



# Series 2: BG22 Bluetooth® SoCs and Modules

NEXT GENERATION IOT WIRELESS CONNECTIVITY



# The Leader in IoT Wireless Connectivity



>35,000  
CUSTOMERS

>3B  
PRODUCTS  
SHIPPED

#1  
IoT WIRELESS  
SOLUTIONS

20-30%  
WIRELESS  
Y-Y CAGR\*



\*Across 15.4, BLE, Wi-Fi, Proprietary

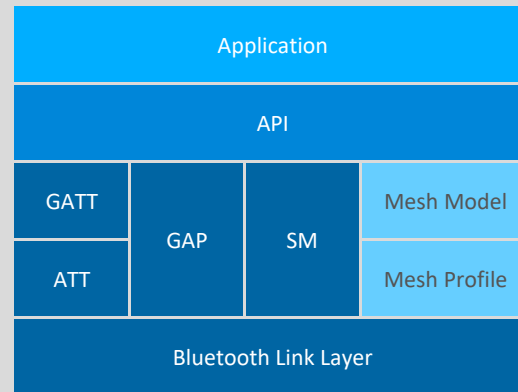
# A Complete Solution for Enabling Bluetooth Products

## SoCS AND MODULES



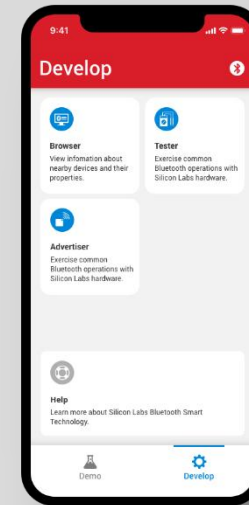
Industry leading Bluetooth 5.1 and 5.2 SoCs and pre-certified modules

## STACK SOFTWARE



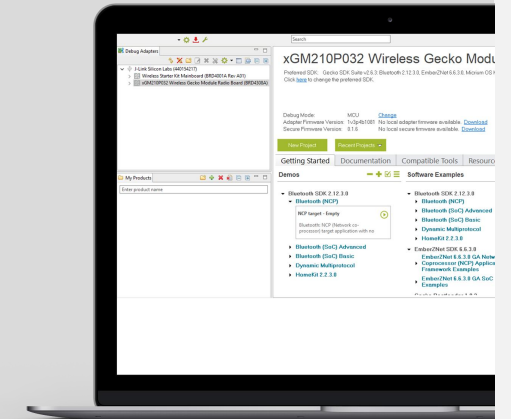
In-house developed stacks with latest Bluetooth 5.2 and mesh features

