2023 tech talks
WEBINAR SERIES

xG27 Unboxing and Development

March 23, 2023

SILICON LABS

BLUETOOTH SERIES

tech talks UPCOMING SESSIONS

FEB 23RD	ML in Predictive Maintenance and Safety Applications
MAR 23RD	Unboxing: What's New With Bluetooth
APR 20TH	What's New with Bluetooth Mesh 1.1
MAY 18TH	Bluetooth Portfolio: What's Right for Your Application
JUN 15TH	The Latest in HADM With Bluetooth LE

Agenda

xG27 Introduction

xG27 Differentiating Features

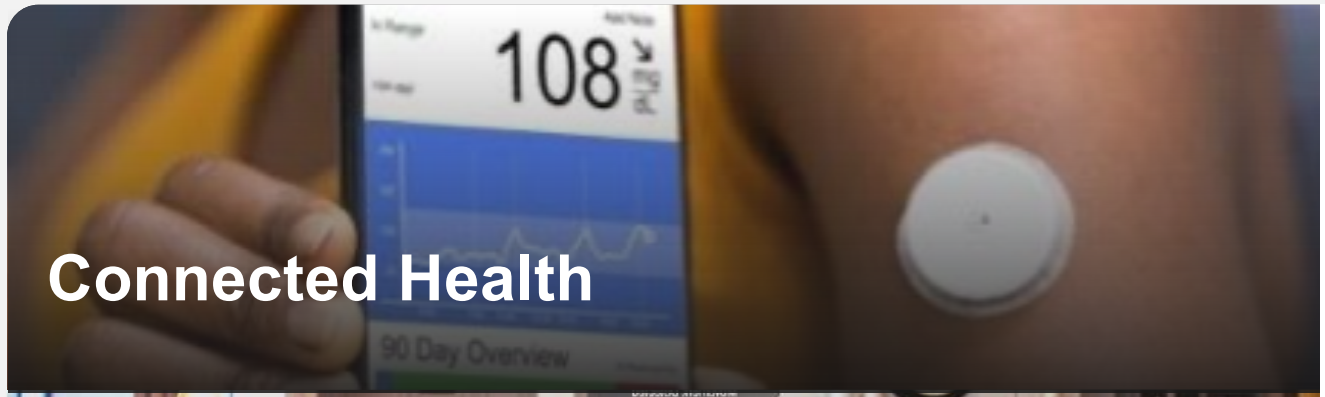
Development Hardware and Software

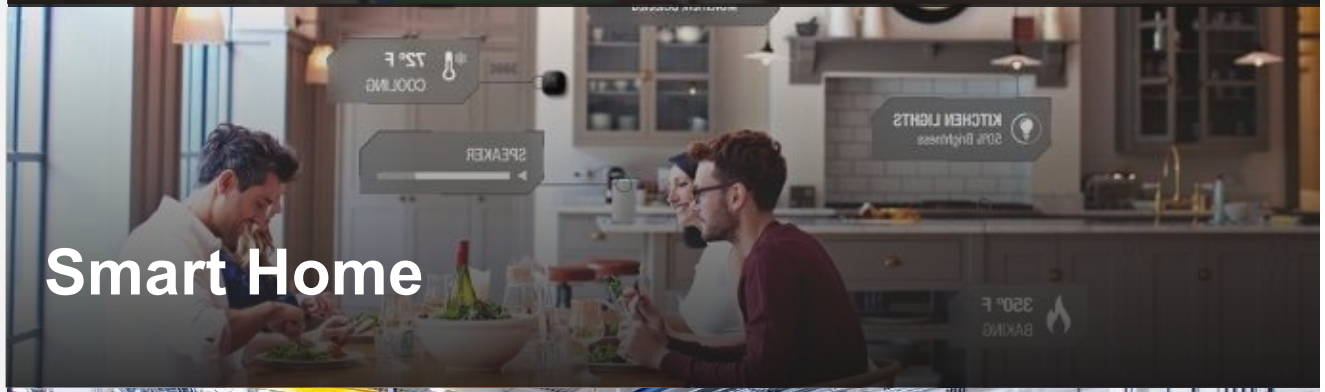
GitHub Demo

Simplicity Studio Demo

Summary and Q&A

EFR32BG27 and EFR32MG27 Target Applications





- **Connected Health**
  - Portable Medical Devices
    - Continuous glucose monitors, pulse oximeters, medical patches, electrocardiograms
  - Clinical Medical Devices
  - Wearables
- **Smart Home**
  - Sensors, Switches
  - Door Locks
  - HVAC, Thermostats
  - LED Lighting
  - Small Appliances
- **Industrial and Commercial**
  - Building Automation
  - Commercial Lighting
  - Access Control
  - Asset Tracking, Indoor RTLS

xG27: Most Battery Versatile Series-2 SoC

Battery Versatile

Ultra-Low Power

Multi-Protocol

Secure

DEVICE SPECIFICATIONS

High Performance 2.4 GHz Radio
- Up to +8 dBm TX
- -98.9 dBm RX @ BLE 1 Mbps
- -106.7 dBm RX @ BLE 125 kbps

MCU Core
- ARM Cortex®-M33 (76.8 MHz with FPU & DSP)

Memory
- Up to 64kB RAM
- Up to 768kB Flash

Ultra Low Power
- 1.1 µA EM2 with 8 kB RAM retention
- 4.1 mA TX @ 0 dBm
- 3.6 mA RX (BLE 1 Mbps)

Multiple protocol support
- Bluetooth 5.3 (1M/2M/LR), Bluetooth mesh
- Zigbee 3.0
- Proprietary 2.4 GHz

Feature Rich peripherals
- 16-bit ADC, USARTs, I2C, I2S, PDM, Timers

Package
- 2.3x2.6 WLCSP (19 GPIO) +85ºC
- 4x4 QFN32 (18 GPIO) +125ºC
- 5x5 QFN40 (26 GPIO) +125ºC

DIFFERENTIATED FEATURES

Extremely small form-factor
- 2.3 x 2.6 WLCSP package[1]

Flexible battery support
- DCDC Buck/Boost
- Supports 1.7 to 3.6 volts
- Supports 0.8 to 1.7 volts

Enhanced security
- Secure Vault™ Mid
- Tamper detect
- Customer Key Management w/PUF

