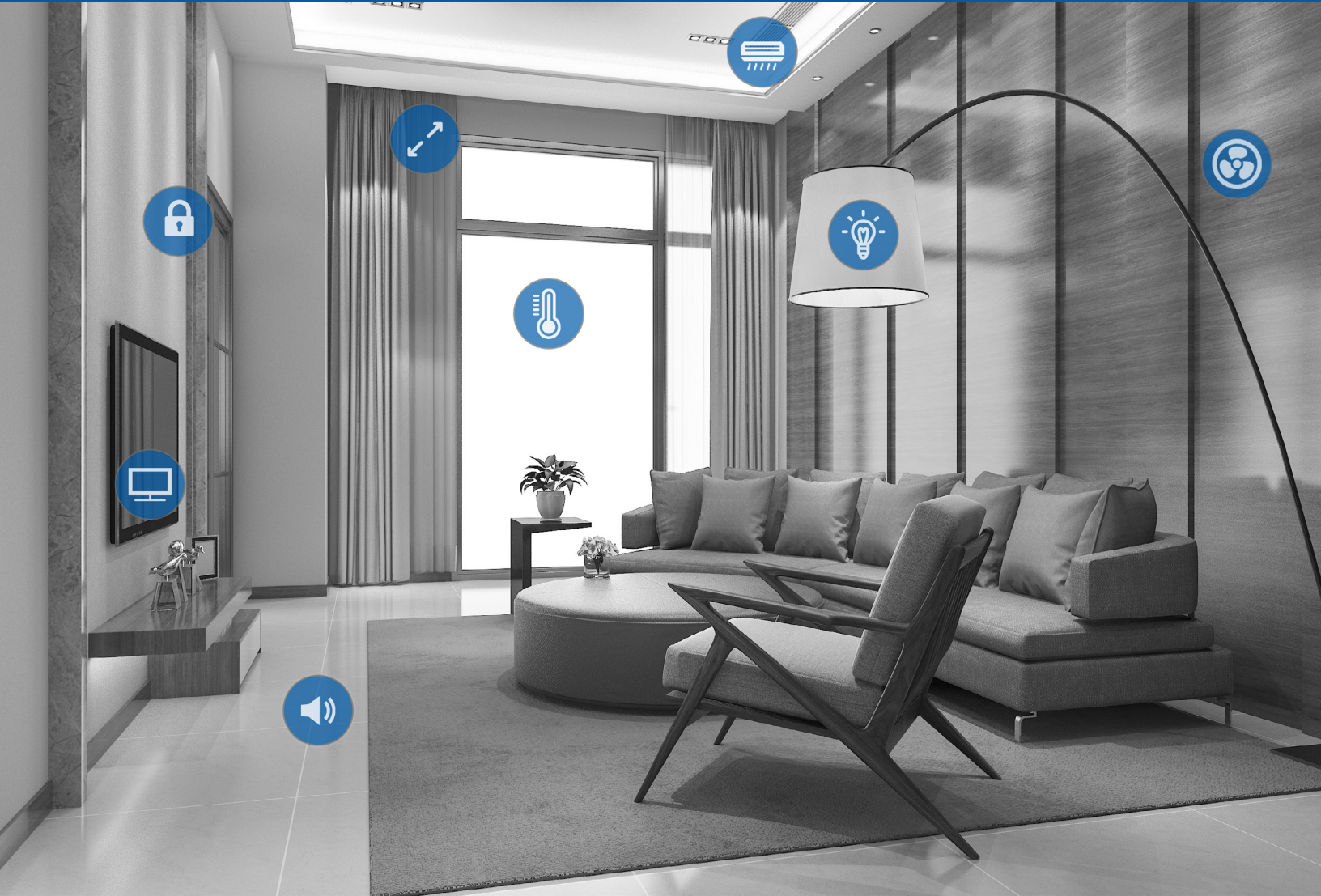


Connectivity Solutions for Smart Spaces





Connectivity: A Key Enabling Technology for Smart Spaces

Smart spaces are characterized by highly integrated technologies. Homes, buildings, education facilities, and commercial structures all are becoming sophisticated as more technologies are interconnected. They are being transformed by IoT technologies and are becoming smart spaces that optimize human comfort, energy footprint, and efficiency. Connectivity is a critical element underpinning IoT implementations for smart spaces.