## MOBILE APPLICATIONS



Reference applications and source code for iOS and Android

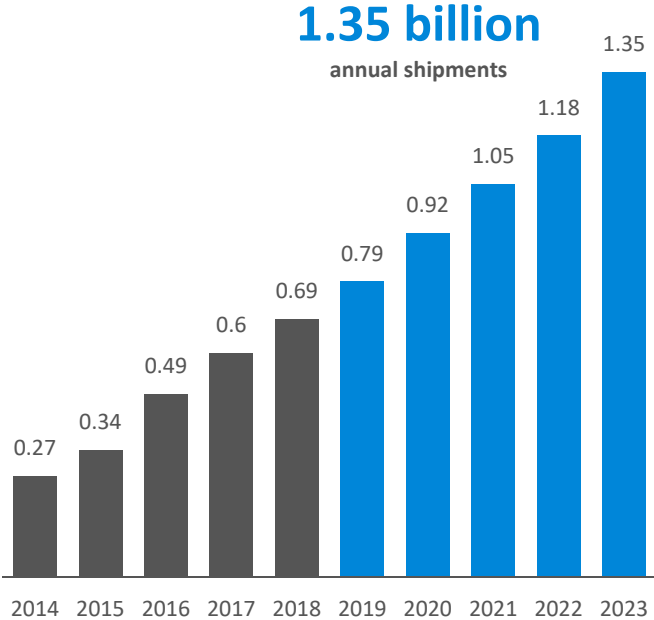
## DEVELOPMENT TOOLS



Free-of-charge development and protocol analysis tools to boost productivity

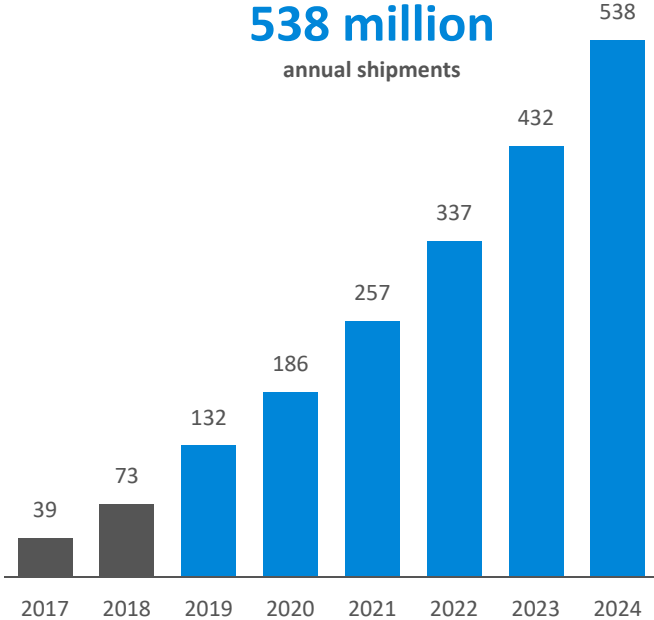
# The Bluetooth LE Opportunity

## DATA TRANSFER



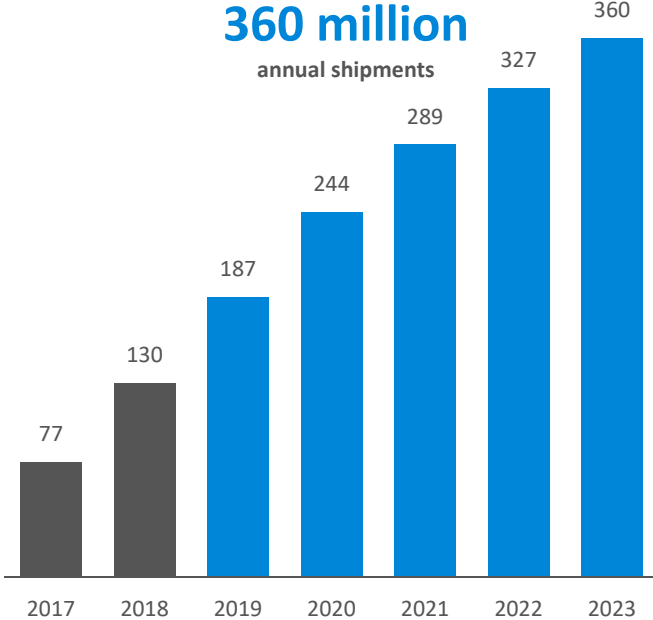
**14% CAGR**  
2018 – 2023

## LOCATION SERVICES



**32% CAGR**  
2019 – 2024

## MESH NETWORKING



**23% CAGR**  
2018 – 2023

Advanced RF | Fast data transfer | High-volume optimized | 10-year battery life | Sub meter accuracy | Secure

# Extending Battery Life in Bluetooth Applications



## Location Services

Advertising 10 bytes every 1000ms

TX at 0dBm and using 1 channel

**Average current: 3.7µA**



## Data Transfer

Connected to a phone at 2000ms interval

Using 2M PHY and transmitting 10 Byte / packet

**Average current: 4.0µA**

5+ years on CR2032

10+ years on a CR2354

# BG22: Optimized Battery Powered Bluetooth LE

# Optimized



## Secure Bluetooth 5.2 SoCs for High-Volume Products

### Radio

Bluetooth 5.2  
+6 dBm TX  
-106.7 dBm RX (125Kbps)  
AoA & AoD

### Ultra-Low Power

3.5 mA TX (radio)  
2.6 mA RX (radio)  
1.4  $\mu$ A EM2 with 32 kB RAM  
0.5  $\mu$ A w/ RTC in EM4

### World Class Software

Bluetooth 5.2  
Bluetooth mesh LPN  
Direction Finding  
Apple HomeKit

### Compact Size

5x5 QFN40 (26 GPIO)  
4x4 QFN32 (18 GPIO)  
4x4 TQFN32 (18 GPIO)

### ARM Cortex-M33 with TrustZone

76.8 MHz  
FPU and DSP  
352/512 kB of flash  
32kB RAM

### Peripherals Fit for Purpose

2x USART, 2x I2C, 2x PDM and GPIO  
12-bit ADC (16 channels)  
Built-in temperature sensor with +/- 1.5  $^{\circ}$ C  
32 kHz, 500ppm PLFRCO eliminates crystal

### Security

AES128/256, SHA-1, SHA-2 (256-bit)  
ECC (up to 256-bit), ECDSA and ECDH  
True Random Number Generator (TRNG)  
Secure boot with RTSL  
Secure debug with lock/unlock

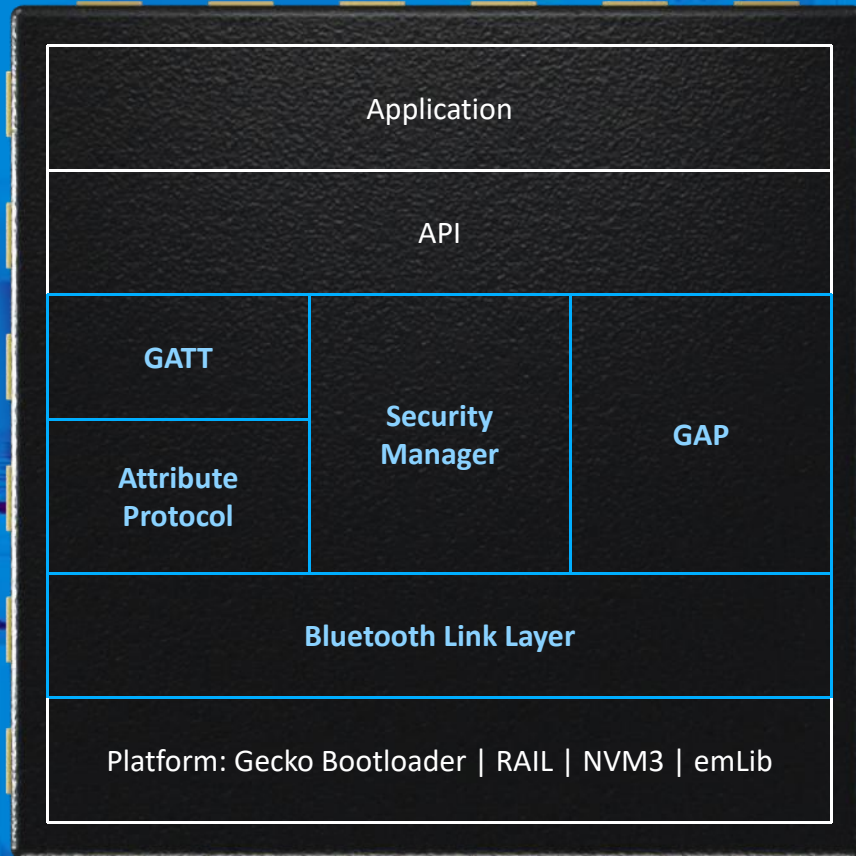
# Securing Bluetooth Products with BG22



- **Hardware Accelerated Crypto**
  - Faster, more energy efficient and secure than software
- **True Random Number Generator (TRNG)**
  - Compliant with NIST SP800-90 and AIS-31
- **Secure Boot with Root of Trust and Secure Loader (RTSL)**
  - Prevents malware injection and rollback
  - Ensures authentic firmware execution and OTA updates
- **Secure Debug with Lock/Unlock**
  - Allows authenticated access for enhanced Failure Analysis (FA)
- **ARM Cortex M33 Core with TrustZone**
  - Provides cost effective hardware isolation