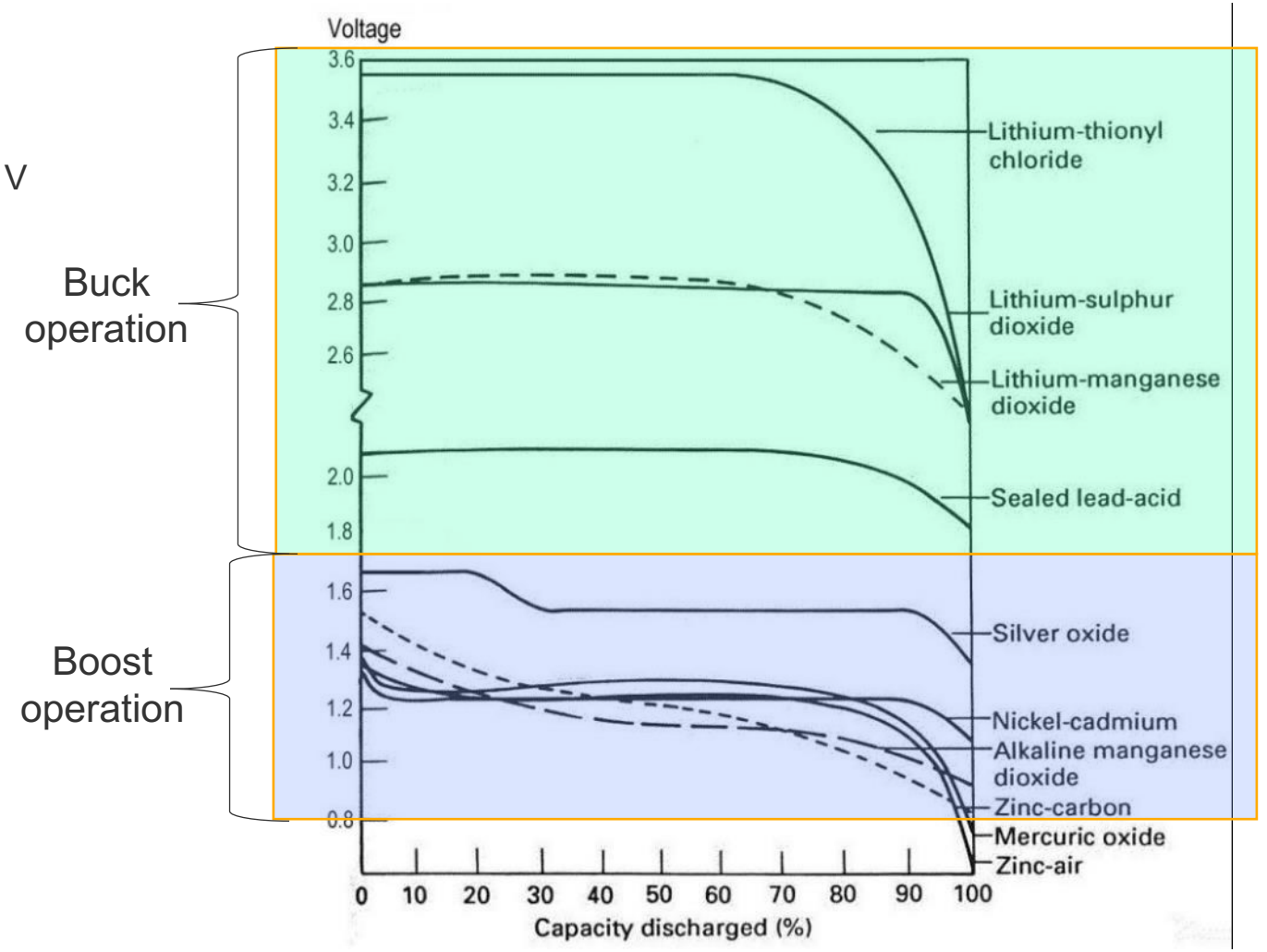
Battery management
- Coulomb counter

Wake-up pin (BOOST_EN)
- Enables <20 nA for long-term storage
- Up to 10 years of shelf storage

Differentiating Features

Boost DC-DC Converter

- **Input range: 0.8 V to ~1.7 V**
  - Adds support for lower voltage batteries
  - Silver Oxide: ~1.2 to 1.65 V
  - Alkaline / Rechargeable AA/AAA form: ~0.9 to 1.5 V
- **Coulomb counter**
  - Enables accurate battery level tracking
- **Shelf mode with a wake-up pin**



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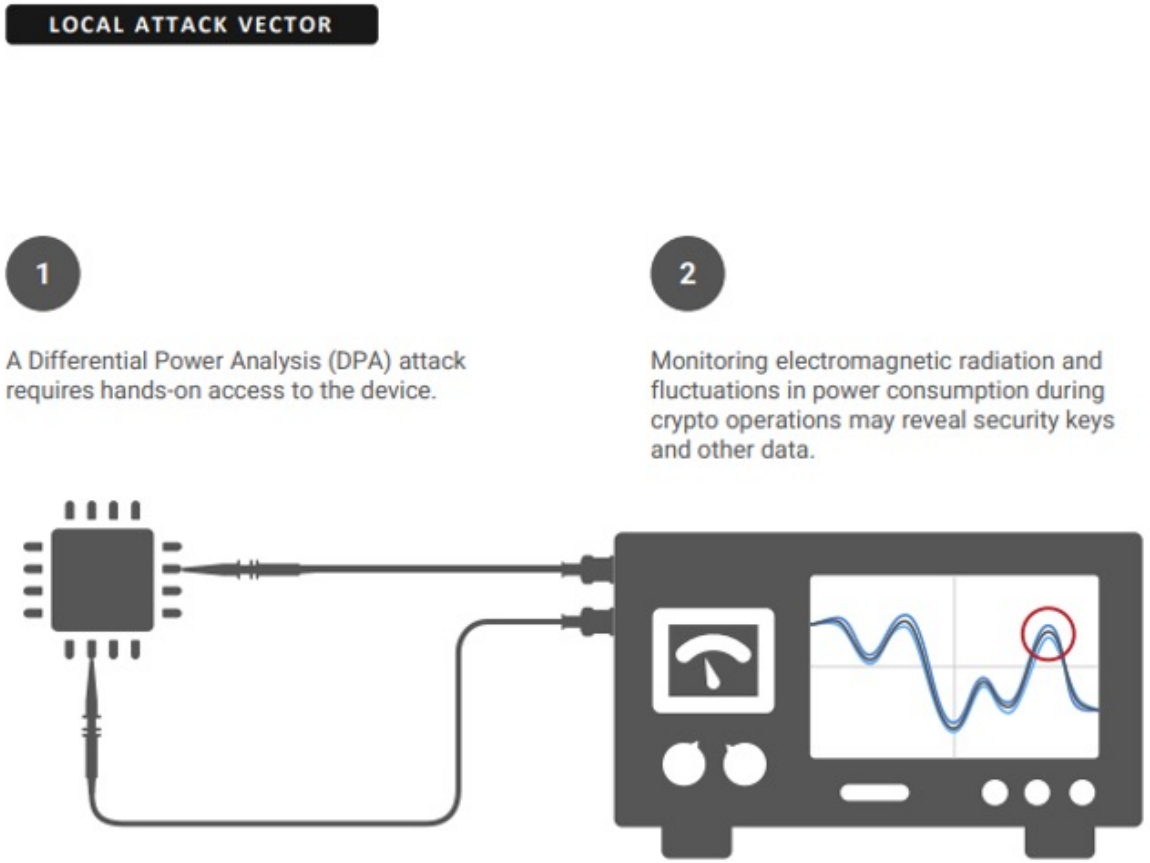
Secure Vault™ - Protecting the IoT Device

