs intends to provide customers with the latest, accurate, and in-depth documentation of all peripherals and modules available for system and software implementers using or intending to use the Silicon Labs products. Characterization data, available modules and peripherals, memory sizes and memory addresses refer to each specific device, and "Typical" parameters provided can and do vary in different applications. Application examples described herein are for illustrative purposes only. Silicon Labs reserves the right to make changes without further notice to the product information, specifications, and descriptions herein, and does not give warranties as to the accuracy or completeness of the included information. Without prior notification, Silicon Labs may update product firmware during the manufacturing process for security or reliability reasons. Such changes will not alter the specifications or the performance of the product. Silicon Labs shall have no liability for the consequences of use of the information supplied in this document. This document does not imply or expressly grant any license to design or fabricate any integrated circuits. The products are not designed or authorized to be used within any FDA Class III devices, applications for which FDA premarket approval is required or Life Support Systems without the specific written consent of Silicon Labs. A "Life Support System" is any product or system intended to support or sustain life and/or health, which, if it fails, can be reasonably expected to result in significant personal injury or death. Silicon Labs products are not designed or authorized for military applications. Silicon Labs products shall under no circumstances be used in weapons of mass destruction including (but not limited to) nuclear, biological or chemical weapons, or missiles capable of delivering such weapons. Silicon Labs disclaims all express and implied warranties and shall not be responsible or liable for any injuries or damages related to use of a Silicon Labs product in such unauthorized applications. **Note: This content may contain offensive terminology that is now obsolete.**

Silicon Labs is replacing these terms with inclusive language wherever possible. For more information, visit www.silabs.com/about-us/inclusive-lexicon-project

Trademark Information

Silicon Laboratories Inc.[®], Silicon Laboratories[®], Silicon Labs[®], SiLabs[®] and the Silicon Labs logo[®], Bluegiga[®], Bluegiga Logo[®], EFM[®], EFM32[®], EFR, Ember[®], Energy Micro, Energy Micro logo and combinations thereof, "the world's most energy friendly microcontrollers", Redpine Signals[®], WiSeConnect, n-Link, ThreadArch[®], EZLink[®], EZRadio[®], EZRadioPRO[®], Gecko[®], Gecko OS, Gecko OS Studio, Precision32[®], Simplicity Studio[®], Telegesis, the Telegesis Logo[®], USBXpress[®], Zentri, the Zentri logo and Zentri DMS, Z-Wave[®], and others are trademarks or registered trademarks of Silicon Labs. ARM, CORTEX, Cortex-M3 and THUMB are trademarks or registered trademarks of ARM Holdings. Keil is a registered trademark of ARM Limited. Wi-Fi is a registered trademark of the Wi-Fi Alliance. All other products or brand names mentioned herein are trademarks of their respective holders.



Silicon Laboratories Inc. 400 West Cesar Chavez Austin, TX 78701

www.silabs.com