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

# Bluetooth LE Software



## A Bluetooth 5.2 compliant Bluetooth stack, with:

- Bluetooth 5.2 dynamic TX power control
- Bluetooth 5.1 Direction Finding
- Bluetooth 5.0 standard features
- Relevant Bluetooth 4.x features

## Packed with advanced functionality

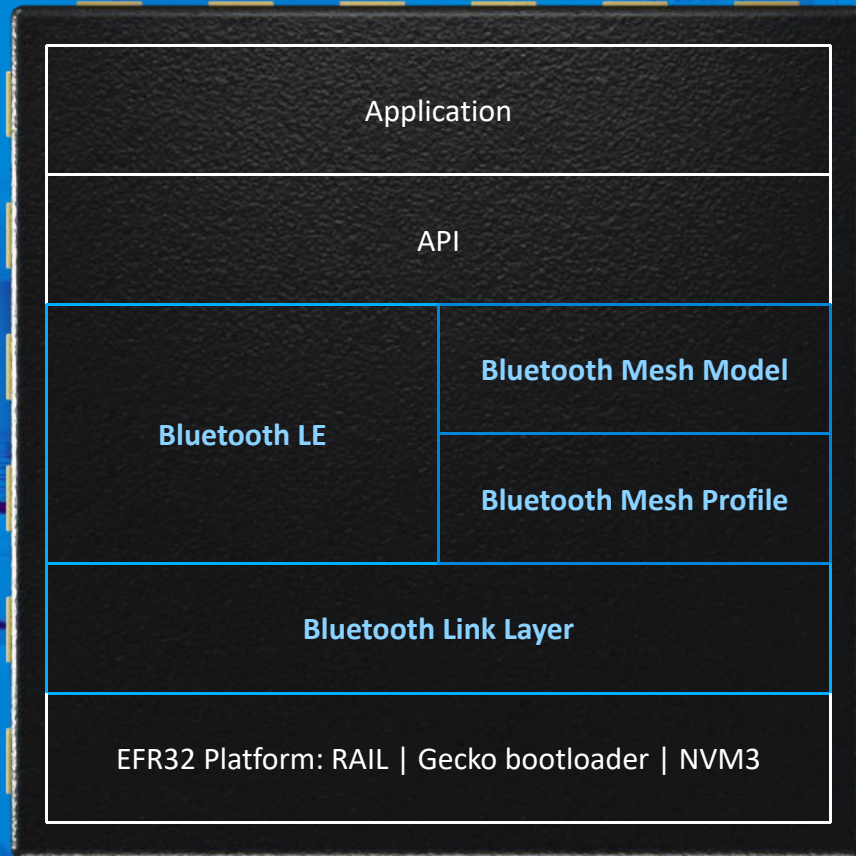
- Multiple connections and advertisers
- Concurrent advertising, scanning and LE connections
- Optimized throughput and power consumption

## Built on top of the common EFR32 software platform

- Gecko bootloader
- emLib for MCU peripherals and drivers
- NVM3 key/value pair data storage with wear leveling
- RAIL radio driver



# Bluetooth Mesh Software



## A feature complete Bluetooth mesh profile, supporting:

- Proxy, relaying and friend nodes
- Bluetooth mesh low power nodes (LPN)
- Low latency communications down to 10ms per hop
- Large network support up to 4096 nodes

## A comprehensive Mesh Model application layer, with:

- Basic lighting models for On/Off, Dimming & color temperature level (CTL)
- ALS and occupancy based lighting for commercial
- Generic, Sensor and Vendor models

## Bluetooth LE support includes

- Beaconing for indoor positioning systems
- Scanning for asset tracking
- Phone connectivity
- Energy harvesting light switches

## BG22 supports Bluetooth mesh LPN

- BG21 is the solution for mains powered relaying nodes

# It's More Than Just a Bluetooth Stack...



## Secure Over-the-Air Updates

- Helps you to easily implement secure in-field software updates

## Network Co-Processor Mode

- Run applications on a separate MCU and use EFR32 as a Bluetooth co-processor

## Direction Finding

- Direction Finding library converts raw IQ data to reliable azimuth and elevation data