Base	Mid	High	Feature
✓	✓	✓	True Random Number Generator
✓	✓	✓	Crypto Engine
✓	✓	✓	Secure Application Boot
—	VSE/HSE	HSE	Secure Engine
—	✓	✓	Secure Boot with RTSL
—	✓	✓	Secure Debug with Lock/Unlock
—	HSE & xG27	✓	DPA Countermeasures
—	xG25, xG27	xG25	E-Tamper
—	xG27*	✓	PUF Support (Seed Key to AES)
—	—	✓	Anti-Tamper
—	—	✓	Secure Attestation
—	—	✓	Secure Key Management
—	—	✓	Advanced Crypto
	EFR32BG27 EFR32MG27		

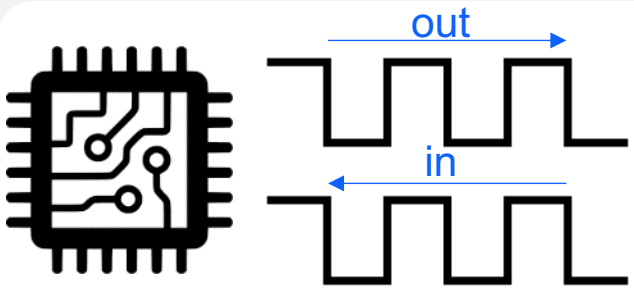
Designing Secure IoT Devices

Enhanced Security – DPA Countermeasures

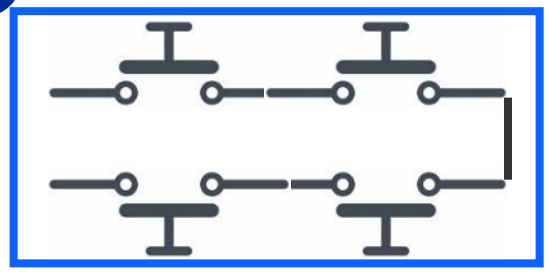


- **Vulnerabilities**
  - Observing subtle differences during given internal operations can provide insight into cryptographic functions
- **DPA Countermeasures**
  - Countermeasures add masks and random timings to internal operations and distorts DPA snooping