A common challenge encountered in connecting devices is the diversity of connectivity technology. A fragmented supplier landscape for devices and software combined with inadequate adherence to standard connectivity protocols makes device connectivity complex. Without easy connectivity, productivity improvements, cost avoidance, and efficiency benefits from IoT implementations go un-fulfilled. Homeowners and enterprises can benefit from an effective connectivity strategy that simplifies data collection to derive operating insights.

Arrow and Silicon Labs have a proven track record of helping smart spaces solution makers drive successful outcomes. The combined portfolio of products, services, and expertise enables solution providers to efficiently build and deploy IoT solutions that make any space a “smart space”.

Wireless Protocols for Smart Spaces

Wireless communication protocols for smart spaces typically use one of six major categories — Bluetooth®, Zigbee®, Z-Wave, Thread, sub-GHz, and Wi-Fi®. Each protocol brings unique benefits and challenges depending on the end application. Choosing the right mix for your designs is an important part of the development process and requires informed trade-offs since no one protocol provides a universal one-size-fits-all solution.

Wireless technologies	Supports 2.4 GHZ	Standard Compliant Radio	Native IP Addressing	Interoperability	Suitable For
Bluetooth® and Bluetooth® Mesh	Yes	Yes	No	Yes	Audio and voice streaming, device-to-device data transfer, beacons and advertising, and mesh device networks
Zigbee®	Yes	Yes (802.15.4)	No	Yes	Mesh connected home networks with many devices. Device to device communication. Devices communicating to a gateway. Critical devices that must have the ability to self-heal (medical/industrial applications), and lighting
Z-Wave	Yes	No	No	Yes	Full Z-Wave ecosystems administered from central gateways, and home security applications
Thread	Yes	Yes (802.15.4)	Yes	Yes	Complex mesh networks with a multitude of devices that would benefit from individual IP addressability
Wi-Fi® g/n/ac	Yes	Yes (802.11)	Yes	Yes	High bandwidth home Internet networking (video cameras)
Sub-GHz	No	No	No	No	Narrowband transmitters long-range



Technologies, connectivity, and device ecosystems for smart spaces continue to evolve at a rapid pace. Security and privacy regulations are becoming key factors for adoption, and concerns related to data misuse need to be minimized. In this dynamic environment, engineers must:

- > Build future-proof systems that can adapt to new technologies while leveraging existing code base
- > Create open and interoperable architectures for easy integration of devices, data, and systems
- > Design cloud-based systems that provide data-driven insights
- > Incorporate security at all stages in the design



Wireless design is more than just hardware. A complete solution that includes silicon, software, security, and prototyping tools is crucial for design success.

Wireless Design Elements

Five elements constitute the core of any wireless development process – embedded software/firmware development, hardware design, application development, cloud engineering and remote management, and security implementation. All these elements must be well integrated and require deep expertise. It is not uncommon to see the wireless development process take up to a year to complete, with each stage posing unique hurdles to overcome.

Security at every stage (device, network, and data)



Firmware Development

- > Wireless software stacks
- > Embedded host and network co-processor design
- > Testing and quality assurance (QA)



Hardware Design

- > Size, power, range and bandwidth optimization
- > Board layout and antenna design
- > Certifications and regulatory needs



Application Development

- > Android and iOS development
- > Low-level wireless APIs
- > Integration with other systems





Cloud Engineering and Remote Management





- > Cloud connectivity frameworks
- > Over the air (OTA) updates
- > Data analytics and visualization

Silicon Labs: Proven Leader in Wireless Solutions for Smart Spaces

Silicon Labs is a proven partner for developers of smart devices and gateways, offering decades of wireless experience in Bluetooth®, Zigbee®, Thread, Z-Wave, Sub-GHz, and Wi-Fi® technologies. The wireless product portfolio comes with software and development tools that deliver secure, scalable, and reliable low-power products. With an interoperable and upgradable architecture, code reuse is maximized and future-proofing of devices is easier. Additionally, Silicon Labs has made securing connected products throughout their lifecycle a cornerstone of their approach.