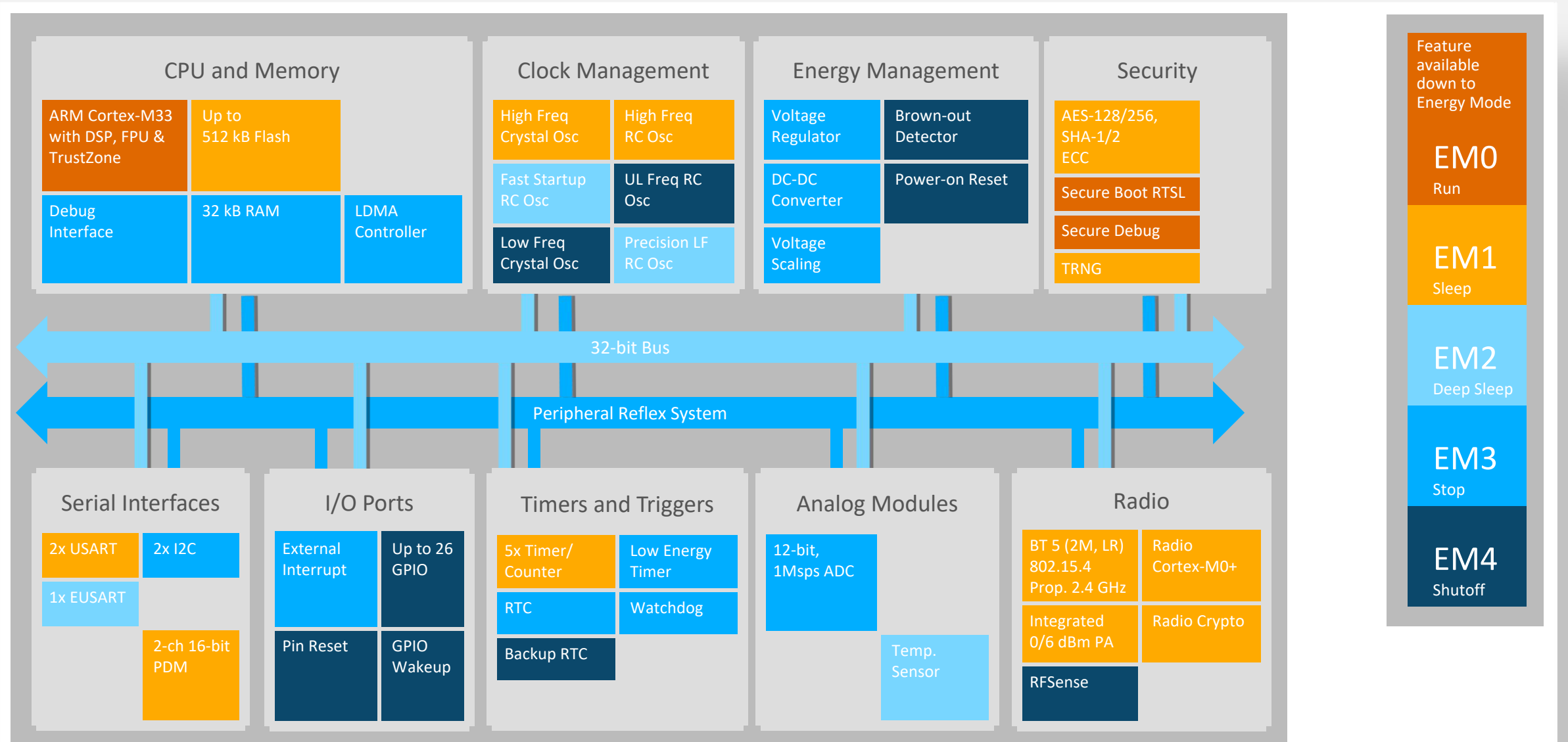
## Wi-Fi Co-Existence

- Wi-Fi co-ex scheme significantly improves performance in co-located radio designs

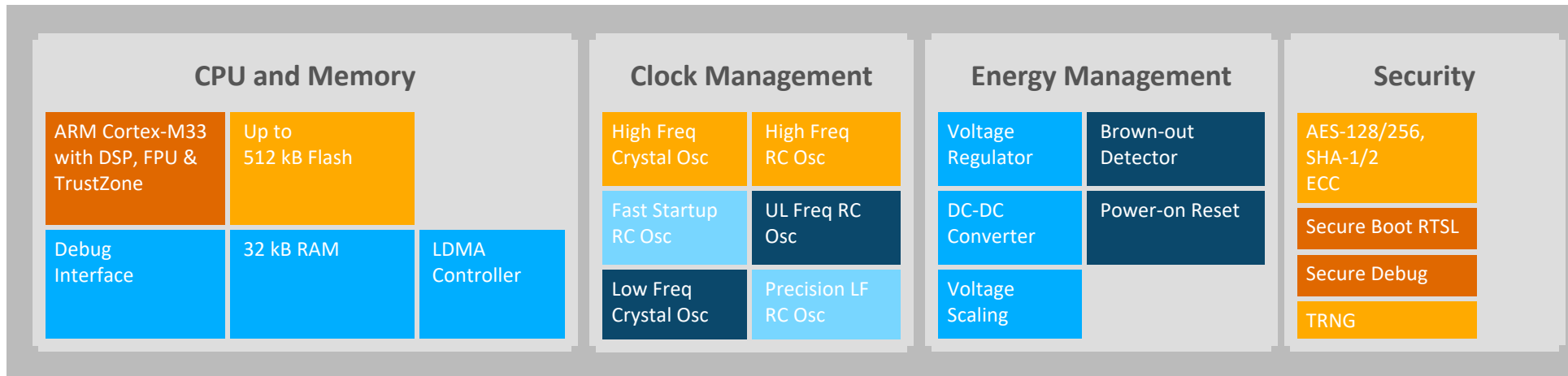
## Apple® Homekit

- Build Apple HomeKit ecosystem compliant Bluetooth smart home devices

# BG22 Block Diagram



# BG22 Product Highlights

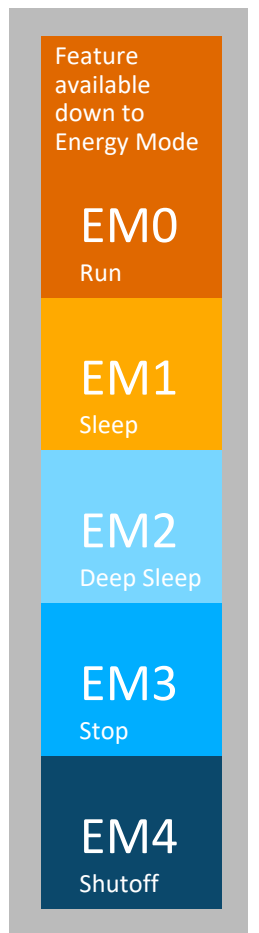


- ARM Cortex-M33 @ 76.8 MHz
  - DSP Extensions and FPU
  - 1.50 Dhrystone MIPS/MHz
  - ARM TrustZone
- LDMA
- ETM and SWD
- 32 kB RAM
- Up to 512 kB Flash