E-Tamper

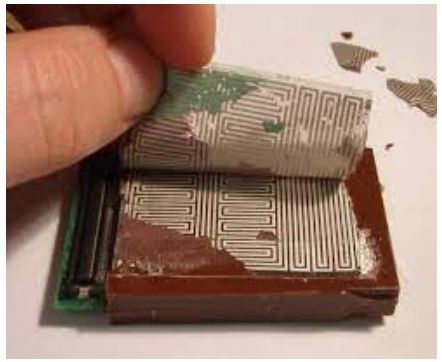


1 Tamper Pins on Case



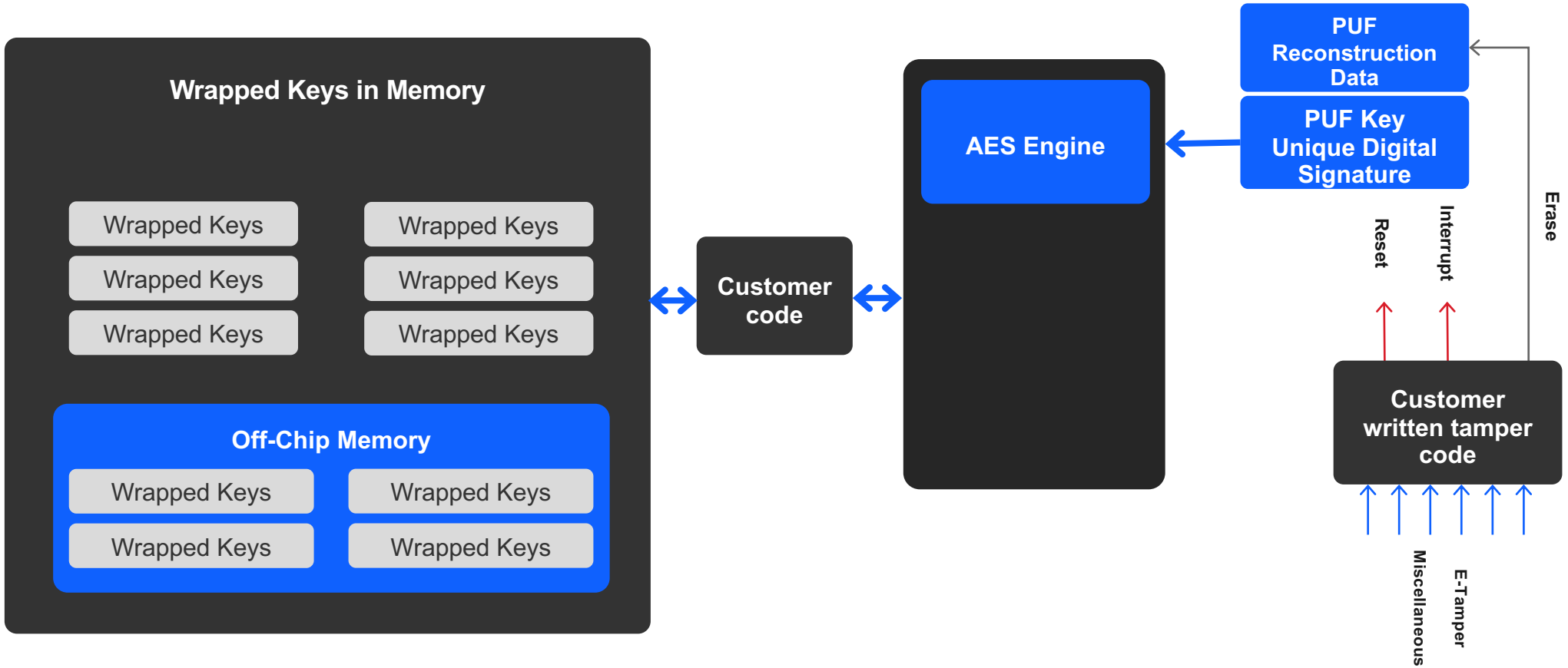
2 Tamper Trace Around Comms Link

3 Purpose Built Tamper Shields

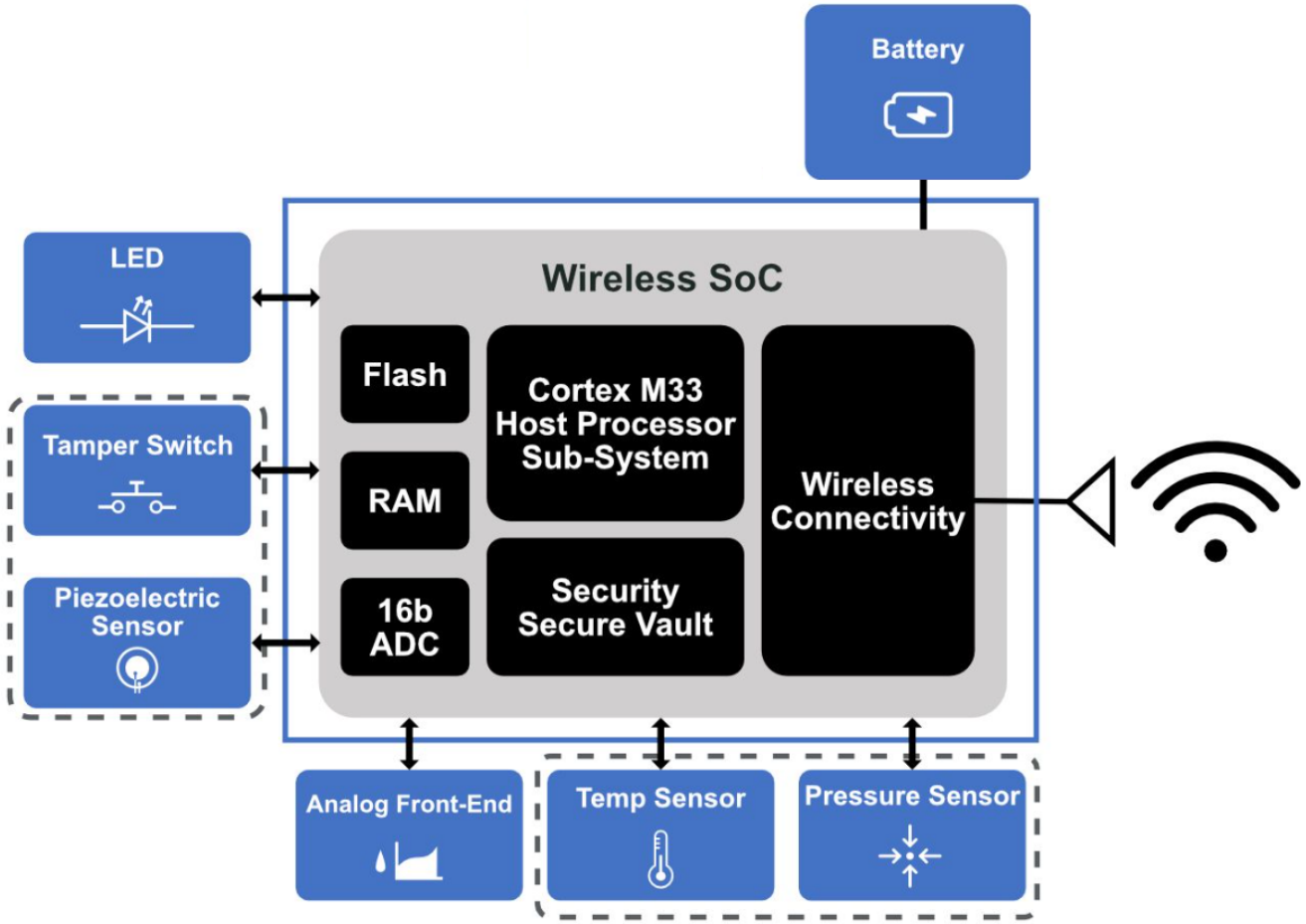


- **Square wave out one pin and in another – broken signal can be fed into other logic to take tamper action**
- **Uses Cases:**
  1) Connect Tamper Pins on a product case and then do trigger action when case opened
  2) Create Wire trace around bus in PC Board to protect communications between two components
  3) Power a tamper shield which can protect several components on a PCB

Enhanced Security - Customer Key Management with PUF



Example of Tiny Medical Device Design – Continuous Glucose Monitor



- **BG27 SoC Based**
- **Highlights**
  - BG27 CSP Package / Size
  - DCDC Buck/Boost
  - Power Optimization
    - Low active and sleep current
    - Shelf Mode (BOOST_EN)
  - Secure Vault
    - E-Tamper
  - Analog/Serial Peripherals
    - 16-bit ADC
  - CGM Sample Application

Silicon Labs' 2.4GHz SoC Portfolio

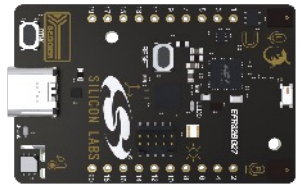
	xG21	xG22	xG24	xG27
Protocols				
Frequency Bands	2.4 GHz	2.4 GHz	2.4 GHz	2.4 GHz
Core	Cortex-M33 (80 MHz) Cortex-M0+ (Security)	Cortex-M33 (76.8 MHz) Cortex-M0+ (Radio)	Cortex-M33 (78 MHz) Cortex-M0+ (Radio) Cortex-M0+ (Security)	Cortex-M33 (76.8 MHz) Cortex-M0+ (Radio)
Max Flash	1024 kB	512 kB	1536 kB	768 kB
Max RAM	96 kB	32 kB	256 kB	64 kB
Security	Secure Vault Mid Secure Vault High	Secure Vault Mid	Secure Vault Mid Secure Vault High	Secure Vault Mid
Rx Sensitivity (15.4)	-104.5 dBm	-102.3 dBm	-105.4 dBm	-102.3 dBm
Rx Sensitivity (BLE 1Mbps)	-97.5 dBm	-98.9 dBm	-97.6 dBm	-98.9 dBm
Active Current	63.8 µA/MHz	26 µA/MHz	33.4 µA/MHz	29 µA/MHz
Sleep Current (EM2, 16 kB ret)	4.5 µA	1.2 µA (8 kB)	1.3 µA	1.6 µA (64 kB)
TX Current @ +0 dBm (2.4 GHz)	9.3 mA	4.1 mA	5.0 mA	4.1 mA
TX Current @ +10 dBm (2.4 GHz)	33.8 mA	8.2 mA @ +6 dBm	19.1 mA	11.3 mA @ +8 dBm
TX Current @ +20 dBm (2.4 GHz)	185 mA	N/A	156.8 mA	N/A
RX Current (802.15.4)	9.4 mA	3.9 mA	5.1 mA	3.9 mA
RX Current (BLE 1 Mbps)	8.8 mA	3.6 mA	4.4 mA	3.6 mA
Serial Peripherals	USART, I2C	USART, EUSART, I2C, PDM	USART, EUSART, I2C	USART, EUSART, I2C, I2S, PDM
Analog Peripherals	12-bit ADC, ACMP	16-bit ADC	20-bit ADC, ACMP, VDAC	16-bit ADC, ACMP, Coulomb Counter
Other	Die Temp Sensor	Die Temp Sensor	Die Temp Sensor	Temp Sensor, PLFRCO, Buck/Boost
Operating Voltage	1.71 V to 3.8 V	1.71 V to 3.8 V	1.71 V to 3.8 V	0.8 – 1.6 V 1.71 – 3.8 V
GPIO	20	18, 26	26, 28/32	26, 18, 19
Package	4x4 QFN32	4x4 QFN32 4x4 TQFN32 5x5 QFN40	5x5 QFN40 6x6 QFN48	5x5 QFN40 4x4 QFN32 2.3x.2.6 WLCSP

