

# Bluetooth Low Energy

Product Brief v1.0

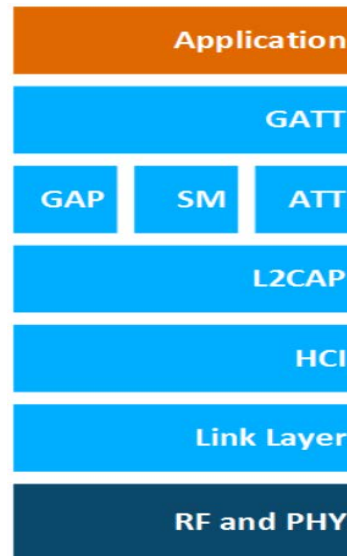
## Overview

Bluetooth version 4.0 introduced Bluetooth with low-energy functionality. Bluetooth low energy (LE) 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 LE technology is built on an entirely new development framework using GATT (Generic Attributes). GATT profiles describe use cases, roles, and general behaviors based on the GATT functionality, and allows developers to quickly and easily develop applications to connect devices directly to applications running on smartphones, PCs, or tablets. 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 LE Architecture

The Bluetooth LE 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 LE 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 LE devices to advertise themselves or other devices, make device discovery, open, manage connections, and broadcast data.
- GATT:** GATT is used to group individual attributes into logical services. GATT also provides information about the attributes (i.e., 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
Direction Finding	Based on the angle-of-arrival (AoA) and angle-of-departure (AoD) techniques, it enables high-accuracy positioning of below one meter (<1 m) for your asset tracking and indoor positioning applications.
GATT	Silicon Labs supports all GATT-based Bluetooth profiles and services.
GATT Caching	GATT Caching enables your Bluetooth applications a faster client reconnection time and lowers power consumption.
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.
Pairing Processes	Silicon Labs Bluetooth provides you with all the specified pairing processes, including CBAP, Just Works, and Man-in-the-Middle with numeric comparison and Out-of-Band passkey.
Other Features	LE secure connections, LE Privacy 1.2 (peripheral), LE packet length extensions, whitelisting (central side), LE power control, LE data length extensions and LE dual-topology.

## Silicon Labs' Bluetooth LE Hardware support

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

## Bluetooth LE Target Applications

- Medical
- Direction Finding
- Smart Home
- Smart Tags
- Sensors
- Switches
- Building Automation
- HVAC
- Smart Plugs
- Gateways/Hubs

## Bluetooth LE Software / Stack / Tools

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

### Software features

- Supports Bluetooth™ LE 5.3
- Direction Finding
- Dynamic TX Power Control
- LE Long Range (500kbps and 125kbps)
- Wi-Fi Coexistence
- 2M PHY
- LE Advertising Extensions
- LE Periodic Advertising
- GATT, and GATT caching
- Simplicity Studio IDE
- Tool Chain – GCC and IAR

Links: [Bluetooth Low Energy SDK](#)

## Learning Center

[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](http://www.silabs.com/products)



## Quality

[www.silabs.com/quality](http://www.silabs.com/quality)



## Support & Community

[www.silabs.com/community](http://www.silabs.com/community)

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