Protocol Support	
Flexible and Secure Hardware	<ul style="list-style-type: none"> > Transceivers > Network co-processors > SoCs > Pre-certified modules
Development Tools	<ul style="list-style-type: none"> > Development boards > Real-time OS, drivers > Wireless stacks > Security frameworks > IDE, APIs for cloud and 3rd-party app integration
Ecosystem Partners	

Featured Silicon Labs Products for Smart Spaces

 <p>Bluetooth® Mesh and Bluetooth® 5.2</p> <ul style="list-style-type: none"> • EFR32BG22 • EFR32BG21 	 <p>Z-Wave</p> <ul style="list-style-type: none"> • ZGM130S 	 <p>Proprietary</p> <ul style="list-style-type: none"> • EFR32FG14 	 <p>Multi-protocol</p> <ul style="list-style-type: none"> • EFR32MG21
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EFR32BG22 Series 2 Bluetooth® Wireless SoC and Modules – Support Bluetooth® 5.1, 5.2 & Bluetooth® Mesh

EFR32BG22 (BG22) SoCs – Ideal for low-cost, high-volume applications

The ultra-low transmit and receive power and a high-performance, low-power Arm® Cortex®-M33 core delivers industry-leading energy efficiency that can extend coin cell battery life up to ten years. Asset tracking tags, beacons, and indoor navigation also benefit from the SoCs' versatile Bluetooth® Angle of Arrival (AoA) and Angle of Departure (AoD) capabilities and sub-one-meter location accuracy.

Features of EFR32BG22 SoCs and Modules

- > Low power wireless SoC: 4.1 mA TX at 0 dBm, 3.6 mA RX)
- > 32-bit 76.8 MHz Arm® Cortex®-M33 with DSP instruction and floating-point unit
- > Up to 512 kB flash program memory
- > Up to 32 kB RAM data memory
- > Security: AES-128 AES-256 ECC SHA-1 SHA-2
- > Maximum output power: -28 to 0 dBm (SoC) and -28 to 06 dBm (Module)
- > Regulatory certifications: for modules FCC, CE, IC/ISED, MIC/TELECOM, KCC
- > Packages
 - SoCs: QFN40 5 mm × 5 mm × 0.85 mm, QFN32 4 mm × 4 mm × 0.85 mm, TQFN32 4 mm × 4 mm × 0.30 mm
 - Modules: 12.9 mm x 15.0 mm x 2.2 mm, 6 mm × 6 mm × 1.1 mm
- > Operating voltage: 1.71 V to 3.8 V (SoC) and 1.8 V to 3.8 V (modules)
- > Operating temperature: -40 °C to 125 °C (SoCs) and -40 °C to +105 °C (modules)

EFR32BG22 (BG22) Modules – Ideal for fast time to market needs

Based on the EFR32BG22 SoC, BGM220 is a complete solution that comes with fully upgradeable, robust software stacks, world-wide regulatory certifications, advanced development and debugging tools, and support to help accelerate time-to-market. Available in multiple packages, PCB, or ultra-compact SiP.



EFR32BG22 SoC



EFR32BG22 Module (BGM220)



Getting Started

SLWSTK602 1A EFR32×G22 Wireless Gecko Starter Kit

This WSTK includes two +6 dBm radio boards that are complete reference designs for EFR32×G22 Wireless SoCs, with matching network and PCB antennas for +6 dBm output power in the 2.4 GHz band. It also contains an onboard J-Link debugger with a packet trace interface and a virtual COM port, enabling application development and debugging of the attached radio board as well as external hardware.