Development Hardware & Software Overview

Tim Sams

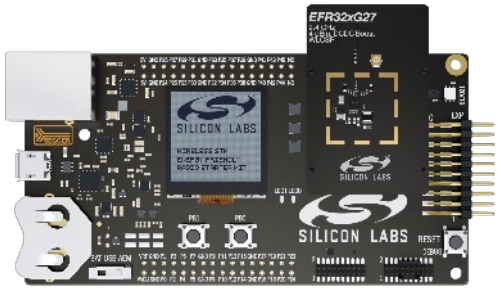
Getting Started with EFR32BG27 and EFR32MG27 SoCs

- **Dev Board**
  - Low-cost development board
  - On-board debugger
  - Signal breakouts
  - On-board sensors
  - 16-bit ADC
- **Contents**
  - 1x dev board



Part Number	Description
xG27-DK2602A	EFR32xG27 2.4 GHz +8 dBm dev board

- **Pro kits**
  - Modular development platform
  - Advanced development
  - RF measurements
  - Energy profiling
  - External device debug
  - Ethernet for large network test
- **Contents**
  - 1 x WSTK main board
  - 1 x radio board

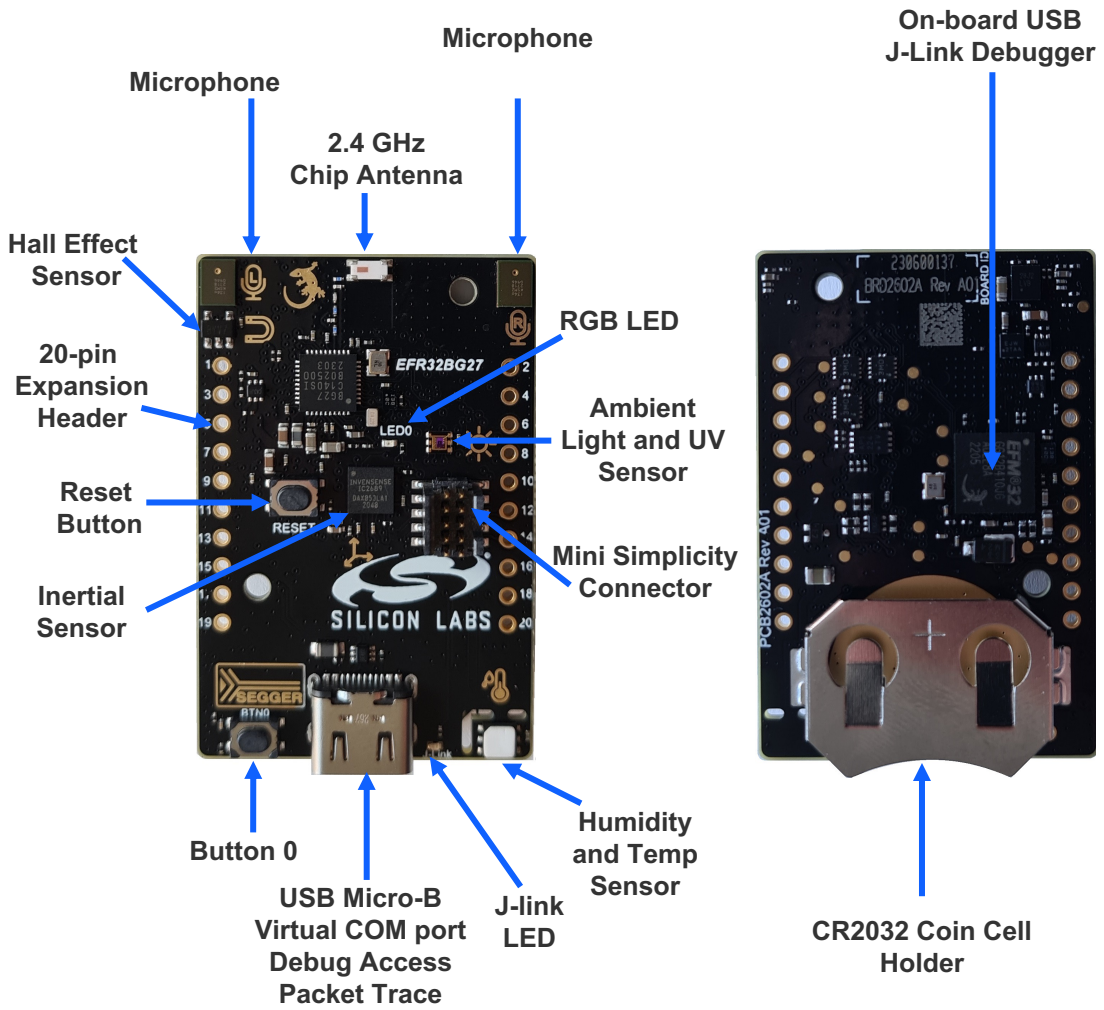


Part Number	Description
xG27-PK6017A	EFR32xG27 2.4 GHz +8 dBm Pro Kit (Buck)
xG27-PK6018A	EFR32xG27 2.4 GHz +4 dBm Pro Kit (Buck)
xG27-PK6019A	EFR32xG27 2.4 GHz +4 dBm Pro Kit (Boost)

- **Radio Board kits**
  - Uses existing WSTK boards
  - Uses existing software tools
- **Contents**
  - 1x radio board