- 38.4MHz external HFXO
- Built-in 32kHz, 500ppm PLFRCO eliminates crystal

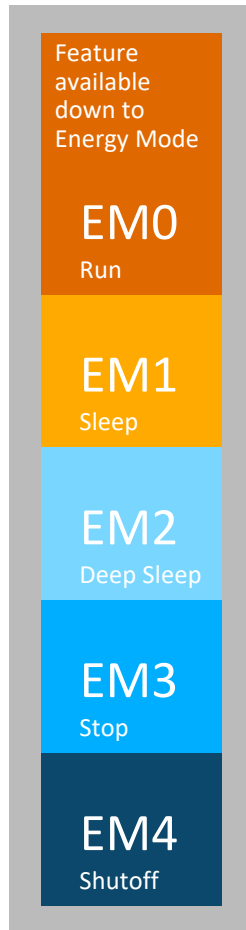
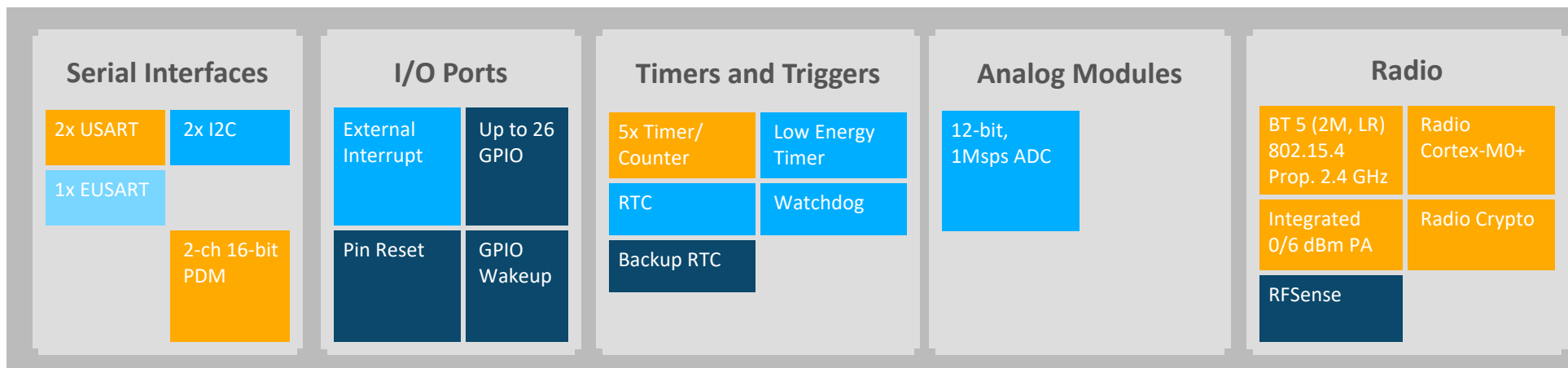
- 1.71 to 3.8V supply voltage
- DC-DC for on-chip circuits
- Brown-Out Detection
- Power on Reset

- AES128/256
- SHA-1/2
- ECC, ECDSA and ECDH
- NIST SP800-90 and AIS-31 compliant TRNG
- Secure boot with RTSL
- Secure Debug with Lock/Unlock
- Secure OTA



# BG22 Product Highlights

- 2x USART (UART, I2S, IrDA, ISO7816)
  - 1x EUSART
  - 2x I2C with SMBus
  - 2x 16-bit PDM
  - Up to 26x GPIO
- Package options**
- QFN40: 5x5mm, 26x I/O
  - QFN/TQFN32: 4x4mm, 18x I/O
  - Up to +125°C
- 4x 16-bit Timer/Counter
  - 1x 32-bit Timer/Counter
  - 1x 32-bit Real Time Counter
  - 1x 24-bit Low Energy Timer
  - 1x Watchdog Timer
- 12-bit, 1Msps SAR
  - Built-in +/- 1.5C temperature sensor
- Bluetooth 5.2
    - 1M, 2M, 500k and 125k PHYs
    - IQ sampling for AoA/D
    - Up to +6 dBm TX
    - 99 dBm RX (1M)
    - 96 dBm RX (2M)
    - 106.7 dBm RX (125k)
    - RFSense
    - Dedicated M0+ and crypto



# Selecting a BG22 Device

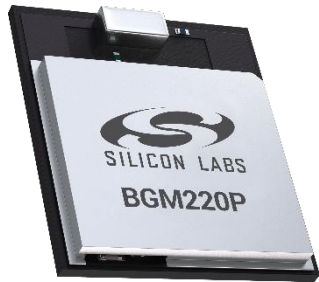
	BG22C112	BG22C222	BG22C224
<b>Use cases</b>	High-volume, consumer	Better RF, more GPIO	Advanced features, higher temp rating
<b>Bluetooth features</b>	1M and 2M PHYs AoA TX	1M and 2M PHYs AoA TX	1M and 2M PHYs 125k and 500k LE Coded PHYs Bluetooth mesh LPN IQ sampling for AoA
<b>Max TX power</b>	0 dBm	6 dBm	6 dBm
<b>RAM</b>	32 kB	32 kB	32 kB
<b>Flash</b>	352 kB	352 kB	512 kB
<b>Max Temperature</b>	-40 to +85°C	-40 to +85°C	-40 to +85°C ( <b>G</b> OPNs) -40 to +125°C ( <b>I</b> OPNs)
<b>Max GPIO</b>	18	26	26
<b>Package options</b>	4x4 QFN32	4x4 QFN32 4x4 TQFN32 5x5 QFN40	4x4 QFN32 4x4 TQFN32 5x5 QFN40