Part #: [SLWSTK602 1A](#)

SLWSTK6103A BGM220 Bluetooth® Module Wireless Starter Kit (WSTK)

This WSTK includes two radio boards that are complete reference designs for BGM220 modules: 1× SLWRB43 1 1A (BGM220P) and 1× SLWRB43 1 0A (BGM220S). The WSTK mainboard contains an on-board J-Link debugger with a packet trace interface and a virtual COM port, enabling application development and debugging with the attached radio board as well as external hardware.



Part #: [SLWSTK6103A](#)

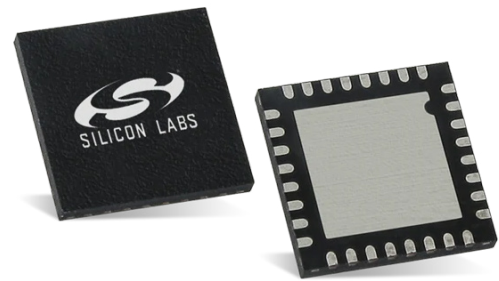
For More Information:
arrow.com/bg22

Blue Gecko Series 2 (EFR32BG21) Bluetooth® Wireless SoCs

The EFR32BG21 devices are 2.4 GHz wireless SoCs optimized for line-powered Bluetooth® Low Energy and Bluetooth® mesh applications, including connected lighting, smart plugs, gateways, and voice assistants. An 80 MHz Arm® Cortex®-M33 core provides plenty of processing capability while a dedicated security core provides faster encryption, secure boot loading, and debug access control. The EFR32BG21B devices are also designed to support Silicon Labs' enhanced security option, [Secure Vault](#).

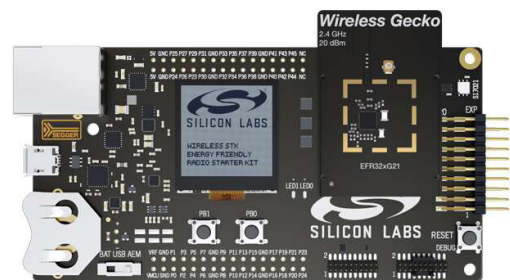
Features

- > Processor: 32-bit 80 MHz Arm® Cortex®-M33 with DSP instruction and floating-point unit
- > Power consumption: 8.8 mA RX current at 2.4 GHz (1 Mbps GFSK)
- > Up to 1024 kB flash program memory
- > Up to 96 kB RAM data memory
- > Security: AES (128/192/256), SHA-1, SHA-2 (SHA-224/SHA256), ECC (256-bit), ECDSA (256-bit) and ECDH (p192, p256), HMAC, J-PAKE
- > Package: QFN32 (4 mm x 4 mm)
- > Operating voltage: 1.71 to 3.8 V single power supply
- > Operating temperature: -40 to 125 °C ambient



EFR32xG21 Wireless Gecko Starter Kit

The EFR32xG21 wireless starter kit supports Bluetooth®, Zigbee®, Thread, and Multiprotocol Zigbee®/Bluetooth® software stacks. Silicon Labs software provides one-click access to design tools, documentation, software, and support resources and comes with precompiled demos, application notes, and examples. Advanced tools including energy profiling and network analysis optimize wireless systems.



Starter Kit
Part #: [SLWSTK6006A](#)

Mighty Gecko Series 2 (EFR32MG21) Multiprotocol Wireless SoC

EFR32MG21 devices bring high performance, low power and secure solutions to the IoT. Designed to increase processing capability, improve RF performance and lower active current, EFR32MG21 devices are 2.4 GHz wireless SoCs optimized for line-powered Zigbee®, Thread and Bluetooth mesh applications, including connected lighting, gateways, voice assistants and smart metering. The EFR32MG21 family of SoCs includes an integrated security subsystem and devices that can take advantage of Secure Vault technologies.