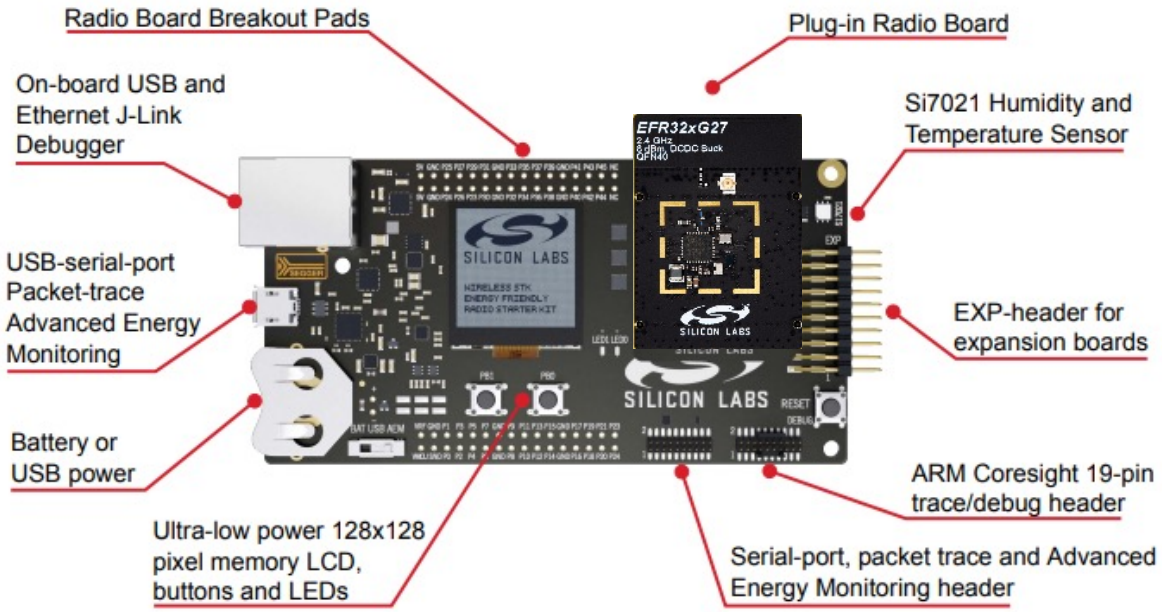
Part Number	Description
xG27-RB4194A	EFR32xG27 2.4 GHz +8 dBm Radio Board (Buck)
xG27-RB4110B	EFR32xG27 2.4 GHz +4 dBm Radio Board (Buck)
xG27-RB4111B	EFR32xG27 2.4 GHz +4 dBm Radio Board (Boost)

Dev Board Features



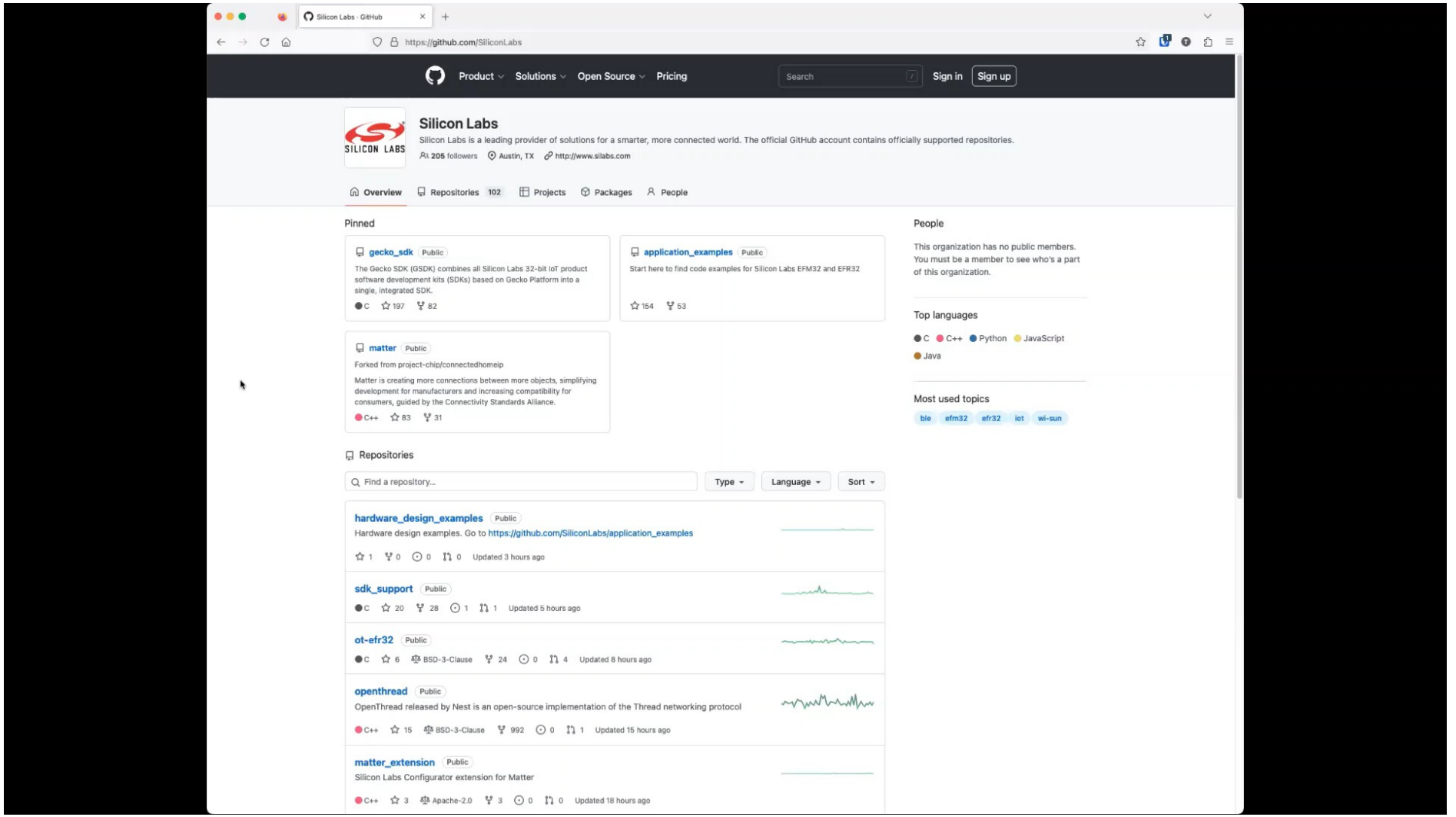
- **Features**
  - EFR32BG27C140F768IM40 for +8 dBm Kit (Buck)
  - Wireless SoC with multi-protocol radio
  - Cortex-M33, 768 kB Flash and 64 kB RAM
  - Coulomb counter
- **Broad Range of Sensors**
  - 9-axis Inertial Sensor
  - 2 Digital Microphones
  - Pressure Sensor
  - Relative Humidity and Temperature Sensor
  - UV and Ambient Light Sensor
  - Hall-effect Sensor
- **Expansion and User Interface**
  - Breakout pads
  - Qwiic connector
  - LEDs and Push Buttons

