SILICON LABS Z-Wave Hardware Selector User Guide

Contents

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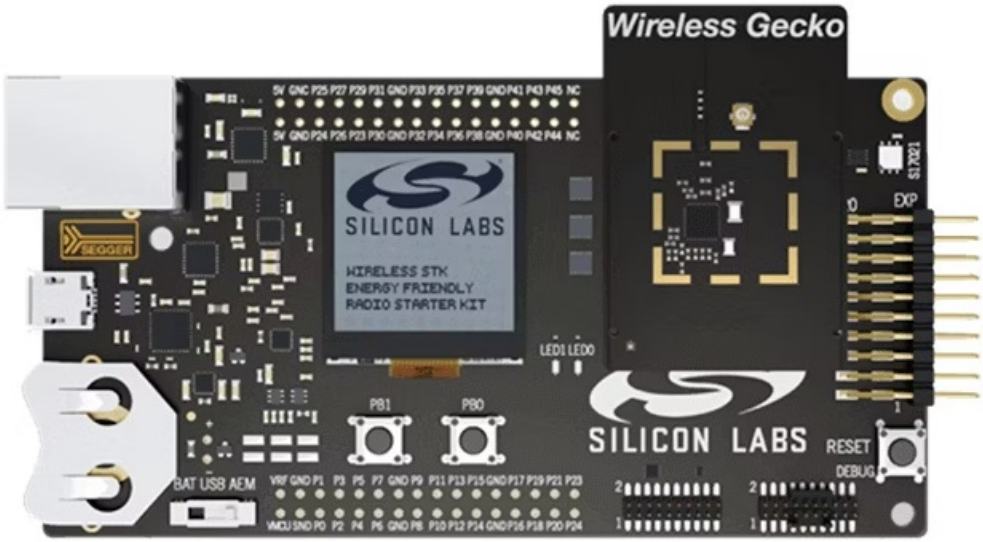
SILICON LABS Z-Wave Hardware Selector



Specifications

- Z-Wave technology
- Sub-GHz frequency bands
- Secure and reliable two-way communication
- Mesh networking capability
- Supports star network topology
- Inclusion and exclusion of devices
- Emphasis on interoperability

Product Usage Instructions

Setting Up Z-Wave Network
To begin, ensure you have a Z-Wave compatible hub or gateway to control the network. Follow the hub's instructions for initial setup.

Adding Devices to the Network
Put your Z-Wave device into inclusion mode according to its manual. Then, initiate the inclusion process on the hub. The devices should pair automatically.

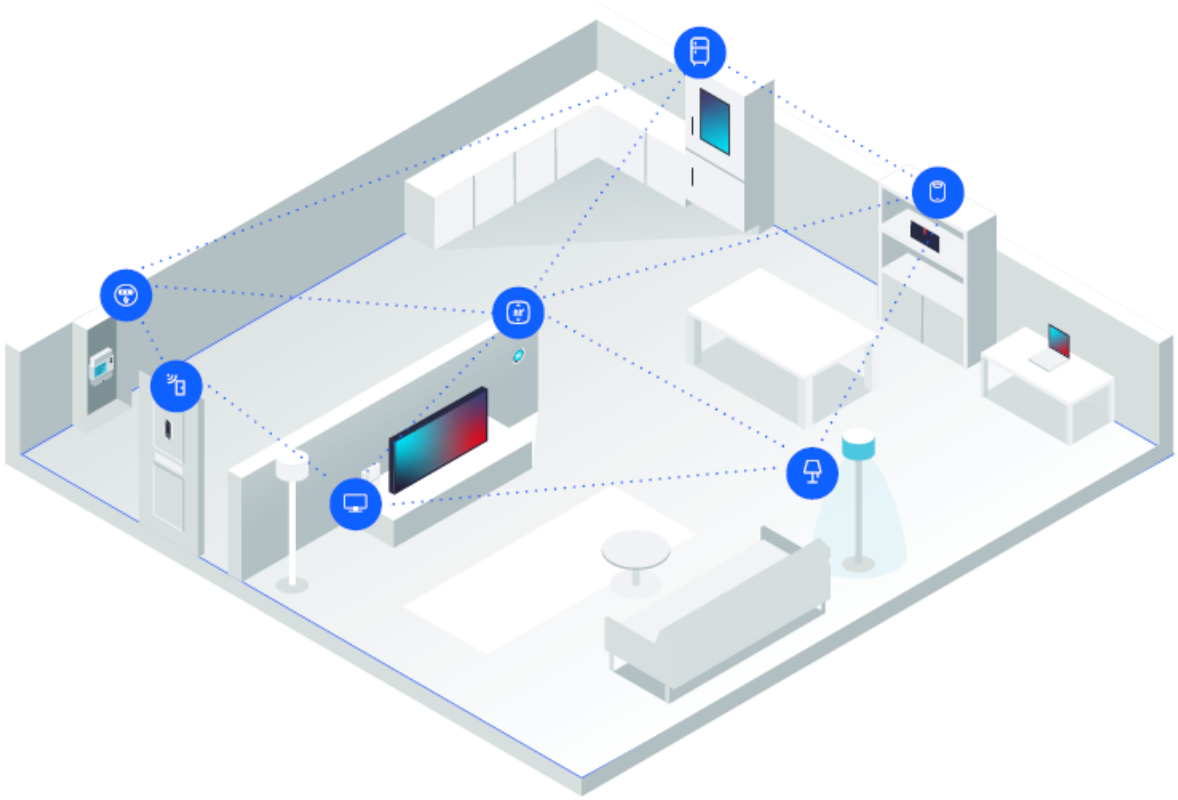
Removing Devices from the Network
To remove a device, follow the exclusion process on both the device and the hub. This will disconnect the device from the network.

Creating Automations
Use your hub's interface to create automation routines based on your preferences. For example, set lights to turn on when a motion sensor detects movement.

Troubleshooting
If you encounter issues with connectivity, try rebooting the hub and ensuring devices are within range of each other. Check for any interference sources that may disrupt the signal.