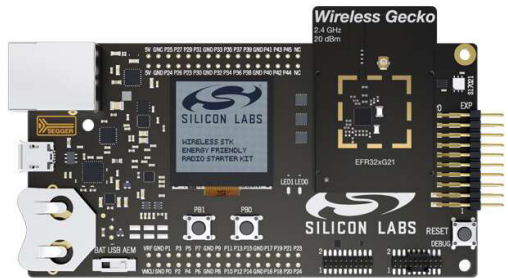
Features

- > Protocol support: Bluetooth® Low Energy (Bluetooth® 5), Zigbee®, Thread
- > Power consumption: 8.8 mA RX current at 2.4 GHz (1 Mbps GFSK)
- > High performance 32-bit 80 MHz Arm® Cortex®-M33 with DSP instruction and floating-point unit
- > Up to 1024 kB flash program memory
- > Up to 96 kB RAM data memory
- > Security: AES (128/192/256), SHA-1, SHA-2 (SHA-224/SHA256), ECC (256-bit), ECDSA (256-bit) and ECDH (p192, p256), HMAC, J-PAKE
- > Package: QFN32 (4 mm x 4 mm)
- > Operating voltage: 1.71 to 3.8 V single power supply
- > Operating temperature: -40 to 125 °C ambient



EFR32xG21 Wireless Gecko Starter Kit

The EFR32xG21 Wireless Starter Kit supports Bluetooth®, Zigbee®, Thread, and Multiprotocol Zigbee®/Bluetooth® software stacks. Silicon Labs software provides one-click access to design tools, documentation, software, and support resources and comes with precompiled demos, application notes, and examples. Advanced tools including energy profiling and network analysis optimize wireless systems.



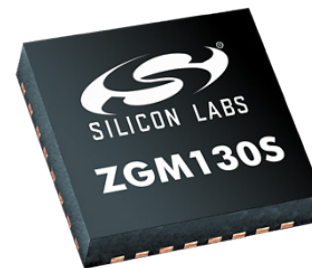
Starter Kit
Part #: [SLWSTK6006A](#)

ZGM130S: Z-Wave 700 Series Modules

This fully integrated Z-Wave module enables rapid development of Z-Wave solutions. Built with low-power Gecko technology, which includes innovative low energy techniques, fast wake-up times, and energy saving modes, the ZGM130S reduces overall power consumption and maximizes battery life. The module contains a native security stack and a comprehensive set of hardware peripherals offering advanced device functionality.

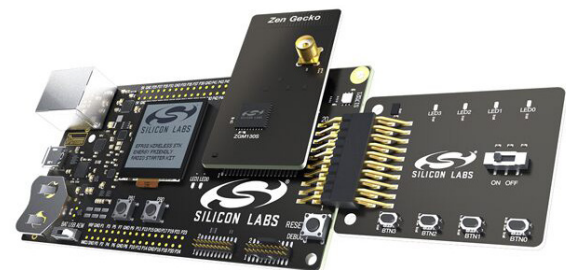
Features

- > Power consumption: 9.8 mA RX current at 100 kbps, GFSK, 868 MHz
- > High performance 32-bit, 39 MHz Arm® Cortex®-M4 with DSP instruction and floating-point unit
- > Embedded Trace Macrocell (ETM) for advanced debugging
- > 512 kB flash program memory (64 kB available for user applications)
- > 64 kB RAM data memory (8kB available for user applications)
- > TX power up to 13 dBm
- > Security: AES 128/256, SHA-1, SHA-2 (SHA-224 and SHA-256) and ECC
- > Package: LGA64 (9 mm x 9 mm)
- > Operating voltage: 1.8 V to 3.8 V single power supply
- > Operating temperature: -40 °C to 85 °C



Z-Wave 700 Starter Kit

The Z-Wave 700 wireless starter kit includes the Z-Wave software stack, sample code, and integrated debug adapter. A single worldwide development kit for both end devices and gateways with multiple radio boards enable developers to create a mesh network and evaluate the Z-Wave 700 module. With the supporting Simplicity Studio suite of tools, developers can accelerate their wireless application development; mesh networking debug and Z-Wave protocol sniffer tools for analysis; and visual energy profiling and optimization.