# Silicon Labs' Bluetooth SoC Families



	Series 1 - BG13	Series 2 - BG21	Series 2 - BG22
<b>Target applications</b>	General purpose Bluetooth LE and mesh	Mains powered Bluetooth LE and mesh	Lowest power Bluetooth LE, Direction Finding and Bluetooth mesh LPNs
<b>Bluetooth features</b>	5.1 and mesh 1.0 (1M, 2M, LE Coded PHYs and AE)	5.1 and mesh 1.0 (1M, 2M, LE Coded PHYs and AE)	5.2 and Bluetooth mesh LPN (1M, 2M, LE Coded PHYs, AE and AoA/D)
<b>Proprietary 2.4G</b>	2/4(G)FSK, OQPSK/(G)MSK, DSSS, BPSK/DBPSK TX, OOK/ASK	N/A	2/4(G)FSK, (G)MSK, OQPSK, DSSS
<b>TX / RX (1M, GFSK)</b>	+19 dBm / -95.8 dBm	+20 dBm / -97.5 dBm	+6 dBm / -99 dBm
<b>TX Current (0 dBm)</b>	9.5 mA	9.3 mA	4.1 mA* 8.2 mA (6 dBm)*
<b>RX Current (1M, GFSK)</b>	9.5 mA	8.8 mA	3.6 mA
<b>CPU / Clock Speed</b>	Cortex M4 (38.4 MHz)	Cortex M33 (80 MHz)	Cortex M33 (up to 76.8 MHz) Cortex M0+ for radio
<b>Flash (kB)</b>	512	Up to 1024	Up to 512
<b>RAM (kB)</b>	64	Up to 96	32
<b>Sleep Current (EM2)</b>	1.3 µA (16 kB RAM)	4.5 µA (16 RAM)	1.21 µA (8 kB RAM) - 1.4 µA (32 kB RAM)
<b>Active Current (EM0)</b>	87 µA/MHz	63.8 µA/MHz	25 µA/MHz
<b>Security</b>	2x AES-128/256, ECC, SHA-1/224/256, TRNG	AES-128/256, SHA-1/2 ECC, ECDSA and TRNG DPA countermeasures Secure boot with RTSL Secure debug with debug lock/unlock	AES-128/256, SHA-1/2 ECC, ECDSA and TRNG Secure boot with RTSL Secure debug with debug lock/unlock
<b>Operating Voltage</b>	1.8V – 3.6V	1.8V – 3.8V	1.71V – 3.8V
<b>Packages (mm)</b>	7x7 QFN48, 5x5 QFN32	4x4 QFN32 (20x GPIO)	5x5 QFN40 (26x GPIO) 4x4 QFN32, TQFN32 (18x GPIO)

# BGM220: Ultra-Low-Power Bluetooth 5.2 Modules



**BGM220P**



**BGM220S**

**Description**

Bluetooth 5.2 PCB module

Bluetooth 5.2 SiP module

**Size**

13.0 x 15.0 x 2.2 mm

6 x 6 x 1.3 mm

## The World's Smallest Bluetooth SiP Module

- 10x Smaller SiP Than Competition
- Worldwide Certifications
- 10-year longevity guarantee
- Up to 105°C



# Selecting a BGM220 Module

	BGM220SC12WGA2	BGM220SC22WGA2	BGM220PC22WGA2	BGM220SC22HNA2	BGM220PC22HNA2
<b>Availability</b>	Q2 2020	Q3 2020	Q2 2020	Q3 2020	Q2 2020
<b>Bluetooth features</b>	1M and 2M PHYs AoA TX	1M and 2M PHYs AoA TX	1M and 2M PHYs AoA TX	1M and 2M PHYs 125k and 500k Coded PHYs Bluetooth mesh LPN IQ sampling for AoA/AoD	1M and 2M PHYs 125k and 500k Coded PHYs Bluetooth mesh LPN IQ sampling for AoA/AoD
<b>Max TX power</b>	+0 dBm	+6 dBm	+8 dBm	+6 dBm	+8 dBm
<b>Flash</b>	352 kB	352 kB	352 kB	512 kB	512 kB
<b>Max GPIO</b>	25	25	25	25	24
<b>Antenna</b>	Built-in or RF pin	Built-in or RF pin	Built-in	Built-in or RF pin	Built-in
<b>RF Shield</b>	No	Yes	Yes	Yes	Yes
<b>Sleep XTAL</b>	PLFRCO or external XTAL	PLFRCO or external XTAL	PLFRCO or external XTAL	PLFRCO or external XTAL	Built-in LFXO
<b>Regulatory cert.</b>	CE and <u>limited</u> FCC/ISED, Telec	CE, FCC/ISED, MIC and Telec	CE, FCC/ISED, MIC and Telec	CE, FCC/ISED, MIC and Telec	CE, FCC/ISED, MIC and Telec
<b>Max Temperature</b>	-40 to +85°C	-40 to +85°C	-40 to +85°C	-40 to +105°C	-40 to +105°C
<b>Package</b>	6x6 SIP	6x6 SIP	13x15 PCB	6x6 SIP	13x15 PCB

# Silicon Labs' Bluetooth Module Families



**BGM13P**



**BGM13S**



**BGM210P**



**BGM210L**



**BGM220P (Q2'20)**



**BGM220S (Q3'20)**

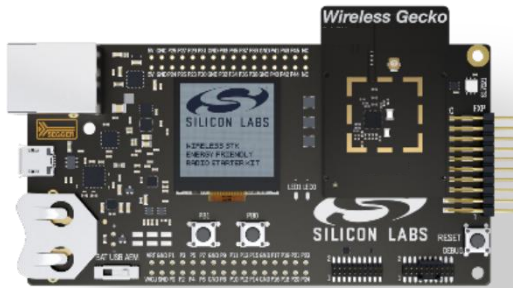
	BGM13P	BGM13S	BGM210P	BGM210L	BGM220P (Q2'20)	BGM220S (Q3'20)
<b>Protocols</b>	5.1 and mesh (1M, 2M, Coded PHY and AE)	5.1 and mesh (1M, 2M, Coded PHY and AE)	5.1 and mesh 1.0 (1M, 2M, Coded PHY and AE)	5.1 and mesh 1.0 (1M, 2M, Coded PHY and AE)	5.2 and mesh 1.0 LPN (1M, 2M, Coded PHY, AE and AoA/D)	5.2 and mesh 1.0 LPN (1M, 2M, Coded PHY, AE and AoA/D)
<b>EFR32 SoC</b>	BG13	BG13	BG21	BG21	BG22	BG22
<b>Antenna</b>	Built-in or U.FL	Built-in or RF pin	Built-in or RF pin	Built-in	Built-in	Built-in or RF pin
<b>Max TX power</b>	+8 / +19 dBm	+8 / +18 dBm	+10 / +20 dBm	+12.5 dBm	+8 dBm	+6 dBm
<b>Sensitivity (1M)</b>	-94.8 dBm	-94.1 dBm	-97 dBm	-97 dBm	-98 dBm	-98 dbm
<b>Flash (kB)</b>	512	512	1024	1024	512	512
<b>RAM (kB)</b>	64	64	96	96	32	32
<b>GPIO</b>	25	30	20	12	24,25	25
<b>Operating Voltage</b>	1.8V – 3.6V	1.8V – 3.6V	1.8 – 3.8V	1.8 – 3.8V	1.71V – 3.8V	1.71V – 3.8V
<b>Operating Temp.</b>	-40 to +85C	-40 to +85C	-40 to +125C	-40 to +125C	-40 to +105C	-40 to +105C
<b>Dimensions W x L x H (mm)</b>	13.0 x 15.0 x 2.2	6.5 x 6.5 x 1.4	13.0 x 15.0 x 2.2	13.0 x 15.0 x 2.2	13.0 x 15.0 x 2.2	6 x 6 x 1.3
<b>Certifications</b>	BT, CE, FCC, ISED, Japan, S-Korea and Taiwan	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	BT, CE, FCC, ISED, Japan & S-Korea