What is Z-Wave?
Z-Wave is a prominent wireless communication standard designed specifically for smart home applications. It enables various smart home devices, such as lights, door locks, security systems, climate controls, and window blinds to communicate and work together seamlessly. This interoperability facilitates the creation of a cohesive

and intuitive smart home ecosystem. Z-Wave technology uses Sub-GHz frequency bands, which are less congested compared to the 2.4 GHz and 5 GHz bands commonly used by other home automation standards. This significantly reduces the chances of interference, enhancing the reliability and robustness of Z-Wave networks. It incorporates secure and reliable two-way communication through message acknowledgment and mesh networking, ensuring that commands are executed as intended.



How Does Z-Wave Work?

Z-Wave is, by far, the most widely used wireless protocol for home automation. It uses simple, reliable, low-power radio waves that easily travel through walls, floors and cabinets, without interference from the other wireless devices you might have in your home. Z-Wave can be added to almost anything electronic, even devices that you wouldn't ordinarily think of as "intelligent," such as appliances, window shades, thermostats, and lights. Z-Wave offers integrators and system designers a world of business opportunities, along with the products and training to make those opportunities pay dividends for both hosts and clients.

Now, integrators can easily deliver all the hot applications that customers are asking for, including remote home and business management, energy conservation, connected solutions for independent aging, real estate and property control, and more. All of this with no new wiring required and the confidence that comes with an interoperable standard that works seamlessly between brands. Z-Wave Long Range is an evolutionary wireless technology that brings forth a new era of connectivity, extending the reach of the Z-Wave dynasty by leveraging existing modulations that can provide greater range (via DSSS OQPSK) while meeting regulatory requirements.

Z-Wave LR offers a significant advantage, as it is designed to provide extended wireless coverage, increased scalability, optimized battery life, and robust security for IoT networks. It is designed to extend the range of Z-Wave networks while maintaining power efficiency, a critical requirement for smart home devices that often rely on battery power. In addition, the Z-Wave 800 series, which supports Z-Wave LR, has been further optimized for low power consumption, enabling devices to run for up to 10 years on a coin-cell battery.

Key Features

Sub-GHz Frequency: Z-Wave uses a sub-GHz frequency band, avoiding the more congested 2.4 GHz and 5 GHz bands. This choice minimizes interference from other wireless devices in and around the home, providing a more reliable communication channel for home automation devices.

 Secure and Reliable Communication: Z-Wave ensures secure and reliable two-way communication through message acknowledgment and mesh networking. Each message sent over a Z-Wave network is acknowledged, ensuring the sender knows the message has been received. If a message is not acknowledged, the network can automatically retry sending the message, enhancing reliability.

 Mesh Networking: In a Z-Wave mesh network, devices (nodes) can communicate directly with each other or relay messages through other devices to reach nodes that are out of direct range. This increases the network's range and reliability, as messages can find multiple paths to their destination.

 Z-Wave (LR): Supports a star network topology. In a star network, all nodes (devices) connect directly to a central hub or gateway. This differs from a mesh network, where nodes can connect to multiple other nodes, not just a central hub. However, while individual Z-Wave LR devices operate in a star network, they can still be part of a larger more extensive Z-Wave mesh network.

 Inclusion and Exclusion: The Z-Wave protocol supports the addition (inclusion) and removal (exclusion) of devices from the network. This allows for flexible configuration and reconfiguration of the smart home setup as devices are added, moved, or removed.

 Interoperability: A key aspect of Z-Wave is its emphasis on interoperability. Z-Wave devices are required to undergo a certification process to ensure they can work seamlessly with other Z-Wave devices, even those from different manufacturers. This is achieved through application layer interoperability, meaning all devices speak the same "language" or use the same commands and protocols.

Silicon Labs Z-Wave Solution

The Silicon Labs Z-Wave solution is an end-to-end solution with software and hardware building blocks for both controllers and end devices to create a full smart home IoT system. The Z-Wave software gives you the foundational features required in the Z-Wave Specification and enables you to focus on your application without the need to be a protocol expert. Z-Wave is designed to meet the demands of the future smart home, hospitality, and MDUs, where increasing needs for more sensors and battery-operated devices require both long-range and low power. Our sub-GHz Z-Wave solutions offer best-in-class security, Smart Start provisioning, battery life of up to 10 years, full home and yard coverage, customer product-level interoperability, and backward compatibility.

 **Broad Ecosystem**
Hundreds of Z-Wave Alliance members

 **Sub GHz**
Penetrates walls, long range, less interference

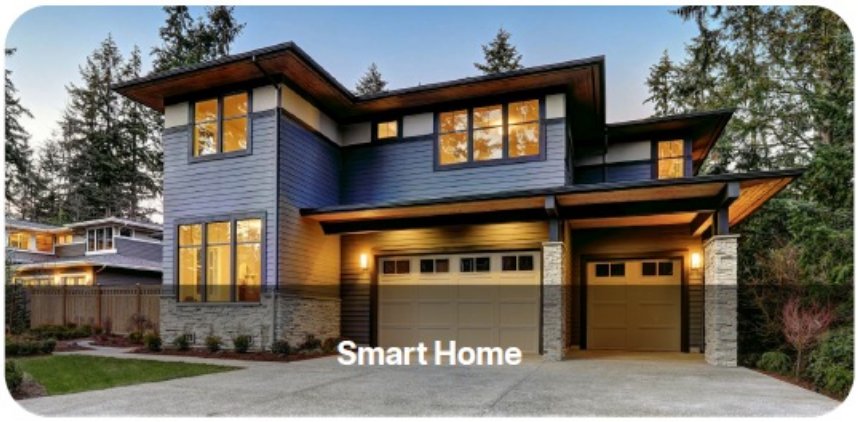
 **All Interoperable**
Thousands of certified products & 100% interoperable

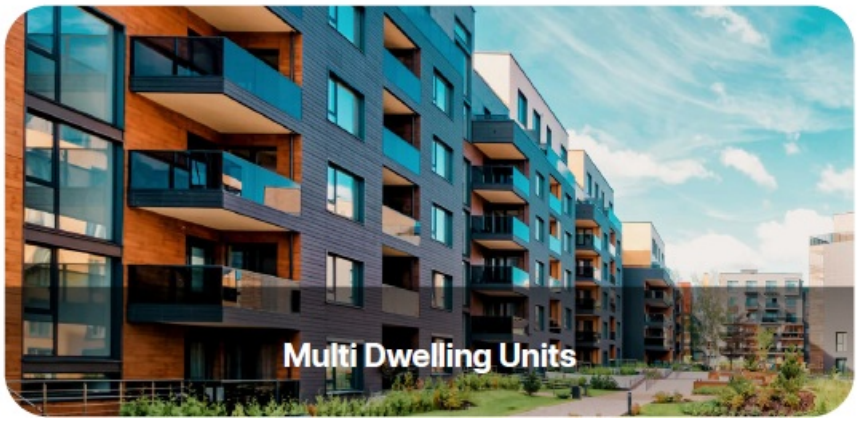
 **Mesh & Star**
Large network coverage Robust