Starter Kit
Part #: [SLWSTK6050A](#)

Flex Gecko FG14 Proprietary Protocol SOCs

EFR32FG14 wireless solutions combine an energy-friendly microcontroller (MCU) with a highly integrated radio transceiver supporting 2.4 GHz and Sub-GHz proprietary wireless protocols. Ideal for proprietary modulation schemes including OOK, shaped FSK, shaped OQPSK, DSSS modulation techniques, and FEC, the single-die solution provides energy efficiency, ultra-fast wakeup times, a scalable power amplifier, and an integrated balun. The devices are well suited for any battery-operated application as well as other systems requiring high performance and low energy consumption.

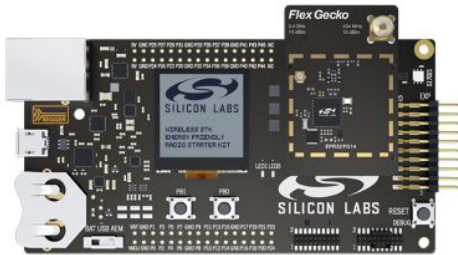
Features

- > Power consumption: 8.4 mA RX current at 38.4 kbps, GFSK, 169 MHz
- > 32-bit 40 MHz Arm® Cortex®-M4 with DSP instruction and floating-point unit
- > Up to 256 kB flash program memory
- > Up to 32 kB RAM data memory
- > Security: AES (128/192/256), SHA-1, SHA-2 (SHA-224/SHA256), ECC (256-bit), ECDSA (256-bit) and ECDH (p192, p256), HMAC, J-PAKE
- > Package: QFN32 5x5 mm, QFN48 7x7 mm
- > Operating voltage: 1.8 V to 3.8 V single power supply
- > Operating temperature: Standard (-40 °C to 85 °C) and extended (-40 °C to 125 °C) temperature grades available

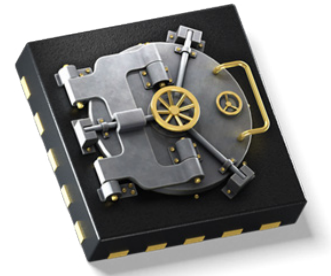


Silicon Labs EFR32 Flex Gecko Wireless Starter Kits

Silicon Labs EFR32 Flex Gecko wireless starter kits offer an ideal starting point to become familiar with EFR32FG Flex Gecko System-on-Chips (SOCs). The wireless starter kits include a mainboard which features an on-board J-Link debugger with a packet trace interface and a virtual COM port. Radio Boards, each including a specific SoC, can be interfaced with the mainboard, allowing application development and debugging. The mainboard also contains sensors and peripherals for easy demonstration of some of the EFR32's many capabilities.



EFR32 Flex Gecko Starter Kits	Proprietary Sub-GHz
SLWSTK6060B	915 MHz
SLWSTK6061B	868 MHz
SLWSTK6062B	490 MHz
SLWSTK6063B	434 MHz
SLWSTK6065B	169 MHz



Security in IoT – Introducing Secure Vault

Securing connected devices is challenging. Threats are continuously evolving, and the demands on product developers to keep up can be burdensome – particularly in low-cost, resource-constrained IoT products. Protecting products in a connected world is imperative, as customer data and online business models are increasingly targeted in costly hacks that jeopardize end-user privacy and impact corporate brand image.

To address these security concerns, Silicon Labs launched Secure Vault, a security technology designed to address increasing threats and regulatory pressures arising from IoT connected devices. Only available with Silicon Labs, Secure Vault will be introduced with the newest generation of the EFR32×G21 devices. Secure Vault advances IoT security through a unique combination of hardware and software features that make it easier for product manufacturers to protect their brand, design, and consumer data.