# Simplicity Studio 4

- **Simplicity Studio IDEs**
  - Free eclipse based IDE with code editing, compilation and debug for Windows, OSX and Linux
  - Pre-compiled demos, source code and documentation
- **Value-add tools include**
  - Graphical hardware configurator
  - Graphical Bluetooth GATT Editor
  - Energy Profiler – visual energy analysis
  - Network Analyzer – packet capture & decode
- **Example applications in source code**
  - Bluetooth 5 beaconing and connections
  - Bluetooth mesh light and switch
  - Voice capture
  - NCP and more
- **Compiler support**
  - GCC 7.2.1 or IAR 7.80.4

# Getting Started with BG22 SoCs



**BG22 SoC Starter Kit**  
SLWSTK6021A



**Thunderboard BG22**  
SLTB010A

**SLWSTK6021A**

1x WSTK main boards  
1x SLWRB4182A radio boards (QFN40)  
1x SLWRB4183A radio boards (QFN32)

---

**SLWRB4182A**

BG22 +6 dBm radio board (QFN40)

---

**SLWRB4183A**

BG22 +6 dBm radio board (QFN32)

---

**SLTB010A**

Thunderboard BG22 kit

# Getting Started with the BGM220 Modules

## BGM220 Bluetooth Module Starter Kit SLWSTK6103A



Wireless Starter Kit (WSTK) main board



BGM220P radio board  
SLWRB4311A

**SLWSTK6103A**

1x WSTK main boards  
1x SLWRB4310A radio boards (BGM220S)  
1x SLWRB4311A radio boards (BGM220P)

**SLWRB4310A**

BGM220S +0 dBm radio board

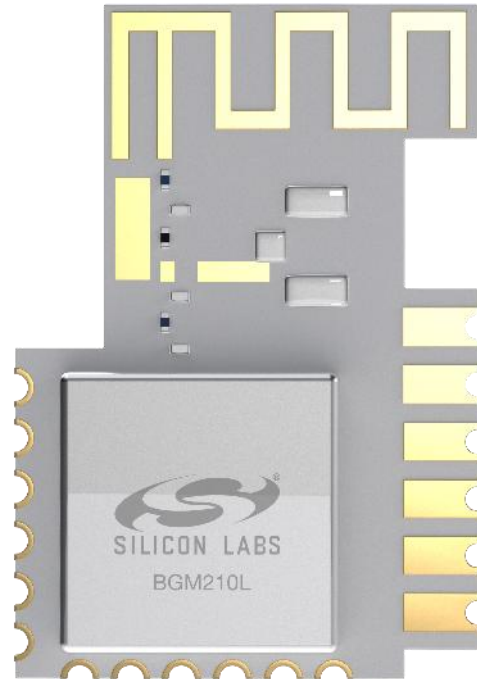
**SLWRB4311A**

BGM220P +8 dBm radio board



BGM220S radio board  
SLWRB4310A

# Silicon Labs: Advancing What's Possible in the IoT



- **Expertise:** 20+ years providing RF solutions with more than 1 billion deployed wireless nodes worldwide
- **Security:** Providing enhanced security features to help developers increase consumer trust in connected products
- **Platform:** Simplifying IoT product design with highly-integrated devices, reusable software and advanced development tools



Thank you!



# BG22 SoC Orderable Part Numbers (OPNs)

	Flash	RAM	I/O	Package	Max. TX Output Power	Max. Operating Temperature	Other
<b>EFR32BG22</b> C112F352GM32-C	352 kB	32 kB	18	QFN32	+0 dBm	-40°C to +85°C	-
<b>EFR32BG22</b> C222F352GM32-C	352 kB	32 kB	18	QFN32	+6 dBm	-40°C to +85°C	-
<b>EFR32BG22</b> C222F352GN32-C	352 kB	32 kB	18	TQFN32	+6 dBm	-40°C to +85°C	-
<b>EFR32BG22</b> C222F352GM40-C	352 kB	32 kB	26	QFN40	+6 dBm	-40°C to +85°C	-
<b>EFR32BG22</b> C224F512GM32-C	512 kB	32 kB	18	QFN32	+6 dBm	-40°C to +85°C	LE Coded PHY IQ sampling for AoA Bluetooth mesh LPN
<b>EFR32BG22</b> C224F512IM32-C	512 kB	32 kB	18	QFN32	+6 dBm	-40°C to +125°C	LE Coded PHY IQ sampling for AoA Bluetooth mesh LPN
<b>EFR32BG22</b> C224F512GM40-C	512 kB	32 kB	26	QFN40	+6 dBm	-40°C to +85°C	LE Coded PHY IQ sampling for AoA Bluetooth mesh LPN
<b>EFR32BG22</b> C224F512GN32-C	512 kB	32 kB	18	TQFN32	+6 dBm	-40°C to +85°C	LE Coded PHY IQ sampling for AoA Bluetooth mesh LPN
<b>EFR32BG22</b> C224F512IM40-C	512 kB	32 kB	26	QFN40	+6 dBm	-40°C to +125°C	LE Coded PHY IQ sampling for AoA Bluetooth mesh LPN