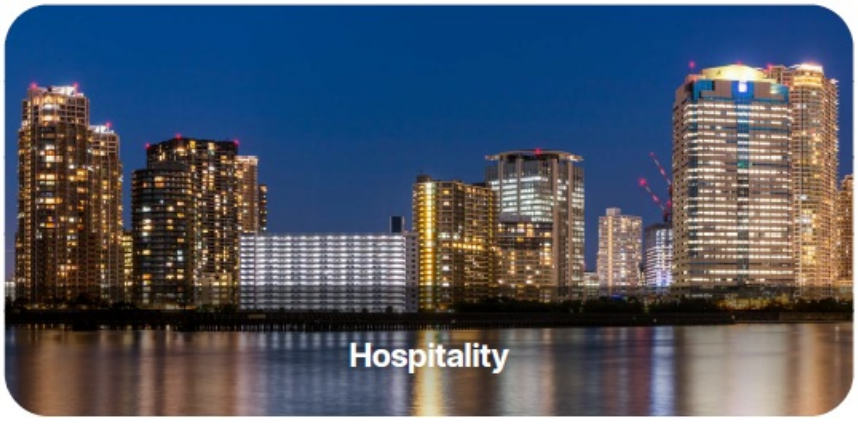
Easy to Install
SmartStart error free installation