Integrating a security system with the SoC helps designers simplify development and makes it possible to securely update connected devices over-the-air (OTA) throughout the product lifecycle. The delivery of genuine, trusted software or firmware to connected products mitigates unforeseen exploits, threats, and regulatory measures. The security subsystem, including a dedicated core, bus, and memory, is separate from the host processor. This unique design of hardware separation isolates critical features, into their own functional areas, making the overall device more secure. The new combination of security features is ideal for companies working to address emerging regulatory measures, such as GDPR in Europe and SB-327 in California.

Feature	Basic	+Root of Trust	+Secure Element	Secure Vault
True Random Number Generator	√	√	√	√
Crypto Engine	√	√	√	√
Secure Boot	√	√	√	√
Secure Boot with RTSL	—	√	√	√
Arm® TrustZone®	—	√	√	√
Secure Debug with Lock/Unlock	—	√	√	√
DPA Countermeasures	—	—	√	√
Anti-Tamper	—	—	—	√
Secure Attestation	—	—	—	√
Secure Key Management	—	—	—	√
Secure Key Storage	—	—	—	√
Advanced Crypto	—	—	—	√

Silicon Labs IoT Product Security

14 **Simplicity** Silicon 28.086 Studio 5



Simplicity Studio 5: Simplified Developer Experience

Simplicity Studio is the core development environment designed to support the Silicon Labs IoT portfolio of system-on-chips (SoCs) and modules. Simplicity Studio 5 focuses on developer experience and offers a more optimized and efficient workflow. Tools supported in Simplicity Studio 5 include:

- > Configuration utilities
- > Compiler
- > Error & validation
- > IDE & command line support
- > Graphical hardware configurator
- > Energy profiler – visual energy analysis
- > Network analyzer – packet capture and decode

Key feature upgrades over prior versions include:

- > Based on the latest versions of Eclipse and the C/C++ development tools. Benefits include added robustness, improved performance, and customization capabilities with plug-ins from the Eclipse Marketplace
- > Supports SecureVault, a new suite of state-of-the-art security features designed to help future proof IoT devices against escalating threats and regulatory pressures
- > Features a new UI engine for modern, responsive, and web-like user interfaces
- > Designed with an optimized workflow that produces quicker project progression and device configuration

[Learn More About Simplicity 5](#)

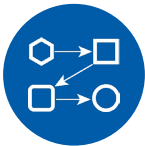
Arrow Engineering Services for Smart Spaces

Arrow brings core competencies in hardware design, cloud integration, and cloud operations to help deliver seamless user experiences by integrating the best of breed technologies. OEMs with comprehensive connected home solutions, service companies, and point-solution providers will all benefit from the Arrow offerings.



Innovate: Convert ideas to industry-first products

- > Ideation/design thinking
- > Hardware implementation
- > Design and validation
- > Prototype and testing
- > Software, application and cloud implementation
- > Certification services



Transform: Stay relevant. Be nimble.

- > Adding connected capabilities to existing products
- > Implementing new business models
- > Modernizing processes
- > Cloud migration
- > Legacy modernization



Scale: Be competitive in the global market

- > Remote device management
- > CloudOps and DevOps
- > Manufacturing
- > Supply chain services
- > Order management
- > Fulfillment
- > Logistics
- > Support services

Arrow Competencies in Smart Spaces

Smart spaces solution providers can procure the entire technology stack from silicon, to services, to software from Arrow. With a wide partner ecosystem and service offerings that span product development to deployment, Arrow can help concepts get to market rapidly and cost-effectively.

Our competencies in the following areas help you build innovative products:

- Sensing
- Connectivity
- Artificial intelligence and machine learning
- Cloud-based product deployments
- Monitoring and remote management
- Security implementations



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