# Bluetooth LE – Supported Features by Device

Bluetooth version	Feature	BG22	BG21	BG13	BG12	BG1
Bluetooth 5.2	LE Audio (multiple subfeatures)					
	Dynamic TX power control	✓				
	Enhanced ATT					
Bluetooth 5.1	Direction Finding (AoA and AoD)	AoA TX/RX, AoD ready				
	GATT caching	✓	✓	✓	✓	✓
	Adv. Channel Index Change					
	Periodic Adv. Sync Transfer					
	Control Length Extension					
Bluetooth 5.0	Higher Output Power		✓	✓	✓	✓
	2M PHY	✓	✓	✓	✓	
	LE Long Range	✓	✓	✓		
	LE Advertising Extensions	✓	✓	✓	✓	
	LE Periodic Advertising	✓	✓	✓	✓	
	LE CSA#2	✓	✓	✓	✓	✓
Bluetooth 4.2	LE Data Packet Length Extensions	✓	✓	✓	✓	✓
	LE Privacy 1.2	✓	✓	✓	✓	✓
	LE Secure Connections	✓	✓	✓	✓	✓
Bluetooth 4.1	LE Link Layer Topolgy	✓	✓	✓	✓	✓

# Bluetooth LE – Performance Figures



Feature	Value
<b>Simultaneous connections</b>	Up to 8 (BG1 and BG22) or 16 (xG12 and xG13, BG21)
<b>Throughput (EFR32-2-EFR32)</b>	1M PHY: ~700 Kbps 2M PHY: ~1300 Kbps 125k PHY: ~100 Kbps
<b>Packets per connection interval</b>	Not limited
<b>Link Layer packet size</b>	Up to 251 bytes
<b>ADV payload size</b>	Up to 191 bytes (per packet)
<b>ATT MTU</b>	Up to 250 bytes
<b>Max bondings</b>	Up to 14 with PS store More with NVM3

# Bluetooth Mesh - Mesh 1.0 Profile Features



## EFR32BG21/13/12

Support all Bluetooth mesh features (Relay, Proxy, Friend etc.)



## EFR32BG22

512 kB parts support Bluetooth mesh Low Power Node, but do not support Relay, Proxy nor Friend features

- Customer is left with 3-4 kB of RAM for the application

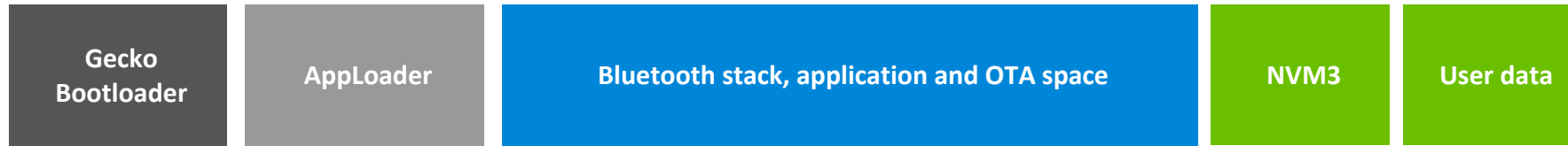
352 kB parts do not have enough flash for Bluetooth mesh

Feature	Value(s)
<b>Supported features</b>	Relay
	Proxy
	Friend
	Low Power
<b>Provisioning bearers</b>	PB-ADV
	PB-GATT
<b>Security</b>	OoB authentication
	Replay protection
	Key refresh (blacklist)
	ECDH
	AES-128 encryption, authentication and obfuscation
<b>GATT services</b>	Proxy
	Provisioning

# Bluetooth Mesh – Supported Bluetooth Mesh Models

	Model	Stack/APIs	Example app(s)	iOS APIs	iOS app	Android APIs	Android app
<b>Vendor</b>	Vendor	✓		✓		✓	
	On/Off	✓	Light & Switch	✓	✓	✓	✓
	Level	✓	Light & Switch	✓	✓	✓	✓
	Default Transition Time	✓	Light & Switch	✓		✓	
	Power On/Off	✓	Light & Switch	✓		✓	
	Power Level	✓		✓			
<b>Generic</b>	Battery	✓		✓		✓	
	Location	✓		✓			
	Admin property	✓		✓			
	Manufacturer property	✓		✓			
	User property	✓		✓			
	Client property	✓		✓			
	Property	✓		✓			
	Lightness	✓	Light & Switch	✓	✓	✓	✓
	CTL	✓	Light & Switch	✓	✓	✓	✓
	<b>Lighting</b>	LC	✓	Light & Sensor	✓	✓	✓
HSL							
xYL							
<b>Sensors</b>	Sensor	✓	✓	✓		✓	
	Scene	✓	Light & Switch	✓	✓	✓	✓
<b>Time and Scenes</b>	Time						
	Scheduler						

# BG22/BG21 Flash Layout with AppLoader OTA



Component	Typical size	Comments
Gecko bootloader	16 kB	Size may depend slightly on used Gecko bootloader features
AppLoader	48 kB	AppLoader is used for OTA updates directly to overriding Bluetooth stack and app area See UG136 for latest information
Bluetooth stack, application and OTA space	133 kB+	Reserved for Bluetooth stack and application code Application and feature dependent. See UG136 for latest information
NMV3 memory	24 kB	User configurable, but minimum size is 3 flash pages (3 x 8 kB)
User data	8 kB	Last flash page
<b>Total minimum size</b>	<b>~229 kB</b>	

# BG22/BG21 Flash Layout with non-AppLoader OTA



Component	Typical size	Comments
Gecko bootloader	16 kB	Size may depend slightly on used Gecko bootloader features
Bluetooth stack and application space	133 kB+	Reserved for Bluetooth stack and application code Application and feature dependent  See UG136 for latest information
OTA space	~70% - 100% of bluetooth stack and application space	OTA space must be at least of equal size of Bluetooth stack and application space, but if OTA image compression is used it can be even 30% smaller (LZMA compression)
NMV3 memory	24 kB	User configurable, but minimum size is 3 flash pages (3 x 8 kB)
User data	8 kB	Last flash page
<b><u>Total minimum size</u></b>	<b>~274 – 314 kB</b>	From 30% compression to 0% compression