Secure
S2 security framework Secure Vault™

Low Power
Up to 10 years on a Coin cell



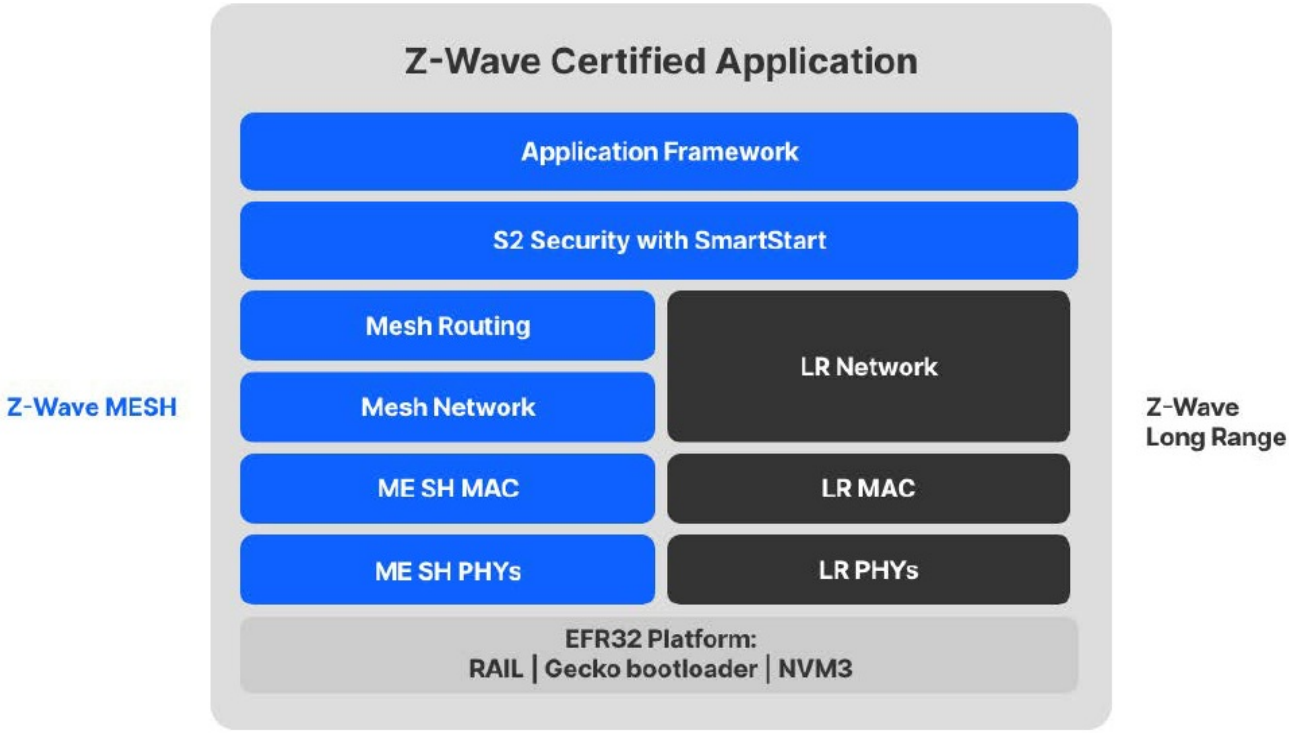




Z-Wave End Device Software

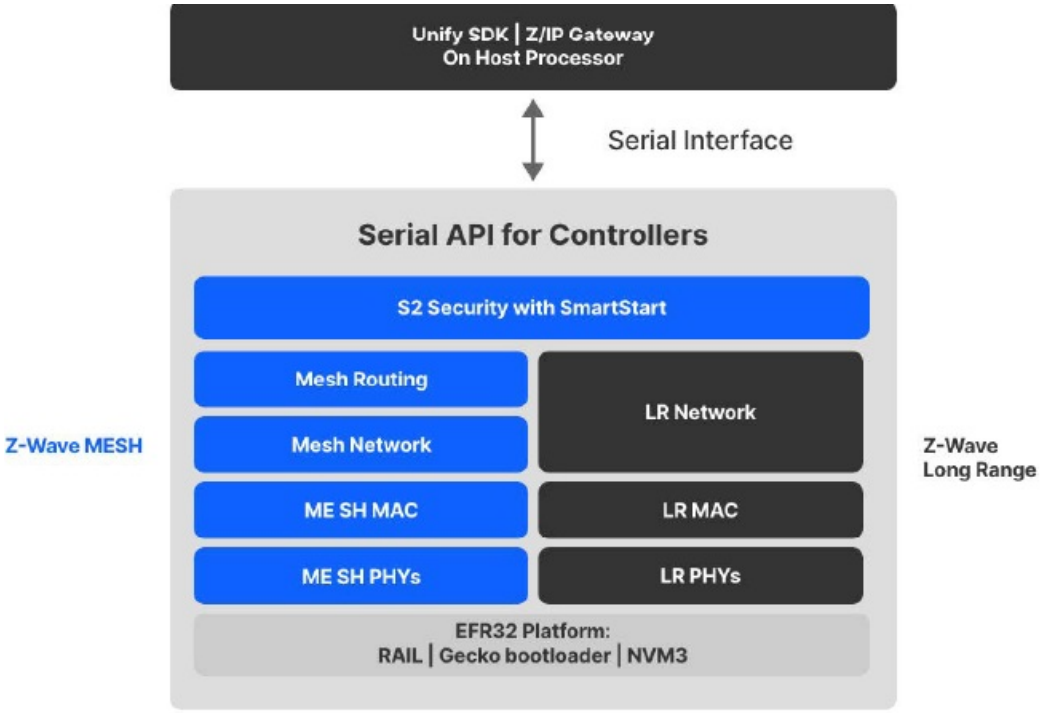
The Z-Wave End Device software from Silicon Labs enables end devices such as security sensors, door locks, light switches/bulbs, and many more to benefit from the pre-certified Z-Wave applications, all certified under the

latest certification program from the Z-Wave Alliance. For more custom device applications you can leverage the Z-Wave Application Framework. The complete suite of Z-Wave-certified hardware and software building blocks enables system solutions for end device makers and controller/gateway companies to build Z-Wave-powered smart home products and enjoy the benefits of taking part in the Z-Wave Ecosystem.



Z-Wave Controller Software

The Z-Wave Controller software from Silicon Labs enables faster time to market, as it handles all connectivity and protocol details, allowing you to focus on your application software and cloud connection. The Z-Wave Controller solution with Unify SDK provides features such as easy and secure commissioning, network maintenance, a mailbox for battery devices, and more, ensuring your controller product is in compliance with the required functionality from the Z-Wave Alliance Specification. The controller solution is pre-certified under the latest Z-Wave certification program from the Z-Wave Alliance and distributed as a source code via GitHub. The pre-certified Z/IP Gateway option is also still available and distributed as a source code, but it is in maintenance mode.



Why Choose Silicon Labs for Your Z-Wave

Silicon Labs Z-Wave wireless solutions are end-to-end solutions with software and hardware building blocks for both controllers and end devices for home security and smart home devices, including door locks, thermostats, shades, switches, and sensors. Z-Wave software provides the foundational features required in the Z-Wave specification and enables you to focus on your application without needing to be a protocol expert.

EFR32ZG28 SoCs

The ZG28 is an ideal dual band sub-GHz + 2.4 GHz SoC. The low-power, high-performance SoC features 1024 kB of Flash, 256 kB, and up to 49 GPIO to enable advanced Z-Wave applications.

- Ideal for smart home, hospitality, MDU, smart cities
- Highest level of IoT security
- Secure Vault™
- Dual band/Bluetooth Low Energy
- Z-Wave, Amazon Sidewalk, Wi-SUN and Proprietary

ZGM230S Modules

Based on the EFR32ZG23 SoC, the ZGM230S delivers robust RF performance, long-range, industry leading security features, and low- current consumption in a 6.5 x 6.5 mm package.

- Ideal for smart home, security, lighting, and building automation
- Highest level of IoT security
- Secure Vault™ High

EFR32ZG23 SoCs

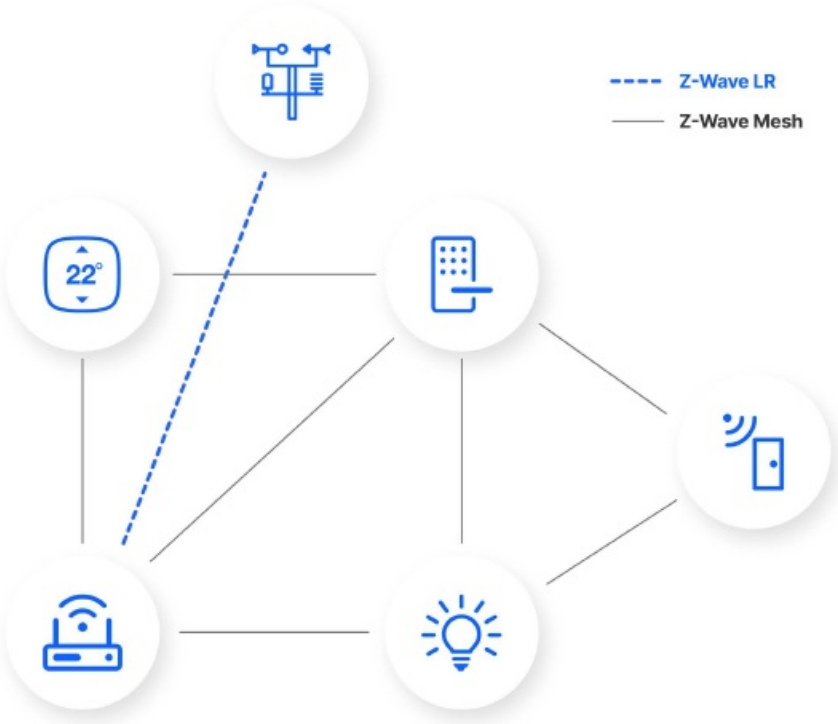
The ZG23 is an optimized low-power, high-performance, sub-GHz SoC that provides up to 512 kB of Flash and 64 kB of RAM for Z-Wave Mesh and Z-Wave Long Range (LR).