Radio Board and Main Board Features



- **Radio Board Features**
  - EFR32MG27C140F768IM40 for +8 dBm Kit (Buck)
  - EFR32BG27C320F768GJ39 for +4 dBm Kit (Buck)
  - EFR32BG27C320F768GJ39 for +4 dBm Kit (Boost)
  - Cortex-M33, 768 kB Flash and 64 kB RAM
  - Secure Vault Mid
  - U.FL for RF Measurements
- **Main Board Features**
  - LEDs and Push Buttons
  - Ethernet and USB connectivity
  - Advanced Energy Monitor
  - Packet Trace Interface
  - Breakout pads and expansion header
  - External debug support
  - Si7021 Relative Humidity and Temperature sensor
  - Low Power 128x128 pixel Memory LCD
  - USB, CR2032, and battery pack options for power

Github Demo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Silicon Labs is a leading provider of solutions for a smarter, more connected world. The official GitHub account contains officially supported repositories.
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Projects
Packages
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gecko_sdk Public
The Gecko SDK (GSDK) combines all Silicon Labs 32-bit IoT product software development kits (SDKs) based on Gecko Platform into a single, integrated SDK.
C 197 82
application_examples Public
Start here to find code examples for Silicon Labs EFM32 and EFR32
154 53
matter Public
Forked from project-chip/connectedhomeip
Matter is creating more connections between more objects, simplifying development for manufacturers and increasing compatibility for consumers, guided by the Connectivity Standards Alliance.
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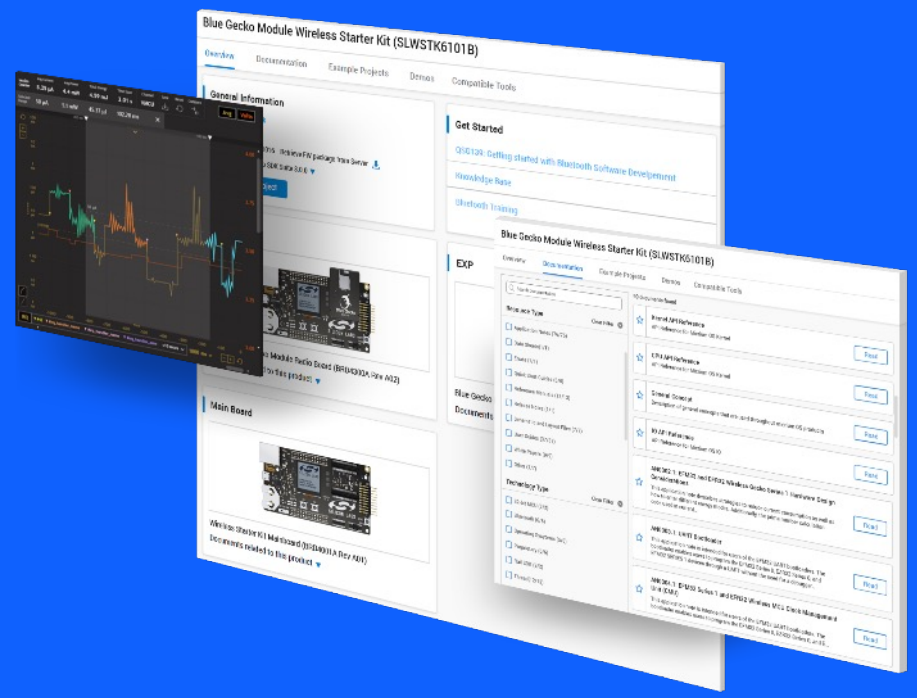
Hardware design examples. Go to https://github.com/SiliconLabs/application_examples
1 0 0 0 Updated 3 hours ago
sdk_support Public
C 20 28 1 1 Updated 5 hours ago
ot-efr32 Public
C 6 BSD-3-Clause 24 0 4 Updated 8 hours ago
openthread Public
OpenThread released by Nest is an open-source implementation of the Thread networking protocol
C++ 15 BSD-3-Clause 992 0 1 Updated 15 hours ago
matter_extension Public
Silicon Labs Configurator extension for Matter
C++ 3 Apache-2.0 3 0 0 Updated 18 hours ago

Simplified Developer Experience

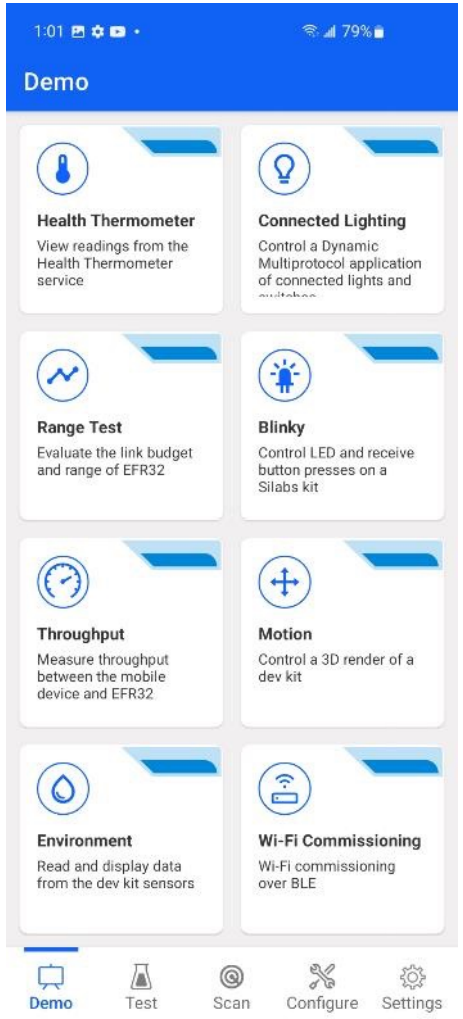


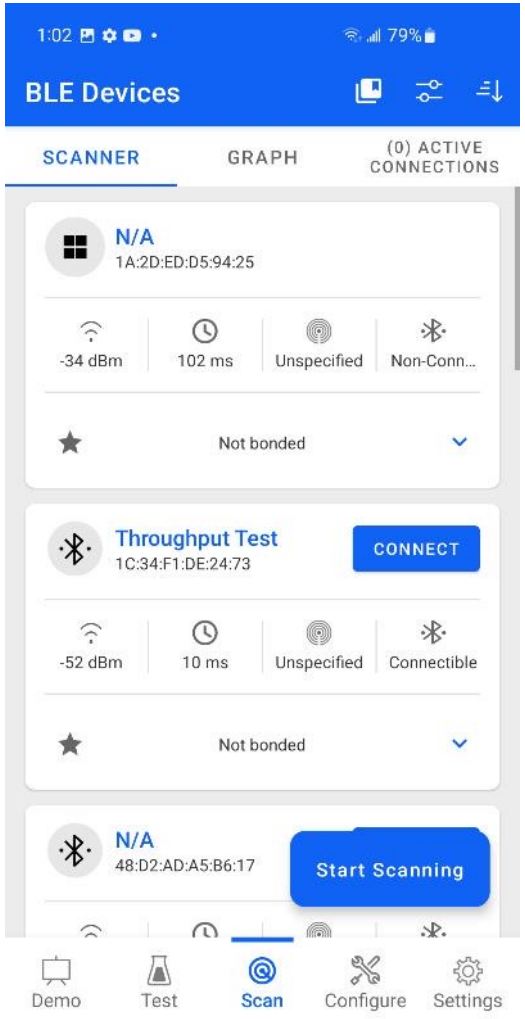
Simplicity Studio 5

Simplicity Studio 5

- **Interface**
  - Fresh, new & simplified
  - Intuitive out-of-the-box experience
  - Fast access to developer resources
  - Linux, Mac & Windows
- **Tools**
  - Configuration utilities
  - Compiler
  - Error & validation
  - IDE & command line support
  - Graphical hardware configurator
  - Energy Profiler – visual energy analysis
  - Network Analyzer – packet capture & decode