- Ideal for smart home, hospitality, MDU, and smart cities
- Highest level of IoT security
- Secure Vault™
- Z-Wave, Amazon Sidewalk, Wi-SUN and Proprietary

Comparing Z-Wave Mesh and Z- Wave LR (Star)

	Z-Wave Mesh	Z-Wave Long Range (LR)
PHY Modulation	FSK/GFSK	DSSS OQPSK
PHY Speed	9.6/40/100 kbps	100 kbps
PHY Frequency in US	908.42/916 MHz	912/920 MHz
PHY max output power*	*1 dBm(FCC), +14 dBm(ETSI)	Spec will allow up to +30 dBm(FCC)
PHY output power control	No	Yes
MAC LBT	Yes	Same as Z-Wave
MAC random back off	Yes	Same as Z-Wave
MAC frames	Single, multi, broadcast, beams (1000ms)	Single, multi, broadcast, beams (100ms fragmented)
Mac address space	32-bit Home Id, 8-bit Node ID	32-bit Home Id, 12-bit Node ID
NWK	Mesh	Star
Routing	Supported	Not Supported
Inclusion	NWI and Inclusion controller support	Direct inclusion only
SmartStart	QR code	Same as Z-Wave
Security	S0, S2 non-Auth, S2 auth, S2 Access	S2 auth, S2 Access
Application framework	Supported	Same as Z-Wave
Sample Apps	Supported	Same as Z-Wave
IMA	Supported	Same as Z-Wave

Z-Wave Mesh and Star Network Topology



Mesh Network Topology
100 kbps
data rate
+0/14 dBm TX power

Star Network
Topology
100 kbps
data rate
Up to +30 dBm TX power

400 m
range (4 hops)
Coverage for the smart home and end of yard

~1.5 Mile
range
Coverage for the whole home, yard and beyond without a repeater

200+ nodes
scalable
8-bit address space

4000 nodes
highly scalable
12-bit address space

How Silicon Labs' Portfolio is Ideal for Z-Wave Development
We provide smart home IoT device makers with a full range of Z-Wave protocols including Z-Wave 500, Z-Wave 700, Z-Wave LR, and the latest Z-Wave 800.

Hardware

- SoCs and SiP Modules
- Supports all Z-Wave frequencies
- Mesh and Long Range
- Z-Wave and Proprietary support

Stack

- Based on open specification
- Complete solution – PHY to App
- Controller reference design
- Secure Vault™ integration

Development tools

- Packet sniffer and analyzer
- Energy Profiler
- Network controller
- Installation and maintenance tool

Certification

- Ensures interoperability and backwards compatibility
- Z-Wave LR certification is part of Z-Wave Plus V2
- Certification is mandatory for all products

Silicon Labs Z-Wave Comparison

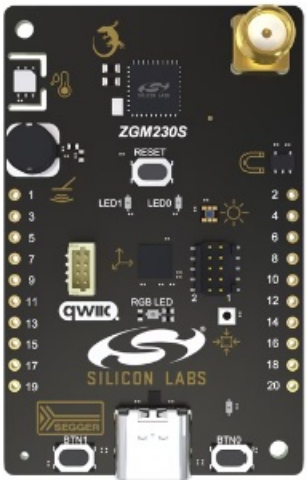
Product	Range	Data rate	Frequency Band	Network Topology
Z-Wave	100 m	100 kbps	915/868 MHz	MESH
Z-Wave LR	>1000 m	100 kbps	912 MHz	STAR

Z-Wave Portfolio Comparison

	Z-Wave 800 SoCs	Z-Wave 800 SiP	Z-Wave 800 SoCs
Family	EFR32ZG23	ZGM230S	EFR32ZG28
Product Focus	Z-Wave End Devices, Controllers	Z-Wave End Devices, Controllers	Z-Wave End Devices, Controllers
Target Applications	End Devices, Controllers	End Devices, Controllers	Z-Wave End Devices, Controllers
Frequencies	868 / 915 MHz (Z-Wave) 110 – 970 MHz (Proprietary)	868/908-920 MHz	868 / 915 MHz (Z-Wave) 110 – 970 MHz (Proprietary) 2.4 GHz (Bluetooth LE)
Core	ARM® Cortex®-M33 w/ Trustzone® Up to 78 MHz	ARM® Cortex®-M33 w/ Trustzone® Up to 39 MHz	ARM® Cortex®-M33 w/ Trustzone® Up to 78 MHz
AI/ML Hardware Accelerator	No	No	Yes
Max Flash / RAM	Up to 512 kB / 64 kB	512 kB / 64 kB	1024 / 256 kB
Security Level	Z-Wave S2 Secure Vault™ - Mid Secure Vault™ - High	Z-Wave S2 Secure Vault™ - Mid Secure Vault™ - High	Z-Wave S2 Secure Vault™ - Mid Secure Vault™ - High
Max TX Power	+20 dBm	+14 dBm	+20 dBm
RX Sensitivity (100 kbps GFSK)	-108.6 dBm	-108.6 dBm	-108.6 dBm
RX Sensitivity (100 kbps OQPSK)	-109.8 dBm	-109.8 dBm	-109.8 dBm
RX Sensitivity (1 Mbps BLE)	N/A	N/A	-95.6 dBm
TX Current @ 0 dBm	9.8 mA	10.7 mA	10.1 mA
TX Current @ +14 dBm	25.0 mA	30.0 mA	26.2 mA
RX Current (100 kbps GFSK)	4.0 mA	4.1 mA	4.3 mA
Operating Voltage	1.71 V – 3.8 V	1.8 to 3.8 V	1.71-3.8 V
Operating Temperature	-40 to 125 °C	-40 to 85 °C	-40 to 125 °C
Package (GPIO)	5×5 QFN40 (22/23 GPIO) 6×6 QFN48 (31 GPIO)	6.5 × 6.5 mm 52 pins (34 GPIO)	8 mm × 8 mm QFN68 (49 GPIO) 6 mm × 6 mm QFN48 (31 GPIO)
Antenna	RF Pin	RF Pin	RF Pin

Development Kits

Kits and Boards



ZGM230-DK2603A

Kit Contents

- BRD2603A – ZGM230s +14 dBm Dev Kit Board
- ANT SS900 – 868-915 MHz Antenna

Kit Features

- Sensors
  - Temperature and Humidity sensor
  - Ambient light sensor
  - LESENSE metal detector LC-sensor
  - Pressure sensor
  - Hall effect sensor
  - 9-axis inertial sensor
- User Interface
  - 2x Buttons (w/ EM2 wake-up)
  - 2x LEDs
  - 1x RGB LED
- On-board Debugger
  - J-Link Pro
  - Packet Trace (PTI) over UART
  - Virtual COM with HW Flow Control
- Power-save Features
  - Controllable and separate power domain(s) for sensors
- Expansion headers for easy I/O access

Radio Boards

SLWRB4206A

Kit Contents

- BRD4206A EFR32ZG14 Z-Wave LR Radio Board

Radio Board Features:

- EFR32 Wireless Gecko Wireless SoC with 256 kB Flash, 32 kB RAM. (EFR32ZG14P231F256GM32)
- SMA antenna connector (863-925 MHz)
- Optional PCB antenna

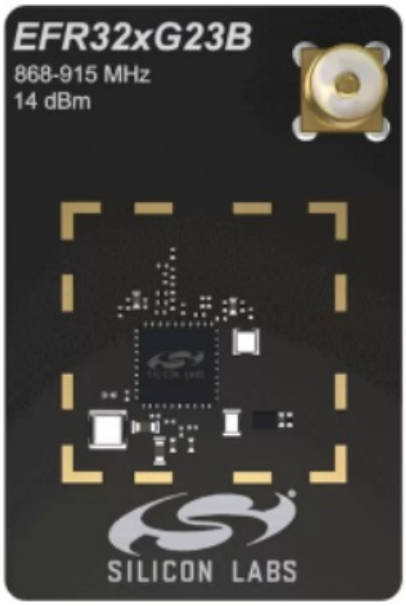
SLWRB4207A

Kit Contents

- BRD4207A ZGM130S Z-Wave LR Radio Board

Radio Board Features:

- ZGM130S Wireless Gecko SiP Module with 512 kB Flash, 64 kB RAM. Integrated RF matching network, crystals, and decoupling capacitors (ZGM130S037HGN2)
- SMA antenna connector
  (863-925 MHz)
- Optional PCB antenna



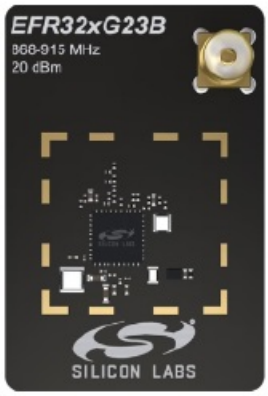
xG23-RB4204D

Kit Contents

- 1 x BRD4204D EFR32xG23 868-915 MHz +14 dBm Radio Board

Kit Features:

- EFR32ZG23 Wireless Gecko Wireless SoC with 512 kB Flash, and 64 kB RAM (EFR32ZG23B010F512IM48)
- Dual band integrated radio transceiver
- 14 dBm output power
- Inverted-F PCB antenna (2.4 GHz)
- SMA antenna connector (868-915 MHz)
- 8 Mbit low-power serial flash for over-the-air upgrades



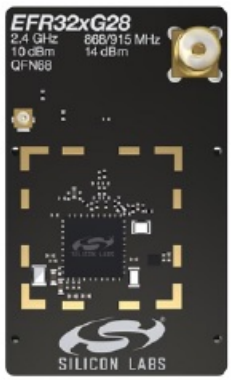
xG23-RB4210A

Kit Contents

- 1 x BRD4210A EFR32XG23 868-915 MHz +20 dBm Radio Board

Kit Features:

- EFR32ZG23 Wireless Gecko Wireless SoC with 512 kB Flash, and 64 kB RAM (EFR32ZG23B020F512IM48)
- Dual band integrated radio transceiver
- 20 dBm output power
- Inverted-F PCB antenna (2.4 GHz)
- SMA antenna connector
  (868-915 MHz)
- 8 Mbit low-power serial flash for over-the-air upgrades.



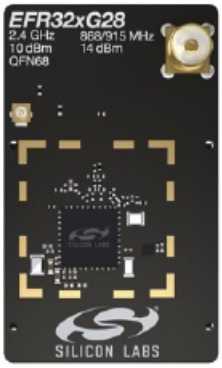
xG28-RB4400C

Kit Contents

- 1 x BRD4400C EFR32xG28 2.4 GHz BLE +14 dBm Radio Board

Kit Features:

- Requires the WSTK main boards
  (sold separately)
- Based on the EFR32ZG28B312F1024IM68 2.4 GHz Wireless SoC
- +14 dBm, 1024 kB Flash, 256 kB RAM, QFN68
- SMA Antenna Connector
  (868-915 MHz)
- Inverted-F PCB antenna, UFL connector (2.4 GHz)
- 8 Mbit low-power serial flash for over-the-air upgrades



xG28-RB4401C

Kit Contents

- 1 x BRD4401C EFR32xG28 2.4 GHz BLE +20 dBm Radio Board

Kit Features:

- Requires the WSTK main boards (sold separately)
- Based on the EFR32ZG28B322F1024IM68 2.4 GHz Wireless SoC
- +20 dBm, 1024 kB Flash, 256 kB RAM, QFN68
- SMA Antenna Connector (868-915 MHz)
- Inverted-F PCB antenna, UFL connector (2.4 GHz)
- 8 Mbit low-power serial flash for over-the-air upgrades

ZGM230-RB4205B

Kit Contents

- BRD4205B ZGM230S Z-Wave Radio Board

Radio Board Features:

- ZGM230S Z-Wave SiP Module with512 kB Flash, 64 kB RAM. Integrated RF matching network, crystals, and decoupling capacitors (ZGM230SB27HGN2)
- SMA antenna connector
  (863-925 MHz)

- Optional PCB antenna

Starter Kit

Kit Contents

- 2x BRD4002A Wireless Pro Kit Mainboard
- 2x BRD4207A Z-Wave 700 – ZGM130S Long Range Radio Board
- 1x BRD2603A ZGM230 +14 dBm Dev Kit Board
- 2x BRD8029A Buttons and LED Expansion Board
- 1x UZB-S (ACC-UZB3-S) UZB-S USB stick network sniffer
- 3x 868-915 MHz Antennas

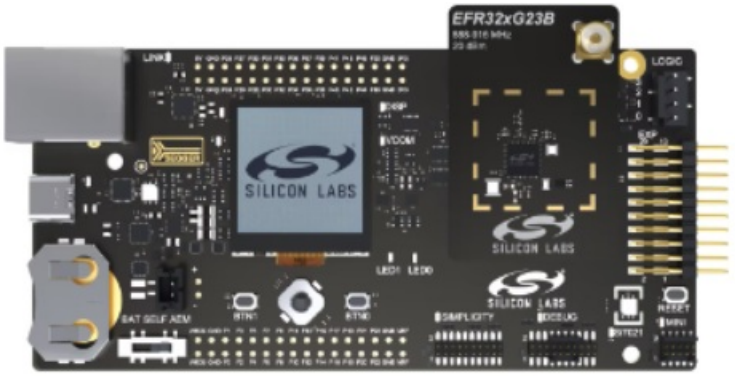
Kit Features:

- Z-Wave 700 SiP module Radio Boards to start your development
- Z-Wave Application Framework and pre-certified common end device application code
- Expansion header allows easy expansion and direct integration with Z-Wave Application Framework
- Z-Wave ZGM230-DK2603A to get started with your gateway development
- Pre-built Z/IP* and Z-Ware binaries allow for easy gateway development at your preferred API level
- Supports Z-Wave LR

Simplicity Studio Features

- Auto-detection for lab evaluation, software development and sample applications
- Z-Wave Application Framework
- Certified Application Code
- Z-Wave Sniffer
- Z-Wave PC Controller
- Energy Profiler

Pro Kits



xG28-PK6024A

Kit Contents

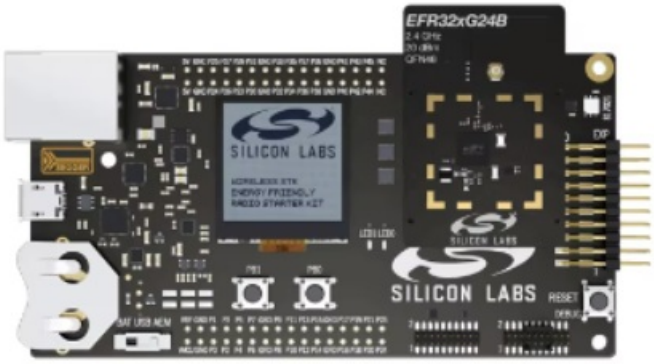
- 1x BRD4002A Wireless Starter Kit Mainboard
- 1x xG28-RB4400C +14 dBM 868/915 MHz radio board
- Sub-GHz Antenna
- 1x Flat cable
- 1x 2xAA Battery Holder

Protocol Support

- Wi-SUN
- Amazon Sidewalk
- Z-Wave
- Wireless M-BUS
- CONNECT
- Proprietary
- Bluetooth Low Energy

Kit Studio Features

- +14 dBm radio board based on the FG28 QFN68 wireless SoC
- SMA connector
- Advanced Energy Monitor
- Packet Trace Interface
- Virtual COM port
- SEGGER J-Link on-board debugger
- External device debugging
- Ethernet and USB connectivity
- Low power 128 x 128 pixel Memory LCDTFT
- User LEDs / pushbuttons
- 20-pin 2.54 mm EXP header
- Breakout pads for Wireless SoC I/O
- CR2032 coin cell battery support



xG28-PK6025A

Kit Contents

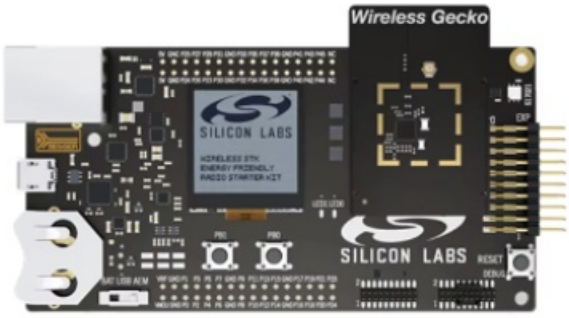
- 1x BRD4002A Wireless Starter Kit Mainboard
- 1x xG28-RB440xB 915 MHz dBm radio board
- Sub-GHz Antenna
- 1x Flat cable
- 1x 2xAA Battery Holder

Protocol Support

- Wi-SUN
- Amazon Sidewalk
- Z-Wave
- Wireless M-BUS
- CONNECT
- Proprietary
- Bluetooth Low Energy

Kit Studio Features

- +20 dBm radio board based on the FG28 QFN68 wireless SoC
- SMA connector
- Advanced Energy Monitor
- Packet Trace Interface
- Virtual COM port
- SEGGER J-Link on-board debugger
- External device debugging
- Ethernet and USB connectivity
- Low power 128 x 128 pixel Memory LCDTFT
- User LEDs / pushbuttons
- 20-pin 2.54 mm EXP header
- Breakout pads for Wireless SoC I/O
- CR2032 coin cell battery support



ZWAVE-PK800B

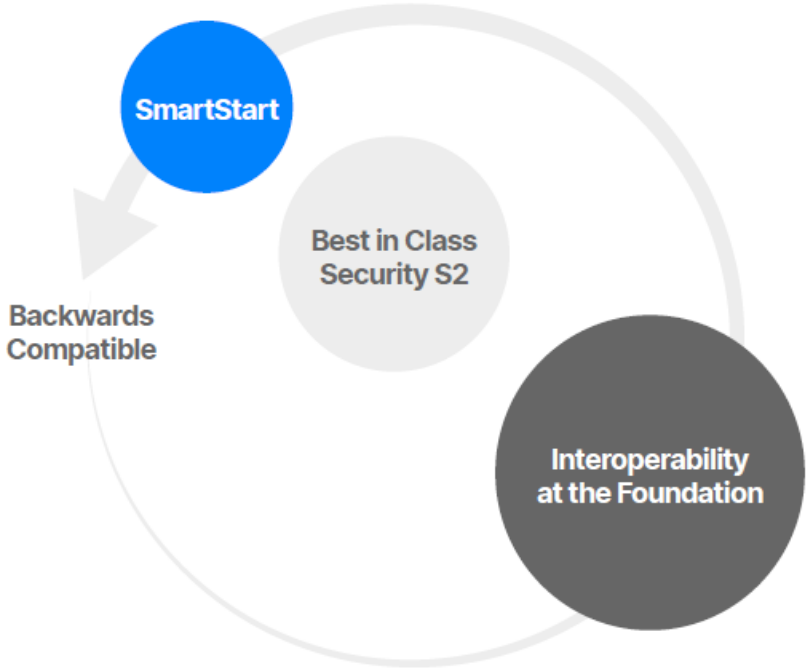
Kit Contents

- 2x BRD4002A Wireless Pro Kit Mainboard
- 1x BRD4204D EFR32ZG23 868-915 MHz 14 dBm Radio Board
- 1x BRD4205B ZGM230S Z-Wave SiP Module Radio Board
- 1x BRD2603A ZGM230 +14 dBm Dev Kit Board
- 2x BRD8029A Button and LEDs Expansion Board
- 3x 868-915MHz Antennas

Kit Studio Features

- Advanced Energy Monitor
- Packet Trace Interface
- Virtual COM port
- SEGGER J-Link on-board debugger
- External device debugging
- Ethernet and USB connectivity
- Silicon Labs Si7021 Relative Humidity and Temperature sensor
- Low power 128 x 128 pixel Memory LCDTFT
- User LEDs / pushbuttons
- 20-pin 2.54 mm EXP header
- Breakout pads for Module I/O
- CR2032 coin cell battery support

Z-Wave Security



S2 + Secure Vault

- S2 framework is part of the Z-Wave protocol security
- Secure Vault is Silicon Labs' additional security fearure

Support

- Out-of-band inclusion
- Elliptic Curve Diffie-Hellman key changes
- Strong AES 128 encryprtion
- Unique/nonce transmissions
- Isolated access control levels
- Secure multicast groups

Protection against

- Hacks and man-in-the-middle- attacks
- Inclusion of rogue nodes
- Deciphering of keys
- Sniff & replay and delay attacks

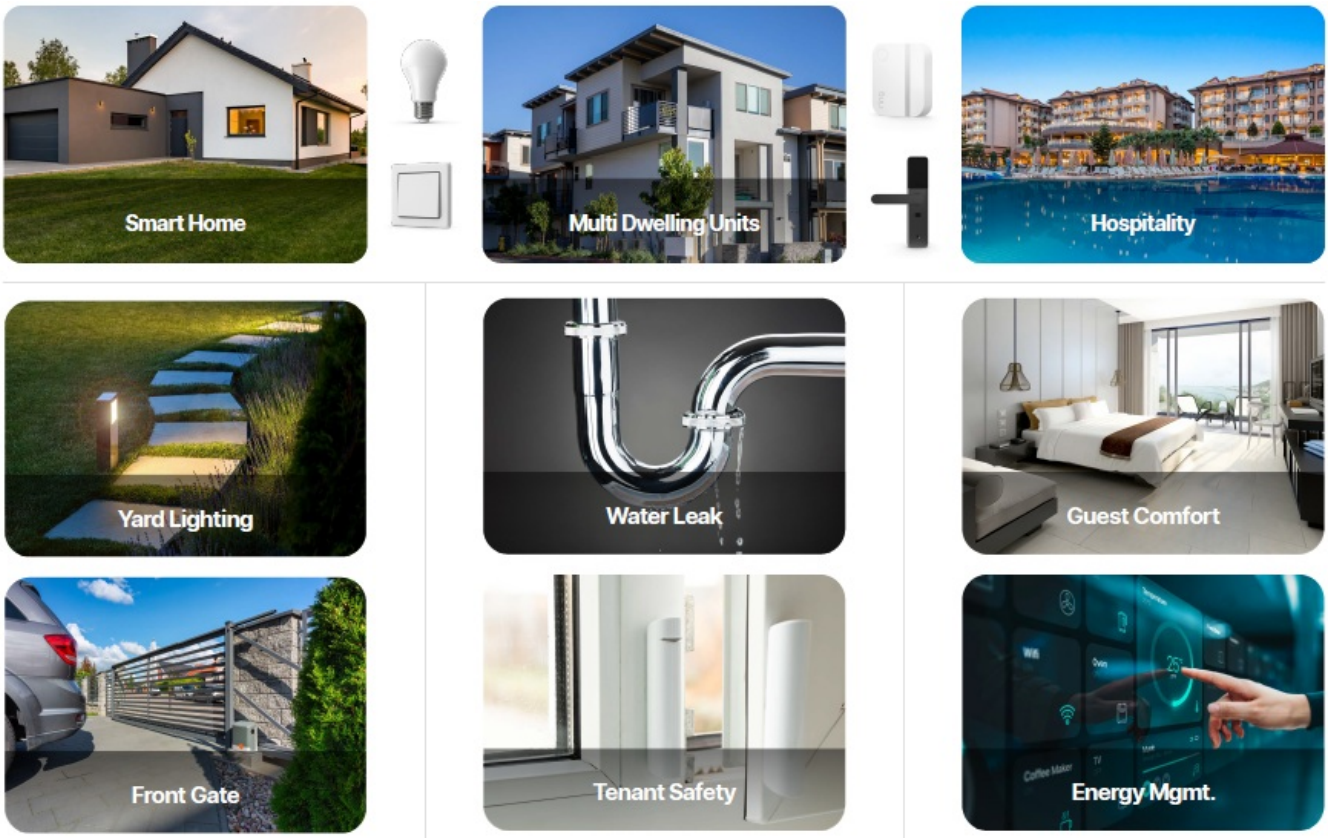
Interoperable

- Z-Wave Alliance-certified devices work seamlessly with devices from multiple vendors

Backward Compatible

- Z-Wave 800 series devices are backward compatible with Z-Wave 700 and 500 Series devices

Z-Wave Applications



About 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 products' reliability. We are the trusted partner for the worldleading consumer and industrial brands. Our customers develop solutions for a wide range of applications, from medical devices to smart lighting to building automation, and much more.
Silicon Labs (NASDAQ: SLAB) is a leader in secure, intelligent wireless technology for a more connected world. Our integrated hardware and software platform, intuitive development tools, thriving ecosystem, and robust support make us an ideal long-term partner in building advanced industrial, commercial, home and life applications. We make it easy for developers to solve complex wireless challenges throughout the product lifecycle and get to market quickly with innovative solutions that transform industries, grow economies, and improve lives. **silabs.com**

FAQ

- **Q: Can I use Z-Wave devices with different manufacturers together?**
  A: Yes, Z-Wave devices are designed to work seamlessly together, even if they are from different manufacturers, thanks to the emphasis on interoperability.
- **Q: How far can Z-Wave signals reach?**
  A: The range of Z-Wave signals can vary depending on the specific devices and environmental factors, but typically they can travel through walls and floors within a standard home.
- **Q: Do I need internet connection for Z-Wave devices to work?**
  A: No, Z-Wave devices communicate directly with each other through the network created by the hub or gateway, so they do not require internet connectivity to function.

Documents / Resources

	**SILICON LABS Z-Wave Hardware Selector** [pdf] User Guide Z-Wave Hardware Selector, Z-Wave, Hardware Selector, Selector

References

- **User Manual**