EFR Connect – Demo / Scan



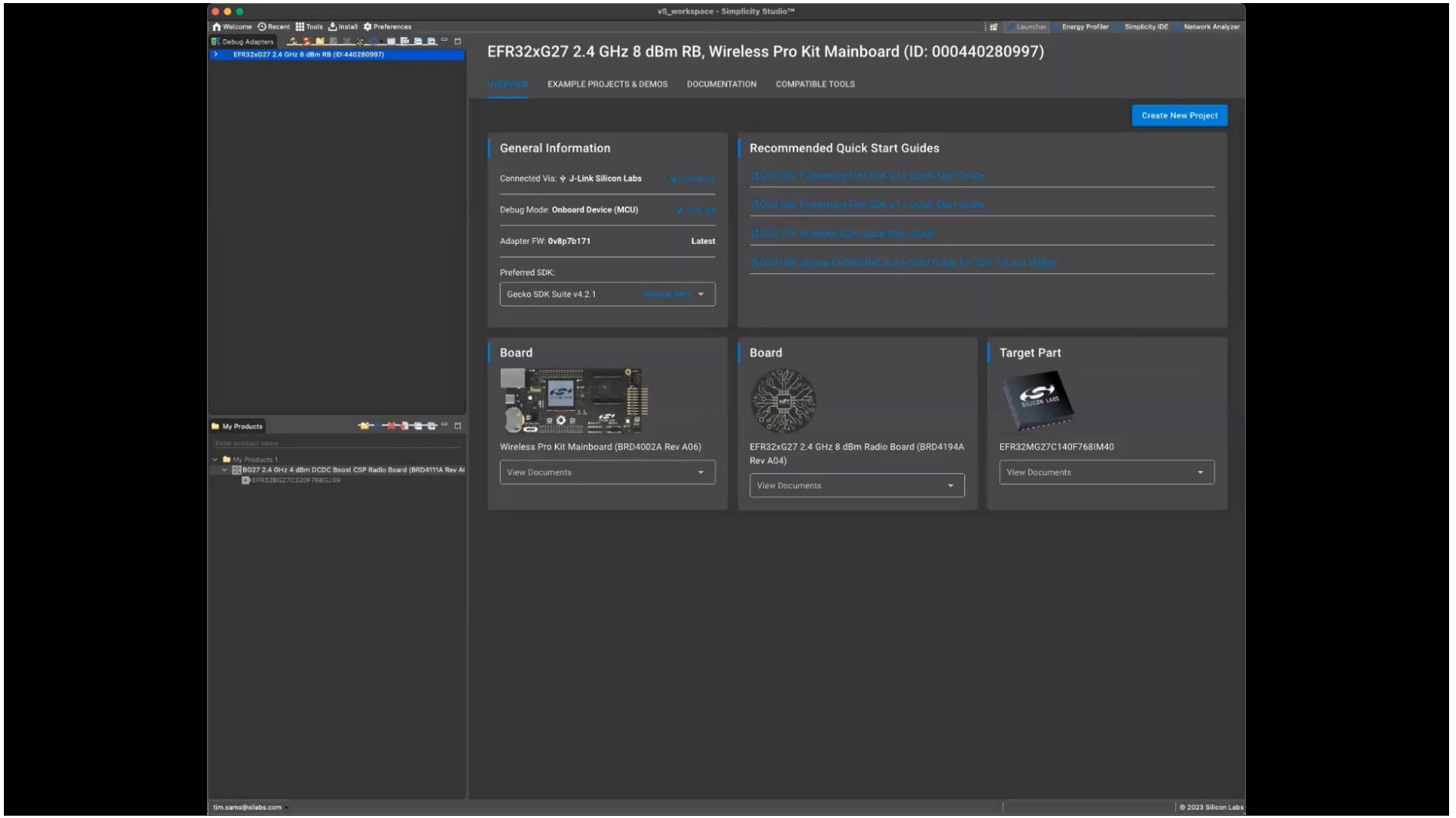


- **EFR Connect combines the smoothest out of box experience with the most advanced developer features for BLE, in a single mobile app**

- **Main Navigation Bar w/ distinct purpose views**
  - Demo: Ready-to-go demos with a matching sample app on GSDK pre-compiled for numerous kits
  - Scan: for searching, connecting and interacting with remote devices
  - Configure: Local Advertise and GATT Configurator for mobile phone
  - Test: (IOP) to assess behavior against Silicon Labs' Bluetooth SW and HW
  - Settings: For System configuration and app information

xG27 and Simplicity Studio Demonstration

Simplicity Studio Demo



Summary

BG27 and MG27: Smallest, and most battery versatile SoCs for the Edge

- **Smaller devices without compromising power, performance, or security**
  - Ultra-compact 2.3mm x 2.6mm WLCSP package
  - DCDC Buck/Boost allowing operation down to 0.8 volts
  - Secure Vault™ Mid
    - Tamper detect
    - Secure Key Management w/PUF
  - 16-Bit ADC for highly accurate analog sensing
- **Worry-free battery-life expectancy**
  - Coulomb counter for enhanced battery monitoring
- **Reliable Wireless**
  - Multiprotocol 2.4 GHz wireless SoC with High-Performance RF
    - Bluetooth, Bluetooth mesh, and Zigbee
- **Unleash Your Innovation and Extend your Product Lifetime!**
  - Enough memory facilitating more features and OTA updates

Resources and Links

BG27 Web Page

- https://www.silabs.com/bg27

MG27 Web Page

- https://www.silabs.com/mg27

Studio 5

- https://www.silabs.com/developers/simplicity-studio

EFR Connect

- https://www.silabs.com/developers/efr-connect-mobile-app

GitHub

- https://github.com/siliconlabs

BLUETOOTH SERIES

tech talks UPCOMING SESSIONS

FEB 23RD	ML in Predictive Maintenance and Safety Applications
MAR 23RD	Unboxing: What's New With Bluetooth
APR 20TH	What's New with Bluetooth Mesh 1.1
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JUN 15TH	The Latest in HADM With Bluetooth LE